

BOOK OF ABSTRACTS



6th Edition

15–17 April 2026

At ISPITS Casablanca

International Congress on Industry, Environment and Health
– 6th Edition –

Focal theme

Water Security, Human Health and One Health: Driving a Sustainable Future
Through Biotechnology

Co-organised by



Partners:



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**CIIES26 – 6th International Congress on Industry, Environment and Health
Book of Abstracts – 2026**

Casablanca, Morocco | 15–17 April 2026

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Special thanks are extended to **Al Faraby Drugs Company** and **Agromillora Morocco** for their valued support.

The Organising Committee also expresses its sincere appreciation to **Dr Michael Brett-Crowther, Editor-in-Chief of *Natural Built Social Environment Health (NBSEH)***, for his valuable linguistic and editorial support in the preparation of the Congress materials and this *Book of Abstracts*.

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NBSEH — Official partner journal of CIIES 2026

Promoting knowledge, innovation, and sustainable health.
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and sustainability.

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PRESENTATION

The Moroccan Association for Environmental and Health Sciences and Techniques (AMSTES), in collaboration with the Faculty of Sciences and Techniques of Mohammedia (FSTM), the Higher Institute of Nursing and Health Techniques of Casablanca (ISPITS Casablanca), and affiliated laboratories including the Laboratory of Agro-Food Biotechnology, Materials and Environment (LBAME), and the Laboratory for Health, Care and Sustainable Development (L2S2D), is honoured to co-organise the sixth edition of the International Congress on Industry, Environment and Health (CIIES 2025), to be held from 15 to 17 April 2026 at ISPITS Casablanca.

This edition, under the theme “*Water Security, Human Health and One Health: Driving a Sustainable Future Through Biotechnology*”, aims to address the critical global challenges related to water resources, environmental sustainability, and public health. In a context marked by increasing water scarcity, environmental degradation, emerging health risks, and climate change pressures, the integration of biotechnology within the One Health framework represents a strategic pathway to ensure resilient ecosystems, safe water systems, and improved human and animal health outcomes.

CIIES 2026 will bring together a diverse international community of scientists, engineers, healthcare professionals, policymakers, industry leaders, and civil society representatives to discuss advances in water resource management, wastewater treatment and reuse, biomass valorisation, renewable energy, circular biotechnologies, and sustainable healthcare systems. The congress aims to foster interdisciplinary dialogue, share cutting-edge research, and stimulate new collaborations focused on strengthening water security, protecting ecosystem health, and promoting sustainable development through innovative biotechnological solutions.

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Keynote Speakers / Plenary Speakers

- **Dr. Youness Ahallal** – Consultant Urologist & Onco-Urologist, Morocco
- **Dr. Khadija Khataby** – Al Faraby Drug Company, Morocco
- **Prof. Olivier Sire** – University of South Brittany (UBS), France
- **Prof. Fatima Zahra Ndadani** – ISPITS Casablanca
- **Dr. Alla Silkina** – Swansea University, United Kingdom
- **Prof. Véronique Le Tilly** – University of South Brittany (UBS), France
- **Johanssen Obanda** – Community Engagement Manager, Crossref
- **Dr. Michael Brett-Crowther** – Editor-in-Chief, NBSEH
- **Prof. Saloua Fertahi** – UM6P, Morocco
- **Dr. Kholoud Maafi** – Pasteur Institute of Morocco
- **Mr. Omar Jnioih** – Robotics Speaker & Consultant, Founder of J&T Robotix, Morocco

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- Prof. Karima Bakri
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- Prof. Karima El Bouqdaoui
- Prof. Sanaa Deblij
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- Prof. Zineb Elgabbas
- Prof. Nadia Boutaleb
- Dr. Oumy Ndiaye
- Dr. Michael Brett-Crowther

Progamme



INTERNATIONAL CONGRESS OF INDUSTRY,
ENVIRONMENT & HEALTH

FOCAL THEME

WATER SECURITY, HUMAN HEALTH AND ONE
HEALTH: DRIVING A SUSTAINABLE FUTURE
THROUGH BIOTECHNOLOGY

PROGRAMME



ISPITS Casa

Welcome to CIIES – 26

6th Edition

April 15 - 17 ,2026
Casablanca, Morocco



DAY 1

WEDNESDAY, 15 APRIL 2026

14:00 – 15:00

Arrival of Participants & Registration



15:00 – 15:20

Opening Statements

Moderator: Prof. Nadia Boutaleb (FST Mohammedia)

- The Minister of Health and Social Protection
- The Regional Director of Health and Social Protection for the Casablanca–Settat Region
- The Director of ISPITS Casablanca
- The President of Hassan II University of Casablanca
- The Dean of the Faculty of Sciences and Technologies, Mohammedia
- The Editor-in-Chief of the NBSEH Journal
- The Deputy Director for Research, Continuing Education and Cooperation, ISPITS Casa
- The Director of Al Faraby Drug Company
- The President of AMSTES
- The President of the Organizing Committee

Hybrid Session Access:

<https://meet.google.com/uar-tjgg-rsd>

15:20 – 15:30

Honouring Ceremony

Dr. Michael Brett-Crowther, Editor-in-Chief, NBSEH

15:30 – 17:00

inaugural Conferences : Moderators: Prof. Hlima Bessi (FST Mohammedia), Prof. Amal Razik (ISPITS Casa), Dr. Alla Silkina (Swansea University, UK)



"Biofilms: Friends or Foes in Industrial Waters?"

By Prof. Olivier Sire (University of South Brittany – UBS, France)



"Robotic Surgery: Population Benefits and Healthcare System Integration"

By Dr. Youness Ahallal (Consultant Urologist & Onco-Urologist, Internationally Recognised Moroccan Surgeon)



"Innovative Biotechnologies for the Prevention and Early Detection of Infectious Diseases"

By Dr. Khadija Khataby (Al Faraby Drug Company, Morocco)

17:00

Welcome Cocktail



DAY 2

THURSDAY, 16 APRIL 2026

09:00 – 10:00

Morning Plenary Conferences

Moderators: Prof. Nadia Ghosne, Prof. Maria Mazouri, Prof. Zakaria Abidli (ISPITS Casa)



"Integrating Brewery CO₂ Capture with Algal Valorization: Technical Potential and Sanitary Constraints"

By Dr. Alla Silkina (Swansea University, United Kingdom)



"Micro- and Nanoplastics: A Challenge for Ecosystem and Human Health"

By Dr. Véronique le Tilly (University of South Brittany – UBS, France)



"Assessment of Marine Pollution and Public Health Risks"

By Prof. Fatima Zahra Ndadani (ISPITS Casa)

10:00 – 10:30

Coffee Break & Poster Visit : Poster list from p. 22

10:30 – 13:00

Parallel Oral Presentation Sessions : Details from p.9

13:00 – 14:30

Coffee Break & Poster Visit.

14:30 – 15:00

Crossref Plenary Conference

Moderators: Prof. Wissam El Idrissi, Prof. Zineb Zine Al Abidine (ISPITS Casa), Hicham Boutracheh (ENSAK — Ibn Tofail University)



"How Crossref Supports Research Visibility and Research Integrity"

By Johanssen Obanda (Community Engagement Manager, Crossref)



Hybrid Session Access:

<https://meet.google.com/epf-yesz-oyt>

15:00 – 17:30

Crossref Workshop | Open Science & Research Visibility (Hybrid session)

Moderators: Prof Bouchaib Bahlaouan-Director of NBSEH, Johanssen Obanda-Community Engagement Manager-Crossref, Prof Nadia Boutaleb- FSTM, Crossref Ambassador – Morocco & MENA, Prof Alami Houda-ISPITS Casa, Dr Hicham Boutracheh- ENSAK — Ibn Tofail University, Prof Karima El Bouqdaoui-ISPITS Casa, NBSEH

Part 1 — Keynote Talks: Open Science and Scholarly Communication

15:00
–
15:20


"The Future of Scholarly Communication in Africa: Metadata, DOIs and Research Interconnectedness"

Dr. Oumy Ndiaye (Crossref Ambassador, Senegal)

15:00
–
15:20


"Inside NBSEH: Editorial Policy, Peer Review and Open Science Principles"

Dr. Michael Brett-Crowther (Editor-in-Chief, NBSEH)

15:00
–
15:20


"From Diamond Open Access Principles to FAIR Infrastructure: The NBSEH Experience"

Prof. Nadia Boutaleb (Crossref Ambassador for Morocco & MENA)

Part 2 — Live student-led demonstrations: From Research to Publication

16:00–16:15 "Preparing for Literature Searching: A Fundamental Step in the Scientific Process"

– By Aouni Khadija, Abdelghafour Elbouzaoui, Fariat Nadia, Ahmed Lachtioui, Souhaila Lazaar, Oumaima Mouflih & Samira Oubaouche

16:15–16:30 "Navigating the Scientific Literature: Effective Strategies for Selecting and Locating Sources"

– By El Aasemy Ghizlane, Ech-Chikhi Sanae, El Farkani Fadwa, El Massadyani Habib, Elmadkouri Fatima Zahra & Hand Nossaiba

16:30–16:45 "Evaluating Information Sources: Criteria for Ethical Scientific Practice"

– By Benabbou Samiha, Drifi Firdawsse, Lagnidila Kaoutar, Sehmani Chaimae, Taji Nawal & Kinana Safia

16:45–17:00 "Optimising Literature Searching in Nursing and Health Sciences in the Digital Era"

– By Elmnetagui Sara, Elhamdi Imane, Maache Halima, Abderzzak Elittaoui, Soumia Mouhsine & El Azizi Ilham

➤ By Master's Students (PSITS), ISPITS Casa

➤ **Academic Supervisors:** Pr. Abidi, Pr. Bahlaouan, Pr. El Bouqdaoui, Pr. El Machtani, Pr. Ahaizouni, Pr. Hrioua

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Part 3 — Interactive Roundtable: Building Open Science Practices

17:00 – 17:30

- The role of metadata in research workflows
- From literature search to publication quality
- Strengthening Open Science practices in Africa
- Bridging training, research and scholarly publishing



Hybrid Session Access:

<https://meet.google.com/epf-yesz-oyt>

15:00 – 17:30

Afternoon Parallel Workshops : *Details from p. 6*

Applied Circular Economy Models and Nature-Based Solutions



Operational Quality and Risk Management in Healthcare



Clinical Training & Pedagogical Practice



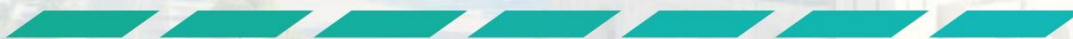
Core One Health Workshop



AI, Simulation and Educational Technologies



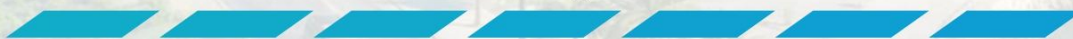
Sustainable Health, Nutrition and Prevention



Hands-On Plant Biotechnology



Hands-On CBA in Clinical Training



DAY 3

FRIDAY, 17 APRIL 2026

09:00 – 11:00

Morning Plenary Conferences

Moderators: Prof. Hind Berradi (ISPITS Casa), Prof. Bouchra Bejjani (FSTM), Prof. Abdelkhalek Hadrani (ISPITS Casa), Dr. Richard Risasi (CAMRS Africa), Dr. Mohamed Bennani (IPM, Morocco)



“Innovative Approaches in Biomass Valorization for Sustainable Materials and Agriculture”

By **Prof Saloua Fertahi** (UM6P, Morocco)



“From Laboratory to Public Health: Molecular Biology and Early Detection of Resistance

The GeneXpert MTB/RIF as a Key Tool in Tuberculosis Control in Morocco”

-By **Dr Kholoud Maafi** (Pharmacist–Biologist at the Pasteur Institute of Morocco; Member of the Moroccan Society of Pharmacology and Therapeutics (SMPT))”



“Contemporary Trends in Humanoid Robotics and Their Emerging Role in Medical and Healthcare Settings”

By **Mr Omar Jnioih** (Robotics Speaker & Consultant -Founder, J&T Robotix, Morocco).

11h00 – 12h30

Parallel Oral Presentation Sessions : Details from p.14

12:30 – 13:00

Award Ceremony
Closing Remarks
Buffet



Online Sessions : Details from p.19

The online Friday sessions will start at **20h00** and will be conducted on Meets under the coordination of Prof Ghosne Nadia. Access links will be provided at the end of the presential sessions

Technical Requirements : ⚠

- ✓ Stable internet access
- ✓ high-quality microphone
- ✓ Have your presentation ready in both PPTX/PDF formats
- ✓ Use 16:9 or 4:3 ratio for slides
- ✓ Minimum 24pt for body text; 36–40pt for headings
- ✓ Webcam positioned it at eye level

THURSDAY, 16 APRIL 2026 Afternoon Parallel Workshops

Applied Circular Economy Models and Nature-Based Solutions



Moderators: Prof. Ayoub Djali (ISPITS Casa) Prof. Fatima Zahra Ndadani (ISPITS casa)

"Biomimicry-Based Waste Management: Towards Nature-Inspired Zero-Waste Systems" — Dr. Khadija Aboulaala (ISPITS Casa)

"Innovative Simulation and Modelling-Based Pedagogies for Sustainable Healthcare Waste Management" — Prof. Karima El Bouqdaoui, Prof. Sanaa Deblij (ISPITS Casa), Prof. Mounia Cherki, Dr. Hamza Rihani (FS Ain Chock)

"The Net-Zero Roadmap: Integrating AI for Campus Sustainability" — Dr. Majda El Hassani, Prof. Nadia Machkour (ENSA Berrechid)

Operational Quality and Risk Management in Healthcare



Moderators: Prof. Mohammed Achmit (ISPITS Casa), Dr. Fatima Azzahra Louanjli (UH2C)

"ISO 7101: A New Vision for Quality and Safety in Healthcare Management" — Prof. Naima Mohssine (ISPITS Casa)

"Blood Exposure Accidents in Healthcare: Clinical Management and Legal Framework" — Prof. Samira Natoubi & Prof. Karima Bakri (ISPITS Casa)

Clinical Training & Pedagogical Practice



Moderators: Prof Bouchra Bejjany (FSTM), Prof. Rihabe Boussetine (ISPITS Casa)

"Practice-Oriented Health Education and Clinical Training" — Prof. Riak Zemmouri (ISPITS Casa)

"Advancing Open Science through Pedagogical Innovation" — Prof. Imane Ettaki, Prof. Zineb Khaddali, Prof. Hind Berradi, Prof. Zineb Zine Al Abidine (ISPITS Casa)

THURSDAY, 16 APRIL 2026 Afternoon Parallel Workshops

AI, Simulation and Educational Technologies



Moderators: Prof. Fatimazahra Boutaleb (UH2C), Prof. Aziza El Baz (ISPITS Casa)



"AI-Assisted Simulation for Nursing Competency Development" — Prof. Amina Lhbibani, Prof. Abderrahmane Laamiri (ISPITS Casa), Dr. Mohamed Benfatah (ISPITS Casa)



"Pedagogical Workshop: Integrating AI Tools into Teaching Practices" — Prof. Houyam Jelloul & Prof. Majda Montacer (ISPITS Casa)



"Developing Researcher Competence: From Question to Analysis" — Prof. Wissam El Idrissi El Machtani (ISPITS Casa)



Sustainable Health, Nutrition and Prevention



Moderators: Prof. Fatimazahra Benchadlia (ISPITS Casa), Prof. Fatima Ezzahra Rihane (ISPITS Casa),



"Promoting Mental Well-being and Stress Management Strategies" — By Prof. Hind Esfadi (ISPITS Casa), Prof. Zineb Zaimi (ISPITS Casa) & Prof. Dris Ghafouri (ISPITS Casa)



"Nutritional Care for Frail Elderly People: Who Should Be Prescribed Oral Nutritional Supplements in Hospital and at Home, and How?" — By Prof. Fatine El Arabi (ISPITS Casablanca), Ms. Hanane Azargui (ISPITS Rabat / Ibn Tofail University, Kenitra) & Ms. Boutaina Kasdi (Ibn Tofail University, Kenitra)



"Sein Sain: Simulation as a Clinical Shield in Breastfeeding Emergencies" — By Amoudi Amina (ISPITS Casa), Azhoune Asmaa (ISPITS Casa), Moutaghfir Nawar (ISPITS Casa), Samiri Fatima (ISPITS Casa), Baghdadi Siham (ISPITS Casa), Ennaani Nadia (ISPITS Casa), & El Mahili Nihad (ISPITS Casa)



THURSDAY, 16 APRIL 2026 Afternoon Parallel Workshops



Core One Health Workshop

Moderators: Prof. Asmaa Hrioua, Prof. Abdelali Moukhass (ISPITS Casa)



"Integrating Environmental Genomics and Drug Response within a One Health Framework" — Prof. Amal Tazzite, Prof. Zineb Khalil, Prof. Zineb Elgabbas (ISPITS Casa)



"One Health in the Emergency Department" — Prof. Hajare Kerazi (ISPITS Casa), Prof. Houda Halloul (FMPC, CHU ibn rochd) , Prof. Oualid Razzok (ISPITS Casa)



"From Knowledge to Action: Interactive Health Education Strategies for Behaviour Change in One Health" — Dr. Khadija Daoudi (I3S Settat)



Hands-On Plant Biotechnology

Moderators: Prof Oualad Bellahcen Touria (FS Ain Chock), Prof Amal Safi (FSTM), Prof Amine Rkhaila (FSTM)



"Hands-On Plant Biotechnology: Micropropagation, Bioinputs and Circular Solutions"



- Plant production techniques: micropropagation, intensive systems and soilless cultivation
- Biotransformation of organic resources into biofertilisers and biostimulants
- Circular economy approaches and sustainable resource management
- Case studies and practical applications



— - By Dr Rajaa Tesse (UH2C), Karima Jmaili (UH2C), Khawla Waddi (UH2C), Mohamed Lahrairi (UH2C)



"Advancing Circular Economy through Wastewater Valorization" — Prof. Malika Naman (ISPITS Casa)



Hands-On CBA in Clinical Training

Moderators: Prof Maria MAZOURI (ISPITS Casa), Prof. Redouane Bachar (ISPITS Casa)

"Competency-Based Approach (CBA) in Healthcare: Structuring, Communication and Implementation in Clinical Settings"

- Fundamental principles of the CBA in healthcare education
- Development of communication skills in clinical contexts
- Identification and strengthening of competencies during clinical placements
- Competency mapping and analysis of clinical placement site resources

— - By Prof Omar ABIDI (ISPITS Casa), Prof Maria MAZOURI (ISPITS Casa), Prof Houda ALAMI (ISPITS Casa), Prof Siham BAGHDADI (ISPITS Casa), Prof Rabia QAISAR (ISPITS Casa), Prof H. NAIT-RICHE (ISPITS Casa))

THURSDAY, 16 APRIL 2026 Parallel Oral Presentation Sessions

Session 1 — Code & Cure

Moderators: Mohamed Achmit – (ISPITS Casa), Amina Amoudi – (ISPITS Casa)

Wiame ADADI — In Silico Prioritization of TCF7L2 Gene Variants Associated with Type 2 Diabetes

Chaimae AMEICH — A 3D-Printed In-Well Electrochemical Platform for Miniaturized On-Site DNA Biosensing Applications

Sanaa CHARROUK — Characterization of Abcc8 Variants in Moroccan Type 2 Diabetes Patients: In Vitro Analysis

Fatima MOURABITI — Repositioning Polyphenols as Potential B-Lactamase Inhibitors: An Integrated Computational and Experimental Approach

Asmae OUAHID — Biocuration of Human Immune Receptor Genomic Regions Using Imgt Standards: Implications for Autoimmune Disease Research

Ghita ELKARHAT — Identification of Deleterious Missense Variants Of Serine Peptidase Inhibitor Kazal Type 2 Gene And Their Impact On KAZAL Domain Structure, Stability, Flexibility, And Dimension

Badre BAKZAZA — Psychosocial and Cognitive Determinants of Quality of Life in Haemodialysis Patients in Morocco: A Multiple Linear Regression Analysis

Session 2 — Smart Care

Moderators: Othmane Ahmoud – (ISPITS Casa), Houda Alami – (ISPITS Casa)

Sakhr AHIZOUNE — Overhauling Morocco's Healthcare System: Perceptions of Healthcare Professionals

Anass AIT CHIKH — Reframing Digital Health in Moroccan Public Healthcare: From Administrative Digitalization to Citizen-Centred Value Creation

Ibtisam HAIDAR — Antidiabetic Medication Adherence During Ramadan Fasting Among Patients with Type 2 Diabetes in Morocco: A Cross-Sectional Analysis

Houda HALLOUL — Healthcare Quality and Risk Management: Lessons learned from literature reviews

Amina LHBIBANI — Simulation and OSCE-Based Training in The Management of Shoulder Dystocia Among Student Midwives at The ISPITS of Casablanca

Oualid RAZZOK — The Applicability of Artificial Intelligence in the Emergency Department

Aziz SAFI — Challenges of Artificial Intelligence-Based Medical Devices: A Systematic Literature Review

THURSDAY, 16 APRIL 2026 Parallel Oral Presentation Sessions

Session 3 — Green Biotech

Moderators: Véronique Le Tilly – (UBS France), Olivier Sire – (UBS France), Nadia Boutaleb – (FST Mohammedia)

Yousra BELAYACHI — Development and Evaluation of a Novel Biopolymer-Based Hydrogel on Plant Growth Under Different Hydric Stress Conditions for Sustainable Agriculture

Marouane CHAHBOUNI — Comparative Evaluation of Maceration and Ultrasound Extraction on the Chemical and Bioactive Profile of *Lavandula multifida*

Madoussou COULIBALY — From Waste to Resource: Physicochemical Characterization of Grass Clipping–Wheat Straw Co-Compost and Its Short-Term Effects on Soil Under Graded Amendment Rates

Fatima Ezzahra DOUBLALI — Optimisation of Anaerobic Digestion of Sardine Fishery Waste Through Fungal Inoculation and Co-Digestion: A Circular Green Biotechnology Approach for Integrated Biogas and Biofertiliser Production

Imad ELGARRAS — Development and Characterization of a Hydrogel-Based Substrate to Enhance Plant Growth in Hydroponic Systems

Karima JMAILI — Biotransformation of whey by native microbiota and its biostimulant effects on Tomato growth

Meriem MAHMOUDI — Enhancing Anaerobic Biotransformation of Agro-Industrial Residues Using Microalgae: Effects on Digestate Quality and Soil Fertility

Fadoua MEKKAoui — Synergistic effects of arbuscular mycorrhizal fungi and compost on tomato performance under combined heat and water stress

Session 4 — One Health and Health Innovation

Moderators: Mounir Arai – (ISPITS Casablanca), Karima Bakri – (ISPITS Casablanca), Hajar Belhaj – (ISPITS Rabat)

Fahd HOUMMASS — Valorization of Snail Shell Biowaste for the Photocatalytic Degradation of Cationic and Anionic Dyes in Water

Ghizlane BOUZINI — Fast Food Consumption Patterns in Moroccan Youth and Their Association with the Risk of Early-Onset Colorectal Cancer

Soukaina BENYAMANE — Effect of Sulphur Nanoparticles on Biopolymer-Based pH-Responsive Indicator Films for Smart Food Packaging

Seloua ESSAIH — Valorization of Some Traditional Recipes Based on Wild Edible Plants by Two Intelligent Programs: DIAL and the BILNUT Software

Mohamed AMZIL — Study of the Correlation Between Antibiotic Resistance and the Ability to Form *Escherichia coli* Biofilm Isolated from Products of Avian Origin

Fatima Zahra ANOUAR TADLAoui — Artificial Intelligence and Improving the Quality of Life in People Living with Chronic Diseases: The Case of HIV

Safaa RHOULAM — Lichens as Bioindicators of Atmospheric Pollution

THURSDAY, 16 APRIL 2026 Parallel Oral Presentation Sessions

Session 5 — AgroResilience

Moderators: Alla Silkina – Swansea University, Dr Michael Brett-Crowther (NBSEH), Laila Chaoui – (ISPITS Casa)

Chaimae NOURI — Biostimulant Potential of *Trichoderma* spp. in Promoting Tomato Growth

Khawla WIFAK — Isolation and Identification of Efficient Phosphate-Solubilizing Fungi from Phosphate-Rich Soils towards the Development of a Novel Phosphorus Biofertilizer

Rajaa TESSE — Role of Abscissic Acid in Improving *in vitro* Salinity Tolerance of *Argania spinosa* L.

Othmane ELGHALMI — Enhancing Forage Production and Nutrient Value through Cereal/Legume Mixtures in Hydroponic Systems: A Study on Barley, Triticale, and Fodder Pea

Raoya KHACHANI — Stability of Mechanical and Physico-Chemical Properties of Pectin-Based Film Incorporated with *Rosmarinus officinalis* and *Syzygium aromaticum* Essential Oils

Widad MOUSSA — Impact of Salinity on Multi-Organ Morpho-Biochemical Parameters (Roots, Aerial Parts, and Cotyledons) of *Pisum sativum* L.

Ba KADIATA — Effects of Natural Biomolecules on Swimming Speed and Oxidative Stress Defence in *Tetrahymena pyriformis*: An Innovative Approach

Juline Diken MALOUNGHOUBOUNANGNAN — Sustainable agriculture: a strategic approach to carbon sequestration in soils and climate change mitigation

Session 6 — One Health Frontiers

Moderators: Mohamed Chakranne – (ISPITS Casa), Kawtar Charaffedine – (ISPITS Casa)

Ayoub BOUHDADI — Computational Study of Metal Phthalocyanine Complexes for Toxic Gas Detection Using DFT

Oumaima EZ-ZAHRAOUI — *In silico* Investigation of Tetracycline Recognition by a DNA Aptamer Using Molecular Docking and Molecular Dynamics Simulations

Kaoutar EL MAHI — Antimelanotic and Antimicrobial Potential of *Lactobacillus plantarum* Cell-Free Supernatant in Deep-Water Pink Shrimp (*Parapenaeus longirostris*) during Chilled Storage

Fatima Zahra KARMIL — Recovery of Highly Reactive Alkaline Earth Oxides from Reverse Osmosis Desalination Brine: Kinetics, Equilibrium, Cost-Effectiveness and Energy Consumption

Kaoutar MENNOUN — Mitigating Biophysicochemical Clogging in Polyethylene Drippers Supplied with Marginal Waters: Towards Water Security and One Health

Hanaa ELKIRI — Detection and Quantification of Heavy Metals in Feed and Poultry Products in Morocco

Hasnae ABOUCHE — Molecular and Phenotypic Characterization of Enteric Viruses in Wastewater from the Rabat-Salé Region (Morocco)

Khadija AOUNI — Climate Change and Urinary Infections in Children: One Health Approach

THURSDAY, 16 APRIL 2026 Parallel Oral Presentation Sessions

Session 7 — Water & Waste Nexus

(Moderators: Karima El Bouqdaoui – ISPITS Casa, Houda El Fane – ISPITS Casa, Khalid El Fihri – ISPITS Casa)

Aicha ASSAL — Sustainable Treatment of Urban Wastewater Using Animal-Derived Biomaterials within a Circular Economy Framework

Oumaima BOUYAKHSASS — Integrated Treatment of Landfill Leachate Using Coagulation, Red Brick Filtration, and Aeration (Kenitra, Morocco)

Amina MARHRAOUI — Integrated Assessment of Surface Water Quality Using Physico-Chemical and Microbiological Parameters and the Diatom Biological Index (IBD): Contribution to Environmental and Health Monitoring

Hamza OUSRI — Assessment of Water Quality and Trophic Status of a Reservoir Fed by Wastewater in a Semi-Arid Region (Hassar Dam, Morocco): Towards Sustainable Resource Management

Hamza RIHANI — Groundwater Pollution and Implications for Ecosystem Health: The Case of the Médiouna Landfill (Morocco)

Khawla WADDI — Treatment of Hospital Wastewater Using a Fungal–Microalgal Co-Culture

Ikrame CHAREF — Comparative Evaluation of Two Mixed Biomass Systems in an MBBR Process for the Treatment of Moroccan Fish-Processing Effluents

Session 8 — Microbial Watch

(Moderators: Amina Drissi – ENSP Rabat, Fatine El Arabi – ISPITS Casa, Abdelhak El Barazi – ISPITS Casa)

Youssef AZIZI — Water Reforms in Morocco: A Political and Health Analysis through the Gill & Walt Framework

Manal NAFAI — Mapping Metagenomics-Based Antimicrobial Resistance Surveillance in Wastewater: A Global Bibliometric Analysis (2004–2024)

Sham FATHALLAH — Environmental Surveillance of SARS-CoV-2 through Wastewater Monitoring in Médiouna, Morocco

Chancia EFOUNTAME NKOGHE EMMELDA NOËL — Bibliometric Analysis of Scientific Production on Thyroid Cancer in Morocco (2016–2026)

Salma BOUZZIR — Detection Methods of *Fusobacterium nucleatum* in the Oral Cavity: A Systematic Review

Brahim JABRI — Species-Level Shift in *Prevotella* and Fungal–Bacterial Interactions in Periodontitis

Khadija BOUKATE — Antibiotic Resistance Profiling of Uropathogenic Enterobacteriaceae in Casablanca, Morocco (2023–2024)

THURSDAY, 16 APRIL 2026 Parallel Oral Presentation Sessions

Session 9 — NutriTech

(Moderators: Fouad Damiri – FS Ben M'Sick, Brahim Darraj – ISPITS Casa, Sanaa Deblij – ISPITS Casa)

Seloua ESSAIH — Nutritional Value of Some Traditional Recipes Based on Wild Edible Plants Using the DIAL Program and Bilnut Software

Barae ABAIDA — From Terroir to Quality: Factors Shaping Product Characteristics

Aicha BOUBKER — Chemical Characterization of Phytobiotic Formulations and Assessment of the Synergistic Effects of Plant Extracts on Zootechnical Performance in Poultry

Fatimazahra JOUGA — Probiotics and Their Contribution to Sustainable Aquaculture Development

Oumayma LAASSILIA — Assessment of Nutritional Status, Biochemical Profiles, and Dietary Habits Related to Depression in Haemodialysis Patients in Morocco

Mohamed LAHRAIRI — Innovations in Non-Dairy Probiotics: Valorising Moroccan Almond Biodiversity through Kefir Fermentation

Session 10 — PhytoTech

(Moderators: Madiha El Ghamrasni – ISPITS Casa, Khaddouj El Goundali – ISPITS Casa, Naila El Hazzat – ISPITS Casa)

Amal AOUMRANI — Medicinal Plants and Male Fertility: Towards Innovative Strategies in Reproductive Health

Omaima BOUDAIA — Comparative Assessment of *in vitro* Cytotoxicity and *in vivo* Acute Toxicity of Flavonoid Extracts from *Tetraena gaetula*

Oumaima MABCHOUR — Enhanced Purification of R-Phycoerythrin from *Gelidium corneum* and Assessment of Its *in vitro* Antioxidant Activity

Ghizlane NOUIOURA — Phenolic Profile and Safety Evaluation of a Moroccan Aqueous Polyherbal Formulation Containing *Petroselinum crispum* L., *Coriandrum sativum* L., and *Apium graveolens* L.: Acute and Sub-Acute Toxicity

Loubna OUAHMANE — Chemical Composition and Antioxidant Activity of Four Essential Oils Extracted from Moroccan Citrus Peel Varieties

Mariem QOSTAL — Evaluation of Antioxidant and Antihyperglycaemic Activities of Different Extracts of *Juniperus phoenicea*

Zakia ZOUAOUI — Biotechnological Potential of *Schinus terebinthifolius* Raddi: A Natural Strategy to Mitigate Oxidative Stress and Glycation in Diabetes Management

Sofia MASBAH — Ageing and environmental risk exposure : insights into mechanisms of vulnerability

FRIDAY, 17 APRIL 2026 Parallel Oral Presentation Sessions

Session 1 — BioSolutions

(Moderators: Sanaa El Jamal – ISPITS Casa, Samira El Kababi – ISPITS Casa, Wissam El Idrissi El Machtani – ISPITS Casa)

Yasmine KHALKI — Algal Biotechnologies for the Reduction of Microplastics in Aquatic Environments

Ilyass BELRHAZI — Catalytic Pyrolysis of Plastic Waste Using Co-MOF-Incorporated Zeolite for Enhanced MAHs Production

Fatima Zahra KARMIL — CTAB-Functionalised Fly Ash Geopolymer for Dual-Dye Removal: Mechanistic Insights, Reusability, Biosafety, and Antimicrobial Properties

Soukaina LAGHOUITA — Effect of Salinity Stress on *in vitro* Germination of Chickpea: An Integrated Approach to Root Responses

Najwa RABAH — Effects of Drought Stress and Varietal Responses during Germination and Early Seedling Growth of Moroccan Wheat Varieties

Soukayna JARJINI — Plant Growth-Promoting Rhizobacteria: A Sustainable Solution to Agricultural Challenges and Public Health Issues

Yasmina MOUZOUN — Cyanobacterial Toxins: Diversity and Biological Impacts

Asmae AIT SIDI ALI — Innovative Multifunctional Agricultural Inputs Derived from Biomass

Session 2 — NutriCare

(Moderators: Nadia Errafiy – UM6SS Casablanca, Morocco, Hind Essfadi – ISPITS Casa, Imane Ettaki – ISPITS Casa)

Sihame DARIA — Malnutrition in Digestive Surgery

Fatine EL ARABI — Nutritional Care for Frail Elderly People: Who Should Be Prescribed Oral Nutritional Supplements in Hospital and at Home, and How?

Khaddouj EL GOUNDALI — Very Preterm Birth in Morocco: The Role of Maternal Vulnerability and Neonatal Factors

Samira EL KABABI — A Systematic Review and Meta-Analysis of the Effects of Vitamin D on Systemic Lupus Erythematosus

Karim EL MOUNS — Physical Performance and Psychological Stability across Menstrual Cycle Phases in Elite Female Athletes

Marouane OUIRDANI — Bridging the Nutritional Care Gap: Nurse-Led Education for Potassium Control in Haemodialysis Patients

Souad EL HAMDAOUI — Body Image Perception and Eating Behaviour Among Moroccan Adolescents

Anouar RAFIK — Assessment of Knowledge, Perceptions, Sustainable Eating Habits, and Adherence to the Mediterranean Diet among ISPITS Students in Safi

FRIDAY, 17 APRIL 2026 Parallel Oral Presentation Sessions

Session 3 — PrecisionDx

(Moderators: Imen Ghazlane – ISPITS Casa, Safaa Hadrach – ISPITS Casa, Bouchra Jeddi – ISPITS Casa)

Mohamed ACHMIT — Contribution of the Bichro-Dubli Fumouze Assay to the Identification of *Candida dubliniensis*: Comparison with PCR

Aicha BAALALA — Gastric Juice pH as a Potential Biomarker for Precancerous Changes: Exploratory Insights from a *Helicobacter pylori*-Endemic Cohort

Hasnae BEN KACEM ZIANI — Reliability of the Nijmegen–Bethesda Assay for FVIII Inhibitor Measurement in the Era of Non-Factor Therapies

Wiam FAYED — Molecular Diagnosis of Myopathies Using Next-Generation Sequencing: Moroccan Clinical Cases

Fatima Zahra KHEIR — Prevalence of *Helicobacter pylori* CagA and VacA Virulence Markers in Moroccan Children and Adolescents

Khalid LAAZIRI — Frequency of HLA-A, -B, -DRB1, and -DQB1 Alleles in Moroccan Adult Patients with Acute Myeloid Leukaemia: A Case–Control Study

Mohamed OUSSI — Pan-Genomic and Core Genome Analysis of *Helicobacter pylori*: Genomic Diversity and Biomarkers Predictive of Gastric Carcinogenesis

Session 4 — Antimicrobial Frontiers

(Moderators: Kaoutar Hichami – ISPITS Casa, Asmaa Hrioua – ISPITS Casa)

Assya AHARRAR — Safety and Antibacterial Efficacy of Plant-Derived Nanoparticles and Essential Oils against *Enterobacter* spp.

Mehdi BOURAQ — Essential Oil of the Moroccan Endemic *Cladanthus scariosus*: Antibacterial and Antioxidant Potential

Amal DAGNI — Moroccan *Dysphania ambrosioides* Essential Oil: A Natural Source of Antimicrobial, Antibiofilm, and Antioxidant Agents

Soukaina ELJAOUAHIRY — Computational Screening and Antibacterial Activity of *Pistacia atlantica* Essential Oils

Hajar ELMOURABIT — Prevalence, Serotype Distribution and Antimicrobial Resistance of Non-Typhoidal Salmonella Isolated from Human Clinical Infections

Badr-Ddine EL MOUNS — Moroccan Red Macroalgae: A Sustainable Source of Eco-Friendly Antifungal Agents

FRIDAY, 17 APRIL 2026 Parallel Oral Presentation Sessions

Session 5 — Public Health Nexus

(Moderators: Hamza Kammous – ISPITS Casa, Mohamed Taha Kensouss – ISPITS Casa, Meftah El Khair Meryem – FS Ben M'sick)

Mohjat BELAATAR — Physical, Psychological, and Sexual Violence as Risk Factors for Mental Disorders among Students at Abdelmalek Essaâdi University

Hiba BENCHEHIDA — The Influence of the Digital Environment on Eating Habits and Risk of Obesity among Moroccan University Students and Impact on Prevention of NCDs

Nawal ELOMARI — Quality of Life of Adults with Diabetes in the Prefecture of Meknès: Assessment and Associated Factors

Hamid FARHANE — Prevalence of Metabolic Disorders and Undiagnosed Metabolic Syndrome in an Apparently Healthy Moroccan Population

Kaoutar HICHAMI — Informal Social Networks and Inequalities in the Management of Chronic Diseases

Chaimae MOUJAHID — Social Influences on Contraceptive Use among Rural Moroccan Women

Session 6 — Care Systems

(Moderators: Amina Lhbibi – ISPITS Casa, Laila Maghfour – ISPITS Casa, Naima Mohssine – ISPITS Casa)

eb AIT ERROUHI — Systematic Review of Clinical Practice Guidelines for the Assessment and Management of Cognitive Impairment in Patients with Cancer

Wajiha EL AFAKI FELLAH — Optimizing the Pre-Analytical Phase of Direct Immunofluorescence in Renal Biopsy: A Quality Management Framework

Khalid EL FIHRI — The Importance of Biomedical Engineers for Effective Healthcare Systems

Wafaa ELISFI — Benefits of ISO 7101:2023 for Quality Management Systems in Healthcare Services

Soukaina ELMOUTAOUAKIL — Assessment of Educational Needs and the Potential Role of the Advanced Practice Nurse in Managing Urinary and Sexual Toxicities Following Radiotherapy for Prostate Cancer

Fatima Ezzahra FERNANE — The Impact of NANDA-I, Nursing Interventions Classification (NIC), and Nursing Outcomes Classification (NOC) on the Improvement of Nursing Practice Worldwide: Systematic Review

Sanaa TOUZAMI — Community Nurses in Low- and Middle-Income Countries: Systematic Integrative Review of Roles, Barriers, and Improvement Perspectives

Reda MHAREK — Burnout Among Healthcare Professionals In Pandemic And Post-pandemic Contexts

FRIDAY, 17 APRIL 2026 Parallel Oral Presentation Sessions

Session 7 — Health Innovation

(Moderators: Malika Naman – ISPITS Casa , Fatima Zahra Ndadani – ISPITS Casa)

Hamid NAJEH — Role of the Alu PV92 Insertion Polymorphism of the CDH13 Gene in Susceptibility to Metabolic Syndrome in Southern Morocco

Zineb SEKKOUT — Modulation of Leukocyte Recruitment by Alkaloids Isolated from *Smyrniolus olusatrum* in Acute Inflammation

Rachid KHOUBBANE — Impact de la Digitalisation sur la Nouvelle Gouvernance Publique au sein de l'ISPITS Casablanca

Lamyaa TALHA — Managers' Emotional Intelligence and the Professional Autonomy of Healthcare Teams: The Case of Ibn Rochd University Hospital Centre in Casablanca

Yassine ELMATOUGUI — Toward Eco-Responsible Hospital Laboratories: Integrating Environmental Sustainability into Quality Management Systems to Enhance Healthcare Safety

Safaa HADRACH — Dose Assessment in Cerebral Radiosurgery: A Comprehensive Dosimetric Evaluation

Touhfa JMARI — Environmental Analysis and Evaluation of Public and Private Hospitals Wastewater in the Greater Casablanca Area

Nabila MSATFA — Perceived Quality of Care and Its Effect on Neonatal Survival: A SERVQUAL Based Analysis in Moroccan Hospitals

Session 8 — SafeCare

(Moderators: Myriem Narjis – ISPITS Casa, Samira Natoubi – ISPITS Casa)

Hajar OUAKEUR — Microbiological Safety and Quality of Hospital Meals: Evaluation of HACCP, Traceability, and Patient Satisfaction

Rachida ERRAHLI — Assessment of Practices and Risk Analysis during the Pre-Analytical Phase of a Medical Biology Laboratory in Morocco

Samar AL HETAILAH — Dietary Supplements and Irritable Bowel Syndrome: Efficacy, Mechanisms of Action, and Role of FODMAPs in Management

Mariya HORCHI — Health Risk Prevention and Optimization of Patient Care: Challenges and Innovations

Fatima HOUSNI — The One Health Approach as a Strategic Lever for the Successful Reform of the Moroccan National Health System

Abdessamad OUASFI — Assessing Knowledge of the Risks Associated with Ionising Radiation among Nurses Working in Operating Rooms in Moroccan Hospitals

Chaimaa EL MOUBCHIRI — Prevalence and Correlates of Substance Use among Middle and High School Students in Settat Province, Morocco

FRIDAY, 17 APRIL 2026 Parallel Oral Presentation Sessions

Session 9 — EduTech

(Moderators: Mohamed Omari – ISPITS Casa, Asmaa Ouchen – ISPITS Casa, Jalila Outalha – ISPITS Casa)

Khadija DAOUDI — Psychometric Characteristics of Roter Interaction Analysis System (RIAS) in the Context of Health Education in a Moroccan School

Asmaa GHAFILI — Barrows Card Games as an Innovative Teaching Strategy in Health Sciences Education: A Cross-Disciplinary Application

Imane GHAZLANE — Reflective Approach and Mentorship in Nursing Sciences: Perceptions, Practices and Professional Challenges

Hajare KERAZI — Preventive and Educational Approaches to Mental Health in Young People: A Literature Review

Khalid MARNOUFI — The Relationship Between Mental Arithmetic Proficiency and AI-Supported Learning

Sohaila MOUSTAID — Perception of Learning Mechanisms and Andragogical Alignment of the Virtual Environment for Radiotherapy Training (VERT) in Medical Physics Education

Zineb ZINE EL ABIDINE — Teaching Sociology in the Digital Age

Session 10 — SocioHealth

(Moderators: Rabia Qaisar – ISPITS Casa, Qualid Razzok – ISPITS Casa, Mouad tantaoui – ENSM Moulay Ismail University)

Mina BENADDI — Simulation Training Impact on Midwives' Students' Skill Retention in Shoulder Dystocia Management

Fatima DAHRA — Adulteration of "Natural" Products Promoted for Weight Gain on Moroccan Social Media Platforms

Reda EL BOUKHARI — Mapping the Patent Landscape of Aromatic and Medicinal Plants in Moroccan Universities

Khalid MARNOUFI — Mental Arithmetic Proficiency as a Predictor of Academic Achievement

Imane MORSSLI — The Impact of Sociodemographic Characteristics of Beekeepers on the Productivity and Sustainability of Beekeeping Operations in Morocco

Aziz RAZOKI — The Precautionary Principle in the Face of Environmental Uncertainties

Khadija REGUIAI — Integration of Artificial Intelligence in Moroccan Hospitals: Strategic Challenges and Opportunities for the Quality of Care

Aziza EL BAZ — Standardized Cadaveric Protocol for Morphometric and Histological Mapping of the Human Pudendal Nerve

FRIDAY, 17 APRIL 2026 Parallel Online Presentation Sessions

Session — EpiHealth

Sessions Coordinator Prof Nadia Ghosne

(Moderators: Hind Berradi – ISPITS Casa, Rihabe Boussette – ISPITS Casa)

Rachid AIT HAMMOU — Prevalence of Diabetic Nephropathy and Its Association with Glycaemic Control and Diabetes Type among Adults

Lahcen BIDARNE — Seroprevalence, Risk Factors, and Prediction of Hepatitis B, Hepatitis C, and HIV among Haemodialysis Patients

Othmane DARBAL — Multi-Model Analysis of COVID-19 Vaccination Dynamics among Young Children in France: A Data-Driven Approach

Rkia EDDABRA — Diagnosis Delay of Breast Cancer among Women at the Regional Oncology Center in Laayoune, Morocco

Mohammed GOURARI — Étude de la prévalence des parasites intestinaux chez l'homme dans la région de Marrakech-Safi

Yasmine MODRAK — Climatic Factors and Predictive Modelling of Scorpion Envenomation in Errachidia City, Morocco

Ahmed OUABRK — Evaluation of Burnout Syndrome among Healthcare Professionals in Morocco: A Systematic Review

Ahmed OUBAASRI — Feature Importance Analysis of Tuberculosis Treatment Non-Adherence in the Guelmim Region Using Machine Learning

Bouchra TARCHOUN — Early Adiposity Rebound as a Predictor of Metabolic Programming during the First 1 000 Days: Implications for Lifelong Health

Session — WaterTech

(Moderators: Ouassima Riffi – ISPITS Casa, Fatima Ezzahra Rihane – ISPITS Casa)

Asmae ALAMI KASRI — Bridging Governance and Innovation: Biotechnology-Enhanced IWRM for Sustainable Water Management in Morocco

Driss AZDEM — Advances in Solar-Driven Desalination: Emerging Materials, Processes, and Challenges for Sustainable Freshwater Production

Ayoub BELAIDI — Predicting the Ecotoxicological Toxicity of Aquatic Contaminants Using Graph Neural Networks

Miloud BELHIMER — Contribution au biomonitoring des éléments traces métalliques au niveau de la lagune de Oualidia (NW du Maroc) et évaluation des risques écologiques et sanitaires associés

Fadila BOUKHOUBZA — Assessment of Groundwater Quality in the Marrakech Region Following Olive Oil Wastewater Storage in Surrounding Areas

Hala HARIFI — Artificial Intelligence for Detecting and Predicting Heavy Metal Water Contamination: Health Consequences and Sustainable Prevention Strategies

Ilyasse LOULIDI — Adsorption Behaviour and Mechanistic Insights into Crystal Violet and Hexavalent Chromium (Cr(VI)) Removal Using Spent Coffee Grounds in Single and Binary Systems

C.Halioui — Interfacial behavior of naphthalenyl-benzimidazole derivatives on carbon steel: An integrated experimental and computational study

FRIDAY, 17 APRIL 2026 Parallel Online Presentation Sessions

Sessions Coordinator Prof Nadia Ghosne

Session — EnviroChemTech

(Moderators: Sanaa Seddik – ISPITS Casa, Amal Tazzite – ISPITS Casa, Zineb Zine El Abidine – ISPITS Casa)

Aziz AIT-KARRA — Preparation of CoS₂ Nanostructures for Efficient Removal of Organic Pollutants from Aqueous Environments

Asmaa BOUABBADI — Electrochemical, Thermodynamic, and Theoretical Studies of 8-Hydroxyquinoline Derivatives Used as Acid Corrosion Inhibitors for Mild Steel

Salma BOUANAN — Comprehensive Neutronic Study of a Single i-SMR Fuel Assembly: Burnup-Dependent Reactivity Coefficients, Power Peaking, Fission Product Accumulation, and Effective Multiplication Factor Evolution

Yousra BEHJA — Environmentally Friendly Treatment of Primary Wastewater Using Natural Adsorbent Mixtures

Nora ELOUHABI — Phosphate Derivatives from Solid-State Synthesis for Carbon Steel Corrosion Inhibition in Hydrochloric Acid

Youssef EL JOUD — Ecological Determinants of Scorpion Envenomation Severity: Integrating Environmental Biology and Public Health

Khawla RACHMOUNE — Biotechnological Evaluation of Chitosan-Based Systems for Enhancing Antioxidant Enzyme Response under Ionising Radiation Exposure

Fatima TIZAR — Anti-Adhesive Effects of *Chlorella* sp. Ethanol Extract on Foodborne Pathogens Adhering to 316L Stainless Steel

Yassine ZNAKI — A survey on blockchain based pharmaceutical supply-chain management and drug distribution

Session — FoodBio

(Moderators: Khadija Aboulaala – ISPITS Casa, Abdessamad Amine – FSTM, Houria Abdelghaffar – FSTM)

Boujemaa EL MARNISSI — Analyse des pratiques et protocoles de sécurité alimentaire dans un centre hospitalier marocain

Aboujihad ENNAJAR — Impact of Digital Marketing on the Migration and International Mobility of Healthcare Professionals: The Case of Eastern Morocco

Selma MABROUKI — Comparative Study of in Vitro Antidiabetic and Antiglycation Properties of Methanolic Extracts from *Sargassum vulgare* and *Sargassum muticum*

Habiba NECHCHADI — Preventive Effects of *Cynara cardunculus* L. var. *ferocissima* Leaves against Hyperlipidaemia and Liver Disorders in Wistar Rats

Basma SAADANI — Occupational Health and Safety (OHS) Management in Moroccan Hospitals: Challenges and Opportunities in the Context of Health System Reform

Adil SAHILI — Population Characteristics of Atlantic Chub Mackerel (*Scomber colias* Gmelin, 1789) in the Northwestern Atlantic Coast of Morocco

Wissal CHOUACHA — Improving the Quality and Shelf Life of Fish Oils: Role of Refining Processes and Synthetic Antioxidants

Mouad JLIYAKH — Salt-Induced Effects on Germination and Osmoregulatory Responses of Common Bean (*Phaseolus vulgaris* L.): Implications for Varietal Selection under Saline Conditions

Mariam SABRI — Comparative Study of Maceration and Ultrasound-Assisted Extraction of *Euphorbia echinus* and Its Potential Antimicrobial Activity

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- Ridouane ABDELOUAHID** — Sociodemographic and Epidemiological Profile of Tuberculosis Patients in the Marrakech-Safi Region: Analysis of CDTMR Data
- Rajaa ADNANE** — Hand Hygiene Practices in Morocco: Current Situation and Future Perspectives for the Prevention of Healthcare-Associated Infections
- Hasna AHYAYAUCH** — PFAS in Tap Water: A Comparative Study Between Madrid and Moroccan Cities
- Mohammed AIBOUDI** — Valorization of Red Onion as a Natural Source of Antioxidants: Green Extraction and Evaluation of Antioxidant Potential for a Sustainable Approach
- Chaimae AIT BELAASRI** — Sterilization of Medical Devices in Morocco: Current Practices, Regulatory Framework, and Compliance with International Standards
- Chaimaa AL MALKI** — Late Diagnosis of Autism in Morocco: An Analysis of the Risks to Child Development and Management Strategies within the Healthcare System
- Noura AOUSSAR** — Use of Medicinal Plants in the Management of Gynaeco-Obstetric Disorders in the Province of Essaouira (Morocco): An Ethnobotanical Survey
- Maryem AQZIZE** — Wastewater Treatment and Valorization at the Skhirat Wastewater Treatment Plant: From Technical Performance to Ecological and Agronomic Innovation
- Danya ARGIG** — Transformation of the Landscape of the Étang de la Galiotte: Spatial Dynamics and Territorial Issues
- Fatima ASLAOU** — Health Risk Assessment of Nitrate Contamination of Surface Water in Nador Canal, Morocco
- Fatima ASLAOU** — Public Service Motivation and Work Performance of Health Professionals
- Asma AZEKOUR** — Biotechnological Valorization of Organic Residues for Sustainable Soil Restoration and Enhanced Water Retention
- Aicha BAALALA** — Prevalence of Helicobacter pylori in Moroccan Adults: Assessing Socio-Demographic Links and Gastric Lesion Severity
- Amal BADOUI** — Development of a Decision Support Tool for Prioritizing Interventions to Reduce Losses in Drinking Water Networks
- Fatima Ezzahra BELARREM** — A Decision-Support Framework for Economic Leakage Management in Large Urban Water Distribution Systems
- Ichraq BEN ELFKIH** — Potential Use of Sargassum muticum as a Source of a Plant Biostimulant for the Germination and Growth of Radish (Raphanus sativus L.) Using Eco-Friendly Extracts for Sustainable Agriculture
- Rim BENHIDA** — Prevalence of Irritable Bowel Syndrome: Results of a Cross-Sectional Study in Morocco
- Salahdine ZEROUAL** — Hospital Waste in Morocco: Organizational Challenges and Environmental Safety Issues
- Nisrine BLIL** — Beyond Phragmites: A Bibliometric Analysis for Diversifying Macrophytes in Constructed Wetlands

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- Khadija BOUKATE** — Epidemiological and Antimicrobial Resistance Trends of Escherichia coli Isolated from Urinary Tract Infections
- Imane BOUNJERTE** — Key Challenges in Implementing a Quality Management System in a Moroccan Medical Laboratory
- Zakaria BOUZAR** — Biochemical Characterization and Traditional Uses of Citrus aurantium within a Circular Economy Framework: Perspectives on Waste and Wastewater Valorization
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- Fatima Zahrae CHAHHOUR** — MR Imaging of Paediatric Brain Tumours
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- Assia DARDOURI** — Intracellular Perinuclear Bacteria in Breast Cancer Cells Identified by FISH
- Chifae DAZIA** — Association of KCNJ11 Gene Variants with Diabetes Susceptibility: Insights from GWAS and Meta-Analysis Studies
- Hanaa DBILIJ** — Prevention of Infectious Risk in Trauma and Orthopaedics: A Critical Review of Aseptic Practices in the Operating Theatre
- Salma DOUMAOU** — Healthcare-Associated Infections
- Kenza EL AOUME** — Using Marine By-Products and Plant Resources to Develop Biodegradable Food Packaging: The Case of Shrimp-Derived Chitosan and Carob
- Fatima EL ASRI** — Evaluating Ecological Quality, Biodiversity, and Spatiotemporal Changes of Macrozoobenthic Assemblages in Dakhla Bay, Morocco
- Mohammed EL FAL** — Synthesis and Biological Activity of New Spiro[thiadiazole-allopurinol] Derivatives
- Nisrine EL KORI** — Biocontamination of Healthcare Surfaces in Moroccan Healthcare Settings: Implications for Healthcare-Associated Infections (HAIs)
- Zakaria ELFATOUAKI** — Physical Properties of Novel Sr_2BNbO_6 (B = Al, Ga) Double Perovskite Oxides: An Ab Initio Study
- Khaoula ELGHAZALI** — TMPRSS2 rs12329760 Variant as a Potential Prognostic Biomarker in Prostate Cancer
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- Amina GIHBID** — Sexually Transmitted Infections among Moroccan Women: Assessment of Knowledge and Associated Determinants
- Nada HANCHI** — Microbiological Indoor Air Quality in Moroccan Public Hospitals: Environmental Risks and Implications for Infection Prevention and Control (IPC)
- Saad HARRIZI** — BULMA: A Stress-Responsive Atlas of ATP-Binding Cassette Transporters in *Saccharomyces cerevisiae* Using Active Learning and Causal Inference
- Otmane JEDDI** — De la Biotechnologie Végétale à l'Application Clinique: Rôle de la Vitamine E dans le Stress Oxydatif chez les Patients Schizophrènes
- Chaimaa JRAMY** — Natural Selection Patterns and Multiethnic Distribution of Pathogenic Mutations in MODY
- Nozha KACHI** — Quality of Life of Haemodialysis Patients: A Comparative Study of Public and Private Dialysis Centres
- Boutaina KASDI** — Diagnosis and Complications of Sarcopenic Obesity in Older Adults
- Yassmine KHALDOUNI** — First Evaluation of Microplastic Contamination in Moroccan Coastal Sands Using the Harmonised NUTEC Plastics Protocol
- Ibtissam KHOUDIRI** — Differences in Physical Qualities and Lower-Limb Asymmetries in Female Soccer Players with a History of Ankle Sprain: A Comparative Study
- Amina LHBIBANI** — Knowledge, Attitudes and Intention to Use Generative Artificial Intelligence among Physiotherapy Students at the ISPITS of Casablanca
- Manar MAKHLOUK** — Breastfeeding during the First 1000 Days: A Major Preventive Lever against Metabolic and Neurocognitive Disorders in Children
- Yasmine MASTARI** — Development of Microorganism-Based Biopesticides for the Sustainable Control of Agricultural Pests
- Fedwa MELAYLOU** — Mapping the Evolution of Molecular Techniques for Detecting Methicillin-Resistant *Staphylococcus aureus*: A Bibliometric Perspective
- Nadira MOURABIT** — Système Management Qualité et Sécurité des Patients au Niveau du Centre Hospitalier Régional du Nord du Maroc
- Outhman MOUSSI** — Quality and Risk Management in Medical and Pharmaceutical Waste Handling: Hospital Practices Assessment and Improvement Perspectives
- Manal NAFAI** — Uropathogen Spectrum and Antimicrobial Resistance Patterns in Hospital- and Community-Acquired Urinary Tract Infections at Al Hoceima Hospital Centre, Morocco
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Amal TAZZITE — Genetic Risk of Cardiotoxicity in Breast Cancer Management

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Khawla WADDI — Solid Hospital Waste: Sources, Risks, and Sustainable Management Approaches

Soufiane YASSARA — BRAF Mutation Profile in Moroccan Colorectal Cancer: A Large North African Series

Nisrine YASSINE — Phytotherapy and Drug Interactions in Older Adults with Type 2 Diabetes: Evidence Synthesis and Clinical Recommendations

Salaheddine ZEROUAL — Hospital Waste in Morocco: Organizational Challenges and Environmental Safety Issues

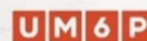
Malika NAMAN — Circular economy: bio-waste recovery and recycling practices.

RAJAA ADNANE — Quality Management and Water-Related Risk Prevention in Moroccan Hospitals



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Institutional partners



Contact for CIIES26 Enquiries

Remote Sessions (Oral Presentations)

Remote Sessions Coordinator

Prof Nadia Ghosne

 +212 6 64 92 32 98

 nghosne@yahoo.com

General Enquiries & Remote Participation Support

Remote Access and Participation Coordinator

Prof Oualid Razzok

 +212 6 04 79 05 03

 oualid.razzok@ispitsme.com

Scientific and Organisational Coordination

Prof Bouchaib Bahlaouan

 ISPITS Casablanca – AMSTES

 +212 6 61 38 93 85

 b.bahlaouan@ispitscasa.ac.ma

Prof Nadia Boutaleb

 Hassan II University of Casablanca – FSTM / AMSTES

 +212 6 61 48 50 88

 nadia.boutaleb@fstm.ac.ma

This abstract corresponds to the conference presentation delivered by **Dr Michael Brett-Crowther** at the 6th International Congress on Industry, Environment, and Health (CIIES26), held in Casablanca from 15 to 17 April 2026.

The Role of Artificial Intelligence

Dr Michael Brett-Crowther 

Editor, Natural Built Social Environment Health 1 rue des Albizias, Queue d'Ageasse, 79190 Lorigné,
Deux-Sèvres, France

E-mail: drmichaelbrettcrowther@gmail.com



Author Profile

Dr Michael Brett-Crowther is a multidisciplinary expert with over thirty years of academic and editorial experience spanning environmental and health sciences, water and environmental management, artificial intelligence, and sustainable development. As Editor-in-Chief of *Natural Built Social Environment Health (NBSEH)*, he promotes scientific rigour, open science, editorial integrity and international scholarly cooperation, while fostering dialogue across disciplines and scientific communities

Abstract: Artificial Intelligence, a product of human intelligence rather than its equivalent, offers remarkable opportunities in medicine, science and society, yet raises profound concerns about control, ethics, inequality, military misuse and the uncertain pursuit of Artificial General Intelligence. Recognising AI's considerable benefits, the author argues that authentic human consciousness, with its freedom, unpredictability and moral judgement, remains superior, and that only development guided by ethics and the common good can ensure AI serves humanity rather than threatens it.

Keywords: *Artificial Intelligence (AI), Human Consciousness, Ethic*

This abstract corresponds to the conference presentation delivered by **Dr Youness Ahallal** at the 6th International Congress on Industry, Environment, and Health (CIIES26), held in Casablanca from 15 to 17 April 2026.

The Role of Artificial Intelligence

Dr Youness Ahallal 

Consultant Urologist & Onco-Urologist, Internationally Recognised Moroccan Surgeon

E-mail: ahallalyouness@gmail.com



Author Profile

Dr Youness Ahallal is a Moroccan urological surgeon specialising in urologic oncology, minimally invasive and robotic surgery, and telesurgery. Trained in Morocco, the United States and France, he developed advanced expertise in robotic surgery through leading international medical environments. Since returning to Morocco in 2025, he has contributed to the development of robotic surgery and telesurgery, including an international telesurgery procedure performed between Shanghai and Casablanca over a distance of approximately 12,000 km. His work also focuses on expanding access to advanced surgical technologies, training healthcare professionals and supporting the development of robotic surgery across Africa

Abstract: The conference explores the potential of robotic surgery to improve healthcare and deliver wider benefits to populations. It also highlights the importance of integrating robotic surgery into healthcare systems to make surgical innovation more accessible and effective.

Keywords: *Robotic Surgery, Healthcare Integration, Patient Outcomes*

This abstract corresponds to the conference presentation delivered by **Prof Olivier Sire** at the 6th International Congress on Industry, Environment, and Health (CIIES26), held in Casablanca from 15 to 17 April 2026.

The Role of Artificial Intelligence

Prof Olivier Sire 

IRDL, UMR CNRS 6027, University of Bretagne Sud, Bretagne INP, ENSTA, Institut Polytechnique de Paris, Univ. Brest, Lorient, France.

E-mail: olivier.sire@univ-ubs.fr



Author Profile

Prof. Olivier Sire is a French biophysicist and Professor Emeritus at the University of South Brittany (UBS), with over four decades of academic experience in biochemistry, microbiology, biofilms and environmental sciences. Former President of UBS (2010–2012), his research and teaching have notably addressed microbial biofilms and their interactions with water and industrial systems. He is an Officer of the Ordre des Palmes Académiques and a Knight of the Ordre National du Mérite

Abstract: Biofilms are complex microbial communities that play contrasting roles in industrial water systems, where they may contribute to useful biological processes or represent significant operational and health risks. This presentation examines the mechanisms governing biofilm formation and colonisation, with particular attention to surface materials, water characteristics and hydrodynamic conditions, and discusses examples from drinking-water networks, food and livestock systems, fermentation processes and cooling towers. Emphasis is placed on understanding, monitoring and controlling biofilms to support safer and more effective management of industrial water systems.

Keywords: *Industrial Water, Microbial Colonisation, Biofilm Control*

This abstract corresponds to the conference presentation delivered by **Dr Khadija Khataby** at the 6th International Congress on Industry, Environment, and Health (CIIES26), held in Casablanca from 15 to 17 April 2026.

Biotechnologie et intelligence artificielle au service de l'oncologie de précision : opportunités et défis au Maroc

Dr Khadija Khataby 

Al Faraby Drugs Company

E-mail: khadija.khataby@gmail.com



Author Profile

Dr Khadija Khataby is a Moroccan scientist and Acting Industrial Director at Al Faraby Drugs Company, specialising in virology, molecular biology, biotechnology and biological pharmaceuticals. Her doctoral research focused on avian coronavirus and vaccine development, earning recognition for her PhD work at Hassan II University of Casablanca. Combining scientific expertise with pharmaceutical industry experience, she is currently involved in industrial performance, quality and continuous improvement within pharmaceutical manufacturing.

Abstract: This conference explores how biotechnology and artificial intelligence can advance precision oncology through improved diagnosis, treatment personalisation and therapeutic innovation. It also highlights the opportunities and key challenges for their integration within the Moroccan healthcare and pharmaceutical ecosystem.

Keywords: *Biotechnology, Artificial Intelligence, Precision Oncology, Morocco*

This abstract corresponds to the conference presentation delivered by **Dr Véronique le Tilly** at the 6th International Congress on Industry, Environment, and Health (CIIES26), held in Casablanca from 15 to 17 April 2026.

Micro- and Nanoplastics: A Challenge for Ecosystem and Human Health

Dr Véronique Le-Tilly 

IRDL, UMR CNRS 6027, University of Bretagne Sud, Bretagne INP, ENSTA, Institut Polytechnique de Paris, Univ. Brest, Lorient, France.

E-mail: veronique.le-tilly@univ-ubs.fr



Author Profile

Dr Véronique Le Tilly is Associate Professor of Biophysics at the University of South Brittany (UBS) and a researcher at IRDL. She is an expert in endocrine disruptors and their biological and health risks, with particular expertise in oestrogen receptor activity and regulation, oestrogenic endocrine-disrupting chemicals, and biomolecular interactions. Her research also addresses emerging environmental contaminants, including micro- and nanoplastics, and their interactions with biological systems. She is a member of the Académie des Sciences et des Lettres de Bretagne and a Knight of the Ordre National du Mérite.

Abstract: This conference examines the growing challenge posed by micro- and nanoplastics in ecosystems and their potential implications for human health. It addresses their environmental occurrence, fate, biological interactions and transfer through food chains, while highlighting emerging health concerns and the need for improved monitoring, risk assessment and prevention.

Keywords: *Microplastics, Nanoplastics, Ecotoxicology, Environmental Pollution*

CONFERENCE ABSTRACT

This abstract corresponds to the conference presentation delivered by *Dr Alla Silkina* at the 6th International Congress on Industry, Environment, and Health (CIIES26), held in Casablanca from 15 to 17 April 2026.

Integrating Brewery CO₂ Capture with Algal Valorisation: Technical Potential and Sanitary Constraints

Alla Silkina 

*Algal Research Group, Department of Biosciences, Swansea University, Singleton Park,
Swansea, Wales SA28PP, United Kingdom*

E-mail: a.silkina@swansea.ac.uk



Author Profile

Dr Alla Silkina is an algal biotechnologist based at Swansea University, UK. Since 2010, she has led applied research on microalgal physiology and cultivation. Her work includes bioremediation, pigment extraction, and the use of waste streams in algal processes. She earned her Ph.D. in marine biotechnology from the Université de Bretagne Sud, France. Her expertise covers large-scale culture systems and the development of bio-based products from algal biomass.

Abstract: This conference explores the integration of brewery CO₂ capture with microalgal cultivation, transforming industrial carbon emissions into valuable algal biomass and bioproducts. It highlights the technical potential of this circular approach while considering the sanitary and operational constraints associated with biomass valorisation.

Keywords: *Microalgae, Brewery, Biomass Valorisation, Circular Economy*

This abstract corresponds to the conference presentation delivered by *Prof Fatima Zahra Ndadani* at the 6th International Congress on Industry, Environment, and Health (CIIES26), held in Casablanca from 15 to 17 April 2026.

Assessment of marine pollution : Occurrence of priority contaminants, risk assessment and implications for public health

Dr Fatima Zahra NDADANI 

Laboratory of Care, Health and Sustainable Development, Higher Institute of Nursing Professions and Health Techniques, Casablanca, Morocco

E-mail: f.ndadani@gmail.com



Author Profile

Dr Fatima Zahra Ndadani is a researcher at the Laboratory of Care, Health and Sustainable Development, Higher Institute of Nursing Professions and Health Techniques, Casablanca, Morocco. Her research focuses on marine pollution, chemical contaminants in fishery products, environmental risk assessment and public health, with particular interest in polycyclic aromatic hydrocarbons (PAHs) along the Moroccan coastline

Abstract: This study assesses polycyclic aromatic hydrocarbon (PAH) contamination in fishery products along the Moroccan coastline and its potential implications for public health. Although PAH concentrations varied across species and sampling sites, detected levels remained below Moroccan and European regulatory limits, indicating no identified risk to Moroccan consumers.

Keywords: *Marine Pollution, PAHs, Fishery Products, Risk Assessment, Public Health*

CONFERENCE ABSTRACT

This abstract corresponds to the conference presentation delivered by *Johanssen Obanda* at the 6th International Congress on Industry, Environment, and Health (CIIES26), held in Casablanca from 15 to 17 April 2026.

How Crossref supports research visibility and research integrity

Johanssen Obanda 

Community Engagement Manager-Crossref

E-mail: jobanda@crossref.org



Author Profile

Obanda joined Crossref in 2023 to work with Crossref Ambassadors to effectively engage their communities and support Crossref's outreach initiatives. Obanda is passionate about building an inclusive research ecosystem where researchers across the globe can easily access scientific knowledge and make meaningful connections. His previous experience includes social entrepreneurship and science communication. For fun, Obanda likes to explore historical sites and experience the sunset.

Abstract: This conference explores how Crossref infrastructure and services support research visibility, discoverability and integrity through persistent identifiers, connected metadata and transparent scholarly records. It highlights the role of reliable metadata in strengthening trust, openness and connectivity in scholarly communication.

Keywords: *Crossref, Research Visibility, Research Integrity, Metadata, Persistent Identifiers*

CONFERENCE ABSTRACT

This abstract corresponds to the conference presentation delivered by *Prof Saloua Fertahi* at the 6th International Congress on Industry, Environment, and Health (CIIES26), held in Casablanca from 15 to 17 April 2026.

Innovative approaches in biomass valorisation for sustainable agricultural inputs.

Prof Saloua Fertahi 

UM6P, Morocco

E-mail: Saloua.FERTAH@um6p.ma



Author Profile

Prof. Saloua Fertahi is an Assistant Professor at Mohammed VI Polytechnic University (UM6P), Morocco, specialising in biomass valorisation, biopolymers and sustainable agricultural materials. Her research focuses particularly on the development of controlled-release fertilisers from biomass-derived materials, with the aim of improving nutrient-use efficiency, soil properties and sustainable crop production.

Abstract: This conference explores innovative approaches to biomass valorisation for sustainable agricultural inputs, highlighting the diversity and abundance of available biomass resources and their potential uses. Particular attention is given to their transformation into value-added materials and agricultural products, contributing to resource efficiency, circular economy and more sustainable agricultural practices.

Keywords: *Biomass Valorisation, Sustainable Agriculture, Circular Economy*

CONFERENCE ABSTRACT

This abstract corresponds to the conference presentation delivered by *Dr Kholoud Maafi* at the 6th International Congress on Industry, Environment, and Health (CIIES26), held in Casablanca from 15 to 17 April 2026.

From Laboratory to Public Health: Molecular Biology and Early Detection of Resistance — The GeneXpert MTB/RIF as a Key Tool in Tuberculosis Control in Morocco

Dr Kholoud Maafi 

Pharmacist–Biologist at the Pasteur Institute of Morocco; Member of the Moroccan Society of Pharmacology and Therapeutics (SMPT)

E-mail: docteurmaafi@gmail.com



Author Profile

Dr Kholoud Maafi is a Pharmacist–Biologist at the Pasteur Institute of Morocco, specialising in medical biology and clinical laboratory sciences. Her expertise spans haematology, biochemistry, virology and microbiology, with a strong research commitment to tuberculosis, particularly improving the diagnosis of challenging forms using advanced molecular tools such as GeneXpert MTB/RIF. Her work contributes to earlier diagnosis, improved patient care and tuberculosis control. She is also a member of the Moroccan Society of Pharmacology and Therapeutics (SMPT).

Abstract: This conference highlights the role of molecular biology and GeneXpert MTB/RIF in the early detection of tuberculosis and drug resistance in Morocco. It emphasises how rapid molecular diagnosis can strengthen patient care, disease surveillance and tuberculosis control.

Keywords: *Tuberculosis, GeneXpert MTB/RIF, Molecular Diagnosis, Public Health*

This abstract corresponds to the conference presentation delivered by *Omar Jnioih* at the 6th International Congress on Industry, Environment, and Health (CIIES26), held in Casablanca from 15 to 17 April 2026.

Contemporary Trends in Humanoid Robotics and Their Emerging Role in Medical and Healthcare Settings

Omar Jnioih 

Robotics Speaker & Consultant, Founder of J&T Robotix

E-mail: omar.jnioih@gmail.com



Author Profile

Mr Omar Jnioih is a Moroccan robotics and artificial intelligence specialist, technology consultant, and Founder of J&T Robotix. With expertise spanning robotics, AI, electronics, industrial engineering and business strategy, he combines technological innovation with strategic development. His work focuses on Deep Tech, intelligent robotic solutions and the application of emerging technologies to create practical and measurable impact for organisations and society.

Abstract: This conference talk about the contemporary advances in humanoid robotics and their emerging applications in medicine and healthcare. It highlights the potential of AI-powered humanoid robots to support healthcare professionals, patient assistance, rehabilitation and clinical services, while considering the technological and human challenges associated with their integration.

Keywords: *Humanoid Robotics, Artificial Intelligence, Medical Robotics, Human–Robot Interaction*

Workshops Activities



WORKSHOP



Thursday April 16 2026



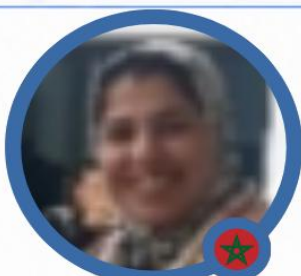
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ISPITS
CASABLANCA



PART 1 – APPLIED ARTIFICIAL INTELLIGENCE AND ROBOTICS FOR WATER, HEALTH AND SUSTAINABILITY



Prof. Amina Lhibani

ISPITS Casa



Prof. Abderrahmane
Laamiri

ISPITS Casa



Dr. Mohamed Benfatah

ISSS SETTAT



Artificial Intelligence–
Assisted Simulation for
Nursing Competency
Development



PART 2 – PEDAGOGICAL WORKSHOP



Prof. Houyam Jelloul

ISPITS Casa



Prof. da Montacir

ISPITS Casa



Pedagogical Workshop:
Integrating Artificial
Intelligence Tools into
Teaching Practices



PART 3 – RESEARCH CAPACITY BUILDING



Prof. Wissam El Idrissi El Machtani

ISPITS Casa



Developing Researcher
Competence – From
Formulating the Research
Question to Analysing Results



ACADEMIC SUPERVISION:

Prof. Fatimazahra Boutaleb (UH2C), Prof. Aziza El Baz (ISPITS Casa)



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CIIES26 | 15–17 April 2026





CIIES26 WORKSHOP

Open Science and Scholarly Communication



Thursday
April 16, 2026



15:00 – 18:30



ISPITS CASABLANCA



We are pleased to present the workshop **“Applied Circular Economy Models and Nature-Based Solutions”** as part of CIIES26, bringing together experts and academics to explore innovative strategies for sustainable healthcare and environmental resilience.

We warmly thank the speakers and contributors for sharing their expertise and commitment to building a greener and healthier future.



Thank you all for this inspiring collaboration.



PART 1 – Biomimicry-Based Waste Management: Towards Nature-Inspired Zero-Waste Systems



Dr Aboulaala Khadija

ISPITS Casa



Nature-Inspired
Zero-Waste
Solutions



PART 2 – Innovative Simulation and Modelling-Based Pedagogies for Sustainable Management of Healthcare Waste and Environmental Protection



**Prof. Karima
El Bouqdaoui**
ISPITS Casa



Prof. Sanaa Deblji
ISPITS Casa



Prof. Mounia Cherki
FS Ain Chock



Dr. Hamza Rihani
FS Ain Chock



Sustainable
Healthcare Waste
and Environmental
Protection



PART 3 – The Net-Zero Roadmap: Integrating AI for Campus Sustainability



Dr Majda El Hassani
ENISA Berrechid



Prof. Nadia Machkour
ENSA Berrechid



Net-Zero
Campus
Sustainability



ACADEMIC SUPERVISION:

Prof. Ayoub Djali (ISPITS Casa) Prof. Fatima Zahra Ndadani (ISPITS casa)



BOOK OF ABSTRACTS
CIIES26 | 15–17 April 2026





CIIES26 WORKSHOP

Applied Sustainable Health, Clinical Nutrition
and Healthy Ageing



Thursday
April 16, 2026



15:00 – 18:30



Casablanca, Morocco



We are pleased to present the workshop “**Applied Sustainable Health, Clinical Nutrition and Healthy Ageing**” as part of **CIIES26**, bringing together experts and academics to address key challenges in sustainable and healthy ageing.

We warmly thank the speakers and contributors for sharing their expertise and commitment to promoting better health, nutrition and well-being for all.



Thank you all for this inspiring collaboration.

THE SPECIFIC PROGRAMME OF THIS WORKSHOP AT CIIES26 (15–17 APRIL 2026)

This programme highlights innovative approaches for sustainable health, nutritional care and well-being across the life course, combining research, practice and experience.



Applied Sustainable Health, Clinical Nutrition and Healthy Ageing

Towards better health, well-being and quality of life for all



WORKSHOP – APPLIED SUSTAINABLE HEALTH, CLINICAL NUTRITION & HEALTHY AGEING

PART 1 – KEYNOTE TALKS: PROMOTING MENTAL WELL-BEING AND STRESS MANAGEMENT STRATEGIES



Prof. Hind Essafadi
(ISPITS Casa)

*Promoting Mental Well-being
and Stress Management Strategies*



Prof. Dris Ghafouri
(ISPITS Casa)

*Promoting Mental Well-being
and Stress Management Strategies*



Prof. Zineb Zaimi
(ISPITS Casa)

*Promoting Mental Well-being
and Stress Management Strategies*



PART 2 – KEYNOTE TALKS: NUTRITIONAL CARE FOR FRAIL ELDERLY PEOPLE

Nutritional Care for Frail Elderly People: Who Should Be Prescribed Oral Nutritional Supplements in Hospital and at Home, and How



Prof. Fatine El Arabi
(ISPITS Casa)



Ms Hanane Azargui
(ISPITS Rabat /
Ibn Tofail University, Kenitra)



Ms Boutaina Kasdi
(Ibn Tofail University,
Kenitra)



ACADEMIC SUPERVISION:

Prof. Fatimazahra Benchadlia (ISPITS Casa), Prof. Fatima Ezzahra Rihane (ISPITS Casa)



BOOK OF ABSTRACTS
CIIES26 | 15–17 April 2026





CIIES26 WORKSHOP

Clinical Training & Pedagogical Practice



Thursday
April 16, 2026



15:00 – 18:30



Casablanca, Morocco



We are pleased to present the workshop “Clinical Training & Pedagogical Practice” as part of CIIES26, bringing together experts and academics to strengthen clinical training and pedagogical competence for better education and care.

We warmly thank the speakers and contributors for sharing their expertise and commitment to advancing the quality of training in healthcare.



Thank you all for this inspiring collaboration.

THE SPECIFIC PROGRAMME OF THIS WORKSHOP AT CIIES26 (15–17 APRIL 2026)

This programme highlights innovative approaches for clinical training and pedagogical practice, promoting quality education and skills development in healthcare.



Clinical Training & Pedagogical Practice

Towards better training, competence and quality of care



Part 1—Practical Workshop



Prof. Riak Zemouri

ISPITS Casa



**Implementing the Objective
Structured Clinical Examination
(OSCE) in Basic Nursing Care**



Part 2—Interactive Session

Advancing Open Science and Research Visibility through Pedagogical Innovation



Prof. Imane Ettaki

ISPITS Casa



Prof. Zineb Khaddali

ISPITS Casa



Prof. Hind Berradi

ISPITS Casa



**Prof. Zineb Zine Al
Abidine**

ISPITS Casa



ACADEMIC SUPERVISION:

Prof. Mohammed Achmit (ISPITS Casa), Dr. Fatima Azzahra Louanjli (UH2C), Prof Bouchra Bejjany (FSTM), Prof. Rihabe Boussetine (ISPITS Casa)



BOOK OF ABSTRACTS
CIIES26 | 15–17 April 2026





CIIES26 WORKSHOP

Core One Health Workshop



Thursday
April 16, 2026



15:00 – 18:30



Casablanca, Morocco



We are pleased to present the workshop “**Core One Health Workshop**” as part of CIIES26, bringing together experts and academics to advance the One Health approach and address global health challenges.

We warmly thank the speakers and contributors for sharing their expertise and commitment to building a healthier future for all.



Thank you all for this inspiring collaboration.

THE SPECIFIC PROGRAMME OF THIS WORKSHOP AT CIIES26 (15–17 APRIL 2026)

This programme highlights innovative approaches that integrate environmental, human and animal health to achieve sustainable and equitable health outcomes.



Core One Health

Towards better for humans, animals and the environment



Part 1—Integrating Environmental Genomics and Drug Response within a One Health Framework



Prof. Amal Tazzite
ISPITS Casa



Prof. Zineb Khalil
ISPITS Casa



Prof. Zineb Elgabbas
ISPITS Casa



Part 2—Bloodborne Pathogen Exposure: Prevention and Management



Prof Oualid Razzok
ISPITS Casa



Prof Hajare Kerazi
ISPITS Casa



Prof Houda Halloul
ISPITS Casa



Part 3—From Knowledge to Action: Interactive Health Education Strategies for BehaviourChange in One Health



Dr. Khadija Daoudi
(I3S Settat)



ACADEMIC SUPERVISION:

Prof. Asmaa Hrioua, Prof. Abdelali Moukhass (ISPITS Casa)



BOOK OF ABSTRACTS
CIIES26 | 15–17 April 2026





CIIES26 WORKSHOP

Open Science and Scholarly Communication



Thursday
April 16, 2026



15:00 – 18:30



Casablanca, Morocco



I would like to extend my sincere thanks to the facilitators of the **Crossref** workshop: **Johanssen Obanda**, **Oumy NDIAYE, PhD** (Crossref Ambassador – Senegal), and **Dr Michael Brett-Crowther** (Editor-in-Chief of NBSEH), for their outstanding contributions and commitment.

I also warmly acknowledge the successful integration of four practical presentations into the Master's programme in Pedagogy at ISPITS Casablanca, under the supervision of **Prof. Omar Abidi**, **Prof. Karima El Bouqdaoui**, **Prof. Bouchaib Bahlaouan**, **Prof. El Machtani**, **Prof. Ahaizouni**, **Prof. Hrioua**.

Your kind collaboration, dedication, and shared vision for advancing open science and scholarly communication have made this initiative a great success.



Thank you all for this inspiring collaboration.

THE SPECIFIC PROGRAMME OF THIS WORKSHOP AT CIIES26 (15–17 APRIL 2026)

This programme reflects a strong commitment to capacity building, metadata excellence, and open science practices, bringing together international experts and emerging researchers.



PLENARY CONFERENCE

Johanssen Obanda (Crossref)

How Crossref Supports Research Visibility and Research Integrity



Crossref



WORKSHOP – OPEN SCIENCE & RESEARCH VISIBILITY

PART 1 – KEYNOTE TALKS: OPEN SCIENCE AND SCHOLARLY COMMUNICATION



Dr Oumy Ndiaye

(Crossref Ambassador, Senegal)

The Future of Scholarly Communication in Africa: Metadata, DOIs and Research Interconnectedness



Dr Michael Brett-Crowther

(Editor-in-Chief, NBSEH)

Inside NBSEH: Editorial Policy, Peer Review and Open Science Principles



Prof. Nadia Boutaleb

(Crossref Ambassador – Morocco & MENA)

From Diamond Open Access Principles to FAIR Infrastructure: The NBSEH Experience



PART 2 – STUDENT-LED DEMONSTRATIONS: FROM RESEARCH TO PUBLICATION

A series of practical sessions led by Master's students (ISPITS Casablanca), covering:



Literature
search
strategies



Scientific
source
selection



Ethical
research
practices



Optimisation of
research in the
digital era



ACADEMIC SUPERVISION:

Prof. Omar Abidi, Prof. Bouchaib Bahlaouan, Prof. Karima El Bouqdaoui,
Prof. El Machtani, Prof. Ahaizouni, Prof. Hrioua



BOOK OF ABSTRACTS
CIIES26 | 15–17 April 2026



WORKSHOP



Thursday April 16 2026



15:00 – 18:30



ISPITS
CASABLANCA



We are pleased to present the workshop “**Hands-On CBA in Clinical Training**” as part of CIIES26, bringing together experts and academics to strengthen competency-based education through practical approaches and effective implementation in clinical settings.

We warmly thank the speakers and contributors for sharing their expertise and commitment to advancing healthcare education and practice.



Thank you all for this inspiring collaboration.



WORKSHOP – HANDS-ON CBA IN CLINICAL TRAINING

Part 1—Competency-Based Approach (CBA) in Healthcare: Structuring, Communication and Implementation in Clinical Settings



Prof Omar ABIDI

ISPITS Casa



Prof Maria MAZOURI

ISPITS Casa



Prof Houda ALAMI

ISPITS Casa



Prof Siham BAGHDADI

ISPITS Casa

Part 2—Competency-Based Approach (CBA) in Healthcare: Structuring, Communication and Implementation in Clinical Settings



Prof Rabia Qaisar

ISPITS Casa

Prof H. Nait Riche

ISPITS Casa



Competency-Based Approach (CBA) in Healthcare:
Structuring, Communication and Implementation
in Clinical Settings



ACADEMIC SUPERVISION:

Prof Maria MAZOURI (ISPITS Casa), Prof. Redouane Bachar (ISPITS Casa)



BOOK OF ABSTRACTS
CIIES26 | 15–17 April 2026





WORKSHOP



Thursday April 16 2026



15:00 – 18:30



ISPITS
CASABLANCA



We are pleased to present the workshop **“Hands-On Plant Biotechnology”** as part of **CIIES26**, bringing together experts and academics to advance plant biotechnology through practical approaches and innovative techniques.

We warmly thank the speakers and contributors for sharing their expertise and commitment to building a better and greener future.



Thank you all for this inspiring collaboration.



WORKSHOP – HANDS-ON PLANT BIOTECHNOLOGY



Part 1—Hands-On Plant Biotechnology



Kaima Jmaili
(UH2C)



Dr. Rajaa Tesse
(UH2C)



Khawla Waddi
(UH2C)



Mohamed Lahrairi
(UH2C)

Part 2—Advancing Circular Economy through Wastewater Valorization: Waste Sorting and Recycling Practices



Prof. Naman Malika

ISPITS Casa



ACADEMIC SUPERVISION:

Prof Oualad Bellahcen Touria (FS Ain Chock), Prof Amal Safi (FSTM), Prof Amine Rkhaila (FSTM)



BOOK OF ABSTRACTS
CIIES26 | 15–17 April 2026



Oral Communications



BARAE ABAIDA

FROM TERROIR TO QUALITY: FACTORS SHAPING PRODUCT CHARACTERISTICS

ABAIDA Barae¹, BOUCHAIB Bahlaouan², WADDI Khawla¹ & BOUTALEB Nadia^{1*}

¹ Hassan II University of Casablanca, Laboratory of Biotechnology, Agri-Food, Materials and Environment, Team: Biotechnologies, Resource Valorisation, Quality, Health and Ecotoxicology, Faculty of Science and Technology Mohammedia, BP 146, Mohammedia 20650, Morocco

² Laboratory of Care, Health and Sustainable Development 2S2D, Higher Institute of Nursing and Health of Casablanca, Morocco

*Corresponding author e-mail address: nadia.boutaleb@fstm.ac.ma

Abstract: Irrigation water plays a key role in determining the quality of aromatic and medicinal plants by influencing soil properties, plant physiology, and the accumulation of bioactive compounds. This study investigates the influence of irrigation water on the quality of verbena (*Aloysia citrodora*), with a particular focus on physicochemical, biochemical, and sensory attributes. Different irrigation water characteristics, including mineral composition, salinity, and pH, were evaluated to assess their impact on plant growth and bioactive compound extraction. The results indicate that variations in irrigation water quality significantly affect phenolic content, aromatic profile, and overall quality of verbena infusions. These findings highlight the importance of irrigation water management as a key factor in the valorisation of verbena, providing a scientific basis for optimising cultivation practices and ensuring consistent product quality.

Keywords: *Irrigation, verbena, Quality, Physicochemical, Composition.*



HASNAE ABOUCHE

**MOLECULAR AND PHENOTYPIC CHARACTERISATION OF
ENTERIC VIRUSES IN WASTEWATER FROM THE RABAT-SALÉ
REGION (MOROCCO)**

ABOUCHE HASNAE^{1*}, ZIDOUH ATIKA², ELOUARDI ABDELMOULA², ELMRABET
SANAA³, AITHAJ-MHAND ROKAYA³, OUMZIL HICHAM¹, & TAGAJDID MOHAMED RIDA¹

¹Faculty of Medicine and Pharmacy of Rabat, Mohammed V University, Rabat, Morocco

²National Institute of Hygiene, Department of Water, Food and Environment Microbiology, Rabat, Morocco

³National Institute of Hygiene, Virology Department, National Reference Laboratory for Poliomyelitis (NRLP),
Rabat, Morocco

*Corresponding author: hasnae.abouche@um5r.ac.ma

Abstract: Enteric viruses are major causative agents of gastrointestinal infections worldwide and represent a significant public health concern. These viruses are mainly transmitted through the faecal–oral route and are excreted in large quantities in human faeces, making wastewater an important reservoir for monitoring their circulation within communities. Environmental surveillance of wastewater has therefore become an effective approach for detecting viral pathogens and assessing their distribution in the population. The present study aims to investigate the presence and circulation of enteric viruses in wastewater samples collected from the Rabat-Salé region in Morocco. Wastewater samples were collected from selected sites and subjected to viral concentration using filtration and polyethylene glycol (PEG) precipitation methods. Viral RNA was subsequently extracted from the concentrates, and molecular detection of enteroviruses was performed using reverse transcription polymerase chain reaction (RT-PCR). This study will contribute to improving the understanding of enteric virus circulation in environmental matrices and may provide valuable epidemiological data to support public health surveillance. Environmental monitoring of wastewater may also serve as an early warning system for the detection of viral outbreaks in the community.

Keywords: *Enteric viruses, Wastewater, Public health.*

MOHAMED ACHMIT
CONTRIBUTION OF THE BICHRO-DUBLI FUMOUEZ ASSAY TO
THE IDENTIFICATION OF CANDIDA DUBLINIENSIS:
COMPARISON WITH PCR

ACHMIT MOHAMED^{1,2*}, EL FALAKI FATIMA³, AOUSSAR NOURA^{2,4}, FAOUZI SLIMANE^{5,6},
BOUZZIT ABDELLAH⁵, BOUZZIR SALMA^{3,5}, & JABRI BRAHIM^{3,6}

¹Higher Institute of Nursing and Health, Casablanca, Ministry of Health and Social Protection, Morocco

²UR Microbiology, Biomolecules and Biotechnology Laboratory of Physical Chemistry and Biotechnologies of
Biomolecules and Materials FST Mohammedia, Morocco

³Higher Institute of Nursing and Health, Rabat, Ministry of Health and Social Protection, Morocco

⁴Higher Institute of Nursing and Health, Kenitra, Ministry of Health and Social Protection, Morocco

⁵Laboratory of Natural Resources and Sustainable Development, Faculty of Sciences, Ibn Tofail University,
Kenitra, Morocco

⁶Research Laboratory in Oral Biology and Biotechnology, Faculty of Dental Medicine, Mohammed V
University in Rabat, Morocco

*achmitmohammed@gmail.com

Abstract: This study evaluated the diagnostic performance of a phenotypic and biochemical method, the Bichro-Dubli Fumouze assay, against polymerase chain reaction as the reference method for identifying *Candida dubliniensis* in clinical oral yeast isolates. A total of 140 yeast isolates from oral and subgingival samples of immunocompetent patients were examined. Each isolate was identified by the Bichro-Dubli Fumouze assay and by PCR amplification of a species-specific 119 bp fragment. The diagnostic parameters calculated included sensitivity, specificity, predictive values, and agreement coefficients. PCR confirmed 37 isolates (26.4%) as *Candida dubliniensis*. The Bichro-Dubli Fumouze assay exhibited high sensitivity (89.2%) and specificity (97.1%). This phenotypic method demonstrated strong agreement with PCR results. The Bichro-Dubli Fumouze assay provided rapid and highly accurate identification of *Candida dubliniensis*. A stepwise diagnostic approach combining a rapid screening test followed by confirmatory testing is recommended, reserving PCR for ambiguous or epidemiological cases.

Keywords: *Candida dubliniensis*, Diagnostic methods, Polymerase chain reaction.



WIAME ADADI

IN SILICO PRIORITIZATION OF TCF7L2 GENE VARIANTS ASSOCIATED WITH TYPE 2 DIABETES

ADADI WIAME^{1*}, JRAMY CHAIMAA^{1,2}, OUAHID ASMAE¹, CHARROUK SANAA¹, & SAFI AMAL¹

¹Laboratory of Biotechnology, Agri-Food, Materials, and Environment, LBAME, Faculty of Science and Technology Mohammeda, Hassan II University of Casablanca, BP 146 Mohammeda 20650, Morocco.

²INSERM U1256, Nutrition, Genetics, and Environmental Risk Exposure (NGERE), Faculty of Medicine of Nancy, University of Lorraine, Nancy, France

*adadi.wiame@gmail.com

Abstract: Type 2 diabetes (T2D) is a multifactorial disease in which genetic factors play a decisive role. The study of genetic variants involved in T2D, and in particular those of the TCF7L2 gene, is essential to understanding their functional impact and their contribution to susceptibility to the disease. The objective of this work was to prioritize in silico and highlight key variants for future research and experimental studies on the North African population. The variants associated with T2D were first extracted from the GWAS Catalog, then supplemented with the results of the most recent meta-analysis on T2D. All of the selected variants were then functionally annotated using several bioinformatics tools, such as VEP, CADD, Splice AI, gnomAD, GTEx, etc. Scores were assigned to each variant in order to synthesize the information from the various annotations. This approach has enabled the identification and prioritization of variants with potential biological impact, providing a basis for future functional and association studies.

Keywords: *Type 2 diabetes, Genetic variants, Variant prioritization.*

ASSYA AHARRAR
SAFETY AND ANTIBACTERIAL EFFICACY OF PLANT-DERIVED
NANOPARTICLES AND ESSENTIAL OILS AGAINST
ENTEROBACTER SPP.

ASSYA ASSYA^{1*}, BLALOUZ ELMAHDI¹, ABOULKASSIM OUSSAMA¹, ELMEGDAR
SOUFIANE¹, LAKTIB ASMA¹, MSANDA FOUAD², HASSI MOHAMED¹, & HAMADI
FATIMA^{1*}

¹Laboratory of Microbial Biotechnology and Plants Protection. Biology Department. Sciences Faculty, Ibn Zohr University, Agadir, Morocco

²Laboratory of Biotechnologies and Valorisation of Natural Resources, Biology Department. Sciences Faculty, Ibn Zohr University, Agadir, Morocco.

*Corresponding authors: assya.aharrar.36@edu.uiz.ac.ma , f.hamadi@uiz.ac.ma

Abstract: The rising resistance of *Enterobacter* spp. to conventional antibiotics underscores the urgent need for alternative antimicrobial strategies. Natural bioactive compounds, including essential oils (EOs) and plant-derived silver nanoparticles (AgNPs), offer promising antibacterial properties. This study evaluated the antibacterial activity and cytotoxicity of essential oils derived from *Ighermia pinifolius*, *Cistus creticus*, and *Lavandula mairei*, as well as biologically synthesised silver nanoparticles. Minimum inhibitory concentrations (MICs) revealed that EOs from *I. pinifolius*, *C. creticus*, and *L. mairei* inhibited *Enterobacter cloacae*, *Escherichia coli*, *Klebsiella pneumoniae*, and *Enterobacter hormaechei* at 1.5–12.5 µL/mL, and AgNPs were effective at 32–64 µg/mL. Cytotoxicity, assessed by LDH release, indicated that AgNPs exhibited minimal toxicity in osteoblasts (~0–5%) and macrophages (~0%), whereas the EO from *L. mairei* was highly cytotoxic (~100% for osteoblasts, ~50% for macrophages), and EOs from *I. pinifolius* and *C. creticus* showed moderate effects (~10–40%). These results demonstrate that both silver nanoparticles and essential oils exhibit antibacterial activity, and AgNPs show minimal cytotoxicity, highlighting their safety and potential for biomedical applications.

Keywords: *Enterobacter* spp., Antibacterial activity, Essential oils.

SAKHR AHIZOUNE

**OVERHAULING MOROCCO'S HEALTHCARE SYSTEM:
PERCEPTIONS OF HEALTHCARE PROFESSIONALS**

AHIZOUNE SAKHR, KHRAMEZ RAJAA, ABIDLI ZAKARIA, BACHAR REDOUANE,
HADRACH SAFAA, & GHOSNE NADIA

*sakhrahizoune@gmail.com

Abstract: Healthcare systems in low- and middle-income countries have faced multiple performance challenges (quality, responsiveness, equity and resilience). During the COVID-19 pandemic, healthcare systems were often unable to respond adequately to population needs, prompting many countries to consider major reforms. This study aims to describe healthcare professionals' perceptions of the Moroccan healthcare system overhaul. This is a descriptive study using a mixed-methods approach. The qualitative component included fifteen interviews with purposively selected participants: six strategic-level managers, four intermediate-level managers and five operational-level managers. The quantitative component involved 71 healthcare professionals surveyed using a questionnaire distributed to doctors and nurses responsible for health programmes. The findings indicate that, although the Moroccan healthcare system has made progress, it does not fully meet national requirements and requires reform. To support this overhaul, key actions include allocating adequate resources, establishing transparent institutional communication, implementing continuous training, promoting stakeholder integration and strengthening leadership to enhance motivation, commitment and engagement. Managers expressed generally positive perceptions, reflecting awareness that this reform forms part of the evolution of the Ministry of Health and Social Protection towards the generalisation of social protection in Morocco. They emphasised participation in the redesign process and communication. In contrast, healthcare professionals expressed more negative perceptions than managers. Participants also noted that the reform would have greater impact if it better valued human resources, both financially and in terms of career development. If this reform is to be successfully implemented, a gradual approach is required to reduce resistance to change.

Keywords: *Overhaul, Healthcare system, Perception, Healthcare professionals.*

ANASS AIT CHIKH
REFRAMING DIGITAL HEALTH IN MOROCCAN PUBLIC
HEALTHCARE: FROM ADMINISTRATIVE DIGITALIZATION TO
CITIZEN-CENTRED VALUE CREATION

AIT CHIKH ANASS*, & RHAJBAL ZINEB

FSJES – Souissi Mohammed V University, Rabat

* Aitchikhanass@gmail.com

Abstract: Moroccan public healthcare faces persistent challenges related to accessibility, trust and perceived service quality. In this context, digital transformation offers new opportunities, yet the strategic contribution of digital marketing remains underexplored. This article examines how digital marketing can support perceived performance in Moroccan public healthcare. It adopts an exploratory qualitative approach based on a targeted literature review and a critical analysis of the Moroccan case using institutional and documentary sources. The study is structured around three interrelated dimensions: digital marketing, perceived performance and the user–public institution relationship. The findings show that, despite the development of several digital health initiatives, their impact remains limited by fragmented systems, weak coordination and insufficient user orientation. As a result, digital tools are still used more as administrative instruments than as relational mechanisms for strengthening trust, service clarity and citizen engagement. The article argues that digital marketing should be considered a public governance lever capable of creating public value through listening, responsiveness and improved user experience. It concludes by calling for a more integrated and citizen- centred digital strategy in Moroccan public healthcare.

Keywords: *Digital governance, Public value, Citizen trust.*



ZINEB AIT ERROUHI

**SYSTEMATIC REVIEW OF CLINICAL PRACTICE GUIDELINES
FOR THE ASSESSMENT AND MANAGEMENT OF COGNITIVE
IMPAIRMENT IN PATIENTS WITH CANCER**

AIT ERROUHI ZINEB^{1*}, BOUTAYEB SABER², & OUBEJJA HOUDA¹

¹Laboratory of Biostatistics, Clinical and Epidemiology Research, Faculty of Medicine and Pharmacy,
Mohammed V University, Rabat, Morocco

²Translational Oncology Research Team, Faculty of Medicine and Pharmacy, Mohammed V University, Rabat,
Morocco

* zineb.aiterrouhi@gmail.com

Abstract: Cancer-related cognitive impairment is one of the most frequently reported symptoms among patients, particularly during and after cancer treatment. The aim of this systematic review was to identify existing clinical practice guidelines, summarise their recommendations and assess their methodological quality. A systematic review was conducted in PubMed, Scopus, Web of Science and ScienceDirect, as well as on the websites of organisations specialising in oncology, covering the period from 2010 to July 2025. The methodological quality of the eligible clinical guidelines was assessed using the ‘Appraisal of Guidelines for Research & Evaluation II’ tool, and data were extracted and synthesised narratively. Five clinical guidelines published between 2015 and 2025 were selected for final assessment based on inclusion criteria. The overall methodological quality was high, with four guidelines judged to be of high quality. The highest-performing guidelines achieved very high scores for rigour of development (up to 99%), editorial independence and stakeholder involvement (100%). One guideline scored lower, particularly regarding stakeholder involvement and applicability (52%). Non-pharmacological strategies, including cognitive rehabilitation, psychological support and physical activity, were strongly recommended to improve cognitive health, psychological well-being and quality of life in cancer patients and survivors.

Keywords: *Cognitive impairment, cancer, clinical practice guidelines.*

RACHID AIT HAMMOU
PREVALENCE OF DIABETIC NEPHROPATHY AND ITS
ASSOCIATION WITH GLYCAEMIC CONTROL AND DIABETES
TYPE AMONG ADULTS

AIT HAMMOU RACHID^{1,2*}& BEN EL CAID MOHAMED³

¹High Institute of Nursing Professions and Health Techniques, ISPITS-Dakhla, Moroccan Ministry of Health and Social Protection, Morocco.

²Laboratory of Microbial Biotechnology and Plant Protection, Faculty of Sciences, Ibn Zohr University, Agadir, Morocco

³Ibn Zohr University, Faculty of Sciences, Department of Biology, Laboratory of Biotechnology and Valorisation of Natural Resources, 8106, Agadir, Morocco

*rachid.aithammou@edu.uiz.ac.ma

Abstract: Diabetes is a chronic metabolic disease of rising prevalence worldwide and a major public health problem. One of its most severe complications is diabetic nephropathy, a leading cause of chronic kidney disease and end-stage renal failure. The objective of this comparative study in Dakhla was to compare renal function between diabetic and non-diabetic individuals. The following biological markers were analysed: GFR (glomerular filtration rate), HbA1c, fasting glucose, urea and albumin. Marked renal impairment was observed in diabetic patients, with a mean GFR of 49.6 mL/min/1.73 m² compared to 72 mL/min/1.73 m² in non-diabetic individuals. There was a significant positive correlation between HbA1c and diabetes duration ($r = 0.584$, $p < 0.001$), as well as a negative association between HbA1c and eGFR ($r = -0.235$, $p < 0.05$), suggesting that poor glycaemic control contributes to the decline in renal function. These results underscore the importance of early identification, effective glycaemic control, screening and lifestyle interventions to prevent or delay the progression of diabetic nephropathy.

Keywords: *Diabetes, Diabetic nephropathy, Renal function, GFR.*



AZIZ AIT-KARRA

PREPARATION OF COS₂ NANOSTRUCTURES FOR EFFICIENT REMOVAL OF ORGANIC POLLUTANTS FROM AQUEOUS ENVIRONMENTS

AIT-KARRA AZIZ^{1*}, MOURAK ABDELLAH¹, ZAKIR OTHMANE¹, IDOUHLI RACHID¹,
DIKICI BURAK², ABOUELFIDA ABDESSELAM¹, KHADIRI EDDINE¹, & BENZAKOUR
JAOUAD¹

¹Laboratory of Physical Chemistry of Materials and Environment, Faculty of Science Semlalia, Cadi Ayyad
University, BP 2390, Marrakech, Morocco

²Department of Mechanical Engineering, Faculty of Engineering, Ataturk University, 25240 Erzurum, Turkey

*a.aitkarra@gmail.com

Abstract: Cobalt disulphide (CoS₂) was successfully prepared using a hydrothermal method at temperatures of 150, 180, and 210 °C for 24 hours. Characterisation techniques, including SEM, EDX, XRD, and FTIR, confirmed the formation of pure CoS₂ with a cubic crystal structure and an average crystallite size of about 14 nm. The material was obtained in the form of spherical nanoparticles (NPs), with diameters increasing as temperature increased. The adsorption activity of the CoS₂ NPs was evaluated using methylene blue (MB) dye. The study showed that all CoS₂ samples act as efficient adsorbents for MB under alkaline conditions. The kinetic study demonstrated that the pseudo-second-order model best describes the adsorption process. Analysis of the adsorption isotherms revealed that the process follows the Freundlich model with a high correlation coefficient ($R^2 = 0.99$), indicating multilayer adsorption on a heterogeneous surface. The adsorption capacity increased from 128.20 mg·g⁻¹ at 298 K to 222.22 mg·g⁻¹ at 318 K, suggesting an endothermic process. Recyclability tests demonstrated that CoS₂ NPs are stable and reusable adsorbents, showing a slight decrease in MB removal efficiency of approximately 4% after six successive cycles.

Keywords: *Nanoparticles, Methylene blue, Adsorption, Cobalt disulphide, Isotherms, Recyclable adsorbent.*



ASMAE ALAMI KASRI

**BRIDGING GOVERNANCE AND INNOVATION:
BIOTECHNOLOGY-ENHANCED FOR SUSTAINABLE WATER
MANAGEMENT IN MOROCCO**

ASMAE ALAMI KASRI^{1*}

¹Euromed Institute of Legal and Political Sciences, Centre for studies, Euromed University of Fes, Fes 30020,
Morocco

^{*}a.alamikasri@ueuromed.org

Abstract: Water scarcity in Morocco is intensifying as a result of climate change, demographic growth, and increasing pressures from agriculture, industry, and urbanisation. These dynamics threaten water security, public health, and ecosystem sustainability, and call for integrated responses that effectively bridge governance frameworks and technological innovation. This study examines how the integration of biotechnological solutions within the Integrated Water Resources Management (IWRM) framework can contribute to sustainable water management in Morocco. Water Law 36-15 provides a comprehensive institutional basis grounded in river basin management, stakeholder participation, and ecosystem protection, yet its implementation remains constrained by institutional fragmentation, limited monitoring capacities, and persistent challenges in wastewater management. The research highlights the potential of biotechnology-based tools, including biosensors for real-time water quality monitoring, bioremediation techniques, and nature-based solutions, to strengthen IWRM implementation. Through the analysis of Moroccan river basins, the study demonstrates how these innovations enhance water quality assessment, support health-sensitive decision-making, and enable decentralised approaches to wastewater treatment and resource recovery in line with circular economy principles. The findings emphasise that the successful adoption of biotechnology depends on adaptive governance arrangements, capacity building, and stronger science–policy interfaces. By bridging governance and innovation, biotechnology-enhanced IWRM represents a viable pathway towards sustainable water management in Morocco.

Keywords: *Biotechnology; Integrated Water Resources Management (IWRM).*

SAMAR AL HETILAH

**DIETARY SUPPLEMENTS AND IRRITABLE BOWEL SYNDROME:
EFFICACY, MECHANISMS OF ACTION, AND ROLE OF FODMAPS
IN MANAGEMENT**

AL HETILAH SAMAR^{1*}, LAASSILIA OUMAYMA¹, & TABOZ YOUNESS¹

¹Human Resources and Sustainable Development Laboratory, Department of Biology, Physiology, Metabolism and Nutrition Research Unit, Ibn Tofeïl University, Kenitra.

*Corresponding author: s.alhetilah@gmail.com

Abstract: Irritable Bowel Syndrome (IBS) is a chronic functional gastrointestinal disorder characterised by recurrent abdominal pain associated with altered bowel habits, with no identifiable organic abnormality. Its global prevalence is estimated at 5–10%, with a significant impact on quality of life and healthcare costs. The pathophysiology involves complex mechanisms including visceral hypersensitivity, altered intestinal motility, microbiota dysbiosis, low-grade inflammation, and dysregulation of the gut–brain axis. Among non-pharmacological strategies, the low FODMAP diet is the most extensively studied dietary approach. At the same time, increasing use of dietary supplements (probiotics, fibres, phytotherapy, digestive enzymes) raises questions regarding their effectiveness and role in integrative management. This review aims to analyse available scientific evidence on the effectiveness of major dietary supplements in IBS and to examine their potential interaction with the low FODMAP diet. A narrative review was conducted using randomised controlled trials, meta-analyses, and international guidelines published over the past fifteen years. Findings indicate that the low FODMAP diet improves global symptoms in 50–70% of patients in the short term. Probiotics show variable effects, whereas soluble fibres such as psyllium and peppermint oil demonstrate moderate benefits. Digestive enzymes appear useful in specific intolerance contexts. In conclusion, an individualised approach combining a low FODMAP diet with selected supplements is recommended

Keywords: *Irritable Bowel Syndrome, FODMAP, Dietary Supplements, Gut Microbiota.*

CHAIMAE AMEICH

A 3D-PRINTED IN-WELL ELECTROCHEMICAL PLATFORM FOR
MINIATURISED ON-SITE DNA BIOSENSING APPLICATIONS

AMEICH CHAIMAE^{1,2*}, MOUSTAKIM HAMZA¹, MOHAMMADI HASNA¹, & BOUGHTRIBIL
SAID²

¹Chemical Analysis and Biosensors Group, Laboratory of Process Engineering and Environment (LGPE),
Faculty of Sciences and Techniques, Hassan II University of Casablanca, Mohammedia, Morocco

²Laboratory of Virology, Oncology, Biosciences, Environment and New Energies (LVO BEEN), Faculty of
Sciences and Techniques, Hassan II University of Casablanca, Mohammedia, Morocco

* chaimaeam7@gmail.com

Abstract: Electrochemical techniques are traditionally carried out in conventional cells requiring large volumes, leading to analyte dilution and slower diffusion. Miniaturisation enables operation with microlitre volumes, increasing local concentration and reducing reagent consumption and cost. In this study, a 3D-printed miniaturised electrochemical device integrating pencil graphite electrodes was developed, operating with an analysis volume of approximately 100 μL and ensuring efficient solution–electrode contact. Cyclic voltammetry revealed well-defined redox peaks, confirming efficient electron transfer. Repeatability tests performed on eight electrodes from three batches demonstrated good reproducibility. Compared to a conventional cell, the device exhibited improved performance, with a twofold reduction in redox peak separation ($\Delta E_p \approx 80 \text{ mV}$ compared to 160 mV) and an I_{pa}/I_{pc} ratio close to unity (≈ 1.01), indicating enhanced reversibility. Following validation by electrochemical impedance spectroscopy and scan rate analysis, the device was applied to guanine detection. A proportional increase in oxidation current was observed over 0.5–20 μM , yielding a linear calibration curve. These results confirm the sensitivity and reliability of the miniaturised system and support its application in the study of DNA–molecule intercalation interactions.

Keywords: *Electrochemistry, 3D printing, Miniaturisation, Biosensors, DNA.*

AMZIL MOHAMED

STUDY OF THE CORRELATION BETWEEN ANTIBIOTIC RESISTANCE AND THE ABILITY TO FORM ESCHERICHIA COLI BIOFILM ISOLATED FROM PRODUCTS OF AVIAN ORIGIN

AMZIL MOHAMED^{1,2*}, EL KETTANI ASSIYA^{1,3,4}, ASSAIDI ABDELWAHID⁵, BARGUIGUA ABOUDDIHJAJ⁶, TIMINOUNI MOHAMMED⁷, CHARAFEDDINE OMAR⁸, AZIZ BOUSFIHA AHMED^{1,9}, EL BAKKOURI JALILA^{1,9}, & NAYME KAOTAR²

¹Clinical Immunology, Infection, and Autoimmunity Laboratory (LICIA), Faculty of Medicine and Pharmacy, Hassan II University, Casablanca, Morocco

²Molecular Bacteriology Laboratory, Pasteur Institute of Morocco - Casablanca, Morocco

³Laboratory of Bacteriology, Virology and Hospital Hygiene, Ibn Rochd University Hospital, Casablanca 20250, Morocco

⁴Laboratory of Bacteriology and Virology, Faculty of Medicine and Pharmacy, Hassan II University, Casablanca 20250, Morocco

⁵Agri-food and Health Laboratory, Faculty of Science and techniques, Hassan First University, Settat, Morocco

⁶Team of Biotechnology and Sustainable Development of Natural Resources, Department of Biology-Geology, Polydisciplinary Faculty, Sultan Moulay Slimane University, Beni Mellal, Morocco

⁷Laboratory of Biotechnology and Bioinformatics, School of Advanced Studies in Biotechnology and Health (EHEB), Casablanca, Morocco

⁸Laboratory of Physical Chemistry and Biotechnology of Biomolecules and Materials, Mohammedia Faculty of Science and Technology, Hassan II University, Casablanca, Morocco

⁹Clinical Immunology Unit, Department of Infectious Diseases, Abderrahim El Harouchi Children Hospital, University Hospital Centre Ibn Rochd, Casablanca, Morocco.

* amzilmohamed20012@gmail.com

Abstract: Biofilms are microbial communities associated with surfaces and embedded in an extracellular matrix. The ability of some biofilm-forming bacteria to survive in the presence of antibiotics may be increased, which can lead to therapeutic failure. This study aims to determine the correlation between antibiotic resistance and the ability to form biofilm. The study is based on a total of 178 strains of *Escherichia coli* isolated from products of avian origin marketed in the city of Casablanca and Mohammedia. The antibiogram was performed by the Mueller–Hinton agar diffusion method according to EUCAST. The quantification of biofilm was performed on static polystyrene plates by measuring the optical density and visualized using crystal violet staining (0.1%). The study of the antimicrobial resistance profile showed that 72% of *E. coli* tested strains are multidrug-resistant. The majority of strains are resistant to tetracycline (96%), amoxicillin–clavulanic acid (88%), cefoxitin (84%), norfloxacin (74%), and ofloxacin (62%). The quantification of biofilm shows that the majority of strains are biofilm-forming with different intensities. The capacity of multidrug-resistant strains to form biofilm is almost always greater than that of non-multidrug-resistant strains. The emergence of virulent and/or multidrug-resistant foodborne *E. coli* strains is a real threat to public health. Therefore, the establishment of a monitoring system for these bacteria is required.

Keywords: *Escherichia coli*, biofilm, antimicrobial resistance.



AMAL AOUMRANI

**MEDICINAL PLANTS AND MALE FERTILITY: TOWARDS
INNOVATIVE STRATEGIES IN REPRODUCTIVE HEALTH**

AMAL AOUMRANI¹, AHLAM ZARHOUTI¹, BOUCHRA EL KHALFI¹, ABDELAZIZ
SOUKRI^{1*}

¹ Hassan II University of Casablanca, Faculty of Sciences Ain Chock, Department of Biology, Health,
Environment and Biotechnology Laboratory, Pathophysiology, Molecular Genetics and Biotechnology
(PGMB) Research Team, Casablanca, Morocco.

*ab.soukri@gmail.com

Abstract: Male infertility is a major public health concern, accounting for approximately 40–50% of infertility cases among couples. This condition is often associated with impaired sperm parameters, particularly sperm concentration, motility and morphology, as well as environmental and pathophysiological factors. In response to growing concerns about the side effects of conventional medical treatments, interest in medicinal plants as complementary and natural therapeutic approaches is increasing. Rich in bioactive compounds, medicinal plants have attracted particular interest due to their potential to modulate various aspects of male reproductive health. This work explores the role of medicinal plants in reproductive health, with a particular focus on their effects on spermatogenesis, sperm quality, hormonal balance and oxidative stress. The aim of this study is to highlight the different roles that medicinal plants may play in male reproductive health and to provide perspectives for their potential use in integrative approaches to the management of infertility.

Keywords: *Male infertility, reproductive health, medicinal plants, spermatogenesis, sperm quality.*



FATIMA ZAHRA ANOUAR TADLAOUI
ARTIFICIAL INTELLIGENCE AND THE IMPROVEMENT OF
QUALITY OF LIFE IN PEOPLE LIVING WITH CHRONIC DISEASES:
THE CASE OF HIV

ANOUAR TADLAOUI FATIMA ZAHRA^{1*}, EL OMARI NAWAL¹, FAOUZI ERRACHIDI¹, &
RAOUI SIDI MOHAMMED²

¹Laboratory of applied organic chemistry, sciences and techniques faculty, USMBA, Fez, Morocco

²Higher Institute of Nursing and Health of Meknes, Morocco

* fatimazahra.anouartadlaoui@usmba.ac.ma

Abstract: The recent emergence of artificial intelligence (AI) is transforming healthcare systems worldwide. AI is increasingly viewed as an inevitable and essential tool to support sustainable, personalised, and patient-centred care. For people living with HIV (PLHIV), advances in treatment have transformed this once fatal infection into a chronic disease. This shift places greater emphasis on long-term quality of life (QoL), highlighting the need for innovative digital solutions. This study aims to examine the role of AI-based tools in improving QoL among people with chronic diseases, with a specific focus on HIV. A systematic review registered in the PROSPERO database and conducted in accordance with PRISMA guidelines was carried out. Major scientific databases were screened to identify studies assessing AI-based tools related to QoL in PLHIV care. The results suggest rapid growth in the number of studies exploring AI-based approaches in chronic HIV care, yet the assessment of QoL remains underrepresented. In conclusion, AI has become an indispensable component of modern healthcare, highlighting its strong potential to improve the QoL of PLHIV by supporting sustainable, personalised, and holistic care strategies.

Keywords: Artificial Intelligence, HIV, Systematic review, Quality of Life.



KHADIJA AOUNI

**CLIMATE CHANGE AND URINARY INFECTIONS IN CHILDREN:
ONE HEALTH APPROACH**

AOUNI KHADIJA^{1*}, EL BOUHALI BACHIR¹

¹Faculty of Science, University Moulay Ismail Meknes

*aounikhadija166@gmail.com

Abstract: Climate change is causing global temperatures to rise. We are investigating whether there is a relationship between temperature and hospitalizations for urinary tract infections in children. A retrospective study was conducted on the medical records of children hospitalised for urinary tract infections in pediatric wards. Statistical correlation and logistic regression analyses revealed no link between hospitalizations of children for urinary tract infections and environmental temperature.

Keywords: *Climate change, Children, Infection, One Health.*



ASSAL AICHA

SUSTAINABLE TREATMENT OF URBAN WASTTEWATTER USING ANIMAL-DERIVED BIOMATTERIALS WITTHIN A CIRCULAR ECONOMY FRAMEWORK

ASSAL AICHA^{1*}, BEN ALI MOHAMED¹, & LOTFI EL MUSTAPHA¹

¹Laboratory of Spectroscopy, Molecular Modelling, Materials, Nanomaterials, Water and Environment,
Environmental Materials Team, ENSAM, Mohammed V University in Rabat, Morocco

*Corresponding author: assalaicha2013@gmail.com

Abstract: Wastewater management remains a crucial environmental issue, particularly when untreated effluent is discharged into natural ecosystems, posing risks to both the environment and public health. Effective assessment of wastewater pollution is therefore essential to ensure that appropriate treatment strategies are implemented. This study evaluates the pretreatment process applied to urban wastewater at the El Jadida wastewater treatment plant (WWTP) with the aim of assessing treatment performance and determining the suitability of pretreated effluent for reuse in irrigation. The main physicochemical parameters, including temperature, pH, electrical conductivity, biochemical oxygen demand (BOD₅), chemical oxygen demand (COD), suspended solids (SS), total nitrogen, and total phosphorus, were analysed. In the context of a circular economy, a pre-treatment method using adsorption, based on an organic waste of animal origin, was proposed as a sustainable and cost-effective biosorbent. This material achieved removal rates of 77% for BOD₅, 63% for COD, and 66% for SS and dye content. ICP- OES analysis confirmed substantial removal of heavy metals, with an average retention rate of approximately 70%. These results highlight the potential of our bioadsorbent for sustainable wastewater treatment.

Keywords: *Wastewater Treatment, Heavy Metal Removal.*

ZAKARIA ASBAI

SMART NUTRIENTS, SMARTER SOILS: DESIGNING NEXT-
GENERATION ORGANOMINERAL FERTILISERS

ASBAI ZAKARIA^{1*}, BOUTALEB NADIA¹ & EL BOUHLAOUAN BOUCHAIB²

¹Laboratory of Biotechnology, Agri-Food, Materials and Environment, Team: Biotechnologies, Resource Valorisation, Quality, Health and Ecotoxicology, Faculty of Science and Technology Mohammeda, Hassan II University of Casablanca

²Higher Institute of Nursing and Health of Casablanca

* zakaria.asbai@etu.fstm.ac.ma

Abstract: Fertilisers remain indispensable for sustaining agricultural productivity, yet their conventional use is often marked by inefficiencies that lead to nutrient losses and environmental degradation. Addressing this challenge requires rethinking both fertilizer composition and nutrient delivery mechanisms. In this context, the present study investigates an integrated approach that combines agro-industrial waste valorisation with bio-based coating technologies to develop organomineral controlled-release fertilisers (CRFs). Nutrient-rich substrates were generated through aerobic and anaerobic biotransformation processes and subsequently blended with phosphogypsum (PG) to form organomineral matrices, while pectin extracted from orange peels and liquid digestate were explored as biodegradable coatings capable of modulating nutrient diffusion. Structural and physicochemical properties were characterised using FTIR, SEM, and pH analysis, alongside evaluations of nutrient release dynamics (NPK), germination performance, and fertilization efficiency. The results highlight how formulation and coating type shape release behaviour: pectin-coated compost (M2) significantly limited nitrogen release to $22.05 \pm 1.43\%$ over 28 days, whereas the M5 formulation (50% compost–50% PG) coated with liquid digestate sustained phosphorus release at $33.17 \pm 2.16\%$, and its pectin-coated counterpart exhibited controlled potassium release reaching $25 \pm 1.45\%$ within the same timeframe—profiles consistent with CRF standards. Beyond performance, these findings point to a broader conceptual shift, where waste-derived materials are not merely recycled but engineered into functional systems capable of synchronizing nutrient availability with plant demand. Such strategies offer a pathway toward improved nutrient use efficiency, reduced environmental impact, and more resilient agricultural practices aligned with circular economy principles and global sustainability goals.

Keywords: Controlled-release fertilisers, Organomineral fertilisers, Biodegradable coatings, Nutrient release, Circular economy.



DRISS AZDEM

ADVANCES IN SOLAR-DRIVEN DESALINATION: EMERGING MATERIALS, PROCESSES, AND CHALLENGES FOR SUSTAINABLE FRESHWATER PRODUCTION

AZDEM DRISS^{1*}, MABROUKI JAMAL¹

¹Laboratory of Spectroscopy, Molecular Modelling, Materials, Nanomaterial, Water and Environment, CERNE2D, Mohammed V University in Rabat, Faculty of Science, Avenue Ibn Battouta, BP1014, Agdal, Rabat, Morocco

*Corresponding author: azdem.driss13@gmail.com

Abstract: The rapid expansion of global freshwater demand continues to intensify interest in solar-driven desalination as a sustainable alternative for water production, particularly in coastal and remote regions. Recent innovations have focused on enhancing thermal localisation, improving salt-management mechanisms, and optimising energy efficiency across a wide range of systems. Interfacial solar evaporation has gained considerable momentum because of its ability to confine heat at the liquid–vapour boundary, yet salt accumulation remains a central technical challenge. Novel materials such as Janus membranes, wood-based evaporators, and carbon-structured absorbers have demonstrated promising improvements in evaporative efficiency and anti-fouling behaviour. Beyond interfacial systems, floating solar stills, freeze desalination, and hybrid adsorption-based processes are being actively explored to treat hypersaline brines using low-grade energy sources. These alternative pathways offer potential advantages in niche applications, particularly when coupled with solar thermal or photovoltaic systems. At the commercial scale, several pilot plants and containerized off-grid units have emerged, illustrating the increasing readiness of solar desalination technologies for field deployment. Despite these advances, key challenges persist, including long-term durability, material stability under real operating conditions, and the scalability of laboratory-optimised designs. Continued research integrating materials science, process engineering, and techno-economic assessment is essential to support the transition of solar desalination towards widespread implementation and contribution to global freshwater security

Keywords: *Solar desalination, Interfacial evaporation, Anti-scaling materials, Hybrid desalination systems, Sustainable water treatment*

YOUSSEF AZIZI

**WATER REFORMS IN MOROCCO: A POLITICAL AND HEALTH
ANALYSIS THROUGH THE GILL AND WALT FRAMEWORK**

**AZIZI YOUSSEF^{1*}, OUDRHIRI SAFIANI MOHAMMED¹, EL HIRI ABDERRAZAK¹, &
MAGDOUD AMINA¹**

¹Sidi Mohamed Ben Abdellah University Fez, Doctoral Studies Centre: Economics and Management Sciences,
Research Laboratory: LIREFIMO

*Youssefazizi1998fes@gmail.com

Abstract: Morocco, facing increasing water stress and the effects of climate change, has undertaken major water management reforms over the last decade. These reforms, including Framework Law 36-15 on water, the National Programme for Potable Water Supply and Irrigation (PNAEPI), and the promotion of innovative solutions such as desalination and wastewater reuse, aim to secure access to drinking water, improve irrigation efficiency, and ensure equitable distribution of resources. This paper proposes an analysis of these reforms through the Gill & Walt framework (policy triangle), examining policy content, actors, processes, and context. In addition, the study evaluates their potential impacts on public health using indicators such as access to drinking water, prevalence of waterborne diseases, and urban–rural disparities. The results suggest that political and institutional structuring contributes to strengthening resource sustainability, yet challenges persist regarding effective implementation and equity of access, which directly affect the health of vulnerable populations. This integrated approach provides a relevant analytical model for other countries experiencing water scarcity.

Keywords: *Water reforms, public policy, public health.*

KADIATA BA
EFFECTS OF NATURAL BIOMOLECULES ON SWIMMING SPEED
AND OXIDATIVE STRESS DEFENCE IN TETRAHYMENA
PYRIFORMIS: AN INNOVATIVE APPROACH

KADIATA BA*, BOUCHRA EL KHALFI, ABDELAZIZ SOUKRI

¹Laboratory of Health, Environment and Biotechnology, Team of Physiopathology, Molecular Genetics
and Biotechnology, Faculty of Sciences Ain Chock, Hassan II University of Casablanca, 20100
Casablanca, Morocco.

*kadiata.kadiata5@gmail.com

Abstract: This study aims to identify antioxidants capable of protecting cells against oxidative stress. We evaluated natural biomolecules for their protective potential against hydrogen peroxide (H₂O₂)-induced oxidative stress in *Tetrahymena pyriformis*. In vitro, the minimum effective concentration of the extract was determined, and its effects on cell growth, swimming speed, morphophysiological parameters, and key biochemical markers—catalase (CAT), superoxide dismutase (SOD), and malondialdehyde (MDA)—were assessed. The results demonstrated that the extract enhances cell growth and mobility, significantly activates antioxidant enzymes, and inhibits lipid peroxidation. These findings suggest that these biomolecules may represent a promising source of antioxidants for the exploration of protective mechanisms against oxidative stress.

Keywords: *Natural biomolecules, Antioxidant, Oxidative Stress*

AICHA BAALALA

**GASTRIC JUICE PH AS A POTENTIAL BIOMARKER FOR
PRECANCEROUS CHANGES: EXPLORATORY INSIGHTS FROM
AN HELICOBACTER PYLORI-ENDEMIC COHORT**

**BAALALA AICHA^{1,2}, KHEIR FATIMA ZAHRA^{1,3}, BADRE BADRE⁴, MELLAH ABDELHAK,
ABIDI OMAR⁵, HARICH NOURDIN², & BOURA HASNA^{1*}**

¹Laboratory of Helicobacter pylori and Gastric Pathologies, Institut Pasteur du Maroc, Casablanca 20360,
Morocco

²Laboratory of Anthropogenetics, Biotechnology and Health, Faculty of Sciences El Jadida, University
Chouaib Doukkali, El Jadida, 24000, Morocco

³Biotechnology and Valorisation of Plant Resources/Algae and Plants Team, Faculty of Sciences El Jadida,
University Chouaib Doukkali, El Jadida, 24000, Morocco

⁴Gastroenterology department, Ibn Rochd University Hospital Centre, Casablanca, Morocco

⁵Health Sciences and Sustainable Development Laboratory, ISPITS of Casablanca, Morocco

*Hasna Boura, 1, Place Louis Pasteur 20360 Casablanca, Morocco hasna.boura@pasteur.ma, +212 610592904.

Orcid ID: 0000-0003-3880-1615

Abstract: Gastric juice is a potential reservoir of biomarkers, with acidity playing a pivotal role in homeostasis. Helicobacter pylori (H. pylori) disrupts acid secretion, potentially inducing hypochlorhydria and atrophic gastritis, a key stage in the Correa cascade. Data on the interplay between gastric pH, H. pylori and mucosal lesions in North African populations remain scarce. This exploratory study examined these associations in 89 patients at Ibn Rochd University Hospital, Casablanca. The infection prevalence was 80.89%. Significant associations were found between H. pylori and gastric pathologies ($p = 0.023$), particularly atrophy ($p = 0.041$). Although a trend towards reduced acidity was observed in advanced lesions, with a mean pH of 6.0 ± 2.1 in intestinal metaplasia compared to 5.0 ± 2.7 in chronic gastritis, no statistical significance was established. In conclusion, H. pylori is a primary driver of the precancerous cascade in this Moroccan cohort, and these exploratory findings provide a basis for future multi-marker studies and warrant larger-scale investigation.

Keywords: *Helicobacter pylori, Gastric acidity, Gastritis, Precancerous lesions.*

BADRE BAKZAZA

**PSYCHOSOCIAL AND COGNITIVE DETERMINANTS OF QUALITY
OF LIFE IN HAEMODIALYSIS PATIENTS IN MOROCCO: A
MULTIPLE LINEAR REGRESSION ANALYSIS**

BAKZAZA BADRE^{1*}, LEMMIH HANANE¹, RACHIQ SAAD¹, & RAOUI SIDI MOHAMMED^{1,2}

¹Functional Ecology and Environment Engineering Laboratory, Faculty of Sciences and Technology, Sidi
Mohamed Ben Abdellah University (USMBA), Fes 30050, Morocco

²Higher Institute of Nursing and Health of Meknes, 50000, Morocco

*badre.bakzaza@usmba.ac.ma

Abstract: Identifying the factors that influence the quality of life of patients living with end stage kidney disease is essential for improving overall patient management and guiding clinical interventions. This study aims to analyse the determinants of quality of life among haemodialysis patients by exploring both physical and mental health dimensions. A cross-sectional study was conducted among several dozen patients with end-stage chronic kidney disease receiving treatment at a haemodialysis centre in the city of Meknes. Health-related quality of life was assessed using the KDQOL-SF questionnaire in a version adapted to the Moroccan context. Statistical analysis included Pearson correlation tests to explore relationships between the studied variables. Multiple linear regression models were subsequently applied to identify factors independently associated with the physical and mental health components. The findings revealed a moderate overall quality of life. Physical health was associated with social interactions, symptom burden, sleep quality, cognitive function, and social support. Mental health was mainly related to cognitive function and the perceived impact of the disease on daily life. These findings highlight the importance of a multidimensional approach integrating psychosocial, cognitive, and symptomatic aspects to improve the well-being and overall care of haemodialysis patients.

Keywords: *Haemodialysis; Quality of life; Chronic kidney disease; Determinants.*



YOUSRA BEHJA

ENVIRONMENTALLY-FRIENDLY TREATMENT OF PRIMARY WASTEWATER USING NATURAL ADSORBENT MIXTURES

BEHJA YOUSRA^{1*}, HADDOUCH BILAL¹, ZAKIR OTHMANE¹, IDOUHLI RACHID¹, EL FELS LOUBNA², KHADIRI MOHY EDDINE¹, ELAATMANI MOHAMED¹, & ABOUELFIDA ABDESSELAM¹

¹Laboratory of Physical Chemistry of Materials and Environment (LPCME), Department of Chemistry, Faculty of Sciences Semlalia, University of Cadi Ayyad, BP 2390, Marrakech, Morocco

²Laboratory of Water Sciences, Microbial Biotechnologies, and Natural Resources Sustainability (AQUABIOTECH), Unit of Microbial Biotechnologies, Agrosciences, and Environment (BIOMAGE)-CNRS Labelled Research Unit N°4, Faculty of Sciences-Semlalia, University Cadi Ayyad, PO Box 2390, Marrakech 40000, Morocco

*y.behja.ced@uca.ac.ma

Abstract: Water scarcity and wastewater pollution represent major environmental challenges, particularly in arid and semi-arid regions where freshwater resources are limited. Conventional wastewater treatment plants often rely on multi-stage processes that are energy-intensive and may remain insufficient for producing effluents suitable for reuse. The development of simple, low-cost, and environmentally-friendly post-treatment solutions is therefore essential. This study evaluates natural diatomite–zeolite mixtures as an eco-friendly filtration medium for the treatment of primary decanted municipal wastewater. Wastewater samples were collected at the preliminary treatment stage of the Marrakech wastewater treatment plant, where screening and sedimentation are applied. Gravity-driven filtration experiments were performed using a fixed adsorbent mass of 5 g and different zeolite-to-diatomite ratios (0–100%). Water quality was assessed through turbidity, biochemical oxygen demand (BOD₅), chemical oxygen demand (COD), and selected metals (Al and Cr). The results show a clear improvement in wastewater quality after filtration, with removal efficiencies strongly dependent on adsorbent composition. Intermediate diatomite–zeolite ratios exhibited the highest performance, indicating a synergistic effect between diatomite filtration and zeolite adsorption and ion-exchange properties. Overall, natural diatomite–zeolite mixtures constitute a promising, sustainable, and low-cost option for improving the quality of primary treated wastewater and supporting decentralised water reuse strategies.

Keywords: *Eco-friendly filtration, Adsorption, Sustainable water reuse.*



AYOUB BELAIDI

**PREDICTING THE ECOTOXICOLOGICAL TOXICITY OF
AQUATIC CONTAMINANTS USING GRAPH NEURAL NETWORKS**
**BELAIDI AYOUB^{1*}, AIT BOUGHROUS SAIDA², EL AYACHI RACHID¹, BINIZ MOHAMED³
& OUBEZZA MOHAMED⁴**

¹Department of Computer Science, Faculty of Science and Techniques Sultan Moulay Slimane University,
Campus Mghilla, Beni Mellal, 23000, Morocco

²Ethnopharmacology and Pharmacognosy, Faculty of Sciences and Techniques Errachidia, Moulay Ismail
University of Meknes, BP 509, Boutalamine, Errachidia 52000, Morocco

³Department of Computer Science, Polydisciplinary Faculty, Sultan Moulay Slimane University, Beni Mellal
23000, Morocco

⁴Department of Computer Science, Faculty of Science, Chouaib Doukkali University, El Jadida, Morocco

[*belaidiayoub7@gmail.com](mailto:belaidiayoub7@gmail.com)

Abstract: The presence of chemical contaminants in aquatic environments poses a growing threat to ecosystems and human health through their potential toxicity and widespread dissemination. Although analytical techniques based on liquid chromatography coupled with high-resolution mass spectrometry (LC-HRMS) can detect a wide range of compounds, they remain costly, time-consuming, and insufficient for systematic toxicity assessment, particularly for emerging substances. This study proposes an approach based on graph neural networks (GNN) for predicting the acute toxicity of aquatic contaminants, expressed in terms of median lethal concentration (LC50). Ecotoxicological data were extracted from public reference databases and subjected to cleaning and preprocessing procedures. Molecular structures were represented as atomic graphs using RDKit, enabling the training of several GNN-type architectures, including GNN, GAT, and MPNN. The results show that graph-based models offer robust performance for toxicity prediction, with the MPNN model achieving the best results (RMSE = 0.82 log-mM; $R^2 = 0.79$). This approach represents a promising tool for rapid screening and prioritization of contaminants of concern in aquatic systems.

Keywords: Ecotoxicity, Graph neural networks, Water monitoring.



MOHJAT BELAATAR

**PHYSICAL, PSYCHOLOGICAL, AND SEXUAL VIOLENCE AS RISK
FACTORS FOR MENTAL DISORDERS AMONG STUDENTS AT
ABDELMALEK ESSAÂDI UNIVERSITY.**

MOHJAT BELAATAR^{1*}, ADIL EL AMMOURI², AND ADIL NAJDI³

¹Laboratory Biology, Ecology, and Health UAE/U08FS, Faculty of Sciences, Abdelmalek Essaâdi University,
Tetouan, Morocco

²Department of Psychiatry, Faculty of Medicine and Pharmacy , Abdelmalek Essaâdi University, Tangier,
Morocco

³Department of Epidemiology, Public Health, and Social Sciences, Faculty of Medicine and Pharmacy,
Abdelmalek Essaâdi University, Tangier, Morocco

*mohjat.belaatar@etu.uae.ac.ma

Abstract : Background: Childhood violence can have long-lasting effects on mental health, increasing the risk of various disorders, including suicide. This study aims to assess the prevalence of mental disorders linked to violence and identify the most severe form of violence in our sample of university students. Methods: A survey was conducted with 1191 students from Abdelmalek Essaâdi University – Campus of Tetouan with an average age of 21, of which 52.56% were female. Sociodemographic data, psychiatric history, and history of childhood violence were collected through a questionnaire developed by the team, while data on mental health disorders were collected using the M.I.N.I. questionnaire. Results: The study found a strong association between different forms of violence and mental disorders. Major depressive episode was the most prevalent disorder, with rates of 61.7%, 55.9%, and 53.7% among victims of sexual, psychological, and physical violence, respectively. Generalized anxiety disorder followed with rates of 53.2%, 50.8%, and 49.5%, along with suicidal risk and social anxiety disorder. Conclusion: This study highlights the impact of childhood violence on mental health, emphasizing the need for awareness and action to protect children's mental well-being in Moroccan society.

Keywords: Violence, Young adult, Mental health, Abuse.



ILYASS BELRHAZI

CATALYTIC PYROLYSIS OF PLASTIC WASTE USING CO-MOF-INCORPORATED ZEOLITE FOR ENHANCED MAHS PRODUCTION

ILYASS BELRHAZI^a, SAID SAIR^b, HANANE AIT OUSALEH^b, MOHAMED ZAHOUILY^a

^a Laboratory of Biotechnology, Agrifood, Materials, and Environment, Faculty of Science and Technology,
Hassan II University of Casablanca, BP 146, Mohammedia 20650, Morocco.

^b College of Chemical Sciences and Engineering (CCSE), Laboratory of Inorganic Materials for Sustainable
Energy Technologies (LIMSET), University Mohammed VI Polytechnic (UM6P), Benguerir, 43150, Morocco

*ilyassbelrhazi20@gmail.com

Abstract: The rapid accumulation of plastic waste represents a critical environmental and societal challenge. Catalytic pyrolysis offers an efficient route to convert these wastes into high-value hydrocarbon products. In this work, real plastic waste was pyrolyzed in situ using a zeolite catalyst modified with cobalt species derived from metal-organic frameworks (MOFs) in a Py-GC/MS system. The incorporation of cobalt improved metal dispersion and electronic properties within the zeolite, enhancing the availability of active sites and directing the reaction toward monocyclic aromatic hydrocarbons (MAHs) and gasoline-range aliphatic compounds. Notably, the modified catalyst suppressed the formation of polycyclic aromatic hydrocarbons (PAHs), which are commonly observed over unmodified zeolites due to secondary oligomerization and condensation reactions. The effect of catalyst-to-plastic ratio was evaluated, revealing that higher catalyst loadings favored secondary transformations, including alkylation and methyl transfer, resulting in more substituted aromatic products. These results provide mechanistic insights into the role of cobalt-incorporated zeolites in steering plastic pyrolysis toward selective hydrocarbon production.

Keywords: *Plastic waste; Zeolite; Co-MOF; Cobalt oxide; MAHs; Catalytic pyrolysis.*



YOUSRA BELAYACHI

DEVELOPMENT AND EVALUATION OF A NOVEL BIOPOLYMER-BASED HYDROGEL ON PLANT GROWTH UNDER DIFFERENT HYDRIC STRESS CONDITIONS FOR SUSTAINABLE AGRICULTURE

BELAYACHI YOUSRA^{1*}, BENYAMANE SOUKAINA¹, ELGARRAS IMAD¹, BACHRA YAHYA¹, & ZAHOUILY MOHAMED^{1,2}

¹Laboratory of Biotechnologies, Agrifood, Materials and Environment, URAC 24, Faculty of Science and Technology, Hassan II University, Casablanca, Morocco

²Fert-Explorer, Mohammed VI Polytechnic University, Ben Guerir, Morocco

*yousrabelayachi9@gmail.com

Abstract: Agricultural activity is currently facing major challenges linked to population growth. Water is a crucial element in agriculture and a key factor for sustainable agricultural production. In this context, the development of hydrogels with controlled water release is considered a valuable strategy to reduce excessive water use. This research project focuses on the synthesis and characterisation of biopolymer-based hydrogels, designed to release water gradually in soil under different hydric stress conditions. The hydrogels were prepared using biopolymers, particularly polysaccharides, which are natural, biodegradable, non-toxic, renewable, inexpensive and environmentally friendly. The synthesised hydrogels will be characterised based on their physicochemical properties, including swelling and retention capacity in soil. In addition, biopolymer-based hydrogels provide effective swelling and water retention capacity. Overall, this research project focuses on the development of new controlled-release hydrogels offering improved water retention through gradual water release.

Keywords: *Hydrogel, Biopolymers, Hydric Stress Conditions, Sustainable agriculture.*

MILOUD BELHIMER

**OUALIDIA LAGOON (MOROCCO): QUANTIFICATION OF METAL
POLLUTION AND ASSESSMENT OF ASSOCIATED ECOLOGICAL
AND HEALTH RISKS**

BELHIMER MILOUD^{1*}, ACHTAK HAFID^{1,2}, & DAHBI ABDALLAH¹

¹Laboratory of Ecotoxicology, Bioresources and Coastal Geomorphology, Department of Biology, Polydisciplinary
Faculty, Cadi Ayyad University, Sidi Bouzid, P.O. Box 4162, 46000 Safi, Morocco

²Laboratory of Biology, Ecology, and Health, Faculty of Sciences, Abdelmalek Essaadi University, Tetouan,
Morocco

*a.belhimer.ced@uca.ac.ma; belhimer.miloud@gmail.com

Abstract: This study assessed trace metal contamination (Cd, Cu, Cr and Zn) in oysters, water and sediments along the Moroccan Atlantic coast between Safi and Oualidia, and evaluated associated ecological and health risks. Oysters showed elevated concentrations, with Zn predominant (1019.20–2326.20 mg/kg), alongside Cd, Cu and Cr. Station S1 was the most contaminated (PERI: 181.03), compared to lower values at S2 and S3. THQ values indicated potential health risks, particularly for Cd, with exceedances above safe thresholds. Estimated daily intakes for Cd exceeded FAO limits in children, whereas adult exposure remained lower. Maximum safe consumption was markedly higher in adults than in children. These findings highlight spatial variability in contamination and indicate significant ecological and health risks, especially for children.

Keywords: *Metal pollution, Oualidia lagoon, Oysters, Health risks.*

BEN KACEM ZIANI HASNAE
RELIABILITY OF THE NIJMEGEN–BETHESDA ASSAY FOR FVIII
INHIBITOR MEASUREMENT IN THE ERA OF NON-FACTOR
THERAPIES

BEN KACEM ZIANI HASNAE^{1*}, HOUARI MOUNA¹, & IDRISSE SERHROUCHNI KARIMA¹

¹Abdelmalek Essaadi University, Tetouan, Morocco

*hasnaebenkacemziani@gmail.com

Abstract: The Nijmegen–Bethesda assay (NBA) is the reference clot-based method for functional quantification of factor VIII (FVIII) inhibitors and was validated in the context of conventional FVIII replacement therapy. Its analytical principle assumes that clotting- based FVIII activity measurements reflect FVIII function alone. The increasing use of non- factor therapies, particularly emicizumab, which mimics FVIII cofactor activity independently of FVIII, challenges this assumption and raises concerns regarding assay reliability. This systematic review aims to evaluate the analytical performance and limitations of the NBA for FVIII inhibitor detection in patients receiving non-factor therapies and to identify proposed methodological adaptations. A structured literature search was conducted in major biomedical databases to identify clinical and laboratory studies assessing NBA performance under non-factor therapy exposure. Eligible studies were screened and analysed for reported assay interference, diagnostic accuracy and mitigation strategies. The available evidence consistently shows that emicizumab interferes with clot-based FVIII activity assays and can lead to inaccurate NBA inhibitor titres, including underestimation or masking of inhibitors. Multiple reports describe reduced assay specificity and variable sensitivity. Proposed solutions include adapted testing algorithms, pre-analytical sample treatment and the use of bovine-based chromogenic FVIII assays as complementary methods. In conclusion, the NBA requires methodological adaptation in patients receiving non-factor therapies. Recognising these analytical limitations is essential to ensure reliable inhibitor monitoring and appropriate clinical interpretation in modern haemophilia A management.

Keywords: *Nijmegen–Bethesda assay, Emicizumab, Haemophilia A.*



HIBA BENCHEHIDA

**THE INFLUENCE OF THE DIGITAL ENVIRONMENT ON EATING
HABITS AND RISK OF OBESITY AMONG MOROCCAN UNIVERSITY
STUDENTS AND IMPACT ON PREVENTION OF NCDs**

BENCHEHIDA HIBA^{1*}, RAZZAK SARA¹, LAASSILIA OUMAIMA¹, & TABOZ YOUNESS¹

¹Natural Resources and Sustainable Development Laboratory, Research Unit in Nutrition, Metabolism and Physiology, Department of Biology, Faculty of Sciences, IBN TOFAIL University, Kenitra, Morocco

*hibabencsehida@uit.ac.ma

Abstract: Non-communicable diseases (NCDs) pose a significant threat to global health sustainability, with lifestyle habits formed during university often persisting into adulthood. This study investigated the impact of the digital environment—including social media and online food marketing—on the dietary behaviours and weight status of Moroccan university students. Through a cross-sectional survey, researchers assessed lifestyle factors such as dietary habits, physical activity, sleep patterns and the perceived influence of digital media. Anthropometric data were used to classify weight categories and identify risk factors for overweight. The results revealed a considerable prevalence of overweight among students, with notable gender differences in physical activity and meal patterns. Frequent exposure to digital content promoting unhealthy eating was significantly associated with a higher likelihood of being overweight. These findings underscore the influence of the digital environment on health outcomes. To support sustainable NCD prevention, university-based strategies should integrate digital health literacy alongside traditional nutrition education to help students navigate modern dietary influences.

Keywords: *Digital environment, Eating behaviour, Overweight, University students.*



SOUKAINA BENYAMANE

**EFFECT OF SULPHUR NANOPARTICLES ON BIOPOLYMER-BASED
PH-RESPONSIVE INDICATOR FILMS FOR SMART FOOD
PACKAGING**

BENYAMANE SOUKAINA¹, BELAYACHI YOUSRA¹, ELGARASS IMAD¹, BACHRA
YAHYA¹, ZAHOUILY MOHAMED^{1,2*}

¹Laboratory of Biotechnology, Agri-food, Materials, and Environment, Faculty of Science and Technology,
Hassan II University, B.P. 146, Casablanca, Morocco

²Fert-Explorer, Mohammed VI Polytechnic University, Lot 660-Hay Moulay Rachid, 43150 Ben Guerir,
Morocco

*mohamed.zahouily@fstm.ac.ma

Abstract: The growing demand for sustainable packaging in the modern food sector, particularly in Mediterranean countries, is driving the development of intelligent materials that preserve food quality while reducing plastic waste and food losses. Eco-friendly packaging capable of providing real-time freshness information has become increasingly important. This study investigates the effect of sulphur nanoparticles (SNPs) on the formulation and performance of biopolymer-based pH-responsive indicator films for smart food packaging. The films are developed from renewable biopolymers and enriched with natural colourimetric indicators such as anthocyanins, enabling visible colour changes in response to pH variations associated with food spoilage. The prepared films are evaluated in terms of mechanical properties, barrier performance, and pH sensitivity, with a focus on how SNP incorporation influences film structure, functionality, and colour stability. Structural and optical characterisation are conducted to assess applicability under realistic packaging conditions, supporting the development of sustainable packaging that enhances food safety and contributes to environmental protection.

Keywords: *Intelligent packaging, Biopolymer film, Sulphur nanoparticles (SNPs).*



ICHRAQ BEN ELFKIH

POTENTIAL USE OF *SARGASSUM MUTICUM* AS A SOURCE OF PLANT BIOSTIMULANTS FOR ENHANCING GERMINATION AND GROWTH OF RADISH (*RAPHANUS SATIVUS* L.) USING ECO-FRIENDLY EXTRACTS

BEN ELFKIH ICHRAQ^{1*}, JADOUR LAHCEN¹, AAMIRI ABDERRAHMANE¹,
TOUHAMIA YASMINE¹, BARHOUM KHARBOUCH², BOUGUIRI HASSAN², REZZOUM
NOR-EDDINE ³, MIMOUNI ABDELAZIZ ⁴, OULD BEL LAHCEN TOURIA ^{1*}

¹Health, Environment and Biotechnology Laboratory, Department of Biology, Faculty of Science - Ain Chock, University Hassan II, Casablanca, Morocco

²Society Agrivivos , Haliopolis park , Drarga, Agadir, Morocco

³Coastal Resources Prospecting Laboratory, Regional Centre of the National Institute of Fisheries Research of Casablanca, Morocco

⁴Regional Centre for Agricultural Research, National Institute of Agronomic Research (INRA), Agadir, Morocco

*benelfkihichraq@gmail.com/bellahcentouria@gmail.com

Abstract: Because of their biostimulatory properties, seaweeds and their derived extracts have gained increasing attention as valuable tools in sustainable agriculture. This growing interest offers a promising opportunity to explore novel applications for the biomass of the invasive brown seaweed *Sargassum muticum*, thereby contributing to the mitigation of its adverse ecological impacts. In this context, this study aimed to determine the biostimulant effects of extracts from the invasive brown alga *S. muticum* on seed germination and growth of radish (*Raphanus sativus* L.) in vitro and in greenhouse conditions via soil application. To achieve these objectives, two different eco-friendly extracts (hot and cold) at varying concentrations were prepared and applied to radish seeds and as soil treatments on radish seedlings grown in experimental pots under natural conditions. The results showed that seeds treated with both types of *S. muticum* extracts at low concentrations (10% and 20%) germinated clearly, with improvements in seedling size, as well as stem size and fresh biomass. Furthermore, greenhouse-grown radish plants exhibited enhanced growth in terms of total plant size, leaf size, fresh weight, and root calcium content when treated with a high concentration of cold extract (7%). This study demonstrates that the Moroccan invasive seaweed *S. muticum* exhibits biostimulant effects, positioning it as a promising tool for sustainable agriculture.

Keywords: *Sargassum muticum*, alien seaweeds, *Raphanus sativus* L. (Radish), Biostimulant, ecofriendly extracts, sustainable agriculture.



LAHCEN BIDARNE

SEROPREVALENCE, RISK FACTORS, AND PREDICTION OF HEPATITIS B, HEPATITIS C, AND HIV AMONG HAEMODIALYSIS PATIENTS

BIDARNE LAHCEN^{1*}, NAJDI ADIL², OBTEL MAJDOULINE³, & AHMED KHARBAS¹

¹ Research Laboratory on Cancer and Communicable Diseases (RLCCD), Faculty of Medicine and Pharmacy of Tangier, Abdelmalek Essaâdi University

² Laboratory of Biostatistics, Clinical Research, and Epidemiology (LBCRE), Faculty of Medicine and Pharmacy of Rabat, Mohamed V University

*Lahcen.bidarne@etu.uae.ac.ma

Abstract: Patients undergoing haemodialysis are at increased risk of blood-borne viral infections, particularly hepatitis B virus, hepatitis C virus, and human immunodeficiency virus, through repeated invasive procedures and prolonged exposure to medical devices. This study aimed to estimate the prevalence of hepatitis B, hepatitis C, and HIV among haemodialysis patients in the Guelmim region, identify factors associated with hepatitis B seropositivity, and assess the performance of machine learning models in predicting hepatitis B infection. A cross-sectional analytical study was conducted among 305 haemodialysis patients in the Guelmim region. Sociodemographic, clinical, and biological data were collected using structured questionnaires and medical records. Descriptive analyses were performed to characterise the study population, and inferential statistical tests were used to identify factors associated with hepatitis B seropositivity. In addition, four supervised machine learning models—Support Vector Machine, Naïve Bayes, Random Forest, and K-Nearest Neighbours—were developed to predict hepatitis B serological status. The overall prevalence was 2.62% for hepatitis B, 0.33% for hepatitis C, and 0.66% for HIV. Hepatitis B seropositivity was significantly associated with incomplete vaccination status, type of vascular access, and duration of haemodialysis. Among the machine learning approaches, Random Forest and Support Vector Machine achieved the highest predictive performance, with near-perfect area under the curve values and sensitivity and specificity exceeding 98%, followed by K-Nearest Neighbours and Naïve Bayes. In conclusion, although the prevalence of viral infections among haemodialysis patients remains relatively low, continuous surveillance is essential. The integration of machine learning models, particularly Random Forest and Support Vector Machine, represents a promising strategy for early detection and targeted prevention in haemodialysis units.

Keywords: *Haemodialysis, Hepatitis; HIV, Seroprevalence, Machine learning.*

ASMAA BOUABBADI

**ELECTROCHEMICAL, THERMODYNAMIC AND THEORETICAL
STUDIES OF CERTAIN 8- HYDROXYQUINOLINE DERIVATIVES
USED AS ACID CORROSION INHIBITORS FOR MILD STEEL**

BOUABBADI ASMAA^{1*}, RBAA MOAHMED², ELOUHABI NORA¹, & HARCHARRAS

MOHAMED¹

¹Laboratory of Advanced Materials and Process Engineering, Department of Chemistry, Faculty of Sciences, Ibn Tofaïl University, B.P. 14000 Kenitra, Morocco

²The Higher Institute of Nursing Professions and Health Techniques of Rabat-Annex Kenitra-Ministry of Health and Social Protection, Morocco

*asmaa.bouabbadi@uit.ac.ma

Abstract: Two derivatives of 8-hydroxyquinoline, (Q-CH₃) and (Q-NO₂), were studied as corrosion inhibitors for mild steel in a 0.5 M H₂SO₄ solution using polarisation (PDP) and electrochemical impedance spectroscopy (EIS) techniques. Electrochemical results indicate that Q-CH₃ and Q-NO₂ act as mixed corrosion inhibitors. The percentage inhibition efficiency increased with inhibitor concentration, and their adsorption on mild steel follows the Langmuir isotherm. Charge transfer resistance and double-layer capacitance were found to vary with inhibitor concentration. In addition, the adsorbed film formed on the metal surface was analysed using scanning electron microscopy (SEM) and EDX spectroscopy. Quantum chemistry calculations and molecular dynamics simulations are in good agreement with the experimental results.

Keywords: *8-hydroxyquinoline derivatives, Corrosion inhibition, Electrochemical techniques.*

AICHA BOUBKER
CHEMICAL CHARACTERISATION OF PHYTOBIOTIC
FORMULATIONS AND ASSESSMENT OF THE SYNERGISTIC
EFFECTS OF PLANT COMBINATIONS ON ZOOTECHNICAL
PERFORMANCE IN POULTRY

AICHA BOUBKER^{1*}, ABDELMOULA EL OUARDI², TAHA EL KAMLI³, MOHAMMED KAICER⁴, FAOUZI KICHOU⁵, KHAOULA ERRAFI⁶, ADNANE EL HAMIDI¹, RACHID BEN AAKAME⁷ AND AICHA SIFOU¹

¹Laboratory of Materials, Nanotechnologies and Environment, Faculty of Sciences, Mohammed V University in Rabat, Morocco

²Department of Microbiology of Water, Food and Environment, National Institute of Hygiene, Rabat, Morocco.

³Laboratory of Anti-Doping Control, Hassan II Institute of Agronomic and Veterinary, Rabat, Morocco.

⁴Laboratory of Analysis, Geometry and Applications, Systems and Optimization, Ibn Tofail University, Kenitra, Morocco.

⁵Department of Pathology and Veterinary Public Health, Hassan II Institute of Agronomic and Veterinary, Rabat, Morocco.

⁶African Genom, University Mohammed VI Polytechnic Centre, Benguerir, Morocco.

⁷Laboratory of Food Toxicology, National Institute of Hygiene, Rabat, Morocco.

*aicha.boubker@um5r.ac.ma

Abstract: The increasing restrictions on the use of antibiotic growth promoters in poultry production have stimulated the search for natural alternatives capable of improving animal health and productivity. Phytobiotics derived from medicinal and aromatic plants have attracted considerable attention due to their antimicrobial, antioxidant, and digestive-stimulating properties. In addition, combinations of different plant species may generate complementary or synergistic effects that enhance their biological activity and overall efficacy.

The present study aims to chemically characterise selected plants and evaluate the effects of their combinations on zootechnical performance in poultry. Plant extracts were prepared and subjected to chemical analyses to characterise their main bioactive constituents. Based on their chemical and biological properties, selected plants were subsequently combined in defined proportions and incorporated into poultry diets in their native form. Feeding trials were conducted to assess the effects of these phytobiotic formulations on growth performance parameters, including body weight gain, feed intake, and feed conversion ratio.

The results highlight the potential of combined plant-based formulations to improve poultry productivity and support the use of phytobiotics as natural alternatives to antibiotic growth promoters.

Keywords: *Phytobiotics, plant synergy, poultry, zootechnical performance, animal nutrition.*



OMAIMA BOUDAIA

**COMPARATIVE ASSESSMENT OF IN VITRO CYTOTOXICITY AND
IN VIVO ACUTE TOXICITY OF FLAVONOID EXTRACTS FROM
TETRAENA GAETULA**

BOUDAIA OMAIMA^{1*}, SEKKOUT ZINEB¹, ELBIRGUI KAOUTHAR², EOUNES NADIA³,
ELAMRANI NAJAT¹, RADALLAH DRISS¹, & EL HAMSAS EL YOUNI AMAL¹

¹Laboratory of Biology and Health, Faculty of Sciences Ben M'Sik, University Hassan II, Casablanca, Morocco

²Laboratory of Chemistry and Biochemistry, Nutrition, Environment and Health, Faculty of Medicine and
Pharmacy of Casablanca, Morocco

³Laboratory of Ecology and Environment, Faculty of Sciences Ben M'Sik, University Hassan II, Casablanca,
Morocco

* omaima.boudaia@gmail.com

Abstract: *Tetraena gaetula* is a medicinal plant native to Morocco and traditionally used in the management of diabetes, gastrointestinal disorders, and dermatological conditions. Its toxicological profile remains insufficiently characterised. The present study aimed to assess the in vitro cytotoxicity and in vivo acute toxicity of flavonoid extracts obtained from *T. gaetula*. In vitro cytotoxicity was evaluated using the *Artemia salina* lethality assay, a widely accepted preliminary screening model for toxicity assessment. Potassium dichromate was used as a reference standard, and LC50 values were calculated by probit analysis after 24 hours of exposure. In parallel, acute in vivo toxicity was investigated in mice following intraperitoneal administration of the extract at doses ranging from 25 to 10 000 mg·kg⁻¹. Animals were monitored for mortality and behavioural or morphological alterations over a 14-day period to estimate the LD50. The results demonstrated concentration-dependent lethality, with weak in vitro cytotoxic activity, as indicated by an LC50 value exceeding 200 µg·mL⁻¹ in the *A. salina* assay. Similarly, no mortality or significant toxic signs were observed in vivo at any tested dose. Consequently, the LD50 was considered to be greater than 10 000 mg·kg⁻¹, classifying the extract as practically non-toxic according to the Hodge and Sterner scale. These findings support the relative safety of *T. gaetula* flavonoid extracts and justify further pharmacological investigations.

Keywords: *Tetraena gaetula*, Flavonoids, Cytotoxicity, Acute toxicity.



KHADIJA BOUKATE

**ANTIBIOTIC RESISTANCE PROFILING OF UROPATHOGENIC
ENTEROBACTERIACEAE IN CASABLANCA, MOROCCO (2023–2024)**

BOUKATE KHADIJA^{1*}, AKHELLOUF FATIMA-ZAHRA¹, AMARIR FATIMA¹, &
BOURJILAT FATNA²

¹Integrative Biology, Department of Biology, Faculty of Sciences Ain Chock, Hassan II University, Casablanca,
Morocco

²Bacteriology and parasitology Laboratory, Biology and Medical Department, Institut Pasteur du Maroc,
Casablanca, Morocco

*boukatekhadija@gmail.com

Abstract: Urinary tract infections are common in both community and hospital settings. In recent years, there has been an increase in the incidence of antibiotic resistance in uropathogenic Enterobacteriaceae. This development highlights the need for periodic regional surveillance, which represents a significant public health concern. This study aims to determine the antibiotic resistance profile of uropathogenic Enterobacteriaceae isolated at the Institut Pasteur in Casablanca between 2023 and 2024. A retrospective analysis was conducted on urine culture (ECBU) samples collected from patients during the study period. Cultures were performed using standard techniques, and the antibiogram was carried out according to the recommendations of the European Committee on Antimicrobial Susceptibility Testing (EUCAST). Statistical analysis was conducted using Python. Among the analysed urine cultures, 18.34% were positive. Enterobacteriaceae represented the predominant isolates, with *Escherichia coli* (57%) and *Klebsiella pneumoniae* (19%) being the most frequently recovered species among all isolates. Antimicrobial susceptibility testing showed high resistance rates to commonly used antibiotics, particularly β -lactams and quinolones. The development of resistance in uropathogenic Enterobacteriaceae to antibiotics is a worrying phenomenon that creates challenges in the therapeutic management of infections.

Keywords: Urinary tract infection, Enterobacteriaceae, Resistance.

FADILA BOUKHOUBZA

**ASSESSMENT OF GROUNDWATER QUALITY IN THE
MARRAKECH REGION FOLLOWING OLIVE OIL WASTEWATER
STORAGE IN SURROUNDING AREAS**

BOUKHOUBZA FADILA^{1*}, AIT BOUGHROUS ALI², YACOUBI-KHEBIZA MOHAMMED¹,
HASSANI LAHCEN³, & NEJMEDDINE AHMED¹

¹Cadi Ayyad University, Faculty of Sciences Semlalia, Department of Biology, Laboratory of Hydrobiology,
Ecotoxicology & Sanitation, BP. 23 90, Boulevard Le Prince Moulay Abdellah, Marrakech, Morocco

²Research team: Biology, Environment and Health; Faculty of Science and Technology of Errachidia, Moulay
Ismail University of Meknes, B.P. 509, Boutalamine, Errachidia, Maroc

³Cadi Ayyad University, Faculty of Sciences Semlalia, Department of Biology, Laboratory of Microbial Biology
and Biotechnology

*mmfadila@gmail.com

Abstract: This study examines the impact of olive oil wastewater storage on the physicochemical quality and underground biodiversity of the vulnerable Haouz groundwater table. These effluents are acidic and rich in organic matter, minerals, and phenolic compounds with antibacterial and phytotoxic properties. They are produced in large quantities in Mediterranean countries and are commonly stored in evaporation basins. Water from fourteen wells located near four olive oil wastewater storage basins was analysed. The results show that physicochemical and biological quality is strongly influenced by the presence of these basins. High values of COD (400 mg O₂ L⁻¹), polyphenols (180 mg L⁻¹), and electrical conductivity (1.89 mS cm⁻¹) were recorded in well P5, situated 5 m from a basin associated with a semi-modern mill. Biological analysis revealed disappearance of fauna typical of good-quality water and dominance of oligochaetes. By contrast, a waterproof basin installed within a modern mill limited infiltration. Wells located near this basin (P7 and P8) showed improved physicochemical quality (COD 26–30 mg O₂ L⁻¹; polyphenols 41–44 mg L⁻¹) and restoration of relatively abundant fauna, mainly crustaceans and ostracods.

Keywords: *Groundwater, Biodiversity, Olive oil wastewater.*



MEHDI BOURAQ

ESSENTIAL OIL OF THE MOROCCAN ENDEMIC CLADANTHUS SCARIOSUS: ANTIBACTERIAL AND ANTIOXIDANT POTENTIAL

BOURAQ MEHDI^{1*}, OUALILI HANANE¹, LAHLOU YOUSSEF¹, BELFAIZA MALIKA¹,
MAKROUM KACEM¹, & MAISSOUR ABDELLAH¹

¹Laboratory of Plant Biotechnology, Ecology, and Ecosystem Valorisation, URL – CNRST No.

10, Faculty of Sciences, Chouaib Doukkali University, El Jadida, Morocco

*bouraq.mehdi@ucd.ac.ma

Abstract: The widespread use of synthetic antioxidants can cause adverse effects, and the overuse of antibiotics contributes to the emergence of multidrug-resistant bacteria. Essential oils from aromatic plants represent promising natural alternatives because of their antimicrobial and antioxidant properties. This study evaluated the antibacterial and antioxidant activities of *Cladanthus scariosus* essential oil collected from the Azilal region. Aerial parts were harvested at full flowering in July 2023 and subjected to hydrodistillation using a Clevenger-type apparatus. Antibacterial activity was assessed using the disc diffusion method against *Staphylococcus aureus*, *Micrococcus luteus*, and *Pseudomonas aeruginosa*. Antioxidant activity was measured using the DPPH radical scavenging assay. The essential oil yield was 0.28% (w/w, dry weight). It exhibited significant antibacterial activity, with inhibition zones of 28.00 ± 1.73 mm for *S. aureus*, 14.00 ± 1.73 mm for *M. luteus*, and 18.33 ± 1.53 mm for *P. aeruginosa*, a strain resistant to lincomycin. The oil also demonstrated notable antioxidant activity ($IC_{50} = 0.36$ mg/mL). These findings highlight the potential of *C. scariosus* essential oil as a natural source of antibacterial and antioxidant agents, supporting its prospective applications in the pharmaceutical and food industries, pending further *in vivo* and toxicological studies.

Keywords: Antioxidant activity, Azilal, Morocco, *Cladanthus scariosus*, Essential oil, Antibacterial activity.

OUMAIMA BOUYAKHSASS

**INTEGRATED TREATMENT OF LANDFILL LEACHATE USING
COAGULATION, RED BRICK FILTRATION, AND AERATION
(KENITRA, MOROCCO)**

BOUYAKHSASS OUMAIMA^{1*}, SIDI ZEINE¹, BOUYAKHSASS ROUKAYA¹, MADINZI
ABDELAZIZ¹, BAKRAOUI HAJAR¹, DIGUA KHALID¹, & SOUABI SALAH¹

¹Laboratory of Process Engineering and Environment, Faculty of Sciences and Techniques Mohammedia,
University Hassan II of Casablanca, Morocco

* o.bouyakhsass@gmail.com

Abstract: Landfill leachate management remains a major environmental challenge in Morocco as a result of increasing waste production and the risk of soil and groundwater contamination. This study evaluates an integrated physicochemical treatment process applied to leachate from the Ouled Berjal landfill in Kenitra. The system combines coagulation using FeCl₃ (40%), filtration through locally sourced red bricks, and aeration. Treatment performance was assessed through chemical oxygen demand (COD), turbidity, and ammoniacal nitrogen (NH₄⁺). Coagulation achieved COD removal between 81% and 92%. After brick filtration, COD reduction reached up to 95%. Turbidity decreased by 69–71%, and NH₄⁺ removal reached approximately 80%. After 7 hours of aeration, a near-complete removal of odour-causing compounds, especially hydrogen sulphide (H₂S), was achieved. The use of red bricks as a low-cost and locally available geomaterial demonstrated effective filtration performance and mechanical stability. This integrated approach provides an efficient and sustainable treatment alternative adapted to Moroccan environmental and economic conditions, contributing to groundwater and soil protection.

Keywords: *Leachate Treatment, Coagulation, Red Brick Filtration, Aeration.*



GHIZLAN BOUZINI

**FAST FOOD CONSUMPTION PATTERNS IN MOROCCAN YOUTH
AND THEIR ASSOCIATION WITH THE RISK OF EARLY-ONSET
COLORECTAL CANCER**

BOUZINI GHIZLAN^{1*}, SAMMOUD KARIMA³, AMZERIN MOUNIA^{1,2}, NAJDI ADIL^{1,3}, & EL
M'RABET FATIMA ZAHRA^{1,2}

¹Cancer and Chronic Disease Research Laboratory, Faculty of Medicine and Pharmacy of Tangier, Abdelmalek
Essaadi University (UAE), Tangier, Morocco

²Oncology Centre of the Mohammed VI University Hospital of Tangier, Faculty of Medicine and Pharmacy of
Tangier, Abdelmalek Essaadi University (UAE), Tangier, Morocco

³Laboratory of Epidemiology and Public Health, Faculty of Medicine and Pharmacy of Tangier, Abdelmalek
Essaadi University (UAE), Tangier, Morocco

[*bouzinighizlan@gmail.com](mailto:bouzinighizlan@gmail.com)

Abstract: The incidence of early-onset colorectal cancer (EO-CRC) is increasing worldwide. Environmental and behavioural changes, particularly dietary patterns, may contribute to earlier onset of colorectal cancer. Morocco is experiencing a nutritional transition characterised by frequent consumption of fast food and industrial food products rich in refined sugars, meat, and saturated fats, alongside a rising number of CRC cases. This study aimed to assess the association between fast food consumption and the risk of EO-CRC among Moroccan youth. A matched case–control study included 308 CRC cases and 308 controls. Dietary intake was evaluated using a validated food frequency questionnaire, and associations were analysed using multivariable conditional logistic regression. The mean age was 54.8 ± 13.16 years in cases and 54.6 ± 13.62 years in controls, with participants under 50 years representing 34.1% and 37%, respectively. Among younger participants, 59.0% of cases reported fast food consumption compared to 0.9% of controls ($p < 0.001$). An adjusted odds ratio of 9.17 (95% CI: 2.93–28.57) was observed for intake exceeding three times per week. Alcohol consumption was identified as an additional risk factor. Higher socio-economic status, daily intake of more than 200 g of fruits and vegetables, and regular legume consumption showed protective effects. Fast food consumption was significantly associated with increased EO-CRC risk.

Keywords: *Fast food consumption; early-onset colorectal cancer.*



MAROUANE CHAHBOUNI

**COMPARATIVE EVALUATION OF MACERATION AND
ULTRASOUND-ASSISTED EXTRACTION ON THE CHEMICAL AND
BIOACTIVE PROFILE OF LAVANDULA MULTIFIDA**

CHAHBOUNI MAROUANE*¹, ELAINOUS HAFSA¹, AZIZI MOHAMED¹, MAJDOULI
KARIMA¹, DARDOURI ASSIA¹, ELHICHOUBILEN HAFIDA¹, HERRADI WAFAA¹,
SAMINE NOUHAILA¹, & AMINE ABDESSAMAD¹

¹Laboratory of Biochemistry, Environment and Agri-Food, Faculty of Science and Technology of
Mohammadia / Hassan II University Casablanca

*marouane.chahbouni-etu@etu.univh2c.ma

Abstract: This study explored the phytochemical profile and biological properties of *Lavandula multifida*, a medicinal species native to the Mediterranean basin. Two extraction techniques—maceration and ultrasound-assisted extraction—were performed at temperatures ranging from 20°C to 50°C, using water and 70% ethanol as solvents. The objective was to evaluate how extraction parameters influence the recovery of bioactive constituents and their associated biological activities. The highest total polyphenol content (20.460 ± 1.350 mg GAE/g extract) and flavonoid content (14.562 ± 0.032 mg QE/g) were obtained through ultrasound-assisted extraction at 20°C with 70% ethanol (SOH20). In contrast, the most pronounced antioxidant activity ($IC_{50} = 0.8 \pm 0.05$ mg/mL) was recorded for the hydroethanolic maceration extract at 20°C (MOH20), suggesting that extraction efficiency and antioxidant performance are not strictly correlated with total phenolic concentration. Antibacterial assays revealed moderate to strong inhibitory effects, with inhibition zones ranging from 7.33 mm to 16.10 mm. Although no significant effect on seed germination was observed, antimutagenic activity was confirmed by a 66.37% reduction in the root length of *Lepidium sativum* treated with MOH20 at 20 mg/mL. Furthermore, acute oral toxicity testing at 2000 mg/kg showed no mortality, indicating a low acute toxicity profile, despite minor physiological changes. Overall, these findings highlight the phytochemical richness of *L. multifida* and support its potential as a promising source of biologically active compounds for application in pharmaceutical and agri-food sectors.

Keywords: *Lavandula multifida*, Antioxidant activity, Antibacterial activity.



SANAA CHARROUK

**CHARACTERISATION OF ABCC8 VARIANTS IN MOROCCAN TYPE
2 DIABETES PATIENTS: IN VITRO ANALYSIS**

CHARROUK SANAA^{1*}, OUAHID ASMAE¹, JRAMY CHAIMAA^{1,2}, ADDADI WIAME¹,
DAZIA CHIFAE¹, & SAFI AMAL¹

¹Laboratory of Biotechnology, Agri-Food, Materials and Environment (LBAME), URAC 36; Faculty of
Science and Technology of Mohammedia, 20650, Morocco

²Nutrition, Genetics and Environmental Risk Exposure (NGRE) – INSERM U 1256 University of Lorraine,
Nancy, France

*Sanaa.charrouk-etu@etu.univh2c.ma

Abstract: Type 2 diabetes (T2D) is a complex metabolic disorder in which genetic factors play a major role in individual susceptibility. The ABCC8 gene, encoding the sulphonylurea receptor 1 (SUR1), a key subunit of the ATP-sensitive potassium channel involved in insulin secretion, has been associated with T2D in several populations. Data regarding the Moroccan population remain limited. The aim of this study was to detect and analyse in vitro genetic variants of the ABCC8 gene in Moroccan patients with T2D compared to non-diabetic controls. A total of 200 biological samples were included, comprising 100 patients diagnosed with T2D and 100 healthy control subjects. Genomic DNA was extracted from collected samples, and targeted ABCC8 polymorphisms were identified using molecular techniques based on polymerase chain reaction (PCR) amplification and variant analysis. Allelic and genotypic frequencies were compared between the two groups. The results revealed differences in the distribution of certain ABCC8 variants between patients and controls. These findings suggest a potential association between ABCC8 gene variants and susceptibility to T2D in the Moroccan population, highlighting the relevance of incorporating genetic data into precision medicine strategies for diabetes management.

Keywords: Type 2 diabetes, ABCC8 gene, Genetic polymorphism, Morocco.



WISSAL CHOUACHA

IMPROVING THE QUALITY AND SHELF-LIFE OF FISH OILS: ROLE OF REFINING PROCESSES AND SYNTHETIC ANTIOXIDANTS

CHOUACHA WISSAL^{1*}, ASBBANE ABDERRAHIM¹, NID AHMED MOUSSA¹, & GHARBY SAID¹

¹Biotechnology, Analytical Sciences and Quality Control, Polydisciplinary Faculty of Taroudant, University Ibn Zohr, Agadir 83000, Morocco

*chouachawissal@gmail.com

Abstract: This study investigated the chemical refining of crude fish oil obtained from sardine and mackerel in order to produce oil suitable for human consumption. The refining process included degumming, neutralization, and bleaching, which effectively removed impurities and improved the physicochemical properties of the oil and preserved the main polyunsaturated fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). The treatment significantly reduced acidity and showed high refining efficiency. The oxidative stability of the refined oil was also evaluated under different storage conditions. Three synthetic antioxidants, namely vitamin E, Naturox, and OT501 (BHT and BHA), were tested during storage at 25 °C and 40 °C for 60 days. Oil quality was evaluated by monitoring acidity or free fatty acids (FFA), peroxide value (PV), para-anisidine value (p-AV), and total oxidation (TOTOX). Our results indicate that antioxidant-treated samples were more stable than the control. Among the tested antioxidants, Naturox showed the highest effectiveness, followed by vitamin E and OT501. Optimal stability was observed at low antioxidant concentration (100 ppm) and storage at 25°C in dark conditions, and higher temperatures or excessive doses promoted pro-oxidant effects. Overall, our results demonstrate that chemical refining combined with appropriate antioxidant stabilization can produce high-quality and stable fish oil suitable for food and nutraceutical applications.

Keywords: *Fish oil, Chemical refining, Oxidative stability*

AMAL DAGNI

ANTIMICROBIAL, ANTIBIOFILM AND ANTIOXIDANT ACTIVITIES
OF MOROCCAN ESSENTIAL OIL OF *DYSPHANIA AMBROSIODES*

DAGNI AMAL^{1*}, SAKOUI SOURAYA¹, SOUKRI ABDELAZIZ¹, & EL KHALFI BOUCHRA¹

¹Laboratory of Health, Environment and Biotechnology, Pathophysiology, Molecular Genetics and
Biotechnology Team, Faculty of Sciences Ain Chock, Hassan II University of Casablanca, 20100 Casablanca,
Morocco

*amaldagni@gmail.com

Abstract: *Dysphania ambrosioides* (L.) is widely used in traditional Moroccan medicine, particularly for the treatment of febrile conditions. This study aims to evaluate the antimicrobial and antioxidant properties of the essential oil of *Dysphania ambrosioides*, in order to explore its potential as a natural source of bioactive compounds. The essential oil was extracted by hydrodistillation, and its chemical profile was characterised by gas chromatography coupled with mass spectrometry (GC-MS). The biological activities were evaluated using different assays, including the agar well diffusion method and broth microdilution for the determination of the minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC). Antioxidant activity was assessed using free radical scavenging assays (DPPH, ABTS and FRAP). The results showed that the essential oil exhibited notable antimicrobial activity against various pathogenic strains, as well as significant antioxidant activity. These findings highlight the potential of *Dysphania ambrosioides* essential oil as a natural source of antimicrobial and antioxidant agents, supporting its traditional uses in Morocco.

Keywords: *Dysphania ambrosioides*, Essential oil, Antimicrobial activity.



FATIMA DAHRA

ADULTERATION OF “NATURAL” PRODUCTS PROMOTED FOR WEIGHT GAIN ON MOROCCAN SOCIAL MEDIA PLATFORMS

DAHRA Fatima^{1*}, CONTE Raffael², &BOUSLIMAN Yasser¹

¹Faculty of Medicine and Pharmacy, Mohammed V University, Rabat, Morocco

²Laboratory of Toxicology, Italy.

^{*}fatimadahra@gmail.com

Abstract: The rapid expansion of social media platforms has facilitated the commercialization of so-called “natural” products promoted for health and weight-related benefits. These products are often marketed without regulatory oversight, raising concerns about adulteration, mislabeling, and consumer safety. This study aimed to investigate the authenticity of natural products sold through social media by identifying undeclared active pharmaceutical ingredients and characterizing their polyphenolic composition using advanced analytical techniques. A selection of products advertised as natural supplements was purchased directly from social media vendors. A total of 15 samples were subjected to qualitative and quantitative analysis. The obtained profiles were compared to the declared label information and reference standards. Analytical findings revealed significant discrepancies between declared and actual compositions. Several products contained undeclared active pharmaceutical ingredients, and others showed either absence or marked variability in the concentrations of claimed bioactive compounds. Such practices pose risks to consumer health and to the environment, particularly through inappropriate manufacturing, distribution, and disposal of pharmaceutical substances. This study identifies serious public health concerns linked to consumption of unregulated natural products promoted online. The presence of hidden pharmacologically active substances demonstrates the need for strengthened regulatory surveillance, analytical monitoring, and consumer awareness. Advanced chromatographic techniques represent essential tools for detecting adulteration and ensuring the safety of natural products in the digital marketplace.

Keywords: *Adulteration, Undeclared pharmaceutical ingredients, Social media marketing.*

KHADIJA DAOUDI
PSYCHOMETRIC CHARACTERISTICS OF THE ROTER
INTERACTION ANALYSIS SYSTEM (RIAS) IN THE CONTEXT OF
HEALTH EDUCATION IN A MOROCCAN SCHOOL

DAOUDI KHADIJA^{1*}, GANTARE ABDELLAH¹

¹Sciences and Engineering of Biomedicals, Biophysics and Health Laboratory, Higher Institute of Health
Sciences

[*k.daoudi@uhp.ac.ma](mailto:k.daoudi@uhp.ac.ma)

Abstract: The Roter Interaction Analysis System (RIAS) is widely used to assess communication in clinical settings but has not yet been applied in educational contexts. This study explores its psychometric properties in Moroccan school health education, assessing feasibility, reliability, and validity, and its potential to improve communication between health educators and students. A cross-sectional study was conducted with 36 Moroccan primary school students. Health education sessions were recorded and analysed using RIAS. Two trained raters independently coded interactions into eight communication behaviour categories. Psychometric analyses assessed feasibility (coding time relative to session duration), inter-rater reliability, and content validity. RIAS demonstrated feasibility, with extended coding times reflecting its comprehensive nature. High inter-rater reliability ($\rho = 0.96-1.00$, $p < 0.01$) confirmed consistent application. Content validity showed adaptability, although challenges with social-emotional utterances and low-frequency categories indicate a need for refinement. This pilot study confirms the feasibility, reliability, and validity of RIAS in Moroccan school health education, with potential to enhance educator–student communication and improve outcomes. It also extends the use of RIAS beyond clinical contexts to diverse, non-Western settings, providing a basis for further refinement aligned with health education and global health promotion.

Keywords: *Roter Interaction Analysis System (RIAS); Health education; Effective communication.*



OTMANE DARBAL

**MULTI-MODEL ANALYSIS OF COVID-19 VACCINATION
DYNAMICS AMONG YOUNG CHILDREN IN FRANCE: A DATA-
DRIVEN APPROACH**

OTMANE DARBAL^{1*}, RACHID EL CHAAL², HAMID DALHI²

¹ENSA of Kenitra, Engineering Sciences Laboratory, Data Analysis, Mathematical
Modelling and Optimization Team, Ibn Tofail University, Kenitra, Morocco.

*otmane.darbal@usmba.ac.ma

Abstract: Understanding the temporal dynamics of COVID-19 vaccination among young children is essential for public health planning. In France, vaccination uptake in children aged 0–4 years has been characterised by delayed implementation, irregular patterns, and strong behavioural influences, which challenge conventional modelling. This study proposes a data-driven multi-model framework to analyse and forecast vaccination dynamics in this population. Daily vaccination data from December 2020 to July 2023 were analysed using statistical and machine learning techniques. The methodology combines SARIMAX models for trend and seasonality, negative binomial regression for overdispersion, Markov regime-switching models to identify low and high activity phases, Hawkes processes to represent social interaction effects, and a hybrid SARIMA–Random Forest model to improve prediction. Results indicate distinct vaccination regimes and significant overdispersion, invalidating simple Poisson assumptions. The hybrid SARIMA–Random Forest approach achieved the best predictive performance, with lower forecasting error than classical models. Overall, the proposed provides usable and practical insights to support vaccination strategies and public health decision-making.

Keywords: COVID-19 vaccination; vaccination dynamics; time series modelling.



FATIMA EZZAHRA DOUBLALI

OPTIMISATION OF ANAEROBIC DIGESTION OF SARDINE FISHERY WASTE THROUGH FUNGAL INOCULATION AND CO-DIGESTION: A CIRCULAR BIOTECHNOLOGICAL APPROACH FOR INTEGRATED BIOGAS AND BIOFERTILISER PRODUCTION

FATIMA EZZAHRA DOUBLALI^{1*}, BOUCHAIB BAHLAOUAN^{1,2}, MOHAMED ZAHOUILY^{1,3}, & NADIA BOUTALEB^{1**}

¹Laboratory of Biotechnology, Agro-Food, Materials and Environment (LBAME); Faculty of Sciences and Techniques of Mohammedia (URAC 36)

²Higher Institute of Nursing and Health, Casablanca, Morocco

³Laboratory of Materials, Catalysis and Valorisation of Natural Ressource (URAC24)

* Fatimaezzahra.doublali@fstm.ac.ma; ** nadia.boutaleb@fstm.ac.ma

Abstract: Morocco, through the National Strategy for Waste Reduction and Valorisation (SNRVD) launched in 2021 by the Ministry of Energy Transition and Sustainable Development, is actively committed to the transition towards a circular economy and sustainable development by promoting innovative waste management strategies. Within this framework, the present study, situated at the interface of green biotechnology and the circular bioeconomy, investigates the valorisation of sardine fishery waste generated by Moroccan agro-industrial sectors through anaerobic digestion. This biotechnological process enables the integrated production of biogas as a renewable energy source, while simultaneously converting the resulting digestates into nutrient-rich biofertilisers, thereby contributing to sustainable agriculture and reducing the overall environmental footprint. To optimise process efficiency, this study evaluates four key parameters: fungal inoculation using *Aspergillus niger*, fermentation mode (solid-state versus liquid), digestion temperature regime (mesophilic versus thermophilic) and co-digestion with molasses. A total of sixteen experimental mixtures were investigated over a period of twenty days, allowing identification of optimal conditions for maximising biogas production while improving the nutritional and hygienic quality of the resulting biofertilisers. These findings highlight the potential of anaerobic digestion as a circular economy model, enabling renewable energy generation, sustainable biofertiliser production and supporting biotechnological solutions for the green energy transition.

Keywords: Green Biotechnology, Biogas, Biofertiliser, Agro-food Industrial Waste.



WAJIHA EL AFAKI FELLAH

OPTIMISING THE PRE-ANALYTICAL PHASE OF DIRECT IMMUNOFLUORESCENCE IN RENAL BIOPSY: A QUALITY MANAGEMENT FRAMEWORK

WAJIHA EL AFAKIFELLAH^{1*}, JINANE KHARMOUM^{2,3} AND MARIAME CHRAIBI^{2,3}

¹ Life and Health Sciences Research Laboratory, Faculty of Medicine and Pharmacy of Tangier, Abdelmalek Essaadi University, Tetouan, Morocco

² Department of Fundamental and Preclinical Sciences, Faculty of Medicine and Pharmacy of Tangier, Abdelmalek Essaadi University, Tetouan, Morocco

³ Department of Pathology, Mohammed VI University Hospital Centre, Tangier, Morocco

*wajiha.elafakifellah@etu.uae.ac.ma

Abstract: Direct immunofluorescence (DIF) on renal biopsy is a key diagnostic tool in nephropathology, and its reliability depends largely on the quality of the pre-analytical phase. This work aimed to assess the impact of pre-analytical management on diagnostic performance and to propose a quality-oriented approach for implementing DIF in anatomical pathology practice. A structured narrative review of the literature and major international quality standards, including ISO 15189:2022, Joint Commission International (JCI:2023) standards, and Good Laboratory Practice (GLP) guidelines, was conducted. The analysis showed that pre-analytical conditions play a decisive role in the interpretability and reproducibility of immunofluorescence findings. Appropriate specimen collection, transport, traceability, and handling are essential to preserve sample integrity and ensure diagnostic accuracy. The review also highlights the importance of staff training and structured quality management systems aligned with international standards to reduce non-conformities and improve process reliability. Optimising the pre-analytical phase therefore represents a fundamental prerequisite for the successful implementation of DIF in renal pathology, with expected benefits in diagnostic consistency, laboratory performance, and patient safety.

Keywords: *Direct immunofluorescence, Pre-analytical phase, Renal biopsy.*

EL BOUKHARI REDA

**MAPPING THE PATENT LANDSCAPE OF AROMATIC AND
MEDICINAL PLANTS IN MOROCCAN UNIVERSITIES**

REDA EL BOUKHARI*, AHMED FATIMI

Chemical Science and Engineering Research Team (ERSIC), Department of Chemistry, Polydisciplinary Faculty of Beni Mellal (FPBM), Sultan Moulay Slimane University (USMS), P.O. Box 592 Mghila Campus, Beni Mellal 23000, Morocco

[*elboukhari.reda.fpb21@usms.ac.ma](mailto:elboukhari.reda.fpb21@usms.ac.ma)

Abstract: Morocco is one of the most botanically diverse countries in the Mediterranean and African regions, harbouring a rich flora whose therapeutic potential has been used for centuries in traditional practice. This natural heritage positions the country as fertile ground for research and innovation in aromatic and medicinal plants (AMPs). This work is part of the broader field of Sustainable Health and Medical Sciences, focusing on the intersection of biodiversity and technological innovation. Patents are a valuable source of information for assessing the innovative output of research institutions. Unlike scientific publications, patent documents capture applied and translational aspects of research, offering insight into technological trends and the evolution of knowledge production. This study applies patent analysis to examine the patenting activity of Moroccan universities in the AMP domain. The objective is to establish a state of the art of AMP-related patents produced by Moroccan academic institutions and to identify prevailing technological trends. A survey explores researchers' perceptions, motivations and barriers to patent filing, revealing structural and cultural constraints influencing engagement with patent systems. These findings contribute to understanding how Moroccan universities engage with intellectual property and support recommendations to strengthen research valorisation in the AMP sector.

Keywords: *Patent analysis, Aromatic and medicinal plants, Research valorisation*

RKIA EDDABRA

**DIAGNOSIS DELAY OF BREAST CANCER AMONG WOMEN AT THE
REGIONAL ONCOLOGY CENTRE IN LAAYOUNE, MOROCCO**

RKIA EDDABRA^{1,2}, SAMI BELLAL³, SOUMEYA BENJELOUAJA³, ABDELALI ELBOHALI³,
NADIA EL BARNOUSS^{1,3}

¹Higher Institute of Nursing and Health, Agadir, Morocco

²Laboratory of Microbial Biotechnology and Plant Protection, Faculty of Sciences, University Ibn Zohr, Agadir,

³Higher Institute of Nursing and Health Techniques, Agadir, Morocco

*eddabra@gmail.com

Abstract: Breast cancer is a significant public health issue in Morocco, mainly linked to the challenges associated with late-stage diagnosis. This study examines factors associated with late presentation of breast cancer in women receiving treatment at the Regional Oncology Centre in Laayoune, Morocco. Data were collected through interviews with a convenience sample of 30 patients with delayed diagnoses. The study was conducted at the Regional Oncology Centre in Laayoune from 29 May to 05 June 2025. The mean age of patients was 45.5 years, with most residing in urban areas (96.68%) and exhibiting low education levels, as 90% were illiterate or had only primary education. A significant barrier to seeking medical attention was fear, reported by 80% of participants, and 70% identified symptoms but did not perceive them as serious. Financial constraints affected 83.33% of women, and competing life priorities were the most common barrier, cited by 90%. Although 86.67% received psychological support, nearly half avoided discussing their illness for fear of judgement. Notably, although 83.33% believed in healing, only 16.67% participated in screening campaigns, highlighting a paradox in health-seeking behaviour. The delay in breast cancer diagnosis in Laayoune reflects a complex interplay of barriers affecting patient outcomes.

Keywords: *Breast cancer, Diagnosis delay, Socio-demographic factors.*

AZIZA EL BAZ

**STANDARDISED CADAVERIC PROTOCOL FOR MORPHOMETRIC
AND HISTOLOGICAL MAPPING OF THE HUMAN PUDENDAL
NERVE**

AZIZA EL BAZ^{1*}, EL ALLALI, K.², MIRIMI, R.² ABOUTAIEB, R.¹

¹ Laboratory of Sexual and Reproductive Health, Faculty of Medicine and Pharmacy, Hassan II University, Casablanca, Morocco

² Hassan II Agronomic and Veterinary Institute, Rabat, Morocco
Aziza.elbaz19@gmail.com

Abstract:

Introduction: The pudendal nerve is a major somatic nerve of the human perineum, with essential roles in continence, sexual function, and perineal sensation. Despite its clinical importance, available anatomical, morphometric, and histological data remain heterogeneous and insufficiently standardised. Establishing a reproducible human anatomical reference is therefore essential for both clinical applications and comparative translational research.

Methods: This protocol aims to establish a standardised cadaveric framework for comprehensive mapping of the human pudendal nerve from the sacral roots (S2–S4) to its distal terminal branches. The study is designed to include 40 adult cadavers, corresponding to 80 anatomical sides, using a stepwise dissection strategy focused on clinically relevant regions, including the infrapiriformis outlet, the sacrospinous–sacrotuberous ligamentous zone, and Alcock’s canal. Standardised histological sampling will be performed at predefined proximal, intermediate, ligamentous, and distal levels. Tissue analysis will combine hematoxylin–eosin, Masson’s trichrome, neurofilament, and toluidine blue staining to evaluate fascicular organisation, axonal density, myelination, connective tissue sheaths, and G-ratio. This human protocol forms the anatomical and microstructural reference component of a broader comparative research framework designed to examine corresponding pudendal nerve characteristics in a caprine model.

Expected Results: The expected outcome is a reproducible anatomical and microstructural reference map of the human pudendal nerve, providing standardised morphometric and histological data for surgical planning, decompression procedures, neuromodulation strategies, and comparative anatomical and translational research using the caprine model.

Keywords: *Pudendal Nerve; Cadaveric Protocol; Human; Morphometry; Histology; Comparative Anatomy*



EL KABABI

A SYSTEMATIC REVIEW AND META-ANALYSIS OF THE EFFECTS OF VITAMIN D ON SYSTEMIC LUPUS ERYTHEMATOSUS

SAMIRA EL KABABI¹, EL MOKHTAR EL OUALI², JIHAN KARTIBOU³, ABDERRAHMAN LAMIRI¹, SANAË DEBLIJ¹, RASHMI SUPRIYA^{4*}, AYOUB SAIEDI⁵, JUAN DEL COSO⁶, ISMAIL LAHER⁷, & HASSANE ZOUHAL^{8*}

1. Laboratory, Higher Institute of Nursing and Health Techniques (ISPITS), Casablanca 20503, Morocco, s.kababi@ispitcasa.ac.ma , a.lamiri@ispitcasa.ac.ma (A.L.), s.debli@ispitcasa.ac.ma.
2. Sports Science Research Team, Institute of Sports Sciences, Hassan I University, Settat 26002, Morocco; elmokhtar.elouali@uit.ac.ma.
3. Laboratory of Biology and Health, Department of Biology, Ibn Tofail University, Kenitra 14000, Morocco; jihan.kartibou@uit.ac.ma.
4. Department of Sports and Health Sciences, Academy of Wellness and Human Development, Faculty of Arts and Social Sciences, Hong Kong Baptist University, Kowloon Tong, Hong Kong 999077, China.
5. Department of Physical Education and Sport Sciences, Faculty of Humanities and Social Sciences, University of Kurdistan, Sanandaj 66177-15175, Iran; saeidi_as68@yahoo.com.
6. Sports Science Research Centre, Rey Juan Carlos University, 28032 Madrid, Spain; juan.delcoso@urjc.es.
7. Department of Anaesthesiology, Pharmacology and Therapeutics, The University of British Columbia, Vancouver, BC V6T 1Z4, Canada; ismail.laher@ubc.ca.
8. International Institute of Sport Sciences du (212S), Irodouer, The University of Renne, 35850 France.

*rashmisupriya@hkbu.edu.hk (R.S.), hassane.zouhal@gmail.com (H.Z.)

Abstract: Systemic lupus erythematosus (SLE) is a chronic autoimmune disease characterised by multisystem inflammation and substantial morbidity. Vitamin D has been investigated as an adjunctive therapy in SLE, although findings remain inconsistent. This systematic review and meta-analysis evaluated the effects of vitamin D supplementation on disease activity in patients with SLE. A systematic search of PubMed, Scopus, Web of Science, and ScienceDirect identified randomised controlled trials published after 2013 that assessed vitamin D supplementation with pre- and post-intervention measures of disease activity. Study quality and risk of bias were evaluated using Cochrane Handbook guidelines and Review Manager (RevMan) version 5.3. Meta-analyses were conducted using random-effects models. Twenty-one studies involving 3,177 adult participants from 16 countries met the inclusion criteria. Twelve studies reported beneficial effects of vitamin D supplementation, whereas nine showed no significant effects. Meta-analysis demonstrated significantly higher serum vitamin D levels in supplemented patients compared to placebo (MD: 13.11 ng/mL; 95% CI: 8–19; $p < 0.00001$) and a significant reduction in SLEDAI scores (MD: -1; 95% CI: -2 to -0.43; $p = 0.002$). These findings indicate that vitamin D supplementation is associated with a modest but significant reduction in SLE disease activity and supports its use as a safe adjunctive therapeutic option.

Keywords : 25-hydroxyvitamin D, Autoimmunity, Immunomodulation.

HANAA ELKIRI

**DETECTION AND QUANTIFICATION OF HEAVY METALS IN FEED
AND POULTRY PRODUCTS IN MOROCCO**

ELKIRI HANAA^{1*}, BAHLAOUAN BOUCHAIB², ABDGHEFFAR HOURIA¹ AND BOUTALEB
NADIA¹

¹Hassan II University of Casablanca, Laboratory of Biochemistry, Agri-Food, Materials and Environment,
LBAME URAC36, 20650 Morocco.

²Higher Institutes of the Nursing Professions and Techniques of Health (ISPITS), Laboratory of Care, Health and
Sustainable Development 2S2D, Casablanca 22500, Morocco

*Nadia.boutaleb@fstm.ac.ma

Abstract: The poultry sector in Morocco plays a vital role in the country's economy. Contamination of raw materials used in poultry feed and compound feed with heavy metals threatens not only animal health but also human health as a result of the accumulation of heavy metal residues in the tissues and organs of edible poultry. This study aimed to determine the levels of four toxic metals, namely lead (Pb), cadmium (Cd), mercury (Hg), and arsenic (As), in samples of poultry feed and edible parts of broiler chickens (meat and liver) collected from various markets in Casablanca and Mohammedia, Morocco, using inductively coupled plasma mass spectrometry (ICP-MS), to assess the risk to consumer health. Pb and Cd were detected in 100% of poultry compound feed samples, with average levels of 0.280 mg/kg and 0.15 mg/kg, respectively. Hg and As were not detected in the raw materials, although they were identified in the compound feed. In broiler chickens, Pb and Cd concentrations were higher in the liver than in the meat. The non-carcinogenic risk assessment, based on the hazard quotient (HQ) and hazard index (HI) values, showed HQ and HI values below 1, indicating no significant long-term health risk. In contrast, the carcinogenic risk assessment revealed values above the acceptable limit (10^{-4}), mainly attributable to cadmium. The highest levels were observed in children, suggesting a potential increased risk with chronic exposure. These results highlight the need for regular monitoring of heavy metal contamination in poultry products and for implementing control strategies to protect public health, particularly for vulnerable populations.

Keywords: Heavy metals, Contamination, Poultry feed, Health risks.



KAOUTAR EL MAHI

**ANTIMELANOTIC AND ANTIMICROBIAL POTENTIAL OF
LACTOBACILLUS PLANTARUM CELL-FREE SUPERNATANT IN
DEEP-WATER PINK SHRIMP (*PARAPENAEUS LONGIROSTRIS*)
DURING CHILLED STORAGE**

KAOUTAR EL MAHI^{1*}, IMANE MAIOUET¹, MARYEME BOUSLIM², HOUSSAM
ABOULOIFA¹, NAIMA RHALLABI¹

¹Research Unit of Microbiology, Biomolecules and Biotechnology, Laboratory of Chemistry Physics and
Biotechnology of Biomolecules and Materials

²Health, Environment, and Biotechnology Laboratory, Ain Chock Faculty of Sciences (FSAC), Hassan II
University, Casablanca 20100, Morocco

*Ka.elmahi.99@gmail.com

Abstract: Melanosis, caused by polyphenol oxidase (PPO), limits the shelf life and commercial quality of shrimp during chilled storage. Sodium metabisulphite inhibits this process; its use may result in sulphite residues in seafood products. Previous work on deep-water pink shrimp (*Parapenaeus longirostris*) in Morocco showed that sulphite-based treatments effectively inhibited melanosis and highlighted the need to control residual SO₂ levels. Lactic acid bacteria, particularly *Lactobacillus plantarum*, produce antimicrobial and antioxidant metabolites, including organic acids and bioactive compounds that inhibit spoilage microorganisms and oxidative reactions. These properties support their use in natural preservation strategies. This study evaluated *L. plantarum* cell-free supernatant (CFS) as a natural antimelanotic treatment for shrimp stored at 4 °C for 8 days. Samples were compared to sodium metabisulphite (positive control) and untreated seawater (negative control). CFS treatment delayed melanosis formation, reduced PPO activity, inhibited microbial growth, and slowed the accumulation of spoilage compounds. These findings indicate that metabolites produced by *Lactobacillus plantarum* may provide a natural alternative to sulphite-based preservatives for maintaining shrimp quality during chilled storage.

Keywords: *Parapenaeus longirostris*, *Lactobacillus plantarum*, Melanosis.

YASSINE ELMATOUGUI

**TOWARDS ECO-RESPONSIBLE HOSPITAL LABORATORIES:
INTEGRATING ENVIRONMENTAL SUSTAINABILITY INTO
QUALITY MANAGEMENT SYSTEMS TO ENHANCE HEALTHCARE
SAFETY**

YASSINE ELMATOUGUI*, RAJAA ADNANE, FATIMA HOUSNI

Higher Institute of Nursing and Health of Casablanca, Morocco

* ellyassinho2014@gmail.com

Abstract: Healthcare systems are increasingly confronted with the challenge of reconciling high- quality medical services with environmental sustainability. Hospital laboratories play a crucial role in patient diagnosis and clinical decision-making, yet their activities are associated with significant environmental impacts linked to the intensive use of chemical reagents, single-use plastics and energy-consuming analytical equipment. Recent studies on sustainable healthcare and “green laboratory” initiatives highlight the need to integrate environmental considerations into healthcare management practices. Within this context, quality management systems implemented in medical laboratories—primarily designed to ensure analytical reliability and patient safety—can provide a strategic framework for incorporating environmentally responsible practices. Environmental performance indicators remain insufficiently integrated into laboratory quality management processes. This study aims to explore how environmental sustainability can be integrated into hospital laboratory quality management systems to reduce environmental footprint while maintaining diagnostic performance and patient safety. A descriptive and exploratory approach was adopted, combining observation of laboratory practices, analysis of quality management documentation and assessment of waste management and resource use. The findings highlight key environmental pressure points, including intensive use of disposable materials, biomedical waste generation and high energy consumption of laboratory equipment. Integrating sustainability indicators into quality management systems may serve as an effective strategy for promoting eco-responsible laboratory practices and advancing sustainable healthcare systems.

Keywords: *Hospital laboratory, Quality management, Environmental sustainability.*

CHAIMAA EL MOUBCHIRI

PREVALENCE AND CORRELATES OF SUBSTANCE USE AMONG
MIDDLE AND HIGH SCHOOL STUDENTS IN SETTAT PROVINCE,
MOROCCO

CHAIMAA EL MOUBCHIRI^{1*}, MOHAMED CHAHBOUNE^{1*}, MORAD GUENNOUNI^{1,2*},
AND ABDERRAOUF HILALI^{1*}

¹ Laboratory of Health Sciences and Technology, Higher Institute of Health Sciences, Hassan I University of
Settat, Settat, Morocco

² Faculty of Science, Higher School of Education and Training, Chouaïb Doukkali University of El Jadida, El
Jadida, Morocco

*elmoubchiri.isss@uhp.ac.maa

Abstract: Adolescent substance use poses significant public health challenges, yet data in Morocco are scarce. This study investigates the prevalence and associated factors of cigarette, alcohol and cannabis use among students in Settat Province. A cross-sectional survey of 320 middle and high school students (aged 12–20) was conducted from December 2023 to May 2024 in urban and rural areas. Substance use was assessed using ADOSPA, CAST and Fagerström tests. Chi-square tests were used to analyse associations ($p \leq 0.05$). Substance use was significantly associated with male gender, age 18 years and older, urban residence and having substance-using peers ($p < 0.0001$). Among key substance use behaviours, 51.5% of students reported early-morning smoking, 28.4% reported alcohol use to relax or feel better, and 3.7% reported cannabis use before midday in the past 12 months. Substance use was significantly related to socio-demographic characteristics and peer influence. Tailored interventions are essential to reduce high-risk behaviours and nicotine dependence among adolescents.

Keywords: *Adolescents, Substance use, Urban and rural students, Morocco.*



BADR-DDINE EL MOUNS

MOROCCAN RED MACROALGAE: A SUSTAINABLE SOURCE OF ECO-FRIENDLY ANTIFUNGAL AGENTS

BADR-DDINE EL MOUNS*, BOUCHRA BENHNIYA, OMAR ERRAFIY, JAMAL BOUHRAOUA, SELMA MABROUKI, FATIMA LAKHDAR, SAMIRA ETAHIRI

Laboratory of Marine Biotechnology and Environment – National Centre for Scientific Technical Research
Labelled Research Unit, Faculty of Sciences, Chouaib Doukkali University, BP 20, El Jadida, 24000, Morocco.

*Elmouns.badr@gmail.com

Abstract: Phytopathogenic fungi pose a major threat to global agriculture, causing significant crop losses and economic damage. The intensive use of synthetic fungicides has led to resistant fungal strains, reduced efficacy, and growing environmental and health concerns, thereby highlighting the need for sustainable antifungal alternatives with new modes of action. Marine macroalgae are a rich source of bioactive secondary metabolites, yet their antifungal potential remains underexplored. This study evaluated the antifungal activity of red algae collected from the Moroccan Atlantic coast against important phytopathogenic fungi, including *Chaetomium elatum*, *Chaetomium globosum*, and *Aspergillus steynii*. The results revealed a selective antifungal response among algal extracts. Although most extracts showed weak to moderate activity, three exhibited strong antifungal potency: the methanolic extract of *Ellisolandia elongata* and the ethyl acetate extracts of *Osmundea pinnatifida* and *Bornetia secundiflora*. Notably, the ethyl acetate extract of *O. pinnatifida* demonstrated a minimum inhibitory concentration of $1.95 \mu\text{g mL}^{-1}$ against *C. globosum*, exceeding the activity of the reference antifungal agent amphotericin B. GC–MS analysis of the most active extracts indicated a predominance of fatty acid derivatives, particularly heptadecanoic acid and methyl tetradecanoate, which are known to exert antifungal effects through membrane disruption. Overall, Moroccan red algae represent a promising and sustainable source of eco-friendly antifungal compounds for the development of alternative biofungicides.

Keywords: *Antifungal activity, Osmundea pinnatifida, Ellisolandia elongata*



NAWAL ELOMARI

**QUALITY OF LIFE OF ADULTS WITH DIABETES IN THE
PREFECTURE OF MEKNÈS: ASSESSMENT AND ASSOCIATED
FACTORS**

ELOMARI NAWAL^{1*}, ANOUAR TADLAOUI FATIMA ZAHRA¹, ARDOUZ HADDA², AZIZI
HAMZA², ERRACHIDI FAOUZI¹, RAOUI SIDI MOHAMMED²

¹Laboratory of Applied Organic Chemistry, FST, USMBA, FES, MOROCCO

²Higher Institute of Health Professions and Nursing, Meknes, Morocco

*nawalelomari@gmail.com

Abstract : Diabetes is a chronic disease that impairs patients' quality of life (QoL). This study evaluates QoL and its associated factors among adult patients with diabetes (≥ 18 years), followed at the Diabetes Reference Centre and the Endocrinology Department of Mohammed V Hospital in Meknes, Morocco. A cross-sectional study was conducted among 70 participants using the WHOQOL-BREF questionnaire. The sample had a sex ratio of 1.4 and a mean age of 48.4 years. The results showed a moderate impairment of QoL, with the lowest mean score observed in the environmental domain (2.44), followed by the psychological (2.63), physical (2.75) and social (2.76) domains. Age was negatively correlated with the physical ($\rho = -0.462$, $p < 0.001$), psychological ($\rho = -0.255$, $p = 0.033$) and environmental ($\rho = -0.277$, $p = 0.020$) domains. Diabetes duration was inversely associated with the physical domain ($\rho = -0.253$, $p = 0.034$). Place of residence, economic status, educational level and health insurance coverage were significantly associated with QoL domains ($p < 0.05$). Physical activity and participation in diabetes education sessions were associated with higher QoL scores in several domains. These findings highlight the determinants of QoL in diabetic patients and support the need for a multidimensional approach to diabetes care.

Keywords: *Quality of life, Diabetes, WHOQOL-BREF, Associated factors, Meknes.*



IMAD ELGARRAS

DEVELOPMENT AND CHARACTERISATION OF A HYDROGEL-BASED SUBSTRATE TO ENHANCE PLANT GROWTH IN HYDROPONIC SYSTEMS

IMAD ELGARRAS¹, YOUSRA BELAYACHI¹, SOUKAINA BENYAMANE¹, YAHYA BACHRA¹ AND MOHAMED ZAH^{1,2*}

¹Laboratory of Biotechnology, Agri-food, Materials, and Environment, Faculty of Sciences and Techniques Mohammedia, University Hassan II of Casablanca, Morocco

²Fert-Explorer, Mohammed VI Polytechnic University, Lot 660-Hay Moulay Rachid, 43150 Ben Guerir, Morocco

*ZAHOUILY@um6p.ma

Abstract: The development of efficient and safe substrates is essential for improving plant performance in hydroponic systems, particularly in environments exposed to heavy-metal contamination. This work focuses on the formulation of hydrogel beads based on sodium alginate and carboxymethylcellulose (CMC) using ionotropic gelation, with biochar incorporated to enhance structural properties and adsorption capacity. The biochar-loaded hydrogels are designed to act simultaneously as a growth-support substrate and as a protective barrier capable of immobilising heavy metals. The beads were characterised by FTIR spectroscopy to identify polymer interactions and confirm crosslinking. Mechanical testing and bead size analysis were performed to evaluate stability and uniformity. Adsorption experiments were carried out to assess the capacity of the materials to retain selected heavy metals. The suitability of the beads as a hydroponic substrate was examined through seed germination tests, providing insight into their biocompatibility and ability to support early plant development. The results demonstrate the promise of alginate–CMC–biochar beads as multifunctional substrates combining water retention, mechanical integrity, and protective capabilities for safer hydroponic cultivation.

Keywords: *Biopolymer, Ionotropic gelation, Hydrogel, Hydroponic cultivation.*

OTHMANE ELGHALMI

**ENHANCING FORAGE PRODUCTION AND NUTRITIVE VALUE
THROUGH CEREAL–LEGUME MIXTURES IN HYDROPONIC
SYSTEMS: A STUDY OF BARLEY, TRITICALE AND FODDER PEA**

Othmane ELGHALMI^{1,2*}, Zaynab EL AADMONI¹, Karima SAMIR² and Mohamed EL KOUDRIM¹

¹National Institute for Agronomic Research, Regional Centre for Agronomic Research, Settati, Morocco

²Ben M'sick Faculty of Sciences, Hassan II University, Casablanca, Morocco

* othmaneelghalmi@gmail.com

Abstract: In arid and semiarid regions, animal production faces challenges such as insufficient rainfall and limited land for fodder crops, leading to feed shortages. To address this, hydroponic fodder has emerged as a water-efficient alternative, yet maximizing its nutritional quality remains a priority. This study assessed the effects of cereal–legume combinations and harvesting times on the yield and nutritional composition of barley, triticale and fodder pea in hydroponic systems. Our findings revealed superior forage production and enhanced nutritional value associated with cereal–legume mixtures. For instance, the combination of barley and fodder pea produced 5.55–8.5 kg of hydroponic forage per kilogram of dry seeds within 7–10 days, compared to 4.7–5.9 kg for barley monocultures. These mixtures exhibited significantly higher levels of crude protein compared to cereal monocultures. Regarding dry matter, significant differences were observed among harvesting dates. On day seven, the barley/fodder pea mixture reached a dry matter value of 22.20%, significantly outperforming barley alone (19.6%). We conclude that harvesting seven days after sowing provides the optimal balance for forage growth and nutritional value. After 10 days, a notable decline in protein and dry matter yield was observed.

Keywords: *Hydroponic Fodder, Cereal–Legume Mixtures, Animal Nutrition.*



SOUKAINA ELJAOUAHIRY

COMPUTATIONAL SCREENING AND ANTIBACTERIAL ACTIVITY OF *PISTACIA ATLANTICA* ESSENTIAL OILS

SOUKAINA ELJAOUAHIRY¹, BOUCHRA KARRAOUAN², IMANE YAMARI³, HASSAN CHARII¹, OUMAIMA FAZZA⁴, BRAHIM BOUCHRIF², SAMIR CHTITA³, ABDELAZIZ EL AMRANI⁵, SAMIR IBENMOUSSA¹ & ANASS EL OUADDARI^{1*}

¹ Laboratory of Chemistry, Biochemistry, Nutrition, Environment and Health, Faculty of Medicine and Pharmacy, Hassan II University, Casablanca, Morocco

² Laboratory of Health and environment, Institut Pasteur du Maroc, Casablanca, Morocco

³ Laboratory of Analytical and Molecular Chemistry, Faculty of Sciences Ben M'Sik, Hassan II University, Casablanca, Morocco

⁴ Laboratory of Biochemistry, Environment and Agri-food, Faculty of Sciences and Technology, Mohammedia, Hassan II University, Casablanca, Morocco

⁵ Laboratory of Organic Synthesis, Extraction and Valorisation, Faculty of Sciences Ain Chock, Hassan II University, Casablanca, Morocco

*elouaddari_anass@yahoo.fr

Abstract : The rapid emergence of antimicrobial resistance has increased the need for new antibacterial agents from natural sources. Essential oils are recognised for their chemical diversity and biological activities, making them promising candidates for therapeutic development. *Pistacia atlantica*, widely distributed in Morocco, represents an important natural resource with pharmacological potential. This study aims to contribute to the valorisation of Moroccan *P. atlantica* by investigating the chemical composition and antibacterial activity of essential oils extracted from branches, as well as leaves and fruits, and by exploring their antibacterial potential through in silico analysis. Essential oils were characterised by GC–MS and showed distinct chemical profiles. The leaf oil was rich in terpinen-4-ol, the fruit oil was dominated by trans- β -ocimene and α -pinene, and the branch oil contained high levels of n-hexadecanoic acid and α -phellandren-8-ol. The branch oil exhibited the strongest antibacterial activity, particularly against *Staphylococcus aureus*. Molecular docking identified γ -muurolene as the most promising compound, showing consistent interactions with selected bacterial proteins. Molecular dynamics and ADMET analyses confirmed its interaction stability and acceptable drug-like properties. These findings highlight the potential of *P. atlantica* as a source of antibacterial compounds.

Keywords: *Pistacia atlantica* Desf., molecular docking, plant-derived antimicrobials.

GHITA ELKARHAT

**IDENTIFICATION OF DELETERIOUS MISSENSE VARIANTS OF
SERINE PEPTIDASE INHIBITOR KAZAL TYPE 2 GENE AND THEIR
IMPACT ON KAZAL DOMAIN STRUCTURE, STABILITY,
FLEXIBILITY, AND DIMENSION**

GHITA ELKARHAT^{1,2}, SAMAH AIT BENICHOUI¹, SALAHEDDINE REDOUANE²,
ABDELHAMID BARAKAT², ABDELAZIZ SOUKRI¹, BOUCHRA EL KHALFI¹, HASSAN
ROUBA^{2*}

¹ Laboratory of Health, Environment, and Biotechnology, Faculty of Sciences Ain Chock, Hassan II University,
Casablanca, Morocco

² Laboratory of Genomics and Human Genetics, Institut Pasteur du Maroc, Casablanca, Morocco

Abstract: The SPINK2 protein, encoded by the SPINK2 gene, is essential for normal spermatozoa development, and its deficiency is associated with spermatogenesis disorders ranging from aspermia to azoospermia. This study aimed to identify deleterious SPINK2 variants and assess their structural and functional impact using an in silico approach. Among 8,028 variants, including 72 missense variants, six (P50L, T58I, C66Y, E62A, P42S, and P45L) were predicted to be deleterious by 11 bioinformatics tools. Protein–protein interaction analysis revealed strong associations with SPINK1 and ACR and moderate links with related proteins. Structural analysis indicated that T58I and C66Y gained hydrophobic interactions, whereas P50L and P42S lost key interactions, potentially affecting protein stability. Molecular dynamics simulations showed that P50L increased stability and reduced flexibility, T58I had a mild effect, and E62A and C66Y decreased stability and flexibility with increased protein size. P42S and P45L induced moderate structural changes. Overall, these findings suggest functional impairment of SPINK2 and provide a basis for future functional and clinical investigations.

Keywords: *SPINK2 gene, Spermatogenesis disorders, Missense variants.*

EL MARNISSI BOUJEMAA

**ANALYSIS OF FOOD SAFETY PRACTICES AND PROTOCOLS IN A
MOROCCAN HOSPITAL CENTRE**

EL MARNISSI BOUJEMAA^{1*}, RADI FATIMA ZAHRA¹, HIBAOUI LAHBIB¹, NGHEYEF
KHALID¹

¹ Higher Institute of Nursing and Health, Fez, Morocco

* belmarnisssi21@gmail.com

Abstract: Food safety is crucial for the health of hospitalised patients, who are often more vulnerable to health risks. The management of food-related risks in hospitals must be rigorous to prevent contamination and to preserve patient health. This study focuses on the sanitary practices and protocols in place in the kitchen of a provincial hospital centre in Fes in order to identify weaknesses and to propose improvements. The main objective of this study is to evaluate the compliance of food practices and safety measures implemented in the kitchen of the Ibn Alkhatib Provincial Hospital Centre in Fes with international standards such as HACCP and Good Hygiene Practices (GHP). It also aims to identify gaps in food safety management and to recommend solutions to strengthen the safety of meals served. A mixed approach was used, combining questionnaires distributed to kitchen staff and healthcare staff, as well as direct observation in the kitchen using standardised checklists. This methodology makes it possible to assess staff hygiene, premises, equipment, as well as food management and meal preparation. The results of this study include the identification of major gaps in food safety management in the hospital, notably the lack of gloves, the presence of pests, and the absence of a thermometer to monitor dish temperatures. The study also revealed that 57.1% of kitchen staff had not received training in food safety, which constitutes a major obstacle to the implementation of Good Hygiene Practices. Finally, the results make it possible to propose concrete corrective actions, such as strengthening HACCP protocols, providing continuous staff training, and modernising equipment, in order to ensure the safety of meals served to patients and staff.

Keywords : *Food Safety, HACCP, Good Hygiene Practices, Risk Management.*

KARIM EL MOUNS

**PHYSICAL PERFORMANCE AND PSYCHOLOGICAL STABILITY
ACROSS MENSTRUAL CYCLE PHASES IN ELITE FEMALE
ATHLETES**

KARIM EL MOUNS *, MOHAMED MARGHICH, ABDELALI BITAR

Nutritional Physiopathology, Neurosciences and Toxicology Team, Laboratory of Anthropogenetic, Biotechnology and Health, Faculty of Sciences, Chouaib Doukkali University, El Jadida, Morocco.

*elmouns.karim@ucd.ac.ma

Abstract : The interaction between physiological rhythms and athletic performance is essential in elite women's sport. This study examined whether professional female athletes exhibit variations in physical performance and psychological state across different phases of the menstrual cycle. Fifty elite athletes (21.8 ± 2.5 years) were assessed during two phases: the menstrual and post-menstrual phases. Psychological state was monitored daily using the Hooper Index, and physical performance was evaluated using the Illinois Agility Test (IAT), vertical jump test, and maximal aerobic speed (MAS). The results showed no significant differences between phases for agility ($p > 0.33$), explosive power ($p > 0.43$), aerobic capacity ($p > 0.13$), and psychological state ($p > 0.84$). These findings indicate that sustained and structured training may reduce cycle-related variations, enabling elite female athletes to maintain stable physical performance and psychological well-being throughout the menstrual cycle.

Keywords: *Menstrual cycle, Physical performance, Psychological state, Elite athletes.*



HAJAR ELMOURABIT

SEROTYPE DISTRIBUTION AND ANTIMICROBIAL RESISTANCE OF SALMONELLA ISOLATES IN MARRAKECH, MOROCCO

ELMOURABIT HAJAR¹, SORAA NABILA², KARRAOUAN BOUCHRA³, BOUCHRIF BRAHIM³, ELJAOUAHIRY SOUKAINA⁴, ELMEHRACH KHADIJA^{1,5}

^{1,3}Laboratory of Plant Biotechnology, Faculty of Sciences, Ibn Zohr University, Agadir, Morocco

²Microbiology Laboratory, University Hospital Mohamed VI, Marrakesh, Morocco

³Laboratory of Food Microbiology, Pasteur Institut, Casablanca, Morocco

⁴Laboratory of Chemistry-Biochemistry, Environment, Nutrition and Health, Faculty of Medicine and Pharmacy of Casablanca, Hassan II University, Morocco.

⁵Department of Environment and Life Sciences, Faculty of Applied Sciences, Ait Melloul, University of Ibn Zohr, National Road N°. 10, Box 6146, Agadir-Morocco

*hajar.elmourabit.94@edu.uiz.ac.ma

Abstract: Non-typhoidal Salmonella (NTS) is a major cause of foodborne infections worldwide and a growing public health concern linked to increasing antimicrobial resistance. In Morocco, data on the epidemiology of human salmonellosis remain limited. This study examined the prevalence, serotype distribution, and antimicrobial resistance patterns of *Salmonella* isolates recovered from clinical samples at the Mohammed VI University Hospital Centre in Marrakech between 2018 and 2024. A total of 60 isolates were identified by MALDI-TOF MS, and serotyping was performed according to the Kauffmann–White scheme. Antimicrobial susceptibility testing was carried out using the disk diffusion method following EUCAST 2023 guidelines. Eight different serotypes were identified, with *S. Enteritidis* (63%) and *S. Typhimurium* (25%) being the most prevalent. Children represented the most affected age group (47%). Resistance to ampicillin was the highest (43%), and multidrug-resistant strains accounted for 20% of isolates, showing a marked increase over the study period. These findings highlight the need for strengthened surveillance and rational antibiotic use.

Keywords: *Salmonella*, Antibiotic, Resistance, Serotype, Enteritidis



NORA ELOUHABI

**PHOSPHATE DERIVATIVES FROM SOLID-STATE SYNTHESIS FOR
CARBON STEEL CORROSION INHIBITION IN HYDROCHLORIC
ACID**

ELOUHABI NORA^{1*}, CHAYMAE HALIOUI¹, ASMAA BOUABBADI¹, NADIA TIMOUDAN²,
ABDELKADER ZARROUK², MOHAMED HARCHARRAS¹

¹Laboratory of Advanced Materials and Process Engineering (LAMPE), Department of Chemistry, Faculty of Sciences, Ibn Tofaïl University, B.P. 133, 14000 Kenitra, Morocco

² Laboratory of Spectroscopy, Molecular Modelling, Materials, Nanomaterials, Water and Environment LS3MN2E, CERNE2D, Faculty of Sciences, Mohammed V University in Rabat, Morocco

* nora.elouhabi@uit.ac.ma

Abstract: Diphosphate materials were synthesised via a solid-state reaction route. In the context of corrosion inhibition, these materials exhibited promising performance. The crystallinity of the prepared compounds was examined using X-ray diffraction (XRD), and vibrational characterisation was carried out by infrared (IR) and Raman spectroscopy. The corrosion inhibition efficiency of carbon steel in a 1 M hydrochloric acid (HCl) solution containing pyrophosphate was evaluated at 303 K using several electrochemical techniques. Potentiodynamic polarisation (PDP) and electrochemical impedance spectroscopy (EIS) were used to assess the inhibitory behaviour of the materials.

Keywords: *Diphosphate; solid-state reaction; corrosion inhibition.*



ABOUJIHAD ENNAJAR

A STUDY OF THE IMPACT OF DIGITAL MARKETING ON THE MIGRATION AND INTERNATIONAL MOBILITY OF HEALTHCARE PROFESSIONALS: THE CASE OF EASTERN MOROCCO

ABOUJIHAD ENNAJAR¹, MOHAMED BEN DAHMANE EL IDRISSE², ABDERRAHMANE
LAMIRI³

¹Research Laboratory in Legal, Political, Economic and Management Sciences, Sidi Mohamed Ben Abdellah University, Polydisciplinary Faculty of Taza, Morocco

²Laboratory in Legal, Political, Economic and Management Sciences, Sidi Mohamed Ben Abdellah University, Polydisciplinary Faculty of Taza, Morocco

³Laboratory of Care, Health, and Sustainable Development, Research Team: Nursing and Health Biology, Higher Institute of Nursing and Health Techniques of Casablanca, Morocco

* aboujihad.ennajar@usmba.ac.ma

Abstract: Against a backdrop of shortages in healthcare human resources and increasing international mobility, digital marketing is emerging as a strategic lever influencing the attractiveness of healthcare systems. Digital campaigns enhance institutional image and reduce recruitment costs, and digital technology increases the visibility of healthcare institutions, with important challenges linked to the migration of skilled workers in the MENA region. A quantitative survey was conducted among 500 healthcare professionals (doctors and nurses) in eastern Morocco. The data were analysed using the Chi-square test and logistic regression. The results show high exposure to international recruitment campaigns via social media, email and job platforms, mainly from Germany (40%) and Canada (30%). Furthermore, 80% of respondents reported knowing healthcare professionals who had emigrated. Although 40% are considering migration, only 8% have taken steps to do so. The Chi-square test reveals a significant association between age and mobility ($p < 0.05$), with younger people being the most affected. Logistic regression confirms the significant effect of digital marketing. Finally, no retention strategies are observed at the national level

Keywords: Digital marketing, Healthcare mobility, Migration.

RACHIDA ERRAHLI

**EVALUATION OF PRACTICES AND IDENTIFICATION OF RISKS IN
THE PRE-ANALYTICAL PHASE IN THE MEDICAL GENETICS
LABORATORY OF IBN ROCHD UNIVERSITY HOSPITAL CENTRE**

RACHIDA ERRAHLI¹, AMAL TAZZITE¹, SARA BERRADA¹

¹CHU Ibn Rochd

Abstract: This study examined the pre-analytical phase of the Medical Genetics Laboratory of Ibn Rochd University Hospital Centre, a crucial stage in the biological analysis process. The main objective was to evaluate current practices and identify associated risks, within a perspective of continuous improvement in service quality, in accordance with the requirements of ISO 15189:2022. To achieve this, a mixed methodology was adopted, combining questionnaires addressed to patients (n = 60), prescribers (n = 41), and laboratory staff (n = 7), direct observation of practices in the field, as well as a risk analysis based on the FMEA method. This approach made it possible to obtain an overall view of dysfunctions while integrating the perceptions of the different stakeholders involved. The results highlighted several areas for improvement, particularly concerning document management, the organisation of sample transport and reception, sample traceability, staff training, as well as interdepartmental communication and communication with prescribers. These elements reflect organisational and structural challenges which, once addressed, will enable better control of the pre-analytical phase and alignment with international quality standards. Furthermore, the study revealed significant strengths: the quality of organisational management, team cohesion and dynamics, as well as the sincere commitment of staff constitute favourable levers for the deployment of a genuine culture of continuous improvement.

Keywords: *Pre-analytical, Quality, Risks, ISO 15189, FMEA, Compliance.*



SELOUA ESSAIH

**VALORISATION OF SOME TRADITIONAL RECIPES BASED ON
WILD EDIBLE PLANTS BY TWO INTELLIGENT PROGRAMS: DIAL
AND THE BILNUT SOFTWARE**

SELOUA ESSAIH^{1*}, BELKASSEM EL AMRAOUI² AND REKIA BELAHSEN²

¹ Faculty of sciences, Chouaib Doukkali University, Nutrition and Food Sciences Training and Research Unit, El Jadida 24000, Morocco

² Polydisciplinary Faculty of Taroudant, Ibn Zohr University, Analyses, Modelling, Engineering, Naturel Substances and Environment Laboratory, Agadir 80000, Morocco

*seloua.essaih@edu.uiz.ac.ma

Abstract: Changes in lifestyles linked to agricultural development and demographic and socio-economic transitions have affected the culinary and medicinal uses of edible spontaneous plants (ESPs). This study aims to enhance the value of traditional recipes based on two spontaneous plants consumed in rural areas of the Rif region of Morocco through a nutritional assessment. The nutritional value of two traditional recipes based on wild edible plants, *Rubia peregrina* and *Ammodaucus leucotrichus* Coss. & Dur., was determined using data from previous mineral analyses conducted by ICP spectrophotometry and nutritional evaluations performed with the DIAL program and BILNUT software. The semolina Azkif recipe with *Rubia peregrina* stems showed high carbohydrate content (12.7 kcal), cholesterol (6.3 kcal) and total fat (4.9 kcal), together with high levels of calcium (1363.466 mg), iron (1524.3 mg) and sodium (3617.19 mg), and notable amounts of vitamin A (20.8 µg), retinol (18.6 µg) and folic acid (13.3 µg). The Moroccan tea recipe with *Ammodaucus leucotrichus* seeds showed high carbohydrate content (2.1 g) and was rich in iron (8346.4 mg), magnesium (2208.5 mg) and sodium (1194.13 mg), with vitamin contributions including retinol equivalents (2.1 µg), folic acid (1.2 µg) and vitamin C (0.32 mg). This research highlights the significant micronutrient and vitamin content of wild edible plants, which remain largely neglected, and supports their potential use in further nutritional and pharmacological studies.

Keywords: *Nutritional value, Traditional recipes, Wild plants.*



SELOUA ESSAIH

NUTRITIONAL VALUE OF TRADITIONAL RECIPES BASED ON WILD EDIBLE PLANTS USING THE DIAL PROGRAM AND BILNUT SOFTWARE

SELOUA ESSAIH^{1,2*}, BELKASSEM EL AMRAOUI^{1,2}, ET REKIA BELAHSEN¹

¹ Faculty of sciences, Chouaib Doukkali University, Nutrition and Food Sciences Training and Research Unit, El Jadida 24000, Morocco

² Polydisciplinary Faculty of Taroudant, Ibn Zohr University, Analyses, Modelling, Engineering, Naturel Substances and Environment Laboratory

Agadir 80000, Morocco

* seloua.essaih@edu.uiz.ac.ma ; essaih.saloua@gmail.com

Abstract: Changes in lifestyles linked to the ongoing development of agriculture and demographic and socio-economic transition have affected the culinary and medicinal uses of edible spontaneous plants (PSCs). This study aimed to enhance the value of traditional recipes based on two spontaneous plants consumed in rural areas of the Rif region of Morocco through nutritional evaluation. The nutritional value of two traditional recipes prepared with the wild edible plants *Rubia pregrina* and *Ammodaucus leucotrichus* Coss. & Dur. was determined using mineral quantification by ICP spectrophotometry and dietary assessment with the DIAL program and Bilnut software. The semoul Azkif recipe with *Rubia pregrina* stems is marked by high carbohydrate content and elevated levels of calcium, iron, and sodium, together with appreciable amounts of vitamin A, retinol, and folic acid. The Moroccan tea recipe with *Ammodaucus leucotrichus* seeds is characterised by high carbohydrate concentration, favourable fatty acid ratios, and notable contents of iron, magnesium, and sodium, as well as measurable levels of vitamin A, folic acid, and vitamin C. This research reveals that wild edible plants constitute valuable sources of micronutrients and vitamins. Their valorisation may support further nutritional and pharmacological studies.

Keywords: Nutritional value, Traditional recipes, Wild plants, Rif of Morocco.



OUMAIMA EZ-ZAHRAOUI

**IN SILICO INVESTIGATION OF TETRACYCLINE RECOGNITION
BY A DNA APTAMER USING MOLECULAR DOCKING AND
MOLECULAR DYNAMICS SIMULATIONS**

**OUMAIMA EZ-ZAHRAOUI^{1*}, EL MEHDI BOURICHA², ILHAME BOURAIS² AND HASNA
MOHAMMADI¹**

¹Faculty of Science and Technology, Hassan II University of Casablanca, Mohammedia, Morocco.

²Mohammed VI Centre for Research and Innovation, CM6RI, Rabat, Morocco

*ouma02ezzahra.oui@gmail.com

Abstract: The widespread use of tetracycline has led to its increasing presence in environmental matrices, raising concerns about ecological impact and human health. In this work, we propose an original sensing strategy based on the repurposing of a single-stranded DNA stem-loop sequence initially developed for hybridization-based recognition. The DNA architecture investigated in a preliminary in silico study demonstrated its potential to be successfully transformed into a functional aptamer capable of Recognising tetracycline. Using experimental approaches, the aptamer was integrated into a gold nanoparticle-based colorimetric assay for tetracycline detection, where target-induced aggregation of gold nanoparticles produces a visible colour change and a quantitative A650/A520 absorbance response. Experimental selectivity was evaluated in the presence of several structurally and biologically relevant interfering molecules, with tetracycline consistently generating a significantly stronger signal. To elucidate the recognition mechanism at the molecular level, molecular docking and molecular dynamics simulations were performed. Analysis of RMSD, radius of gyration, and solvent-accessible surface area confirmed the high structural stability of the aptamer-tetracycline complex, supporting the experimental results and demonstrating the robustness of the proposed sensing platform.

Keywords: *Tetracycline, DNA aptamer, Colorimetric biosensor.*

HAMID FARHANE

**PREVALENCE OF METABOLIC DISORDERS AND UNDIAGNOSED
METABOLIC SYNDROME IN AN APPARENTLY HEALTHY
MOROCCAN POPULATION**

HAMID FARHANE¹, MAJIDA MOTRANE¹, SOUFIANE KARCHALI¹, FATIMA-EZZAHRA ANAIBAR¹, OUMAIMA EL ALAOUI EL ABDALLAOUI¹, AÏCHA MOTRANE², SAID NASSOR ABEID¹, OMAR ABIDI³, NOURDIN HARICH^{1*}.

¹Laboratory of Anthropogenetics, Biotechnology and Health, Faculty of Science, Chouaïb Doukkali University, El Jadida, Morocco

²El Jadida Centre for the Diagnosis and Treatment of Diabetes, Morocco

³Higher Institute of Nursing and Health of Casablanca, Morocco

* harichanthropo@gmail.com

Abstract: Metabolic syndrome (MetS) represents a major public health concern in Morocco. This study aimed to evaluate the prevalence of metabolic disorders and undiagnosed MetS among apparently healthy individuals from the Moroccan general population. A cross-sectional study was conducted among 385 asymptomatic adults (226 women and 159 men), aged 18 to 86 years. MetS components were diagnosed according to the harmonised 2009 definition. The predictive capacity of anthropometric indices, blood pressure and biochemical parameters was evaluated using the area under the receiver operating characteristic curve (AUC). The prevalence of MetS components and undiagnosed MetS was 29.4% and 17.9%, respectively. Women had a significantly higher risk of pre-MetS (OR = 2.64) and undiagnosed MetS (OR = 3.47) compared to men. Age was positively associated with progression to MetS (mean age: non-MetS = 29.7 years; pre-MetS = 39.0 years; undiagnosed MetS = 47.6 years). For prediction of metabolic states, waist circumference showed the highest predictive capacity for pre-MetS (AUC = 0.799) and undiagnosed MetS (AUC = 0.897). Systolic blood pressure showed an AUC of 0.672 for pre-MetS and 0.873 for undiagnosed MetS. Fasting glucose showed significant predictive capacity for undiagnosed MetS (AUC = 0.783), whereas the triglyceride index showed an AUC of 0.63 for predicting pre-MetS. These findings highlight the importance of rigorous monitoring of anthropometric and biochemical MetS components for early detection of pre-MetS and undiagnosed MetS, and provide key insights for the prevention of metabolic diseases in the Moroccan population

Keywords: *Metabolic syndrome, Prevalence, Risk prediction.*

YOUSRA FARIAT

**ELECTRODEPOSITED TIN SULPHIDE (SNS) THIN FILMS: FROM
NUCLEATION TO GROWTH AND SOLAR ABSORPTION
PROPERTIES**

FARIAT YOUSRA^{1*}, AITLAYACHI OMAR*, OUMMI LAMIAE*, BATTIWA IMANE*,
BOUDOUMA ABDERRAZZAK*, AND KHOUMRI ELMATI*

¹Laboratory of Physical Chemistry and Biotechnologies of Biomolecules and Materials Faculty of Sciences and
Techniques of Mohammed VI University of Casablanca-Morocco

*yousrafariat1999@gmail.com

Abstract: SnS thin films were synthesised on ITO substrates by electrodeposition from aqueous electrolytic solutions, and their nucleation and growth mechanisms were systematically investigated. Cyclic voltammetry and chronoamperometry were employed to analyse the electrochemical behaviour of the system. The current transients were normalised and interpreted using the Scharifker–Hills model, revealing a three-dimensional diffusion-controlled nucleation process, with a tendency towards instantaneous nucleation at higher overpotentials. These kinetic results were used to optimise the deposition conditions and improve film continuity. Post-deposition annealing at 500 °C for 1 h led to a marked improvement in crystallinity. X-ray diffraction confirmed the formation of orthorhombic SnS, and SEM observations showed a dense and homogeneous morphology characteristic of three-dimensional growth. UV–visible spectroscopy indicated strong absorption in the visible region, and Tauc analysis yielded an indirect band gap of approximately 1.5 eV. Energy-dispersive X-ray spectroscopy confirmed a uniform distribution of Sn and S throughout the films. In addition, the apparent diffusion coefficient estimated using the Randles–Ševčík equation decreased during SnS deposition, reflecting the influence of coupled nucleation and growth phenomena. These results demonstrate that controlled electrodeposition combined with appropriate thermal treatment enables the fabrication of high-quality SnS thin films, highlighting their strong potential for thin-film photovoltaic applications.

Keyword: *Tin sulphide thin films, Electrodeposition, Photovoltaic applications.*



SIHAM FATHALLAH

**ENVIRONMENTAL SURVEILLANCE OF SARS-COV-2 THROUGH
WASTEWATER MONITORING IN MÉDIOUNA, MOROCCO**

SIHAM FATHALLAH^{1,4}, BRAHIM BOUCHRIF¹, HOUDA EL ALAMI⁴, HAJAR
ELMOURABIT¹, ABDELMADJID ELOUALID², ABDELLAH FAOUZI², HOUDA EN-NASSIRI¹,
PAULINE MICHON³, VINCENT MARECHAL³, SAMIR IBENMOUSSA⁴, BOUCHRA
KARRAOUAN¹.

¹Laboratory for the Monitoring of Emerging and Re-emerging Pathogens in Wastewater – Pasteur Institute of Morocco, Morocco

²Virology Laboratory, Pasteur Institute of Morocco, Morocco

³Saint-Antoine Research Centre, Cancer Biology and Therapeutics, Paris, France.

⁴Department of Chemistry, Biochemistry, Environment, Nutrition and Health. Faculty of Medicine and Pharmacy, Hassan II University, Casablanca, Morocco.

*sihamspc@gmail.com

Abstract: Wastewater-based epidemiology has been widely used to monitor outbreaks of infectious diseases, including the spread of SARS-CoV-2. The objective of this study was to detect and quantify the SARS-CoV-2 genome in wastewater collected from the Médiouna wastewater treatment plant (WWTPM), Morocco. A total of 100 wastewater samples were collected from the treatment plant between June and December 2024. In addition to quantifying the SARS-CoV-2 genome, the F-specific RNA bacteriophage GII and a specific gene were used as internal process controls for normalisation and to assess the inhibition rate. A protocol (DHPI) combining RNA extraction and purification from 5 mL of raw wastewater was applied. The results showed SARS-CoV-2 genome concentrations ranging from Ct values of approximately 31 to 37 in the analysed samples during the study period. Wastewater surveillance of SARS-CoV-2 is an important and effective tool for detecting viral circulation in urban populations

Keywords: SARS-CoV-2, RT-PCR, Wastewater-based epidemiology, Morocco.



WIAM FAYED

MOLECULAR DIAGNOSIS OF MYOPATHIES USING NEXT-GENERATION SEQUENCING: MOROCCAN CLINICAL CASES

WIAM FAYED¹, HICHAM CHAROUTE², SALAHEDDINE REDOUANE², ASSIA IDYAHIA², MAJIDA CHARIF³, REDOUANE BOULOUIZ³, HOSSEIN MOSSAFA⁴ AND FAIZA CHBEL¹

¹ Interdisciplinary Laboratory of Fundamental and Applied Sciences, Higher Normal School, Hassan II University, Casablanca, Morocco.

² Laboratory of Genomics and Human Genetics, Pasteur Institute of Morocco, Casablanca, Morocco.

³ Genetics and Cellular Immunotherapy Team, Mohammed I University, Oujda, Morocco.

⁴ Laboratory of the Océanic Clinic, Oncorad Group, Casablanca, Morocco.

* fayedwiam167@gmail.com

Abstract: Hereditary myopathies are genetically diverse disorders affecting skeletal and cardiac muscles and resulting in progressive muscle weakness. Combined cardiac and neuromuscular manifestations are associated with variants in structural protein-encoding genes such as TTN, SYNE1, and TNNI3. To illustrate this heterogeneity, three families with suspected hereditary myopathies were investigated. Two heterozygous TTN variants were identified in the first family by whole-exome sequencing (WES): c.105946G>T (p.Glu35316*) and c.98716del (p.Val32906Tyrfs4). Segregation analysis by Sanger sequencing showed that the c.98716del deletion was inherited from the mother, and the c.105946G>T variant was transmitted by the father. Exome sequencing in the second family identified two rare missense substitutions in SYNE1 (p.Val7010Glu and p.Glu6031Lys). Structural modelling and molecular dynamics simulations indicated alterations in the structural stability and intraprotein interactions of nesprin-1, supporting a functional effect of these variants and their possible involvement in the clinical phenotype. In addition, a 206-gene cardiomyopathy panel revealed a nonsense TNNI3 mutation (c.292C>T; p.Arg98) in exon 6 in the third family. The two daughters presenting with dilated cardiomyopathy were considered homozygous, whereas the consanguineous parents were healthy heterozygous carriers. Overall, our findings underline the importance of integrated diagnostic strategies combining next-generation sequencing, bioinformatic annotation, structural modelling, and molecular dynamics, and emphasise the marked genetic and clinical heterogeneity of hereditary myopathies.

Keywords: Hereditary myopathies; Whole-exome sequencing.



MERIEM FEDOUI

**TOWARD THE ACCREDITATION OF MEDICAL BIOLOGY
LABORATORIES: A STRATEGIC APPROACH BASED ON ISO
15189:2022**

FEDOUI MERIEM^{1,2*}, SIHAM BENNANI², HICHAM MOHAMMADI², JOUMANA EL TURK³,
ILHAM BADREDDINE¹

¹ Biochemistry Laboratory, Neurosciences, Natural Resources and Environment, Faculty of Sciences and
Technology of Settat, Hassan I University, Settat, Morocco.

² Pasteur Institute of Morocco

³ Faculty of Health Sciences, Department of Fundamental Sciences, International University of Casablanca,
Casablanca, Morocco

*meriamfedoui@gmail.com

Abstract: The main objective of this project is to contribute to the implementation of the quality management system according to the ISO 15189 standard (2022 version) within the biochemistry-immunochemistry department, in order to ensure technical competence, patient safety, and the reliability of analyses. The approach adopted is based on the PDCA cycle (Deming wheel) and process management, incorporating project charter framing, a Gantt chart, global mapping, and a risk criticality assessment. An initial self-diagnosis targeting pre-analytical (clause 7.2) and analytical (clause 7.3) requirements was conducted to identify non-conformities and develop a corrective action plan. The initial assessment revealed an overall compliance rate of 54.57% (55% for pre-analytical and 54% for analytical), identifying major gaps related to sample traceability, transport, or method validation. The establishment of an adapted document management system and targeted preventive measures made it possible to control risks and engage the laboratory in continuous improvement.

Keywords: *ISO 15189:2022, Medical biology, Quality management, Risk assessment.*

IMANE GHAZLANE

**REFLECTIVE APPROACH AND TUTORING IN NURSING SCIENCES:
PERCEPTIONS, PRACTICES, AND PROFESSIONAL CHALLENGES**

IMANE GHAZLANE*, KHALID MARNOUFI, SAFAA HADRACH, AMINA LHBIBANI, OMAR ABIDI, BOUZEKRI TOURI

Laboratory of Physical Chemistry of Applied Materials (LCPMA) Faculty of Sciences Ben M'Sick, Hassan II University of Casablanca, Morocco

Care and Biology-Health/Care, Health and Sustainable Development Laboratory (2S2D), Higher Institute of Nursing and Health of Casablanca, Casablanca-Settat., Morocco.

Laboratory of Sciences and Technologies of Information and Education, STCED Research Team, FSBM, Hassan II University of Casablanca, Morocco

*imaneghazlane55@gmail.com

Abstract: Tutoring constitutes an essential pillar of the training and support of healthcare professionals. In the context of increasing complexity of care situations, the reflective approach appears as a relevant lever to support the development of tutoring competencies, promote experiential learning, and strengthen the quality of professional support. Its effective integration into tutoring practices remains heterogeneous and still poorly documented. This descriptive study aims to analyse the role of the reflective approach in tutoring in nursing sciences through exploration of the perceptions, practices, and professional challenges reported by healthcare professionals. The study was conducted among nursing professionals involved in tutoring activities. Data were collected using two complementary questionnaires addressing perceptions of the reflective approach and its use in tutoring practices. The results were analysed in order to identify perceived contributions, modes of integration of reflexivity, and barriers encountered. The findings show an overall positive perception of the reflective approach as a tool supporting tutoring. Participants emphasise its role in improving learner support, fostering professional autonomy, and strengthening the capacity to analyse complex care situations. Obstacles persist, particularly lack of specific training, organisational constraints, and workload. The reflective approach therefore represents a strategic lever for strengthening tutoring in nursing sciences, provided that institutional support and appropriate training mechanisms are in place.

Keywords: *Reflective approach, Tutoring, Nursing sciences, Professional practice.*



ASMAA GHAFILI

BARROWS CARD GAMES AS AN INNOVATIVE TEACHING STRATEGY IN HEALTH SCIENCES EDUCATION: A CROSS-DISCIPLINARY APPLICATION

ASMAA GHAFILI^{1,2*}; CHAIMAA MOUJAHID¹; MERYEM HAMDOUNE¹;
KHAOULA JOUNAIDI¹; ABDELLAH GANTARE¹

¹ Nursing and Midwifery Unit, Laboratory of Health Sciences and Technologies, Higher Institute of Health Sciences, Hassan First University of Settat, Settat, 26000, Morocco

² Laboratory of Health Sciences, Environment, Food Technologies, and Biotechnologies, Private University of Marrakesh, Marrakesh, Morocco

*Corresponding author e-mail address : asmaaghafili@gmail.com

Abstract: The evolution of teaching approaches in health sciences increasingly emphasises active learning methods that enhance student engagement and the development of both cognitive and non-technical skills. Barrows card games, inspired by problem-based learning, represent an innovative pedagogical tool designed to stimulate clinical reasoning, decision-making, and teamwork.

This study aims to describe the implementation of Barrows card games in health sciences education and to explore their contribution to student learning across different disciplines. A descriptive educational approach was adopted, involving students from various health science programmes. The intervention consisted of interactive sessions using card-based clinical scenarios that encouraged discussion, critical thinking, and collaborative problem-solving. Findings indicate that this approach improved student engagement, enhanced clinical reasoning abilities, and promoted essential skills such as communication and teamwork. Participants reported high levels of satisfaction and perceived the method as both motivating and relevant to their professional training.

Barrows card games appear to be an effective and adaptable teaching strategy that supports student-centred learning and competency development in health sciences education.

Keywords: Health sciences education; Active learning; Problem-based learning; Clinical reasoning; Teaching innovation.

SAFAA HADRACH

**DOSE ASSESSMENT IN CEREBRAL RADIOSURGERY: A
COMPREHENSIVE DOSIMETRIC EVALUATION**

SAFAA HADRACH^{1,2*}

¹Faculty of Medicine and Pharmacy, Hassan II University, Casablanca B.P. 5696, Morocco.

²Care and Biology-Health/Care, Health and Sustainable Development Laboratory (2S2D), Higher
Institute of Nursing and Health

*safaa.rx@gmail.com

Abstract: This study evaluates dose accuracy in intracranial radiosurgery using stereotactic techniques with flattening filter free (FFF) photon beams at 6 Gy. The work included computed tomography (CT) simulation, treatment planning, and dose delivery using advanced medical imaging and radiotherapy systems. Dosimetric measurements were performed to assess dose distribution, target coverage, and preservation of healthy tissues. The results demonstrated strong agreement between planned and delivered doses for three simulated lesions, with mean delivered doses of 8.26 ± 0.13 Gy, 8.33 ± 0.16 Gy, and 8.35 ± 0.16 Gy, and a maximum dose at the hot spot of 8.60 ± 0.19 Gy. Dose distribution accuracy was verified using a gamma conformity index of 99.5%. This study demonstrates that quality assurance in stereotactic radiosurgery, particularly in regions where tumour size is less than **1 cm**, is essential to **minimise** complications such as necrosis and damage to surrounding healthy tissues.

Keywords: *Dosimetry, Stereotactic techniques treatment planning, Quality assurance*



IBTISAM HAIDAR

**ANTIDIABETIC MEDICATION ADHERENCE DURING RAMADAN
FASTING AMONG PATIENTS WITH TYPE 2 DIABETES IN
MOROCCO: A CROSS-SECTIONAL ANALYSIS**

HAIDAR IBTISAM^{1*}, CHADLI ASMA², HARAJ NASSIM ESSABAH², EL AZIZ SIHAM²,
IGGAR MALAK², BOUNJERTE IMANE¹, KETTANI ANASS¹, SAILE RACHID¹, BENNANI
HOUDA¹

¹ Laboratory of Biology and Health, Faculty of Sciences Ben M'Sik, Hassan II University, Casablanca, Morocco.

² Department of Endocrinology, Diabetology, Metabolic Diseases and Nutrition, Ibn Rochd University Hospital, Casablanca, Morocco.

[*ibtisam.haidar-etu@etu.univh2c.ma](mailto:ibtisam.haidar-etu@etu.univh2c.ma)

Abstract: Fasting during Ramadan remains a common practice among patients with type 2 diabetes (T2D), despite potential metabolic risks. Evidence regarding antidiabetic medication adherence during Ramadan in Morocco is limited. This study evaluated medication adherence among fasting patients with T2D and explored associated factors. A cross-sectional study was conducted during Ramadan 2025 at Ibn Rochd University Hospital, Casablanca. Adult patients with T2D who fasted for at least 15 days were enrolled. Socio-demographic, clinical, and fasting-related characteristics were collected. Fasting risk was assessed using the IDF–DAR 2021 tool. Medication adherence was measured using the Arabic version of the MMAS-8. Multivariate logistic regression identified independent determinants of adherence. Ninety patients were included, of whom 25.6% were classified as high fasting risk. Overall, 28.0% fasted against medical advice and 36.0% reported self-modification of treatment. Low medication adherence was observed in 53.0% of participants. During Ramadan, hypoglycaemia and hyperglycaemia were reported in 23.3% and 21.1% of patients, respectively. Pre-Ramadan therapeutic education and absence of depression were associated with better adherence, and age 60–69 years and absence of abdominal obesity showed negative associations. Medication adherence during Ramadan remains suboptimal among patients with T2D, highlighting the importance of structured pre-Ramadan education and systematic risk assessment to support safer fasting.

Keywords: *Type 2 diabetes, Ramadan fasting, Associated factors.*



HALA HARIFI

ARTIFICIAL INTELLIGENCE FOR DETECTING AND PREDICTING HEAVY METAL WATER CONTAMINATION: HEALTH CONSEQUENCES AND SUSTAINABLE PREVENTION STRATEGIES

HALA HARIFI^{1*}, ABIR FGUIROUCHE²

¹ Laboratory of Biology and Health, Faculty of Science, Ibn Tofail University, Kenitra, Morocco

² Laboratory of Immunology and HLA, Centre of Clinical Research, Mohammed VI University Hospital, Marrakech 40080, Morocco

*hala.harifi@uit.ac.ma

Abstract: Heavy metal contamination of water supplies is a significant environmental and public health issue, largely linked to the persistence, bioaccumulation potential and toxicity of metals such as lead (Pb), cadmium (Cd), arsenic (As), mercury (Hg) and manganese (Mn). Prolonged exposure to these pollutants has been linked to adverse health effects, including neurotoxicity, renal failure, cardiovascular impairment and increased risk of chronic disease. Traditional monitoring methods, although analytically precise, are often limited by processing delays, restricted spatial coverage and limited predictive capacity. Recent advances in artificial intelligence (AI) offer significant potential for improving water quality monitoring and risk mitigation. This narrative review (2015–2025) examines the use of AI-driven models for detecting and predicting heavy metal contamination in aquatic systems and assesses their implications for environmental health protection. A focused literature search was conducted using the Scopus, PubMed and IEEE Xplore databases. Evidence shows that machine learning and deep learning methods—including Random Forest, Support Vector Machines, Artificial Neural Networks, Convolutional Neural Networks and Long Short-Term Memory networks—enhance contamination pattern recognition, concentration prediction and identification of high-risk areas. These models support early warning strategies and assist in health risk assessment by integrating physicochemical, geochemical, geographical and sensor-derived data. The integration of AI into environmental monitoring systems represents a promising approach to sustainable water management, proactive public health protection and improved decision-making.

Keywords: Heavy metal exposure, Artificial intelligence, Public health.



KAOUTAR HICHAMI

INFORMAL SOCIAL NETWORKS AND INEQUALITIES IN THE MANAGEMENT OF CHRONIC DISEASES

HICHAMI KAOUTAR*

Higher Institutes of the Nursing Professions and Techniques of Health , Laboratory of Care, Health and Sustainable Development 2S2D, Casablanca 22500, Morocco

*hichamikaoutar@-gmail.com

Abstract: This research examines the contribution of informal support networks, including extended family, neighbourhood relations, and women's social groups, to the care trajectories of individuals living with chronic diseases in Morocco. It explores how these everyday forms of solidarity shape access to medical services, continuity of care, and treatment adherence. The study also considers social disparities that influence the availability of support, alongside the gendered organisation of caregiving within families and communities. Using a qualitative sociological approach, the research demonstrates that these often unseen networks, which are rarely acknowledged in official health policies, play a decisive role in structuring patients' experiences and therapeutic pathways. Through analysis of the interaction between institutional healthcare provision and informal solidarities, the study highlights key social determinants of chronic illness management in Morocco and supports the development of more inclusive and context-sensitive health strategies.

Keywords: *Informal care; Social support; health inequalities.*



MARIYA HORCHI

HEALTH RISK PREVENTION AND OPTIMIZATION OF PATIENT CARE: CHALLENGES AND INNOVATIONS

MARIYA HORCHI *

Mohammed V University in Rabat, Rabat, Morocco

* mariya.horchi223@gmail.com

Abstract: The prevention of health risks and the optimization of patient care represent major challenges for contemporary health systems, which are confronted with the increasing prevalence of chronic diseases and adverse events related to healthcare delivery. This study is based on a literature review drawing on recent research on patient safety, hospital risk management, and healthcare quality improvement, as well as strategic frameworks developed by the World Health Organisation. The findings highlight that the implementation of structured risk management systems, the integration of digital tools, and the strengthening of interprofessional coordination significantly contribute to reducing preventable errors and improving the quality of care. Thus, the articulation between risk prevention and Organisational innovation constitutes a key lever for enhancing patient safety and the performance of health systems

Keywords: *Public Health, Patient Safety, Quality of Care, Risk Management*



FAHD HOUMMASS

VALORISATION OF SNAIL SHELL BIOWASTE FOR THE PHOTOCATALYTIC DEGRADATION OF CATIONIC AND ANIONIC DYES IN WATER

FAHD HOUMMASS¹, SMAIL MANYANI¹, YASSIR BENCHERQUI¹, ILYASS BELRHAZI²,
MOUAD LATIF¹, YOUNES OUZIDAN¹ AND MOHAMED SAFI^{1*}

¹ Laboratory of Physical Chemistry and Biotechnology of Biomolecules and Materials, Faculty of Sciences and Technology of Mohammedia, Hassan II University of Casablanca, BP 146, Mohammedia 28806, Morocco

² Laboratory of Biotechnology, Agrifood, Materials and Environment, Faculty of Science and Technology of Mohammedia, Hassan II University of Casablanca, BP 146, Mohammedia 20650, Morocco.

*Corresponding author e-mail address: mohamed.safi@fstm.ac.ma

Abstract: The continuous discharge of dye-contaminated wastewater from textile and related industries constitutes a serious environmental concern, highlighting the need for sustainable and efficient treatment technologies. In this study, snail shell biowaste was valorized as a low-cost and environmentally friendly photocatalyst for the degradation of cationic and anionic dyes in aqueous media, in line with circular economy principles. Snail shells were calcined and subsequently modified with titanium dioxide (TiO₂) to enhance their photocatalytic performance. The synthesised composite was characterised using standard physicochemical techniques to investigate its structural and optical properties. Photocatalytic experiments were carried out under UV irradiation using Methylene Blue (MB) and Methyl Orange (MO) as representative cationic and anionic dyes, respectively. Under optimised operating conditions, high degradation efficiencies were achieved, reaching approximately 99% for MB and 97% for MO. These results demonstrate that snail shell biowaste can be effectively converted into a functional photocatalyst for the removal of organic dyes from water. The proposed approach provides a sustainable solution for wastewater treatment and contributes to waste valorisation and environmental protection, in accordance with green chemistry and sustainable water management strategies.

Keywords: *Snail shell biowaste, Dye degradation, Wastewater treatment.*

FATIMA HOUSNI

**THE ONE HEALTH APPROACH AS A STRATEGIC LEVER FOR THE
SUCCESSFUL REFORM OF THE MOROCCAN NATIONAL HEALTH
SYSTEM**

FATIMA HOUSNI*, RAJAA ADNANE, YASSINE EL MATOUGUI

Higher Institute of Nursing and Health, Laboratory of Care, Health and Sustainable Development 2S2D,
Casablanca 22500, Morocco.

*fatimahousni1984@gmail.com

Abstract: The overhaul of the Moroccan healthcare system, initiated by the 2018 royal address and laws 06-22 and 09-21, aims to achieve universal health coverage and to strengthen governance. Its sustainability is, nevertheless, threatened by major challenges such as zoonotic diseases (75% of emerging diseases) and climate change. Faced with these challenges, the One Health approach, promoted by international organisations, represents a strategic lever. A review of Moroccan legal texts and reports from the WHO, FAO, and UNEP is conducted to demonstrate how the One Health approach can concretely strengthen the system's effectiveness and resilience. The results show that its integration strengthens prevention through integrated surveillance of zoonoses and environmental determinants. It also improves intersectoral governance, which is essential for a coordinated fight against antimicrobial resistance and for improved preparedness for health emergencies, in accordance with the International Health Regulations. In conclusion, the One Health approach is a strategic and operational asset. Its is key to transforming the Moroccan healthcare system into a more integrated, resilient, and sustainable model.

Keywords: *Reform, One Health, National Health System*

BRAHIM JABRI

BRAHIM JABRI

SPECIES-LEVEL SHIFT IN PREVOTELLA AND FUNGAL–BACTERIAL INTERACTIONS IN PERIODONTITIS

BRAHIM JABRI^{1,2*}, MOHAMED ACHMIT^{3,4}, SALMA BOUZZIR^{1,5}, SLIMANE FAOUZI^{2,6},
HOUDA EL AYACHI⁷, MEYEM IKEN⁸ AND OUMKELTOUM ENNIBI⁹

¹Higher Institute of Nursing and Health, Rabat Ministry of Health and Social Protection, Morocco.

² Research laboratory in Oral Biology and Biotechnology, Faculty of Dental Medicine, Mohammed V University in Rabat, Morocco

³ Higher Institute of Nursing and Health, Casablanca, Morocco

⁴UR Microbiology, Biomolecules and Biotechnology Laboratory of Physical Chemistry and Biotechnologies of Biomolecules and Materials FST Mohammedia, Morocco

⁵ Biology and Health Research Laboratory, Department of Life Sciences, Faculty of Sciences, Ibn Tofail University, Kenitra, Morocco

⁶ Laboratory of Natural Resources and Sustainable Development, Faculty of Sciences, Ibn Tofail University, Kenitra, Morocco.

⁷ Department of Dental Sciences, Faculty of Medicine, Pharmacy, and Dentistry of Fez Sidi Mohamed Ben Abdellah University

⁸ Department of Clinical Biology, Faculty of Medicine and Pharmacy, Mohammed V University in Rabat, Morocco

⁹ Department of Periodontology, Faculty of Dental Medicine, Mohammed V University in Rabat, Morocco

*brahim_jabri@um5.ac.ma

Abstract: Periodontitis is a chronic inflammatory disease driven by polymicrobial dysbiosis. Increasing evidence suggests that fungal–bacterial interactions may amplify periodontal destruction, yet species-level associations remain insufficiently characterised. This age-stratified case–control study included 283 participants (148 with periodontitis; 135 controls). Subgingival pooled samples were analysed for *Candida* spp. using culture, MALDI-TOF identification, and multiplex PCR confirmation, and for *Prevotella* spp. using anaerobic culture and MALDI-TOF. Overall prevalence was 45.2% for *Candida* spp., 63.2% for *Prevotella* spp., and 33.2% for co-infection. *Candida albicans* and *Prevotella intermedia* were significantly associated with periodontitis ($p < 0.05$). Co-infection was more frequent in cases than controls (46% vs 19.2%, $p < 0.001$; crude OR = 3.57). Multivariate logistic regression confirmed independent associations for *C. albicans* (adjusted OR = 2.52) and *P. intermedia* (adjusted OR = 2.73), with a significant interaction effect ($p = 0.029$). The model showed good discrimination (AUC = 0.83). These findings support a multikingdom dysbiosis model in which fungal–bacterial synergy contributes to periodontal inflammation and may have broader implications for systemic health.

Keywords: Periodontitis, *Candida albicans*, *Prevotella intermedia*, Multikingdom Dysbiosis

SOUKAYNA JARJINI

**PLANT GROWTH-PROMOTING RHIZOBACTERIA: A
SUSTAINABLE SOLUTION TO AGRICULTURAL CHALLENGES AND
PUBLIC HEALTH ISSUES**

**JARJINI SOUKAYNA^{1*}, MOUZOUN YASMINA ¹, SOUKRI ABDELAZIZ ¹ AND EL KHLAFI
BOUCHRA ¹**

¹Laboratory of Health, Environment and Biotechnology, Team of Physiopathology, Molecular Genetics and
Biotechnology, Faculty of Sciences Ain Chock, Hassan II University of Casablanca, 20100 Casablanca,
Morocco.

* jarjinisoukaina@gmail.com

Abstract: The increasing global demand for food is putting significant pressure on agricultural systems to produce more with fewer resources. Conventional farming practices often depend heavily on chemical fertilisers and pesticides, which contribute to soil degradation, water pollution, and reduced crop quality. In this context, the plant rhizosphere has gained considerable attention as a reservoir of beneficial microorganisms, including rhizobacteria. These bacteria can enhance plant growth and yield by stimulating phytohormone production, improving nutrient availability through biofertilization, protecting plants against pathogens through biocontrol mechanisms, improving soil health, and helping to reduce environmental contamination. Their use offers a sustainable alternative input and contributes to healthier and more resilient agroecosystems by limiting chemical residues in food and the environment. This study aims to highlight the potential of these rhizobacteria as an innovative and sustainable approach to improving agricultural productivity, preserving ecosystem health, and addressing food security challenges.

Keywords: *Rhizobacteria, PGPR, Sustainable agriculture, Food security*



MOUAD JLIYAKH

**SALT-INDUCED EFFECTS ON GERMINATION AND
OSMOREGULATORY RESPONSES IN COMMON BEAN (*PHASEOLUS
VULGARIS* L.): IMPLICATIONS FOR VARIETAL SELECTION UNDER
SALINE CONDITIONS**

MOUAD JLIYAKH^{1*}, SOUKAINA LAGHOUITA¹ AND SAID BOUGHRIBIL¹

¹Laboratory of Biotechnology, Agri-Food, Materials and Environment, Faculty of Sciences and
Techniques of Mohammedia, Hassan II University of Casablanca

*mouadjliyakh1221@gmail.com

Abstract: The common bean (*Phaseolus vulgaris* L.) is a legume of major nutritional and economic importance, particularly cultivated in arid and semi-arid regions. Increasing soil salinity represents a major constraint to its germination and growth. This study investigates the effects of NaCl on the in vitro germination of common bean seeds at salt concentrations ranging from 0 to 10 g·L⁻¹. Several morpho-physiological parameters were assessed, including germination percentage, germination speed, germination rate index, root development, and water content. The results show that germination percentage is only slightly affected by salinity, with a reduction of about 20% at 10 g·L⁻¹ NaCl. Salt sensitivity is more clearly reflected by a marked decline in germination speed. The root system is more severely affected, with a significant reduction in secondary roots (−41.03%) and an apparent decrease in root hair density, thereby limiting water and mineral uptake. In conclusion, identification of additional morpho-physiological or biochemical parameters could support varietal selection strategies aimed at improving salinity tolerance in this species.

Keywords: Common bean, NaCl stress, Root development.



KARIMA JMAILI

BIOTRANSFORMATION OF WHEY BY NATIVE MICROBIOTA AND ITS BIOSTIMULANT EFFECTS ON TOMATO GROWTH

KARIMA JMAILI¹, KHAWLA WADDI¹, MOHAMED LAHRAIRI¹, MERIEM MAHMOUDI¹, KENZA EL AOUAME¹, ASMAE AZEKOUR¹, ALLA SILKINA², BOUCHAIB BAHLAOUAN³ & NADIA BOUTALEB^{1*}

¹Faculty of Sciences and Techniques of Mohammedia, Hassan II University of Casablanca, Morocco

²Algal Research Group, Bioscience Department, College of Science, Swansea University, Singleton Park, Swansea, SA2 8PP, UK

³Higher Institute of Nursing and Health of Casablanca, Morocco

* nadia.boutaleb@fstm.ac.ma

Abstract: The dairy industry generates large volumes of whey, a nutrient-rich by-product whose improper disposal can cause serious environmental problems. This study explores the valorisation of raw and pasteurised bovine whey through spontaneous anaerobic fermentation mediated by indigenous microbiota, aiming to produce natural biostimulant and biofertiliser formulations for sustainable agriculture. Fermented products were characterised using physicochemical, biochemical, and agronomic analyses. Fermentation led to a marked decrease in pH and promoted the accumulation of organic acids, peptides, and free amino acids, indicating extensive biochemical transformation of the initial substrate. Germination assays on *Solanum lycopersicum* L. (cv. Campbell 33) showed that fermented whey significantly improved germination rate, seedling biomass, and root and shoot development compared to the control. Greenhouse experiments demonstrated that fermented whey applied at 1% (v/v), via soil irrigation or foliar spraying, stimulated vegetative growth, as reflected by increased shoot and root length, fresh and dry biomass, and leaf area. Photosynthetic pigments, including chlorophyll a, chlorophyll b, and carotenoids, were significantly enhanced, indicating improved physiological performance. Reproductive parameters such as flower and fruit production were also positively affected. Statistical analyses confirmed the robustness of these results. Overall, whey fermentation represents a sustainable dual-purpose strategy that effectively reduces dairy effluent pollution and provides value-added products for agriculture.

Keywords: *Whey, Fermentation, Native microbiota, Biostimulant, Tomato.*



FATIMAZAHRA JOUGA
PROBIOTICS AND THEIR CONTRIBUTION TO SUSTAINABLE
AQUACULTURE DEVELOPMENT

FATIMAZAHRA JOUGA^{1*}, FATIMA MOURABITI¹, SOURAYA SAKOUI¹, REDA DERDAK^{1,2}, ABDELAZIZ SOUKRI¹ AND BOUCHRA EL KHALFI¹

¹Laboratory of Health, Environment and Biotechnology, Team of Physiopathology, Molecular Genetics and Biotechnology, Faculty of Sciences Ain Chock, Hassan II University of Casablanca, Casablanca 20100, Morocco

² Department of Biology, Faculty of Sciences El Jadida, Chouaïb Doukkali University, B.P 20, El Jadida 24000, Morocco

*jougafatimazahra@gmail.com

Abstract: Over the last three decades, global aquaculture growth has outpaced all other agricultural sectors, playing a key role in meeting the rising demand for seafood, a valuable source of high-quality protein. This rapid expansion faces multiple challenges, including poor water quality, overcrowding, disease outbreaks (bacterial, viral and parasitic), and the use of aquaculture chemicals, which pose risks to aquatic species, consumers, and the environment as a result of residual effects and the emergence of drug-resistant bacteria. To address these issues, developing safe, natural alternatives such as high-quality aquafeeds with beneficial nutritional profiles is crucial for sustainable and environmentally responsible aquaculture. In this context, probiotics, defined as live micro-organisms that confer health benefits to the host when administered in adequate amounts, represent a promising management strategy. Various probiotics in aquaculture have demonstrated the ability to improve animal health, enhance water quality, and support food safety. This study provides an overview of probiotic applications in aquaculture, highlighting their roles in improving seafood quality and safety. It also examines their mechanisms of action, including modulation of microbial balance, enhancement of immune responses, and inhibition of pathogenic bacteria, as well as their different modes of administration within aquaculture systems.

Keywords: *Aquaculture, seafood, probiotics, sustainability*

KARMIL FATIMA ZAHRA

**RECOVERY OF HIGH REACTIVE ALKALINE EARTH OXIDES
FROM REVERSE OSMOSIS DESALINATION BRINE: KINETICS,
EQUILIBRIUM, COST-EFFECTIVENESS AND ENERGY
CONSUMPTION**

FATIMA ZAHRA KARMIL^{1*}, AND HANAN EL ALAOUÏ-BELGHITI¹

¹Laboratory of Physical Chemistry of Materials, Department of Chemistry, Faculty of Sciences, University Chouaib Doukkali, P.O. Box 20, El Jadida 24000, Morocco.

* karmil.f@ucd.ac.ma

Abstract: Reactive alkaline earth oxides (CaO and MgO) have recently received significant attention because of their low production costs, availability, and capacity for CO₂ storage. This study examined the high content of bivalent ions (Ca²⁺ and Mg²⁺) in RO reject brine for the production of reactive quicklime and magnesia via selective precipitation. Various precipitating agents were evaluated at different molar ratios to assess purity and process efficiency. Oxalic acid dosage was optimised at a molar ratio (C₂H₂O₄/Ca²⁺) of 2, achieving a high recovery efficiency of calcium oxalate monohydrate (97.5 ± 0.5%). Geochemical modelling was performed using PHREEQC with the Pitzer model to simulate precipitation behaviour under selected conditions. The caustic soda dosage was set at a molar ratio (NaOH/Mg²⁺) of 3, corresponding to the highest precipitation extent of brucite (97 ± 0.5%). Calcination of the precipitated solids for 2 h at 900°C and 500°C produced reactive quicklime and magnesia. The produced oxides were characterised at optimised conditions in terms of composition, microstructure, and reactivity. BET analysis showed surface areas of 10.4 m²·g⁻¹ and 58.3 m²·g⁻¹, respectively. Energy consumption and production cost analysis indicated that RO reject brine represents a viable secondary source for recovering highly reactive alkaline earth oxides and contributes to reducing the environmental footprint of desalination plants.

Keywords: *Reject brine, Recovery, MgO, CaO, Cost–energy.*



HAJARE KERAZI

PREVENTIVE AND EDUCATIONAL APPROACHES TO MENTAL HEALTH IN YOUNG PEOPLE: A LITERATURE REVIEW

HAJARE KERAZI^{1,2}, MOUNA SABIRI¹³, RACHID ABOUTAIB^{4*}

¹ Laboratory of Healthcare and Sustainable Development, Higher Institute of Nursing and Health, Casablanca, Morocco

² Laboratory of Sexual and Reproductive Health, Hassan II University, Faculty of medicine and pharmacy of Casablanca, Morocco

*haj.kerazi@gmail.com

Abstract: Youth mental health is an emerging public health issue, marked by an increase in disorders such as anxiety, depression, and psychosocial distress. This study is a narrative review of the literature, based on an analysis of recent international guidelines and available epidemiological data on youth mental health. The analysed data highlight the role of several risk factors, including social pressures, excessive use of digital technologies, and socio-economic inequalities. In contrast, preventive and educational approaches appear to be effective levers for enhancing psychological well-being. School-based interventions focused on developing psychosocial skills, stress management, and promoting self-esteem are particularly recommended. In addition, certain national strategies, such as integrating mental health into school health programmes and strengthening community-based services, represent promising approaches. In conclusion, an integrated approach combining education, prevention, and tailored public policies is essential for the sustainable promotion of the mental health of young people.

Keywords: *Mental health, Young people, Prevention, Health education*



RAOYA KHACHANI

STABILITY OF MECHANICAL AND PHYSICO-CHEMICAL PROPERTIES OF PECTIN- BASED FILM INCORPORATED WITH ROSMARINUS OFFICINALIS, SYZYGIIUM AROMATICUM ESSENTIAL OILS

RAOYA KHACHANI^{1*}, OUIAM EL GALIOU¹, AMIN LAGLAOUI¹, MOUNIR HASSANI
ZERROUK¹

¹ Research team Biotechnologies and Biomolecular Engineering. FSTT, Abdelmalek Essaadi University,
Tetouan, Morocco.

Khachaniraoya@gmail.com

Abstract: Biopolymer-based films offer a promising and eco-friendly alternative to traditional plastic packaging, a significant source of environmental pollution. Integrating bioactive agents such as essential oils (EOs), known for their antimicrobial and antioxidant properties, can enhance the functionality of these materials. This study examines the impact of *Rosmarinus officinalis* and *Syzygium aromaticum* essential oils (REO and CLEO) on the functional performance of pectin-based films during storage. Films incorporating 1% (w/w) of each EO were prepared using the casting technique and evaluated for their mechanical and physicochemical properties. Results revealed that both EOs significantly enhanced the films' functional characteristics. Their incorporation improved flexibility by increasing elongation at break (EB) and reducing tensile strength (TS), moisture content and thickness. Over the storage period, a slight increase in moisture content and a minor reduction in mechanical strength were observed. These findings highlight the potential application of EO-enriched pectin films as effective bioactive packaging solutions to extend the shelf life of food products.

Keywords: *Rosmarinus officinalis*, *Syzygium aromaticum*, *Pectin-based film*.



YASSMINE KHALDOUNI

FIRST EVALUATION OF MICROPLASTIC CONTAMINATION IN MOROCCAN COASTAL SANDS USING THE HARMONISED NUTEC PLASTICS PROTOCOL

YASSMINE KHALDOUNI^{1,2}, OTMANE KHALFAOUI^{2*}, ABDEL FETTAH BENCHRIF²,
MOUNIA TAHRI², ABDELMOIRHIT LAISSAOUI², HOCEIN BAZAIRI²

¹National Centre for Nuclear Energy, Science and Technology (CNESTEN), Rabat 10001, Morocco

²Laboratory of Biodiversity Ecology and Genome, Faculty of Science, Mohammed V University in Rabat, 4 Avenue Ibn Battouta, B.P. 1014 RP, Rabat 10000, Morocco

*Corresponding author e-mail address o.khalfaoui@cnesten.org.ma

Abstract: Microplastic pollution is recognised as one of the most pressing emerging environmental challenges worldwide. With approximately 3,500 km of coastline along the Atlantic Ocean and the Mediterranean Sea, the Moroccan littoral is increasingly exposed to anthropogenic pressures from urbanisation, port activities, fisheries, and tourism. Nevertheless, scientific data on microplastic contamination in Moroccan beach sands remain scarce. This study was conducted as part of the IAEA regional programme RAF7022, aiming to harmonise methodologies for monitoring microplastics in marine environments. For the first time in Morocco, the standardised NUTEC Plastics protocol was applied to assess the abundance, morphology, and polymer composition of microplastics ranging from 0.3 to 5 mm in beach sediments. Seven pilot sites were investigated across both Atlantic and Mediterranean coasts. Results reveal widespread but spatially variable contamination, with the highest abundances recorded in northern sites. The coarse fraction (1–5 mm) predominates, suggesting that macroplastic fragmentation is a major source. Morphologically, foams dominate (≈45%), consistent with the prevalence of polystyrene, followed by polyethylene and polypropylene. These findings provide a baseline for future monitoring and support the implementation of harmonised assessment strategies.

Keywords: *Microplastics, Beach Sands, NUTEC Plastics Protocol.*

YASMINE KHALKI

**ALGAL BIOTECHNOLOGIES FOR THE REDUCTION OF
MICROPLASTICS IN AQUATIC ENVIRONMENTS**

YASMINE KHALKI¹, SALMA SIHAM ELKHAYAT², BAHLAOUAN BOUCHAIB³, & NADIA
BOUTALEB^{1*}

¹ Hassan II University of Casablanca, Laboratory of Biotechnology, Agri-Food, Materials and Environment,
Team: Biotechnologies, Resource Valorisation, Quality, Health and Ecoto/icology, Faculty of Science and
Technology Mohammedia, BP 146, Mohammedia 20650, Morocco

² Nephrology Department, Ibn Rochd University Hospital of Casablanca

³ Higher Institute of Nursing and Health of Casablanca, Laboratory of Care, Health and Sustainable Development
2S2D, Casablanca 22500, Morocco.

* nadia.boutaleb@fstm.ac.ma

Abstract: Microplastic pollution has emerged as a major environmental challenge as a result of its persistence, widespread distribution, and potential risks to aquatic ecosystems and human health. Conventional physical and chemical treatment methods often show limited efficiency, high operational costs, and may generate secondary pollutants. In this context, algal biotechnologies are gaining increasing attention as sustainable and eco-friendly alternatives for microplastic removal. This study explores the potential of microalgae-based systems for the reduction of microplastics in aquatic environments. Particular emphasis is placed on the mechanisms involved, including biosorption, bioflocculation, and biodegradation. The role of extracellular polymeric substances in enhancing microplastic aggregation and removal efficiency is also discussed. Furthermore, key operational parameters influencing microalgal performance, such as light intensity, nutrient availability, and hydraulic conditions, are examined. The integration of algal technologies into wastewater treatment systems is highlighted as a promising strategy to improve removal efficiency and to contribute to a circular bioeconomy. Overall, algal biotechnologies represent a cost-effective and environmentally sustainable solution for mitigating microplastic contamination and protecting aquatic ecosystems.

Keywords: *Microplastics, Microalgae, Biosorption, Wastewater Treatment.*

FATIMA ZAHRA KHEIR

**PREVALENCE OF *HELICOBACTER PYLORI* CAGA AND VACA
VIRULENCE MARKERS IN MOROCCAN CHILDREN AND
ADOLESCENTS**

FATIMA ZAHRA KHEIR^{1,2}, AICHA BAALALA^{1,4}, GHIZLANE BOUNDER¹, ABDELHAK
ABKARI³, DALAL BEN SABBACHIA³, MERIEM ATRASSI³, MARIAMA LASKY², HASNA
BOURA^{*1}

¹ Laboratory of *Helicobacter pylori* and Gastric Pathologies, Institut Pasteur du Maroc, Casablanca 20360, Morocco.

² Biotechnology and Valorisation of Plant Resources/Algae and Plants Team, Faculty of Sciences El Jadida, University Chouaib Doukkali, El Jadida, 24000, Morocco.

³ Pediatric Gastroenterology Unit, Pediatric Service 3, Hospital Mother and Child Abderrahim Harouchi, CHU Ibn Rochd, Casablanca, Morocco.

⁴ Laboratory of Anthropogenetics, Biotechnology and Health, Faculty of Sciences El Jadida, University Chouaib Doukkali, El Jadida, 24000, Morocco.

*Corresponding author's e-mail address: hasna.boura@pasteur.ma

Abstract: Heterogeneity in the VacA and CagA pathogenicity factors of *Helicobacter pylori* has been correlated with the progression and severity of gastrointestinal disease in adults; data regarding these markers in paediatric populations remain limited. The objective of this research was to assess the distribution of VacA and CagA virulence markers in symptomatic Moroccan children and adolescents, as well as their association with histological and endoscopic findings. Gastric tissue samples were collected from two hundred children and adolescents referred for upper gastrointestinal endoscopy. Conventional PCR was employed to detect *H. pylori* infection and the presence of the cagA gene, whereas multiplex PCR was used to characterise vacA allelic variants (s and m alleles). Of the 200 participants, 84.5% tested positive for *H. pylori*. Among these, 32% carried the cagA gene, and vacA was identified in all strains. The most prevalent genotype combination was vacA s2/m2, observed in 67.5% of infected patients. Gastric nodularity was frequently observed in patients harbouring cagA-positive strains. A significant association was noted between *H. pylori* colonisation density and the vacA s1 and m1 genotypes. Histological findings showed no significant variation according to vacA and cagA genotypes. These results show that *H. pylori* strains harbouring vacA s2/m2 and cagA-negative genotypes were the most frequently detected among children and adolescents in Morocco.

Keywords: *Helicobacter pylori*, Children, Virulence factors.

RACHID KHOUBBANE

**THE IMPACT OF DIGITALISATION ON NEW PUBLIC
GOVERNANCE WITHIN ISPITS CASABLANCA**

RACHID KHOUBBANE ^{1,2*}, TAHA RAFIK ¹, REDOUANE BACHAR ¹, AMINE ZITI ¹,
MERIEM CHERKAOUI ¹

¹Faculty of Legal, Economic and Social Sciences – Ain Sebaa (FSJES-AS), Hassan II University of Casablanca, Morocco

²Higher Institute of Nursing and Health, Casablanca, Morocco

* ykhoubbane@yahoo.fr

Abstract: Digitalisation constitutes a major lever for modernising public administrations and enhancing efficiency, transparency and service quality. In this context, the emergence of e-government reflects a broader trend towards bureaucratic rationalisation, improved public performance and strengthened transparency. In the Moroccan context, and particularly within the Higher Institute of Nursing Professions and Health Techniques (ISPITS) in Casablanca, as a sectoral higher education institution, administrative processes remain partially digitalised, which limits the institute's capacity to fully adopt and effectively implement the principles of New Public Management (NPM). Understanding the concrete impact of digitalisation on internal governance is therefore essential to guide reforms and optimise institutional performance.

Keywords: *Digitalisation, Public governance, New Public Management, Higher education*

OUMAYMA LAASSILIA

ASSESSMENT OF NUTRITIONAL STATUS, BIOCHEMICAL PROFILES, AND DIETARY HABITS RELATED TO DEPRESSION IN HAEMODIALYSIS PATIENTS IN MOROCCO

OUMAYMA LAASSILIA^{1*}, SAMAR AL HETEILAH¹, HIBA BENCHHIDA¹, YOUNESS TABOZ¹

¹Natural Resources and Sustainable Development Laboratory, Research unit in Nutrition, Metabolism and physiology, Departement of biology, Faculty of Sciences, IBN TOFAIL University, Kenitra, Morocco

* oumayma.laassilia@gmail.com

Abstract: End-stage chronic kidney disease is characterised by irreversible loss of kidney function requiring replacement therapy such as haemodialysis, which is the most commonly used treatment. Patients treated with haemodialysis face several nutritional, social and psychological problems. This study was conducted to evaluate associations between depression and nutritional and biochemical parameters. The study included 200 patients undergoing haemodialysis in three cities (Kelaâ des Sraghna, Kenitra and El Jadida), with a mean age of 55.24 ± 15.07 years. The results showed that 80% of patients had depression, including mild (33.5%), moderate (23%) and severe depression (23.5%). Significant associations were found between marital status, educational level and occupation and the level of depression ($p < 0.05$). Significant associations were also observed between fresh fish consumption and depression ($p = 0.022$), phosphorus intake on haemodialysis and non-haemodialysis days ($p < 0.05$), and haemoglobin levels and depression ($p = 0.005$). These findings demonstrate the influence of socio-demographic, nutritional and biochemical factors on the psychological state of patients with end-stage renal disease, highlighting the importance of multidisciplinary care to improve survival and quality of life.

Keywords: *Haemodialysis; Depression; Nutritional status*



KHALID LAAZIRI
FREQUENCY OF HLA-A, -B, -DRB1 AND -DQB1 ALLELES IN MOROCCAN ADULTS' PATIENTS WITH ACUTE MYELOID LEUKAEMIA: A CASE CONTROL STUDY

KHALID LAAZIRI^{1,2*}, ABDELMAJID ZYAD³, FATIMA EZZAHRA LAHLIMI⁴,
OUADIABAKARIM⁴, ILLIAS TAZI⁴, IKRAM BRAHIM², NADIA LAKHOUEJA², RAJA
HAZIME^{2,5}, EL MOSTAFA MTAIRAG¹ AND BRAHIM ADMOU^{2,5}

¹Laboratory of Integrative Biology, Faculty of Science Ain Chock, Hassan II University, Casablanca, Morocco 20000

²Laboratory of Immunology and HLA, Centre of Clinical Research, Mohammed VI University Hospital, Marrakech 40080, Morocco

³ Agro-industrial and Medical Biotechnology Laboratory; Experimental Oncology and Natural Substances Team; Cellular and Molecular Immunopharmacology, Faculty of Sciences and Technology, Sultan Moulay Slimane University, Beni Mellal 23000, Morocco

⁴Department of Clinical Hematology and Bone Marrow Transplantation, Mohammed VI University Hospital, Marrakech 40080, Morocco

⁵Bioscience Research laboratory, Faculty of Medicine and Pharmacy, Cadi Ayyad University, Marrakech 40080, Morocco

*khalid.laaziri07@gmail.com.com;

Abstract: Acute myeloid leukaemia (AML) is the most common acute leukaemia in adults, with over 50% of individuals succumbing to the disease annually. This study aimed to assess the correlation between human leukocyte antigen (HLA) genes and acute myeloid leukaemia (AML) in an adult Moroccan cohort. We included 60 persons with acute myeloid leukaemia (AML) who were eligible for hematopoietic stem cell transplantation and compared them to a control group of 90 healthy adults. Patients and controls were subjected to HLA class I and II typing utilizing either sequence-specific primers (SSP) or sequence-specific oligonucleotides (SSO) in polymerase chain reaction-based methodologies. The AML categories were predominantly represented by AML2, AML3, and AML4, comprising 36.66%, 30%, and 16.66%, respectively. We identified a notable correlation between HLA-A*11 ($p = 0.003$) and HLA-B*27 ($p = 0.005$) with acute myeloid leukaemia (AML), and for HLA class II allele groups, we detected an elevated frequency of HLA-DQB1*05 ($p = 0.002$) in adult AML patients. We identified a notable correlation between AML 2 and the allele groups examined, namely with HLA class I: HLA-A*11 ($p = 0.0003$) and HLA-B*27 ($p = 0.00006$). Our study suggests a potential association between specific HLA alleles and the development of AML specifically AML type 2 in adults. Further, larger studies are needed to confirm these findings.

Keywords: Acute myeloid Leukaemia; Adults; HLA-A; HLA-B; DRB1; DQB1; Morocco.



SOUKAINA LAGHOUITA

EFFECT OF SALINITY STRESS ON *IN VITRO* GERMINATION OF CHICKPEA: AN INTEGRATED APPROACH TO ROOT RESPONSES

LAGHOUITA SOUKAINA^{1*}, JLIYAKH MOUAD¹ AND BOUGHRIBIL SAID¹

¹Laboratory of Biotechnology, Food Science, Materials and Environment,
Faculty of Sciences and Techniques, Mohammeda, Hassan II University of Casablanca.

* soukaina.laghouita-etu@etu.univh2c.ma

Abstract: Chickpea (*Cicer arietinum* L.), a legume widely cultivated in arid and semi-arid regions, is particularly exposed to salinity stress. This stress represents a major abiotic factor limiting its germination. The aim of the present study was to investigate the effect of six NaCl concentrations (0, 2, 4, 6, 8 and 10 g L⁻¹) on the main parameters of in vitro germination under dark conditions at 25 °C. The effect of salinity stress on germination was assessed through germination capacity and rate, water uptake, and radicle length. The results showed that, despite the stability of the final germination percentage, higher salinity concentrations induced a delay in the germination process, as well as a reduction in radicle growth (−40.38%), accompanied by a decrease in the number of secondary roots (−76.89%) and in the apparent density of root hairs. A progressive decrease in water content was also observed under salinity stress (−21.93%). In conclusion, it would be of great interest to identify the physiological and/or biochemical mechanisms involved in the observed osmoregulation, which may contribute to salinity tolerance.

Keywords: *Cicer arietinum* L., Salinity, Germination capacity, Radicle length.



MOHAMED LAHRAIRI

INNOVATIONS IN NON-DAIRY PROBIOTICS: VALORISING MOROCCAN ALMOND BIODIVERSITY THROUGH KEFIR FERMENTATION

MOHAMED LAHRAIRI^{1*}, KARIMA JMAILI¹, KHAWLA WADDI¹, HLIMA BESSI¹,
BOUCHAIB BAHLAOUAN², AND NADIA BOUTALEB¹

¹Laboratory of Biotechnology, Agri-Food, Materials and Environment, Team: Biotechnologies, Resource Valorisation, Quality, Health and Ecotoxicology, Faculty of Science and Technology Mohammeda, Hassan II University of Casablanca

²Higher Institute of Nursing Professions and Health Techniques ISPITS Casablanca

*mohamed.lahrairi@gmail.com

Abstract: The growing demand for plant-based dairy alternatives has led to increased interest in non- dairy fermented beverages. This study explores the potential of valorizing Moroccan biodiversity by developing a novel plant-based kefir from three indigenous almond (*Prunus dulcis*) varieties: Assoul, Aknoul, and Al Hoceima. The almond milks were fermented for 24 hours using a commercial kefir starter culture and analysed for their physico-chemical, functional, microbiological, and sensory properties. Fermentation induced significant, favourable transformations across all tested varieties. The process significantly decreased pH (to 4.7–5.2) and total soluble solids, whilst increasing titratable acidity. Crucially, fermentation markedly enhanced functional bioactive compounds; total phenolic content increased two- to three-fold, and DPPH antioxidant activity more than doubled, peaking between days 7 and 14. Microbiological analysis confirmed robust populations of lactic acid bacteria, reaching 8.27–8.33 log CFU/mL. Varietal differences strongly influenced the final product, with the Al Hoceima cultivar consistently demonstrating superior functional properties and the highest consumer acceptability. This research highlights the viability of Moroccan almond biodiversity for developing innovative, plant-based probiotic beverages.

Keywords: *Prunus dulcis*, Probiotic beverage, Plant-based kefir.



AMINA LHBIBANI

SIMULATION- AND OSCE-BASED TRAINING IN THE MANAGEMENT OF SHOULDER DYSTOCIA AMONG STUDENT MIDWIVES AT ISPITS CASABLANCA

LHBIBANI AMINA^{1,2,3*}, QAISAR RABIA^{1,3}, NATOUBI SAMIRA^{4,5}, RACHID GOUIFRANE^{1,3}, GHAZLANE IMANE^{1,2}, LAMIRI ABDERRAHMAN^{1,3}, BACHAR REDOUANE², BENFETAH MOHAMED⁶, HADRACH SAFAE^{3,7}, GHOSNE NADIA², SAID LOTFI⁸, ABIDI OMAR³, SAÏD BELAAOUAD¹

¹ Laboratory of Physical Chemistry of Applied Materials (LCPMA), Faculty of Sciences Ben M'sik, Hassan II University, Morocco.

² Research Team in Health Sciences, Education and Management (2SEM) – Health and Sustainable Development (2S2D), Higher Institute of Nursing and Health, Casablanca-Settat, Salem Cherkaoui Street, Hospital District, Casablanca, 20250, Morocco.

³ Healthcare and Biology Team, (2S2D), Laboratory, Higher Institute of Nursing professions and Health Techniques (ISPITSC), Casablanca-Settat, Salem Cherkaoui Street, Hospital District, Casablanca, 20250, Morocco.

⁴ Hassan II University of Casablanca, Faculty of Sciences and Technology of Mohammedia, Laboratory of Biochemistry, Environment and Agri-Food, LBEA, Morocco.

⁵ Laboratory of Health, Care, and Sustainable Development, Higher Institutes of the Nursing Professions and Techniques of Health ISPITS Casablanca, Morocco.

⁶ Hassan First University of Settat, Higher institute of Health Sciences, Laboratory of Health Sciences and Technologies, Settat, Morocco.

⁷ Laboratory of Chemistry-Biochemistry, Environment, Nutrition and Health, Faculty of Medicine and Pharmacy, Hassan II University, Casablanca B.P. 5696, Morocco.

⁸ Multidisciplinary Laboratory in Health Sciences, Education and Training Engineering (LMSEEIF), Higher Normal School (ENS), Hassan II University of Casablanca, P.O. Box 50069, Morocco.

*aminalhbibani@gmail.com or aminalhbibani2@gmail.com.

Abstract: Shoulder dystocia is a rare obstetric emergency associated with a high risk of maternal and neonatal complications. Practical training based on simulation and Objective Structured Clinical Examination (OSCE) is essential for effective preparation of student midwives. This study aimed to evaluate the effect of a pedagogical programme combining procedural simulation and OSCE on theoretical knowledge and clinical performance related to shoulder dystocia. An experimental study was conducted among 31 fifth-semester student midwives at ISPITS Casablanca. Participants were assessed before and after the intervention using multiple-choice questions to measure theoretical knowledge and OSCE to assess clinical performance. Pre- and post-intervention scores were statistically analysed ($p < 0.05$). Theoretical knowledge increased significantly after the intervention ($t = 15.924$; $p < 0.001$). Clinical performance also improved markedly (Post-OSCE: $t(29) = 20.26$; $p < 0.001$). These findings indicate concurrent improvement in knowledge and practical skills following the combined pedagogical approach. The integration of procedural simulation and OSCE represents an effective strategy for strengthening preparedness of student midwives for the management of shoulder dystocia.

Keywords: *Procedural simulation, Student midwives, Clinical performance.*



ILYASSE LOULIDI

ADSORPTION BEHAVIOUR AND MECHANISTIC INSIGHTS INTO CRYSTAL VIOLET AND HEXAVALENT CHROMIUM (Cr(VI)) REMOVAL USING SPENT COFFEE GROUNDS IN SINGLE AND BINARY SYSTEMS

ILYASSE LOULIDI^{1,2*}, FATIMA BOUKHLIFI², MBARKA OUCHABI³

¹ Laboratory of Chemistry and Biology Applied to the Environment. URL-CNRST-N°13. Faculty of Sciences. Moulay Ismail University. BP 11.201-Zitoune. Meknes. Morocco

² Ministry of Health and Social Protection, Higher Institute of Nursing and Health, Meknes, Morocco

³ Laboratory of Catalysis and Corrosion of Materials. Chouaib Doukkali University. Faculty of Sciences El Jadida. BP. 20. El Jadida. Morocco

* il.loulidi@gmail.com

Abstract: Spent coffee grounds (SCGs) were evaluated as a low-cost and sustainable adsorbent for the removal of crystal violet (CV) and hexavalent chromium (Cr(VI)) from aqueous solutions in single and binary systems. Adsorption data were well described by the Langmuir isotherm and pseudo-second-order kinetic model, indicating monolayer adsorption dominated by chemisorption processes. Mechanistic investigations using SEM, EDS, and FTIR analyses showed that CV removal proceeds through electrostatic attraction, hydrogen bonding, and π - π interactions, whereas Cr(VI) adsorption involves electrostatic interaction followed by its reduction to Cr(III) via electron-donating surface functional groups. In binary systems, adsorption capacities decreased moderately as a result of competitive interactions between both contaminants, though effective simultaneous removal was maintained. Regeneration experiments demonstrated that SCGs can be reused over multiple cycles, with relatively stable performance for CV and a more pronounced decline for Cr(VI) attributed to partial irreversible binding of reduced chromium species. These results demonstrate the applicability of spent coffee grounds as an efficient and recyclable biosorbent for multicomponent wastewater treatment within a circular economy framework.

Keywords: *Spent coffee grounds, Hexavalent Chromium, Crystal Violet, Adsorption mechanisms, Binary systems, Circular economy.*



OUMAIMA MABCHOUR

**OPTIMIZATION OF R-PHYCOERYTHRIN PURIFICATION FROM
GELIDIUM CORNEUM AND EVALUATION OF ITS IN VITRO
ANTIOXIDANT POTENTIAL**

**OUMAIMA MABCHOUR^{1*}, ZAKARIA MAHDI MOUMEN¹, ABDEL KHALID ESSAMADI¹
AND ABDELLATIF RAHIM¹**

¹Laboratory of Biochemistry, Neurosciences, Natural Resources and Environment, Faculty of Sciences and
Techniques, Hassan I University of Settat, P.O. Box 577, 26000, Settat, Morocco

*oumaima.mabchour.doc@uhp.ac.ma

Abstract: This study aimed to develop an optimised and cost-effective method for extracting and purifying R-phycoerythrin (R-PE) from the red macroalga *Gelidium corneum*, harvested along the Atlantic coast of Morocco. Various extraction buffers and cell disruption techniques, including freeze–thaw cycles, maceration, and ultrasonication, were evaluated to maximise pigment recovery. The crude extract was clarified using activated charcoal, followed by two-step ammonium sulphate precipitation and DEAE-cellulose ion-exchange chromatography. R-PE content, yield, and purity index were measured by UV–visible spectrophotometry, and total protein was determined by the Lowry method. Optimal conditions included phosphate buffer (1:10, w/v), 0.43% activated charcoal, and ammonium sulphate precipitation at 25% and 45%, yielding a purity index of 3 and an R-PE concentration of 0.123 mg/mL. SDS-PAGE confirmed pigment purity. Purified R-PE exhibited significant antioxidant activity in DPPH and ABTS assays, demonstrating its potential for agri-food, cosmetic, and biomedical applications.

Keywords: *R-phycoerythrin, Gelidium corneum, Extraction, Purification, Antioxidant activity.*

SELMA MABROUKI

**COMPARATIVE STUDY OF IN VITRO ANTIDIABETIC AND
ANTIGLYCATION PROPERTIES OF METHANOLIC EXTRACTS
FROM *SARGASSUM VULGARE* AND *SARGASSUM MUTICUM***

SELMA MABROUKI^{1*}, FATIMA LAKHDAR¹, ABDELMOUNAIM LAABAR², JAMAL BOUHRAOUA¹, BOUCHRA BENHNIYA¹, BADR-DDINE EL MOUNS¹, NAZHA SAMRI¹, JAMAL MABROUKI³, OMAR ASSOBEI⁴, SAMIRA ETAHIRI¹.

¹Laboratory of Marine Biotechnology and Environment–CNRST Labelled Research Unit, Faculty of Sciences, Chouaib Doukkali University, BP 20, El Jadida 24000, Morocco

²Laboratory of Pharmacology and Toxicology, Biopharmaceutical and Toxicological Analysis Research Team, Faculty of Medicine and Pharmacy, University Mohammed V of Rabat, Morocco

³Mohammed V University in Rabat, Faculty of Science, Avenue Ibn Battouta, BP1014, Agdal, Rabat, Morocco.

⁴University Sidi Mohamed Ben Abdellah, BP 2202, Fez, Morocco.

*Mabrouki.selma@ucd.ac.ma

Abstract: The search for natural bioactive compounds capable of preventing diabetes-related complications offers a promising route to alternative therapies. This study evaluated the in vitro antidiabetic and antiglycation activities of methanolic extracts from *Sargassum vulgare* (SV) and *Sargassum muticum* (SM). Antidiabetic activity was assessed through inhibition of α -amylase and α -glucosidase. SV showed significantly higher activity, with IC_{50} values of $95.66 \pm 0.07 \mu\text{g/mL}$ and $77.87 \pm 0.18 \mu\text{g/mL}$, compared to SM ($412.43 \pm 0.03 \mu\text{g/mL}$ and $326.25 \pm 0.04 \mu\text{g/mL}$). Both extracts were less active than acarbose. Antiglycation activity was assessed via fructosamine formation, thiol group content and inhibition of fluorescent advanced glycation end-products (AGEs). At 3 mg/mL, SV reduced fructosamine levels ($0.26 \pm 0.12 \text{ mmol/L}$) compared to SM ($1.17 \pm 0.24 \text{ mmol/L}$) and preserved thiol groups (3.98 ± 0.07 vs $1.54 \pm 0.09 \text{ nmol/mg protein}$), indicating stronger protection against oxidative stress. SV also showed greater inhibition of fluorescent AGEs ($IC_{50} = 0.34 \pm 0.04 \text{ mg/mL}$) compared to SM ($1.08 \pm 0.04 \text{ mg/mL}$), although both were less effective than aminoguanidine. Overall, methanolic extract of *Sargassum vulgare* showed superior antidiabetic and antiglycation properties, highlighting its potential for preventing diabetes-related complications.

Keywords: Antidiabetic activity, Antiglycation, *Sargassum vulgare*, *Sargassum muticum*



MERIEM MAHMOUDI

ENHANCING ANAEROBIC BIOTRANSFORMATION OF AGRO-INDUSTRIAL RESIDUES USING MICROALGAE: EFFECTS ON DIGESTATE QUALITY AND SOIL FERTILITY

MERIEM MAHMOUDI¹, ASMA AZEKOUR¹, KARIMA JMAILI¹, KHAWLA WADDI¹,
YASMINE MASTARI¹, BOUCHAIB BAHALOUAN², & NADIA BOUTALEB^{1*}

¹Faculty of Sciences and Techniques of Mohammedia, Morocco

²Higher Institute of Nursing and Health of Casablanca, Morocco

*nadia.boutaleb@fstm.ac.ma

Abstract: The sustainable management of agro-industrial residues remains a major challenge for environmental protection and agricultural productivity. Anaerobic biotransformation offers an efficient route to convert organic wastes into valuable biofertilisers, yet the quality and agronomic performance of the resulting digestate are strongly influenced by substrate composition and process optimization. This study explores the potential of microalgae and other microbial additives as innovative tools to enhance the anaerobic conversion of agricultural residues and improve soil fertility. Various mixtures of agro-industrial by-products, including poultry manure, molasses, and olive pomace, were subjected to anaerobic treatment with or without selected microbial supplements. The effects of these additives on process efficiency, digestate characteristics, and fertilizing potential were evaluated through comprehensive physicochemical analyses and soil application experiments. The results demonstrate that microbial additives, particularly microalgae, can enhance both the quality and agronomic value of the digestate. Integrating these biological resources into anaerobic systems represents a promising strategy for valorizing locally available residues, reducing environmental impacts, and promoting sustainable and circular agricultural practices.

Keywords: Anaerobic biotransformation, Agro-industrial residues, Microalgae, Biofertiliser

AMINA MARHRAOUI

**INTEGRATED ASSESSMENT OF SURFACE WATER QUALITY
USING PHYSICO-CHEMICAL AND MICROBIOLOGICAL
PARAMETERS AND THE DIATOM BIOLOGICAL INDEX (IBD):
CONTRIBUTION TO ENVIRONMENTAL AND HEALTH
MONITORING**

AMINA MARHRAOUI ^{1*}, LHOUCINE BENHASSANE ², TOURIA OUD BELLAHCEN ¹

¹Laboratory of Health, Environment, and Biotechnology, Faculty of Sciences Ain Chock, Hassan II University of Casablanca, Morocco

² Public Laboratory for Testing and Studies (LPPE), Casablanca, Morocco

*m.amina.marhraoui@gmail.com

Abstract: The monitoring of water quality is a major challenge for environmental protection, public health, and sustainable water resource management. Growing anthropogenic pressures such as urbanisation, industrial effluents, and agricultural runoff are increasingly affecting the ecological integrity of aquatic ecosystems. In this context, a comprehensive evaluation of water quality relies on the combined use of physico-chemical, microbiological, and biological indicators, which together provide a more accurate understanding of ecosystem responses to environmental disturbances. This study aims to analyse the relationships between physico-chemical parameters, microbiological contamination indicators, and the Diatom Biological Index (IBD), a widely used tool for the ecological assessment of surface waters. The objective is to evaluate the consistency between these indicators and to highlight the need for intercalibration of the IBD to adapt its application to local environmental conditions and assess its robustness within water quality monitoring programmes. The dataset was collected from monitoring stations distributed across Moroccan rivers and provided by the Hydraulic Basin Agencies. These sites represent areas exposed to diverse anthropogenic pressures related to urbanisation, industrial discharges, and agricultural activities. A multivariate statistical analysis combining Principal Component Analysis (PCA) and Spearman correlation tests was performed to identify the main environmental factors influencing diatom community structure and assess the relationships between biological indices and conventional water quality parameters.

Keywords: *Water quality, Diatom Biological Index (IBD), Environmental monitoring.*

KHALID MARNOUFI
**MENTAL ARITHMETIC PROFICIENCY AS A PREDICTOR
OF ACADEMIC ACHIEVEMENT**

KHALID MARNOUFI^{1*}

¹Higher Institute of Nursing and Health of Essaouira

* khalid.marnoufi@gmail.com

Abstract: This research study aims to investigate the correlation between proficiency in mental arithmetic—considered a fundamental indicator of scientific and logical reasoning—and general academic achievement. In this context, the focus was placed on a specific category of learners: students in the Mathematical Sciences track at the qualifying secondary level, given the high cognitive demands of this specialisation. To ensure measurement accuracy, the study relied on the Wechsler Intelligence Scale for Children, specifically focusing on the ‘Arithmetic Subtest’, which assesses attention, working memory, and numerical processing capabilities. The experimental sample included 117 adolescents, with a mean age of 15 years, 12 months, and 21 days, and a minimal standard deviation of 1 month and 9 days, reflecting the homogeneity of the sample. The analysis was based on comparing overall academic results with scores obtained in the psychometric arithmetic test. The results revealed a strong statistical correlation between proficiency in arithmetic reasoning and academic excellence. Furthermore, the analyses demonstrated statistically significant homogeneity, indicating that specialisation in sciences is positively correlated with higher levels of creative thinking and problem-solving abilities.

Keywords: *Academic Achievement, Arithmetic, Skills, Education.*



SOFIA MASBAH

**AGEING AND ENVIRONMENTAL RISK EXPOSURE : INSIGHTS
INTO MECHANISMS OF VULNERABILITY**

SOFIA MASBAH^{1*}, JAÂFAR HEIKEL AND MOHAMMED OUHSSINE¹

¹Ibn Tofail University, Kenitra, Morocco

²Mohammed VI University of Health Sciences, Casablanca, Morocco

*Corresponding author e-mail address : sofia.masbah@uit.ac.ma

Abstract: Ongoing environmental transformations represent an increasing challenge for public health, with particularly significant implications for older adults. The intensification of climate-related phenomena, including rising temperatures, more frequent heatwaves, declining air quality, and the occurrence of extreme environmental events, heightens exposure to health risks in this vulnerable population. Age-related physiological changes, often combined with chronic conditions and polypharmacy, reduce the ability of older individuals to adapt to environmental stressors. As a result, they are more susceptible to dehydration, electrolyte imbalances, and cardiovascular and renal complications. In addition, environmental disruptions can affect food systems by altering both the availability and quality of food, potentially compromising nutritional intake and increasing the risk of malnutrition. Beyond physical health, environmental stressors may also negatively affect mental wellbeing, contributing to higher levels of anxiety, depression, and cognitive decline among older adults. This narrative review, based on recent scientific literature, highlights the complex interactions between environmental exposure, nutritional status, and overall health in ageing populations. It emphasises the need for an integrated and multidisciplinary approach combining public health strategies, nutritional monitoring, and adaptive responses to environmental risks. Preventive measures such as monitoring hydration and nutritional status, raising awareness among caregivers, and developing targeted response strategies during extreme events are essential. In the context of increasing environmental vulnerability, protecting the health and autonomy of older adults remains a critical priority for sustainable health systems.

Keywords: Ageing, Climate Change, Public Health, Dehydration, Nutrition, Vulnerability.

FADOUA MEKKAOUI
SYNERGISTIC EFFECTS OF ARBUSCULAR MYCORRHIZAL FUNGI
AND COMPOST ON TOMATO PERFORMANCE UNDER COMBINED
HEAT AND WATER STRESS

FADOUA MEKKAOUI^{1*}, MOHAMED AIT-EL-MOKHTAR¹, NADA ZAARI JABRI¹, NAJWA RABAH¹, ABDELAZIZ HMYENE¹

¹Laboratory of Biotechnology, Agri-Food, Materials and Environment, Faculty of Science and Technology
Mohammed VI, Hassan II University of Casablanca

* fadouamekkaoui1@gmail.com

Abstract: Heat and water stress, especially when occurring simultaneously, represent some of the most severe abiotic constraints affecting the growth, physiology, and metabolism of tomato plants. In an environmentally friendly approach, this study aimed to evaluate the potential effects of biostimulants, including arbuscular mycorrhizal fungi (AMF), compost, and their combination, on enhancing tomato tolerance to combined heat and water stress. A greenhouse experiment was conducted using the Campbell33 variety, where tomato seeds were treated with an AMF consortium and compost under control conditions (25°C, 100% field capacity) and combined stress conditions (35°C, 40% field capacity). The study focused on key biochemical parameters such as soluble sugars, proteins, chlorophyll (a and b), hydrogen peroxide (H₂O₂), and malondialdehyde (MDA) content, along with the activity of antioxidant enzymes including catalase (CAT), peroxidase (POX), ascorbate peroxidase (APX), and polyphenol oxidase (PPO). The results revealed that all treatments compost alone (C), mycorrhizae alone (M), and their combination (MC) positively influenced sugar accumulation in leaves, roots, and fruits under combined stress conditions. For protein content, significant improvements were observed with C and M treatments at the leaf level. At the root level, M and MC treatments showed notable positive effects, while at the fruit level, C and MC were the most effective. Regarding photosynthetic pigments, treatments C and M significantly enhanced chlorophyll a and b contents, whereas M treatment also positively affected carotenoid levels. All treatments contributed to mitigating oxidative stress by reducing H₂O₂ and MDA levels in both leaves and roots, with the MC treatment showing the highest efficiency in lowering MDA content. Additionally, M treatment significantly increased CAT activity, while all treatments (C, M, and MC) enhanced the activity of other antioxidant enzymes, including PPO, POX, and APX. Overall, this study provides valuable insights into sustainable agricultural practices, highlighting the effectiveness of combining compost and AMF to improve tomato resilience and performance under the challenging conditions of combined heat and water stress.

Keywords: *Tomato, Combined heat and water stress, Arbuscular mycorrhizal fungi, Compost, Biostimulants, Oxidative stress, Antioxidant enzymes.*



KAOUTAR MENNOUN

**MITIGATING BIO-PHYSICOCHEMICAL CLOGGING IN
POLYETHYLENE DRIPPERS SUPPLIED WITH MARGINAL
WATERS: TOWARDS WATER SECURITY AND ONE HEALTH.**

KAOUTAR MENNOUN^{1*}, YOUSSEF NAJH¹, HAFIDA ZAHIR¹ AND HASSAN LATRACHE¹

¹Laboratory of Industrial Engineering and Surface Engineering, Bioprocesses and Biointerfaces Team, Faculty of Sciences and Techniques of Béni Mellal, Sultan Moulay Slimane University, Béni Mellal, Morocco

*mennoun.kaoutar@usms.ac.ma

Abstract: Clogging of drip irrigation emitters is a major constraint for water security and sustainable food production, especially when hard groundwater or reclaimed wastewater is used. Bio-physicochemical deposits inside polyethylene (PE) drippers reduce discharge uniformity and create microbial niches at the soil–plant–water interface, raising One Health concerns. In this work, an integrated strategy is proposed, combining polymer surface engineering and multiphysics modelling. A closed-loop test bench with commercial PE emitters was supplied with model water reproducing Béni Mellal groundwater (high hardness, $\text{Ca}^{2+}/\text{Mg}^{2+}$, HCO_3^- , Fe) and controlled turbidity ($50\text{--}200\text{ mg}\cdot\text{L}^{-1}$). Quantitative results show that increasing suspended solids and iron content increases mean discharge loss from about 7% to more than 25% and doubles the coefficient of variation between emitters. Three-dimensional COMSOL Multiphysics simulations identify low-velocity recirculation zones that correlate with observed deposit hot spots. Surface-modified PE with lower adhesion, combined with optimised labyrinth geometry, reduces the clogging index by nearly 50% and approximately doubles the time required to reach a critical clogging threshold. These findings support safer and more efficient use of marginal waters for irrigation within a biotechnology-based One Health framework.

Keywords: Emitter clogging, marginal waters, biofilms, water security and One Health.



REDA MHAREK

BURNOUT AMONG HEALTHCARE PROFESSIONALS IN PANDEMIC AND POST-PANDEMIC CONTEXTS

REDA MHAREK^{1,2}, ABDECHAHID LOUKILI^{2,1}, EL MAHJOUB AOUANE¹

¹Laboratory of Natural Resources and Sustainable Development, Department of Biology, Faculty of Science, Ibn Tofail University, Kenitra, Morocco;

²Laboratory “Scientific Research and Pedagogical Innovation”, Team “Biology and Pedagogical Innovation”, Regional Centre for Teaching and Training Professions, Rabat-Salé-Kénitra, Morocco.

Reda.Mharek@Uit.Ac.Ma

Abstract: Burnout, also known as occupational exhaustion syndrome among healthcare professionals, is a major public health issue characterised by emotional exhaustion, depersonalisation, and reduced personal accomplishment. During the COVID-19 pandemic, healthcare workers faced unprecedented working conditions, leading to a significant increase in burnout and negatively affecting their performance and concentration. This study aimed to assess burnout among healthcare professionals at Idrissi Hospital in Kenitra during the COVID-19 pandemic. A sample of 80 participants was included. Data were collected using a socio-demographic questionnaire, and burnout was measured using the Maslach Burnout Inventory (MBI). The results showed that 92.6% of participants presented a high level in at least one of the three MBI dimensions. Furthermore, 50% were at risk of burnout, while 17.6% were classified as experiencing burnout. These findings highlight the significant psychological impact of the pandemic on healthcare professionals. To ensure continuity in scientific research in this field, our results were compared to recent international studies to analyse findings obtained during and after the COVID-19 pandemic and to observe the evolution of burnout among healthcare workers over time.

Keywords: *Burnout, Healthcare professionals, Pandemic, Post-pandemic, Stress, Mental health.*



YASSMINE MODRAK

CLIMATIC FACTORS AND PREDICTIVE MODELLING OF SCORPION ENVENOMATION IN ERRACHIDIA CITY, MOROCCO

YASSMINE MODRAK^{1,*}, HAJAR TAHER², HASSAN CHAACHOUAY², FARID KHALLOUKI¹, AHMED KARMAOUI²

¹Ethnopharmacology and Pharmacognosy, Faculty of Sciences and Techniques Errachidia, Moulay Ismail University of Meknes, BP 509, Boutalamine, Errachidia 52000, Morocco

² Health and Environment Research Team, Moulay Ismail University (UMI, Meknes), Morocco

*y.modrak@edu.umi.ac.ma

Abstract: Scorpion stings are a major public health problem in the arid regions of Morocco, particularly in the town of Errachidia, where environmental conditions favour the presence and activity of scorpions. Climatic factors, particularly temperature and relative humidity, can influence the temporal dynamics of stings and their seasonal distribution. This study analyses the influence of climatic parameters on the incidence of scorpion stings and develops a predictive model. Monthly data from 2009 to 2012 (1652 cases) were correlated with average temperature and relative humidity. Multiple linear regression was used to assess the relationship between climate and monthly incidence, and subsequently used to predict cases for 2013, which were compared to the 319 actual cases to evaluate the model's performance. The results highlight the influence of climatic factors on the seasonal variability of scorpion stings and demonstrate the value of predictive approaches in anticipating periods of risk. This approach could help improve strategies for the prevention and management of scorpion stings in the arid regions of Morocco.

Keywords: *Scorpion envenomation, Climatic factors, Predictive modelling.*



IMANE MORSSIL

**THE IMPACT OF SOCIODEMOGRAPHIC CHARACTERISTICS OF
BEEKEEPERS ON PRODUCTIVITY AND SUSTAINABILITY OF
BEEKEEPING OPERATIONS IN MOROCCO**

IMANE MORSSIL^{1*}, NOUREDDINE CHAACHOUAY², ABDELLATIF RAHIM¹,
ABDELKARIM MOUJANNI³, ABDELKHALID ESSAMADI¹

¹ Laboratory of Biochemistry, Neurosciences, Natural Resources, and Environment, Hassan First University,
Faculty of Sciences and Technology, BP 577, Settat 26000, Morocco

² ESEF of Berrechid, Agri-Food and Health Laboratory, Hassan I University of Settat, PO Box 382, Settat
26000, Morocco

³ National Office of Food Safety (ONSSA), Avenue Hadj Ahmed Cherkaoui, 10090 Agdal, Rabat, Morocco

*imanemorssli1@gmail.com

Abstract: Beekeeping is a crucial agricultural activity in Morocco, providing significant environmental benefits, particularly through the enhancement of biodiversity, as well as economic opportunities for small-scale farmers. This study examines how beekeepers' socio-demographic characteristics influence honey production and the diversification of apicultural products. Data were collected through face-to-face interviews using a structured and validated questionnaire administered to 599 beekeepers across the country. Statistical analyses were conducted using IBM SPSS software. The findings indicate that most beekeepers have substantial practical experience, yet their level of formal education is generally low. Beekeeping activities are mainly concentrated in the Tangier–Tetouan–Al Hoceima and Souss-Massa regions. Practices vary considerably in terms of organisation and degree of modernization. Nevertheless, the production of pollen, propolis, and royal jelly remains underdeveloped and currently provides limited economic returns. In many apiaries, emphasis is placed on the capture and purchase of swarms rather than on systematic queen rearing, which may undermine the sustainable management of bee breeding stock. Despite its relatively high costs, beekeeping generates employment, strengthens social cohesion, and contributes to the stability of the sector. Training, recognition of traditional knowledge, product diversification, and well-designed marketing strategies are essential to ensure the long-term sustainability and development of the apiculture sector in Morocco.

Keywords: *Beekeeping, Biodiversity, Climate change, Colonies, Pollination, Sustainability.*



ABDELADIM MOUMEN

FROM BENCH TO MARKET: DEVELOPMENT, CLINICAL VALIDATION AND COMMERCIALIZATION OF MOLECULAR DIAGNOSTIC ASSAYS FOR INFECTIOUS DISEASES AND CANCER

ABDELADIM MOUMEN ^{1*}

¹Diagnostic Kits and Medical Devices Center, UM6P**

*Corresponding author e-mail: abdeladim.moumen@um6p.ma

Abstract: Over the past decade, our team has developed and clinically validated a portfolio of molecular diagnostic assays addressing major public health challenges in infectious diseases and oncology. Our work spans the complete complete innovative range, from assay design and biomarker identification to analytical validation, clinical performance evaluation, regulatory preparation and market deployment. In infectious diseases, we developed and implemented qPCR-based tests for COVID-19, tuberculosis (TB), hepatitis C virus (HCV) and other emerging pathogens, ensuring high sensitivity and specificity in diverse clinical settings. In oncology, we established molecular assays for breast cancer, leukaemia, and HPV-associated cancers, supporting early detection, prognosis and patient stratification. Clinical validation was conducted in collaboration with national and international healthcare institutions, following rigorous quality standards. Importantly, these innovations were translated into commercially available diagnostic kits, enabling large-scale production and distribution. This bench-to-market experience demonstrates a sustainable model for developing locally manufactured, high-quality molecular diagnostics to strengthen health systems and improve patient outcomes

Keywords: *Molecular diagnostic, qPCR, LAMP, Molecular biology, Infectious diseases, cancer.*



CHAIMAE MOUJAHID

SOCIAL INFLUENCES ON CONTRACEPTIVE USE AMONG RURAL MOROCCAN WOMEN

CHAIMAE MOUJAHID¹, SOUFIANE YASSARA⁴, JACK E TURMAN JR^{2,3}, ASMAA GHAFILI¹, LOUBNA AMAHDAR¹

¹Laboratory of Biomedical Sciences and Engineering, Biophysics and Health, Higher Institute of Health Sciences, Hassan I University, Settat 26000, Morocco

²Department of Social and Behavioural Sciences, Richard M. Fairbanks School of Public Health, Indiana University, Indianapolis, IN 46202, USA

³Department of Paediatrics, School of Medicine, Indiana University, Indianapolis, IN 46202, USA

⁴Faculty of Medicine and Pharmacy, Mohammed V University in Rabat, Morocco; Medical Biotechnology Research Laboratory (MEDBIOTECH), Department of Pathology, National Institute of Oncology, Rabat, Morocco

*moujahidchaimae45@gmail.com

Abstract: Objective: Women's fertility choices are often shaped by social and relational factors. This study explores the knowledge, attitudes, and practices of married women of reproductive age in rural Morocco regarding family planning. **Methods:** We conducted in-depth interviews with 49 postpartum women in a rural maternity ward. Open-ended questions examined contraceptive practices, decision-making autonomy, and social influences on reproductive choices. **Results:** Most participants used oral contraceptives, but many reported at least one unintended pregnancy due to misuse. Women preferred smaller families to ensure financial stability and quality of life but faced resistance from husbands and extended families. Misconceptions about intrauterine devices were common, and spousal consent often influenced contraceptive use. **Conclusion:** Social and relational factors strongly affect women's reproductive decisions. Addressing misconceptions, improving reproductive health education, and involving husbands in counseling may enhance family planning and support women's autonomy.

Keywords: Contraception, Family Planning, Decision-Making, Rural Women, Morocco, Reproductive Health.

FATIMA MOURABITI

REPOSITIONING POLYPHENOLS AS POTENTIAL B-LACTAMASE INHIBITORS: AN INTEGRATED COMPUTATIONAL AND EXPERIMENTAL APPROACH

FATIMA MOURABITI¹, FATIMAZAHRA JOUGA¹, LORENA G. CALVO², ROSA-ANTÍA VILLARINO², YASSINE ZOUHEIR³, ABDELAZIZ SOUKRI¹, TRINIDAD DE MIGUEL^{2,*} AND BOUCHRA EL KHALFI¹

¹ Laboratory of Health, Environment and Biotechnology, Team of Physiopathology, Molecular Genetics and Biotechnology, Faculty of Sciences Ain Chock, Hassan II University of Casablanca, Casablanca 20100, Morocco.

² Department of Microbiology and Parasitology, Universidade de Santiago de Compostela, E-15782 Santiago de Compostela, Spain.

³ Laboratory of Molecular Bacteriology, Pasteur Institute, Casablanca, Morocco.

*Corresponding author e-mail address fatimaamourabiti@gmail.com

Abstract: The production of β -lactamases is the main mechanism underlying carbapenem resistance. This study combined in silico and in vitro approaches to identify polyphenols as potential carbapenemase inhibitors. Molecular docking, molecular dynamics and ADMET prediction were performed to assess the binding affinity, stability and safety of quercetin, kaempferol, caffeic acid and 3,4-dihydroxybenzoic acid against three carbapenemases. In vitro antibacterial assays and checkerboard analyses were conducted against *Klebsiella pneumoniae*, *Escherichia coli* and *Pseudomonas aeruginosa* to assess antibacterial and synergistic effects. β -lactam hydrolytic activity inhibition was then confirmed. In silico results showed that quercetin, kaempferol and caffeic acid exhibited strong binding affinity and consistent stability towards the targets. Quercetin and kaempferol showed the highest affinity (-8.0 kcal/mol) and stable interactions with key catalytic residues. ADMET profiles indicated good pharmacokinetic behaviour and low acute toxicity. In vitro assays revealed that the polyphenols exhibited MIC values ranging from 12.5 to 25 mg/L and MBC values of 25–50 mg/L. Combined with cefotaxime, they enhanced bacterial susceptibility and inhibited β -lactam hydrolysis, with quercetin achieving complete inhibition at 200 mg/L. These findings highlight the potential of these polyphenols as natural β -lactamase inhibitors. Further enzyme kinetics and in vivo studies are needed to confirm their therapeutic relevance.

Keywords: Carbapenemases, Molecular docking, β -lactamase inhibition.



WIDAD MOUSSA

IMPACT OF SALINITY ON MULTI-ORGAN MORPHO-BIOCHEMICAL PARAMETERS (ROOTS, AERIAL PARTS, AND COTYLEDONS) OF *PISUM SATIVUM* L

WIDAD MOUSSA^{1*}, MANAL ELGEROIUNI¹, DALILA LOUDYI² AND SAID BOUGHRIBIL¹

¹Laboratory of Biotechnology, Agri-Food, Materials and Environment, Faculty of Sciences and Techniques Mohammedia, Hassan II University of Casablanca, Casablanca, Morocco

² Laboratory of Process and Environmental Engineering, Faculty of Science and Technology, Mohammedia- University Hassan II of Casablanca, Morocco

*Corresponding author: widad.moussa@uit.ac.ma

Abstract: In arid and semi-arid regions, salinity constitutes one of the major factors limiting productivity and contributing to agricultural land degradation. The present study aims to evaluate the germination of *Pisum sativum* L. under ten NaCl concentrations (2–20 g·L⁻¹) through a combined analysis of germinative, morphological, and biochemical parameters. The results show that germination rate remains relatively stable up to 10 g·L⁻¹ NaCl, then gradually decreases at higher concentrations, reaching 58% at 20 g·L⁻¹. Post-germinative development is markedly more sensitive, with complete inhibition of shoot growth at 14 g·L⁻¹. The absence of secondary root emergence from 12 g·L⁻¹ indicates that this concentration represents a critical threshold of morphological alteration. At the biochemical level, proline content increased markedly in roots, reaching an increase of approximately 900% at 10 g·L⁻¹ compared to the control, reflecting an osmotic adjustment mechanism under moderate salt stress. Similarly, soluble sugar content increased mainly in cotyledons, with an increase of about 210% at 8 g·L⁻¹ compared to the control. This accumulation declines at higher concentrations, indicating a limitation in metabolic adaptation capacity. In conclusion, identification of physiological and biochemical mechanisms underlying this early-stage sensitivity remains highly relevant for this species.

Keywords: *Pisum sativum* L., Salinity stress, Osmotic adjustment.



SOHAILA MOUSTAID

**PERCEPTION OF LEARNING MECHANISMS AND ANDRAGOGICAL
ALIGNMENT OF THE VIRTUAL ENVIRONMENT FOR
RADIOTHERAPY TRAINING (VERT) IN MEDICAL PHYSICS
EDUCATION**

SOHAILA MOUSTAID^{1*}, MOHAMMED REDA MESRADI², MOHAMED CHAHBOUNE²,
ABDELAZIZ ESSADIKE², NAOUFAL HIMMOUCHE², ABDERRAHMAN MOUJAHD¹

¹Laboratory of Biochemistry and Neuroscience, Faculty of Science and Technology, Université Hassan 1er,
Settat, Morocco

²Laboratory of Health Sciences and Technologies, Higher Institute of Health Sciences, Université Hassan 1er,
Settat, Morocco

*Corresponding author e-mail address: sohaila.moustaid.doc@uhp.ac.ma

Abstract: This study aims to evaluate medical physics students' perceptions of the learning mechanisms activated by the Virtual Environment for Radiotherapy Training (VERT) and to assess its alignment with andragogical principles. A descriptive quantitative design will be implemented among master's students following immersive simulation sessions using VERT. Data will be collected through an original questionnaire structured into two domains: perceived learning mechanisms (repetition of scenarios, immediate feedback, three-dimensional visualisation, active knowledge construction, collaborative learning, and metacognition) and alignment with adult learning principles, including learner autonomy, problem-centred activities, integration of prior knowledge, motivation, engagement, and adaptation to individual learning pace. Responses will be recorded on a five-point Likert scale and analysed using descriptive statistics. The study is expected to reveal favourable perceptions regarding conceptual understanding supported by immersive visualisation, performance improvement through repeated practice, and collaborative reasoning during simulation activities. Positive alignment with core andragogical principles is also anticipated. These findings may inform the pedagogical integration of virtual simulation platforms in radiotherapy curricula and encourage future multicentre investigations incorporating objective educational outcomes.

Keywords: *Virtual simulation, Radiotherapy education, Learning mechanisms, Andragogy.*



MANAL NAFI

MAPPING METAGENOMICS-BASED ANTIMICROBIAL RESISTANCE SURVEILLANCE IN WASTEWATER: A GLOBAL BIBLIOMETRIC ANALYSIS (2004–2024)

MANAL NAFI^{1,2*}, ASSIA BOUHOUDAN², HAJAR OUAKEUROU^{1,2}, FADWA MELAYELOU³, RAJAE CHAHBOUN³, MOHAMMED BAKKALI¹, NADIRA MOURABIT²

¹ Research Team in Biotechnology & Biomolecules Engineering (ERBGB), Faculty of Science and Technology of Tangier, Abdelmalek Essaâdi University, Tangier, Morocco.

² Laboratory of Research and Development in Engineering Sciences, Faculty of Science and Technology-Al Hoceima, Abdelmalek Essaâdi University, Al Hoceima, Morocco.

³ Biology Molecular Unit, Life and Health Sciences Laboratory, Faculty of Medicine and Pharmacy of Tangier, Abdelmalek Essaâdi University, Tangier, Morocco.

* nafaimanal@gmail.com

Abstract: Antimicrobial resistance (AMR) constitutes a major and escalating public health threat, with wastewater systems increasingly recognised as critical reservoirs and transmission pathways for resistance determinants. Despite the widespread adoption of metagenomic approaches in wastewater-based AMR surveillance, the global organisation and analytical balance of this field remain poorly synthesised. We conducted a bibliometric analysis to characterise metagenomics-based AMR research in wastewater between 2004 and 2024. Publications indexed in Scopus, Web of Science, and PubMed were analysed using Bibliometrix/Biblioshiny and VOSviewer. A total of 6,200 records were examined to explore temporal trends, geographical distribution, analytical strategies, and AMR biomarker distribution. Approximately 65–70% of publications were produced after 2015, reflecting accelerated integration of metagenomics into surveillance. Research output was concentrated in Asia, Europe, and North America (about 80% of studies), with limited contributions from Africa and parts of Latin America. Antibiotic resistance genes dominated the literature (70–75%), particularly β -lactamase and tetracycline resistance genes, and mobile genetic elements were reported in about 40% of publications. Clinically relevant resistant pathogens and antibiotic residues were investigated in fewer than 30% of studies and were rarely examined within integrated frameworks. These findings reveal persistent geographical and methodological imbalances and emphasise the need for harmonised biomarker panels to strengthen wastewater-based AMR surveillance within a One Health framework.

Keywords: *Antimicrobial resistance, Metagenomics, One Health.*

HAMID NAJEH

ROLE OF THE ALU PV92 INSERTION POLYMORPHISM OF THE CDH13 GENE IN SUSCEPTIBILITY TO METABOLIC SYNDROME IN SOUTHERN MOROCCO

HAMID NAJEH¹, HAMID FARHANE², NOURDIN HARICH², RACHID NOUREDDINE³, OMAR ABIDI⁴, AHMED BELMOUDEN¹, BOUCHRA RHERISSI¹, SMAIL CHADLI^{1,5}

¹Laboratory of Cell Biology and Molecular Genetics, Faculty of Science, Ibn Zohr University, Agadir, Morocco.

²Laboratory of Anthropogenetics, Biotechnology and Health, Department of Biology, Faculty of Science, Chouaïb Doukkali University, 24 000, El Jadida, Morocco

³Morizgo Medical Analysis Laboratory, Casablanca, Morocco

⁴Healthcare and Biology-Health Team, Lab 2S2D, Higher Institutes of the Nursing Professions and Techniques of Health, Casablanca

⁵Laboratory of Health and Environmental Sciences, Biotechnology, Environment and Health Team, Higher Institute of Nursing and Health Technical Professions (ISPITS), Agadir, Morocco.

* najehhamid@yahoo.fr

Abstract: Metabolic syndrome (MetS) increases cardiovascular risk. This study examined the link between the Alu PV92 polymorphism in the CDH13 gene and MetS components in a southern Moroccan population. A case-control study involved 495 adults (277 controls, 218 MetS cases) from the Souss region. Genotyping was performed by PCR, with statistical analysis conducted using logistic regression. Genotypic distribution differed significantly. The ID genotype was more frequent in MetS cases (46.9% vs. 35.9%). The I allele showed a dominant effect, increasing MetS risk by 55% (OR = 1.55). The ID genotype itself was also a significant risk factor (OR = 1.64). Among MetS components, the strongest association was with high blood pressure in the dominant model (OR = 1.68), particularly in men (OR = 2.24). Low HDL cholesterol was also significantly linked to the ID genotype (OR = 1.53), with a much stronger effect in men (OR = 2.38) than in women (OR = 1.43). Associations with hyperglycaemia and obesity were only observed in the co-dominant model. Allelic analysis confirmed the link between the I allele and low HDL cholesterol (OR = 3.95) and increased systolic blood pressure (OR = 1.33). In conclusion, the Alu PV92 polymorphism is a susceptibility marker for MetS, with a dominant effect of the I allele, and may contribute to sex-based differences in the syndrome.

Keywords: Genetic polymorphism, Metabolic syndrome, Cardiovascular risk, Morocco.

HABIBA NECHCHADI

PREVENTIVE EFFECTS OF *CYNARA CARDUNCULUS* L. VAR. *FEROCISSIMA* LEAVES AGAINST HYPERLIPIDAEMIA AND LIVER DISORDERS IN WISTAR RATS

HABIBA NECHCHADI^{1*}, FATIMA EZZAHRA KACIMI¹, YOUSSEF NADIR²,
HICHAM BERROUGUI¹, SAMIRA BOULBRAOUD¹, MHAMED RAMCHOUN¹

¹Department of Biology, Polydisciplinary Faculty, Sultan Moulay Slimane University, Beni Mellal 23020, Morocco

²Laboratory of Biological Engineering, Faculty of Sciences and Techniques, Sultan Moulay Slimane University, 23000 Beni Mellal, Morocco

*habiba.nechchadi@gmail.com

Abstract: *Cynara ferocissima* is a wild plant that grows naturally in several regions of Morocco. Phytotherapy represents an effective approach for the prevention and management of hyperlipidaemia and associated disorders. This study aimed to investigate the antihyperlipidaemic and antioxidant effects of *Cynara cardunculus* var. *ferocissima* leaf extract in a Wistar rat model with Triton WR-1339-induced hyperlipidaemia. To this end, the extract was administered for 14 days by oral gavage at a dose of 400 mg·kg⁻¹, followed by intraperitoneal injection of Triton WR-1339 to induce hyperlipidaemia. The lipid profile and hepatic and renal biochemical biomarkers were assessed 24 hours after Triton injection, and malondialdehyde levels and total antioxidant capacity were determined in serum and liver. Administration of *Cynara ferocissima* leaf extract significantly prevented lipid increases and associated liver and kidney disorders. In addition, the extract reduced oxidative stress biomarkers while increasing total antioxidant capacity in the blood and liver. In conclusion, *Cynara cardunculus* var. *ferocissima* leaf extract prevents hyperlipidaemia and exerts promising hepatoprotective effects by reducing hepatic lipid accumulation and oxidative stress.

Keywords: *Cynara ferocissima*, Hyperlipidaemia, Liver, Oxidative stress.



NORA ELOUHABI

**PHOSPHATE DERIVATIVES FROM SOLID-STATE SYNTHESIS FOR
CARBON STEEL CORROSION INHIBITION IN HYDROCHLORIC
ACID**

ELOUHABI NORA^{1*}, CHAYMAE HALIOUI¹, ASMAA BOUABBADI¹, NADIA TIMOUDAN²,
ABDELKADER ZARROUK², MOHAMED HARCHARRAS¹

¹Laboratory of Advanced Materials and Process Engineering (LAMPE), Department of Chemistry, Faculty of Sciences, Ibn Tofail University, B.P. 133, 14000 Kenitra, Morocco

² Laboratory of Spectroscopy, Molecular Modelling, Materials, Nanomaterials, Water and Environment LS3MN2E, CERNE2D, Faculty of Sciences, Mohammed V University in Rabat, Morocco

* nora.elouhabi@uit.ac.ma

Abstract: Diphosphate materials were synthesised via a solid-state reaction route. In the context of corrosion inhibition, these materials exhibited promising performance. The crystallinity of the prepared compounds was examined using X-ray diffraction (XRD), and vibrational characterisation was carried out by infrared (IR) and Raman spectroscopy. The corrosion inhibition efficiency of carbon steel in a 1 M hydrochloric acid (HCl) solution containing pyrophosphate was evaluated at 303 K using several electrochemical techniques. Potentiodynamic polarisation (PDP) and electrochemical impedance spectroscopy (EIS) were used to assess the inhibitory behaviour of the materials.

Keywords: *Diphosphate; solid-state reaction; corrosion inhibition.*

GHIZLANE NOUIOURA

**PHENOLIC PROFILE AND SAFETY EVALUATION OF A MOROCCAN
AQUEOUS POLYHERBAL FORMULATION CONTAINING
PETROSELINUM CRISPUM L., *CORIANDRUM SATIVUM* L., *APIUM
GRAVEOLENS* L.: ACUTE AND SUB-ACUTE TOXICITY**

GHIZLANE NOUIOURA^{1*}, ELHOSSINE DERWICH²

¹Laboratory of Drug Sciences, Faculty of Medicine, Pharmacy, and Dental Medicine, Sidi Mohamed Ben Abdellah University, 30000 Fez, Morocco

²Laboratory of Biotechnology, Conservation, and Valorisation of Bioresources (BCVB), Research Unit: Api-Phytotherapy, Physiology, Environment, and Health. Department of Biology, Faculty of Sciences, Dhar Mehraz, Sidi Mohamed Ben Abdellah University, 30000 Fez, Morocco

*Corresponding author e-mail address: Ghizlane.nouioura@usmba.ac.ma

Abstract: Medicinal plants harbour numerous natural bioactive compounds with therapeutic potential, utilised in the synthesis of various drug formulations. Although the diverse benefits of herbal formulations have been extensively researched, a toxicity assessment is crucial to establish a wide margin of safety for the therapeutic application of this polyherbal formulation. The present study aimed to assess the phytochemical profile and potential toxic effects of an aqueous extract derived from a polyherbal formulation containing *Petroselinum crispum* L., *Coriandrum sativum* L., and *Apium graveolens* L. The investigation involved acute and sub-acute toxicity studies conducted in male and female Swiss albino mice, as well as adult rats. High-performance liquid chromatography analysis revealed a rich composition of phytochemical compounds in the extract. In acute toxicity assessments, oral administration of the extract up to 14 g/kg showed no signs of toxicity or fatalities in mice. In contrast, intraperitoneal administration resulted in dose-dependent toxicity, with a calculated LD₅₀ of 11.8 g/kg. Sub-acute toxicity studies in rats over 28 days showed no significant changes in organ weights, haematological or biochemical parameters, except for a minor decrease in WBC count. Histopathological examination revealed no morphological disturbances in the liver and kidneys, indicating a wide margin of safety for therapeutic use.

Keywords: *Petroselinum crispum* L., *Coriandrum sativum* L., *Apium graveolens* L., Polyherbal Formulation.



CHAIMAE NOURI

BIOSTIMULANT POTENTIAL OF *TRICHODERMA* SPP. IN PROMOTING TOMATO GROWTH

CHAIMAE NOURI^{1*}, MOUADH SAADAoui², IMANE ES-SAHM¹, JAMILA DICH¹, AICHA RIFAI¹ AMAL SMAILI^{1,3}, SIHAM ESSERTI¹, KOUSSA TAYEB¹, MOHAMED FAIZE¹, JEAN-STÉPHANE VENISSE²

¹Laboratory of Plant Biotechnology, Ecology and Ecosystem Valorisation CNRST-URL10, Faculty of Sciences, University Chouaib Doukkali, 24000 El Jadida Morocco

²INRAE, PIAF, University Clermont Auvergne, Clermont-Ferrand 63000, France

³ Higher Institute of Nursing and Health, Marrakech-Safi, Morocco

*nourichaimae6@gmail.com

Abstract: Facing the challenges of sustainable agriculture and the need to develop environmentally-friendly practices, the use of biotechnological solutions based on biological alternatives to stimulate crop growth has attracted increasing interest. In this context, the present study evaluates the effects of *Trichoderma atroviride* and *Trichoderma afroharzianum* as plant growth-promoting fungi in tomato. Greenhouse experiments showed that seed priming with these two species resulted in a significant increase in stem height compared to untreated control plants. This enhancement of shoot growth was accompanied by a marked improvement in other morphological parameters, particularly leaf area, which increased by 52–60%, and fresh root biomass, which increased by 44–53%. In addition, *T. atroviride* and *T. afroharzianum* improved plant physiological performance by enhancing photosynthetic pigments and photosynthetic activity. These findings highlight the strong potential of *T. atroviride* and *T. afroharzianum* as biological biostimulants capable of improving tomato growth and physiological efficiency within a sustainable agricultural approach.

Keywords: *Trichoderma* spp., tomato, plant growth, biostimulant.



AHMED OUABRK

EVALUATION OF BURNOUT SYNDROME AMONG HEALTHCARE PROFESSIONALS IN MOROCCO: A SYSTEMATIC REVIEW

AHMED OUABRK ^{1*}, KAMAL WIFAQ ^{1,2}, OTMANE ABOURI ³, JALILA EL BAKKOURI ^{1,4}

¹Laboratory of Clinical Immunology, Infection and Autoimmunity (LICIA), Faculty of Medicine and Pharmacy, Hassan II University, Casablanca, Morocco

²Occupational Health Department, Ibn Rochd University Hospital Centre, Casablanca, Morocco

³Laboratory of Inflammatory, Degenerative and Oncological Cellular and Molecular Pathophysiology, Faculty of Medicine and Pharmacy, Hassan II University of Casablanca, Morocco

⁴Laboratory of Immunology, Ibn Rochd University Hospital Centre, Casablanca, Morocco

*ouabrkahmed@gmail.com

Abstract: Introduction: Burnout has emerged as a major public health issue, particularly within the healthcare sector. In Morocco, available data remains limited, despite a recent increase in studies examining this syndrome among healthcare professionals. The aim of this study is to conduct a systematic review to determine the prevalence of burnout among healthcare professionals in Morocco. **Methods:** A systematic review of the literature was conducted in line with the PRISMA 2020 guidelines. A literature search was carried out in the PubMed, Scopus, ScienceDirect, Web of Science, Medline and ProQuest databases. Quantitative studies published before July 2024, conducted in Morocco and using the Maslach Burnout Inventory (MBI) were included. The extracted data were summarised descriptively. **Results:** 14 studies were included to assess burnout among 4,382 healthcare professionals in Morocco. The prevalence of burnout was reported in eight of the 14 articles included in this review, ranging from 58.10% to 85.30%. The average prevalence was 73.36%. **Conclusion:** Assessing burnout among healthcare professionals in Morocco will help to ensure a good quality of life at work through measures designed to prevent it.

Keywords: Health, Burnout, Healthcare professional, Prevalence, Morocco.



OUAHID ASMAE

**BIOCURATION OF HUMAN IMMUNE RECEPTOR GENOMIC
REGIONS USING IMGT STANDARDS: IMPLICATIONS FOR
AUTOIMMUNE DISEASE RESEARCH.**

OUAHID ASMAE^{1*}, CHARROUK SANAA¹, JRAMY CHAIMAA^{1,2}, ADDADI WIAME¹, DAZIA
CHIFAE¹ AND SAFI AMAL¹.

¹Biotechnology, Agri-Food, Materials, And Environment Laboratory (Lbame)¹

²Nutrition, Genetics And Environmental Risk Exposure (Ngere) – Inserm U1256

[*asmae.ouahid@etu.fstm.ac.ma](mailto:asmae.ouahid@etu.fstm.ac.ma)

Abstract: IMGT®, the international ImMunoGeneTics information system®, is the global reference for standardised immunogenetics data. This project focused on the biocuration and annotation of the human T cell receptor gamma (TRG) locus using IMGT procedures and standards, with the objective of improving genomic annotation and characterizing allelic diversity. Analyses were performed on human genome assemblies from the Human Pangenome Reference Consortium, including the paternal and maternal haplotypes of (**HG02055**) and (YAO) maternal assembly. The TRG locus, located on chromosome (7p14), was identified and delimited using BLAST analyses against IMGT/GENE-DB reference sequences. Flat file preparation, novel allele detection, detailed annotation, and sequence gapping were conducted according to IMGT rules. Eleven novel alleles were identified, encompassing variable (TRGV) and constant (TRGC) genes, with functional, ORF, and pseudogene classifications. Given the pivotal role of T cell receptors in adaptive immunity, these findings provide insight into the genetic basis of T cell diversity, which is relevant to autoimmune diseases such as Type 1 Diabetes. The integration of these alleles into IMGT databases supports future immunogenetic studies and may contribute to personalised approaches for understanding and managing T1D.

Keywords: *IMGT®; Immunogenetics; Autoimmune disease, Type 1 Diabetes.*



LOUBNA OUAHMANE

**CHEMICAL COMPOSITION AND ANTIOXIDANT ACTIVITY OF
FOUR ESSENTIAL OILS EXTRACTED FROM CITRUS PEELS**

OUAHMANE LOUBNA^{1*}, ABDESSADEK MOHAMMED¹, KCHIKICH ANASS¹, SBIHI
KARIM¹, BOUFTILA BOUCHRA¹, HASNA BOURA³, AMRI OUKACHA^{1,2} AND EL
AMRAOUI BELKASSEM¹

¹Laboratory of Analysis, Modelling, Engineering, Natural Substances and Environment, Polydisciplinary Faculty
of Taroudant, Ibn-Zohr University, 83000 Taroudant, Morocco

² Laboratory of Plant Biotechnologies (BioTechV), Faculty of Sciences, Ibn Zohr University of Agadir, Morocco

³*Pasteur Institute of Morocco, Casablanca, Morocco*

*loubna.ouahmane.62@edu.uiz.ac.ma

Abstract: Citrus essential oils are recognised for their biological properties, particularly their antioxidant potential. This study aimed to evaluate the antioxidant activity and chemical composition of four essential oils extracted from citrus peels. The oils were obtained by hydro distillation, and their chemical composition was analysed using gas chromatography–mass spectrometry (GC–MS). Antioxidant activity was assessed using DPPH radical scavenging and ferric reducing antioxidant power (FRAP) assays. The results showed that the essential oils were mainly composed of monoterpenes, with limonene identified as the major compound. All tested oils exhibited antioxidant activity in both assays, although variations were observed depending on their chemical composition. These findings highlight the potential of citrus essential oils as natural antioxidant agents with possible applications in pharmaceutical, cosmetic, and food industries.

Keywords: *Citrus peels, essential oils, Antioxidant activity, DPPH assay, FRAP assay, GC–MS analysis, Chemical composition.*



HAJAR OUAKOUROU

MICROBIOLOGICAL SAFETY AND QUALITY OF HOSPITAL MEALS: EVALUATION OF HACCP, TRACEABILITY, AND PATIENT SATISFACTION

HAJAR OUAKOUROU^{1,2*}, MANAL NAFAI^{1,2}, FADWA MELAYELOU³, KHADIJA ELWARDI¹, ASSIA BOUHOUDAN², RAJAE CHAHBOUN³, MOHAMMED BAKKALI¹ AND NADIRA MOURABIT²

¹ Research Team in Biotechnology and Biomolecule Engineering (ERBGB), Faculty of Science and Technology of Tangier, Abdelmalek Essaâdi University, Morocco.

² Laboratory of Research and Development in Engineering Sciences, Faculty of Sciences and Techniques of Al-Hoceima, Abdelmalek Essaadi University, Tetouan, Morocco.

³ Biology Molecular Unit, Life and Health Sciences Laboratory, Faculty of Medicine and Pharmacy, Abdelmalek Essaâdi University, Tangier 93000, Morocco.

* hajar.ouakourou@etu.uae.ac.ma

Abstract: The safety and quality of hospital meals are crucial for preventing microbiological risks and ensuring patient satisfaction. In this prospective study conducted in a regional hospital, the food chain was assessed from ingredient receipt to consumption, including microbiological control, compliance with Prerequisite Programmes (PRPs), HACCP implementation, traceability, and patient satisfaction, using a standardised questionnaire. Several critical non-conformities were identified, including cross-contamination, breaks in the cold and hot chain, inadequate staff hygiene, and limited tray-cleaning effectiveness. *Escherichia coli* was detected in some meals, and the lack of systematic surface and air monitoring limited a full evaluation of microbiological risks. Patient satisfaction was generally positive yet was influenced by meal temperature, presentation, and palatability, revealing discrepancies between overall satisfaction and perceived meal quality. These results emphasise the need to reinforce HACCP and PRP practices through structured verification, regular audits, and systematic documentation to ensure microbiological safety, traceability, and the overall quality of hospital meals.

HACCP : Hazard Analysis and Critical Control Points

Keywords: Hospital meals, Food safety, HACCP, Traceability

ABDESSAMAD OUASFI

**ASSESSING KNOWLEDGE OF THE RISKS ASSOCIATED
WITH IONIZING RADIATION AMONG NURSES WORKING
IN OPERATING ROOMS IN MOROCCAN HOSPITALS.**

ABDESSAMAD OUASFI^{1*}, MOUNIR MKIMEL¹, MAROINE TAHIRI¹, KHALID RAKIB²,
ABDELLAH GANTARE¹

¹ Sciences and Engineering of Biomedicals, Biophysics and Health Laboratory, Higher Institute of Health Sciences, Hassan I University, Settat.

² Occupational physician, Provincial Health and Social Protection Delegation, Ministry of Health and Social Protection.

[*ouasfi.iss@uhp.ac.ma](mailto:ouasfi.iss@uhp.ac.ma)

Abstract: Ionizing radiation is an occupational hazard for healthcare professionals, particularly operating room nurses. Ensuring adequate knowledge and adherence to radiation protection protocols is essential to mitigate associated risks. This study evaluates the knowledge levels of operating room nurses in Moroccan hospitals concerning ionizing radiation risks and protective measures. A descriptive cross-sectional study was conducted using a structured questionnaire. A total of 118 nurses participated, and data were analysed using descriptive and inferential statistics. The study found that all participants acknowledged the risks associated with ionizing radiation, yet many lacked an in-depth understanding of its health effects. In addition, 85.59% of respondents were unfamiliar with radiation protection principles, and 87.29% had no prior knowledge of the ALARA principle. Furthermore, 94.07% had not received continuing professional training in radiation safety, despite unanimous agreement on the necessity of such education. These findings highlight a significant knowledge deficit regarding ionizing radiation risks and protective measures among operating room nurses. There is an urgent need for targeted educational programmes, mandatory continuing training and rigorous enforcement of radiation safety protocols to improve workplace safety in Moroccan hospitals.

Keywords: *Ionising radiation, Nurses, Radiation protection.*



AHMED OUBAASRI

**FEATURE IMPORTANCE ANALYSIS OF TUBERCULOSIS
TREATMENT NON-ADHERENCE IN THE GUELMIM REGION USING
MACHINE LEARNING**

AHMED OUBAASRI^{1*}, SOUAD BENAICH¹

¹Mohammed V University in Rabat, Faculty of Sciences, Physiology and Physiopathology Team, Morocco

*ahmed_oubaasri@um5.ac.ma

Abstract: Tuberculosis (TB) remains a major global health challenge, particularly in low- and middle-income countries. Non-adherence to TB treatment poses a significant public health threat, undermining treatment effectiveness and contributing to drug resistance. Understanding the factors that influence non-adherence is essential for developing effective interventions. This study identifies key predictors of TB treatment non-adherence using the Random Forest (RF) algorithm. The analysis was conducted on a dataset containing demographic, clinical, and behavioural variables from TB patient records at the Centre for Diagnosis and Treatment of Respiratory Diseases in the Guelmim region, Morocco. Feature importance was determined using the Mean Decrease in Impurity (MDI) criterion. Variable selection was performed using multiple thresholds: variables with importance scores ≥ 0.02 , the top 10 most important features, and the top 5 most influential predictors. Body weight (importance = 0.15) emerged as the strongest predictor. These findings underscore the multifactorial nature of treatment non-adherence and highlight the potential of leveraging routinely collected clinical data to identify high-risk patients and guide targeted interventions.

Keywords: *Tuberculosis, Machine learning, Treatment non-adherence, Feature selection, Guelmim, Morocco.*



MAROUANE OUIRDANI

**BRIDGING THE NUTRITIONAL CARE GAP: NURSE-LED
EDUCATION FOR POTASSIUM CONTROL IN HAEMODIALYSIS
PATIENTS**

MAROUANE OUIRDANI^{1*}, AMAL BOUTIB²¹, FATIMA EZZAHRA FERNANE¹,
ABDERRAOUF HILALI¹, EL MADANI SAAD¹, ABDELGHAFOR MARFAK²³, IBTISSAM
YOULYOUZ-MARFAK²¹.

¹ Laboratory of Health Sciences and Technologies, Higher Institute of Health Sciences, Hassan I University of
Settat, Settat, Morocco

² Euro-Mediterranean University of Fez (UEMF), Fez, Morocco

³ National School of Public Health, Ministry of Health and Social Protection, Rabat, Morocco

* m.ouirdani@uhp.ac.ma

Abstract: In Morocco, a gap persists between recommended standards of care and routine practice in haemodialysis units, related to heavy clinical workload and limited availability of dietitians. This study explored the feasibility and clinical relevance of a nurse-led educational intervention in centres operating without nutrition specialists. A quasi-experimental pre-post pilot study was conducted among 30 haemodialysis patients from three Moroccan centres. The programme addressed dietary potassium management, fluid intake control, thirst management, and basic physical activity. Serum potassium, quality of life (EQ-5D-5L), and interdialytic weight gain were assessed at baseline and post-intervention. Serum potassium levels decreased significantly ($p = 0.002$), and the proportion of patients within the recommended range increased from 36.7% to 46.7%. No significant changes were observed in quality of life or interdialytic weight gain. These findings suggest that a nurse-led educational intervention improves potassium control in resource-limited haemodialysis settings, whereas more intensive strategies may be required to influence other outcomes.

Keywords: *Haemodialysis, Serum potassium, Health education.*



HAMZA OUSRI

**ASSESSMENT OF WATER QUALITY AND TROPHIC STATUS OF A
RESERVOIR FED BY WASTEWATER IN A SEMI-ARID REGION
(HASSAR DAM, MOROCCO): TOWARDS SUSTAINABLE RESOURCE
MANAGEMENT**

**OUSRI HAMZA^{1*}, CHLAIDA MOHAMED¹, RIHANE ABDESLAM^{1,2} AND NAHLI
ABDELMOTTALIB¹**

¹Laboratory of Ecology and Environment (LEE), Hassan II University of Casablanca, Faculty of Sciences Ben M'Sik, BP 7955-Sidi Othman, Casablanca, Morocco.

²Department of Life and Earth Sciences, Regional Centre for Education and Training Professions (CRMEF), Casablanca-Settat.

*hamzaousri74@gmail.com

Abstract: In Morocco's arid landscape, dam reservoirs serve as vital socio-economic and ecological hubs. Yet, these systems face unprecedented pressure from climate change and human activities. This study evaluates the physicochemical health and trophic status of the Hassar Reservoir (north-east of Casablanca), a system uniquely influenced by treated wastewater from the Médiouna plant and surrounding diffuse pollution. An annual monitoring campaign (March 2024–February 2025) was conducted across seven stations and one deep-water point. By integrating the Water Quality Index (WQI), Trophic State Index (TSI), and Moroccan Surface Water Standards (NMES), the results reveal a critical degradation of the ecosystem. The water quality is categorised as “very poor” (WQI > 120), driven by high organic loads (BOD₅ up to 32.9 mg O₂/L) and nutrient enrichment. Furthermore, the reservoir has reached a hypereutrophic state (TSI > 90). These findings highlight the **severe** impact of untreated riparian discharges and solid waste. Immediate integrated management is essential to restore the reservoir's ecological functions and safeguard its socio-economic value.

Keywords: Hassar Reservoir, Water quality index (WQI), Trophic state index (TSI).

MOHAMED OUSSI

**PAN-GENOMIC AND CORE GENOME ANALYSIS OF
HELICOBACTER PYLORI: GENOMIC DIVERSITY AND
BIOMARKERS PREDICTIVE OF GASTRIC CARCINOGENESIS**

MOHAMED OUSSI^{1,2*}, MOHIEDDINE MOUMNI¹, HASNA BOURA²

¹Biotechnology and Bioresources Valorisation Laboratory, Biology Department, Faculty of Sciences, Moulay Ismail University, Meknes, 11201, Morocco

²Laboratory of *Helicobacter pylori* and Gastric Pathologies, Institut Pasteur du Maroc, Casablanca, 20360, Morocco

*mo.oussi@edu.umi.ac.ma

Abstract: Gastric cancer remains one of the leading causes of cancer-related mortality worldwide and is strongly associated with chronic *Helicobacter pylori* infection, particularly in high-prevalence regions. Although this bacterium is recognised as a key aetiological factor, progression to gastric cancer remains heterogeneous, suggesting a determining role for bacterial genomic diversity in the variability of clinical manifestations. This study aimed to characterise the genomic diversity of *Helicobacter pylori* and identify genomic determinants potentially involved in gastric carcinogenesis. A pan-genome analysis was carried out on the whole genomes of forty clinical strains associated with different gastric pathologies and from various geographical origins. A phylogeny based on the core genome revealed high genetic variability and complex evolutionary relationships between strains. Strains from the same geographical region showed lower genetic diversity than those from different regions, suggesting phylogeographical structuring and local adaptation of the bacterium. The findings suggest that virulence genes involved in inflammatory response and cell proliferation pathways play a crucial role in the progression from infection to cancer. Specifically, the *vacA*, *sabA*, *hpaA* and *cagA* genes are part of the accessory genome rather than the core genome. This research contributes to understanding host–pathogen interactions and the genomic determinants of *Helicobacter pylori* virulence, supporting improvements in prevention strategies, early diagnosis and personalised therapeutic approaches.

Keywords: Gastric cancer, Pan-genome, Virulence genes, *Helicobacter pylori*.



MARIEM QOSTAL

EVALUATION OF ANTIOXIDANT AND ANTIHYPERGLYCAEMIC ACTIVITIES OF DIFFERENT EXTRACTS OF *JUNIPERUS PHOENICEA*

MARIEM QOSTAL^{1*}, AALILOU YOUSRA¹, MORTADA SALMA¹, LAABAR ABDELMOUNAIM¹, FAOUZI MY EL ABBES¹

¹ Laboratory of Pharmacology and Toxicology, Faculty of Medicine and Pharmacy, Mohammed V University, Rabat, Morocco

*mariemqostal.20@gmail.com

Abstract: Medicinal plants are widely recognised as valuable sources of bioactive compounds with potential therapeutic applications. *Juniperus phoenicea*, a Mediterranean species, has long been used in traditional medicine for the management of various ailments. The present study aimed to evaluate the antioxidant and antihyperglycaemic activities of different extracts obtained from this plant. Three extracts were prepared: an aqueous extract, an ethanolic extract, and an essential oil. Antioxidant activity was assessed using three in vitro assays (DPPH, ABTS, and FRAP). The antihyperglycaemic potential was evaluated through α -amylase inhibition, as well as in vivo tests, including the Oral Glucose Tolerance Test (OGTT) and the Oral Starch Tolerance Test (OSTT). In addition, an acute toxicity study was carried out to assess the safety profile of the tested extracts. The results demonstrated that the extracts exhibited notable antioxidant activity, with variations depending on the extraction solvent. The extracts also showed inhibitory effects on α -amylase activity and improved glucose tolerance in experimental animals. Acute toxicity findings indicated that the extracts were relatively safe at the tested doses. These results suggest that *Juniperus phoenicea* may represent a promising natural source of compounds with antioxidant and antihyperglycaemic properties.

Keywords: Medicinal plants, Antio/idant activity, α -amylase inhibition.



NAJWA RABAH

DROUGHT STRESS EFFECTS AND VARIETAL RESPONSES DURING GERMINATION AND EARLY SEEDLING GROWTH OF MOROCCAN WHEAT VARIETIES

NAJWA RABAH¹, MOHAMED AIT-EL-MOKHTAR¹, NADA ZAARI JABRI¹, FADOUA MEKKAOU¹ AND ABDELAZIZ HMYENE¹

¹Laboratory of Biotechnology, Agri-food, Materials, and Environment (LBAME), Department of Biology, Faculty of Science and Techniques Mohammedia, Hassan II University of Casablanca, BP 146, Mohammedia, 28 800, Morocco

*najwarabah@gmail.com

Abstract: The study focuses on evaluating the varietal response of wheat to water stress during the germination stage. Water stress was induced by increasing the osmotic pressure of the germination medium to simulate drought conditions. This approach allowed the assessment of the response of different wheat varieties at early stages of development. The results demonstrated that higher osmotic pressure significantly reduced germination percentage and delayed germination initiation. In addition, water stress negatively affected seedling growth, resulting in shorter root and shoot lengths and reduced seedling vigour. These effects indicate that limited water availability restricts water uptake by seeds, thereby slowing the metabolic processes required for successful germination and early growth. Furthermore, noticeable differences were observed among the tested varieties. Some wheat varieties exhibited greater tolerance to water stress by maintaining higher germination rates and better seedling growth under increased osmotic pressure. This variability reflects the presence of genetic traits linked to drought tolerance. In conclusion, the study highlights the sensitivity of wheat germination and early seedling growth to water stress and underlines the importance of varietal selection to improve drought tolerance, particularly in arid and semi-arid regions.

Keywords: *Drought stress, Wheat, Germination, Tolerance, Biodiversity.*



KHAWLA RACHMOUNE

**BIOTECHNOLOGICAL EVALUATION OF CHITOSAN-BASED SYSTEMS
FOR ENHANCING ANTIOXIDANT ENZYME RESPONSE UNDER
IONIZING RADIATION EXPOSURE**

KHAWLA RACHMOUNE^{1,2,3,4,*}, ABDELGHANI IDDAR¹, MOHAMMED RHAZI³,
EL HASSAN EL MOUDEN⁴, ADEM GHARSALLAOUI², ADNANE MOUTAOUAKKIL¹

¹ Biotechnology and Biomolecules Engineering Unit, National Centre for Nuclear Energy, Science and Technology (CNESTEN), Rabat, Morocco

² Claude Bernard Lyon 1 University, CNRS, LAGEPP UMR 5007, F-69100 Villeurbanne, France

³ Interdisciplinary Laboratory in Bio-Resources, Environment and Materials, Higher Normal School, Cadi Ayyad University, Marrakech, Morocco

⁴ Laboratory of Water Science, Microbial Biotechnology and Sustainability of Natural Resources, Faculty of Science Semlalia, Cadi Ayyad University, Marrakech 40000, Morocco

* k.rachmoune.ced@uca.ac.ma

Abstract: Ionizing radiation represents a major challenge for human health and environmental safety because of its capacity to induce excessive oxidative stress at the cellular level. Within the One Health framework, biotechnological strategies aimed at strengthening endogenous antioxidant defences are gaining increasing attention for the development of sustainable and biocompatible radioprotective solutions. This study investigates the biological and enzymatic effects of chitosan-based systems as potential radioprotective agents. Using an in vitro cellular model exposed to ionizing radiation, we evaluated the impact of chitosan treatment on oxidative stress modulation and antioxidant enzyme responses. Key antioxidant enzymes were analysed to elucidate their contribution to cellular defense mechanisms against radiation-induced oxidative damage. The results demonstrate that chitosan-based systems significantly attenuate radiation-induced oxidative stress by enhancing antioxidant enzyme activity and improving post-irradiation cell viability. These findings suggest that chitosan acts not only as a protective biomaterial but also as a biotechnological modulator of cellular antioxidant responses. Overall, this work highlights the potential of chitosan-based biotechnological approaches to enhance cellular resilience to ionizing radiation. Such strategies align with One Health principles by promoting human health protection through sustainable, biodegradable, and environmentally-friendly materials with promising applications in healthcare and radiation safety.

Keywords: *Chitosan, Antioxidant enzymes, Radioprotection, Ionizing radiation.*



ANOUAR RAFIK

ASSESSMENT OF KNOWLEDGE, PERCEPTIONS, SUSTAINABLE EATING HABITS, AND ADHERENCE TO THE MEDITERRANEAN DIET AMONG ISPITS STUDENTS IN SAFI

ANOUAR RAFIK¹, BENADDI GHIZLANE¹, SOUKAINA BEN ANGUA¹, MOHAMMED ELAYACHI¹, ABDELLAH EL HABAZI¹ AND REKIA BELAHSEN¹

¹Laboratory of Anthropogenetics, Biotechnologies, and Health, Department of Biology, Faculty of Sciences, Chouaib Doukkali University, El Jadida 24000, Morocco

[*rekiabelahsen@gmail.com](mailto:rekiabelahsen@gmail.com)

Abstract: Introduction: The beneficial impact of sustainable food systems is evident in health, environmental, economic, and social terms. The Mediterranean diet is recognised as a sustainable food model by several international organizations. However, adherence to this diet is currently declining among Mediterranean populations, including those in Morocco, due to changing dietary habits, particularly among younger generations. This underscores the need for education on food sustainability, which would be relevant to the training curriculum of healthcare professionals, specifically nursing and health sciences students at ISPITS.

Objective: To assess the knowledge, perceptions, sustainable eating habits and adherence to the Mediterranean diet (MD) among ISPITS students in Safi in order to identify educational needs related to food sustainability. **Methodology:** A cross-sectional survey was conducted among 432 students at the ISPITS in Safi using a structured questionnaire to assess their knowledge of food sustainability, perceptions, sustainable eating habits, and adherence to the Mediterranean diet (using the KIDMED index). Scores were assigned to each dimension and then categorised for analysis. **Results:** The results show that 77.1% of students had a low level of knowledge, 48.9% had an average perception of sustainability, and only 22.5% adopted sustainable eating habits, while only 18.6% demonstrated good adherence to the Mediterranean diet as assessed by the KIDMED score. Significant correlations were observed between knowledge, perceptions, and sustainable eating practices ($p < 0.001$), as well as between knowledge and adherence to the Mediterranean diet ($p < 0.05$). **Conclusion:** This study highlights a significant gap in the current nursing and health science curricula. Integrating educational modules focused on food sustainability appears essential to strengthen students' skills and to promote healthy, sustainable, and culturally appropriate eating behaviours

Keywords: *Sustainable food; Mediterranean diet; knowledge; perceptions; habits; nutrition education.*

AZIZ RAZOKI
THE PRECAUTIONARY PRINCIPLE IN THE FACE OF
ENVIRONMENTAL UNCERTAINTIES

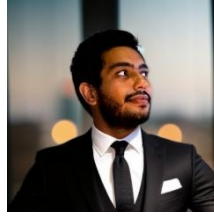
RAZOKI AZIZ *, MAZOURI MARIA

Higher Institute of Nursing and Health of Casablanca 22500, Morocco

* razokiaziz@hotmail.com

Abstract: The precautionary principle is now recognised as a normative framework for public action in the face of scientific uncertainties, particularly in the fields of environment, health, and emerging technologies. It is based on the idea that the absence of absolute scientific certainty should not delay the adoption of measures aimed at preventing serious or irreversible risks. This principle marks a shift from a strictly curative approach to risk, by prioritizing anticipation and prevention. In the context of evolving and sometimes controversial scientific knowledge, it invites decision-makers to integrate uncertainty into the decision-making process, while mobilising available scientific expertise. Nevertheless, its application raises debates, particularly regarding the risk of hindering innovation or political instrumentalisation. The precautionary principle must therefore constitute a balanced governance tool, ensuring the protection of fundamental interests and the proportionality of measures.

Keywords: *Precaution, Risk, Management, Scientific uncertainties.*



OUALID RAZZOK

**THE APPLICABILITY OF ARTIFICIAL INTELLIGENCE IN THE
EMERGENCY DEPARTMENT**

OUALID RAZZOK ^{1,2*}, BOUCHAIB BAHLAOUAN ^{1,3}, BRAHIM RABHI ⁴.

¹ Laboratory of Healthcare and Sustainable Development, Higher Institute of Nursing and Health, Casablanca, Morocco.

² Laboratory of Integrated Research in Cancerology, Hassan II University, Faculty of medicine and pharmacy of Casablanca, Morocco

³ Laboratory of Biochemistry, Environment and Agri-Food, Hassan II University, Faculty of Science and Technology, Casablanca, Morocco

⁴ The National School of Public Health (ENSP), Rabat, Morocco

*oualid.razzok@gmail.com

Abstract: This research explores the application of artificial intelligence (AI) in healthcare, in the context of the emergency department of Moroccan public hospitals. Natural language processing (NLP) AI tools, including ChatGPT 4o, LLaMA 3.3-70B, Gemini 1.5-flash, Claude 3.5-Sonnet, and Mistral-Nemo-Instruct-2407, were deployed alongside physicians to generate medical diagnoses for patients visiting the emergency departments of eight public hospitals across Casablanca. The physicians evaluated the AI tools in terms of usefulness, speed, and reusability, and the tools were graded on accuracy and similarity to human diagnoses. Although AI tools were able to provide similar and correct diagnoses and treatments across a variety of patients, physicians did not find them useful for day-to-day practice. They were still willing to reuse these tools in future cases and even requested them in some instances, which suggests that AI tools may have a role that has not been fully recognised.

Keywords: *Innovation, Diagnosis, medicine, AI, LLM, NLP.*

KHADIJA REGUIAI

**INTEGRATION OF ARTIFICIAL INTELLIGENCE IN MOROCCAN
HOSPITALS: STRATEGIC CHALLENGES AND OPPORTUNITIES
FOR THE QUALITY OF CARE**

KHADIJA REGUIAI^{1*}, LAMYAA TALHA¹ AND NAIMA MOHSSINE¹, BOUCHAIB
BAHLAOUAN¹

¹ Master in Management and Quality of Healthcare Services, Higher Institute of Nursing and Health, Casablanca, Morocco

*khadijareg35@gmail.com

Abstract: Artificial intelligence (AI) is transforming global healthcare systems and is generating growing interest in Morocco to improve the quality of care and optimise hospital resources. Its integration requires a strategic and ethical approach, aligned with international quality standards, in particular the ISO 42001 standard, which sets requirements for the governance and management of AI in organisations. A structured literature review was conducted on recent scientific publications in French and English, focusing on the Moroccan hospital context. An analysis grid was used, including inclusion criteria based on publication recency and language. AI offers promising applications, including medical image analysis, clinical decision support systems and predictive analytics for resource management. Its adoption also raises challenges related to data governance, cybersecurity, regulatory frameworks and digital skills, which must be addressed in accordance with the ISO 42001 standard to ensure quality and safety. AI represents a strategic opportunity to strengthen the efficiency and quality of care in Morocco, requiring ethical and standardised deployment in line with ISO 42001.

Keywords: *Artificial intelligence, Moroccan hospitals, Quality of care, ISO 42001*



SAFAA RHOULAM

LICHENS AS BIOINDICATORS OF ATMOSPHERIC POLLUTION

SAFAA RHOULAM^{1*}, MAROUANE MELLOUL², EL ALAOUI ABDELAZIZ¹

¹ Laboratory of Botany, Biotechnology, and Plant Protection, Faculty of Sciences, Ibn Tofail University, Kenitra, Morocco.

² Laboratory of Biological Analysis and CCMM - National Centre for Scientific and Technical Research (CNRST), Rabat, Morocco

* safaa.rhoulam@gmail.com

Abstract: Natural and urban ecosystems are currently suffering from the direct effects of atmospheric pollution and climate change. It is therefore essential to develop reliable, affordable, and low-cost monitoring tools. The physiological characteristics of lichens, defined by the absence of a cuticle and a large surface area, expose them directly to atmospheric pollutants and facilitate toxin accumulation. Recent studies demonstrate the remarkable ability of lichens to bioaccumulate fine particles of heavy metals (Pb, Zn, Cu, Ni, etc.) particles, and toxic gases. These pollutants can be quantified using analytical techniques such as X-ray fluorescence, ICP-MS, and atomic absorption spectrometry (AAS). Biological responses associated with their accumulation include decreased chlorophyll fluorescence, morphological alterations of the thallus, and activation of antioxidant enzyme systems. Overall, published studies confirm that lichens are powerful bioindicators of air quality over large areas and long periods. Nevertheless, interspecific variability and climatic influences require standardised methodologies to improve the accuracy and comparability of environmental assessments.

Keywords: *Atmospheric pollution, Lichens, Heavy metals, Bioindicators.*

HAMZA RIHANI

**GROUNDWATER POLLUTION AND IMPLICATIONS FOR
ECOSYSTEM HEALTH: THE CASE OF THE MÉDIOUNA LANDFILL
(MOROCCO)**

RIHANI HAMZA^{1*}, EL BOUQDAOUI KARIMA¹, BENNANI MOHAMED², MLIJI EL
MOSTAFA³, AIT BENICHOUSAMAH¹

¹Laboratory of Health, Environment and Biotechnology, Faculty of Sciences Ain Chock, Hassan II
University, Casablanca, Morocco

²Physicochemical and Toxicology Laboratory, Department of Health and Environment, Pasteur Institute of
Morocco

³Laboratory of Water Microbiology and Environmental Hygiene

[*rihanihamza19@gmail.com](mailto:rihanihamza19@gmail.com)

Abstract: Groundwater quality is a key component of ecosystem functioning and the sustainability of agricultural and domestic uses, particularly in urban and peri-urban areas. In Morocco, inadequate solid waste management and the presence of uncontrolled landfills contribute to progressive degradation of water resources, with potential disruption of local ecosystem balance. The Médiouna landfill, one of the largest sites in the Casablanca region, represents a major source of environmental pressure through infiltration of leachates rich in organic and inorganic pollutants into underlying aquifers. This study evaluated groundwater quality around the Médiouna landfill and examined potential implications for ecosystem health and associated uses. Monthly sampling was conducted in wells located at different distances from the landfill to analyse microbiological parameters (total coliforms, *Escherichia coli*, faecal streptococci, sulphate-reducing bacteria, and *Pseudomonas* spp.) and physicochemical parameters (chlorides, nitrates, and phosphates). The results show marked deterioration of groundwater quality, with concentrations frequently exceeding recommended limits for drinking and irrigation water. This contamination may affect soil fertility, microbial biodiversity, and the functioning of agricultural ecosystems dependent on these water resources. In response, sustainable biotechnological approaches, including microbial biodegradation, controlled composting, phytoremediation, and biofiltration, appear promising for reducing environmental impacts, improving water quality, and strengthening ecosystem resilience.

Keywords: *Groundwater quality, Ecosystem health, Leachates, Microbial contamination.*



BASMA SAADANI

OCCUPATIONAL HEALTH AND SAFETY (OHS) MANAGEMENT IN MOROCCAN HOSPITAL: CHALLENGES AND OPPORTUNITIES IN THE CONTEXT OF HEALTH SYSTEM REFORM

BASMA SAADANI^{1*}, LOUBNA TAHRI², ABDELJALIL EL KHOLTI²

¹ Laboratory of Cellular Molecular Physiopathology Inflammatory, Degenerative and Oncological Diseases, Faculty of Medicine and Pharmacy, Hassan II University/Casablanca

² Occupational Health Unit, Faculty of Medicine and Pharmacy/ Hassan II University/ Casablanca

* basmatse@yahoo.com

Abstract: The health system reform in Morocco represents a major opportunity to rethink hospital governance and strengthen the protection of human capital. In this context, OHS management in hospitals appears as an essential strategic lever for improving working conditions and quality of care. This study is based on a conceptual approach founded on a thematic literature review. The analysis has enabled the construction of an integrative conceptual framework to analysis the influence of the reform on OHS performance in Moroccan hospitals. The analysis reveals that although the reform promotes the formalization of prevention policies, the standardization of practices and improved institutional coordination, its implementation faces challenges including Organisational and financial constraints, regulatory complexity, ethical issues, and resistance to change. On this basis, an integrative conceptual framework is proposed, linking managerial practices to OHS performance, while incorporating regulatory, ethical, and patient safety dimensions. The reform acts as a strategic lever for OHS, but its success remains dependent on strong managerial leadership and governance that is integrated with quality of care. In practice, operationalization is hampered by structural barriers. Adapting international models to the Moroccan context represents a major challenge, requiring a gradual and contextualized approach aligned with the specific realities of the Moroccan hospital. Successful OHS management in the new hospital management model depends on a proactive integrated approach and committed governance.

Keywords: *Occupational health and safety, Management, Hospital, Morocco.*

MARIAM SABRI

COMPARATIVE STUDY OF MACERATION AND ULTRASOUND-ASSISTED EXTRACTION OF *EUPHORBIA ECHINUS* AND ITS POTENTIAL ANTIMICROBIAL ACTIVITY

MARIAM SABRI^{*1}, FATIMA TIZAR^{1,2}, KHALID MAJOURHAT¹, ABDELLAH HOUARI¹

¹Geo-Bio-Environmental Engineering and Innovation Laboratory, Molecular Engineering, Biotechnology and Innovation Team, Polydisciplinary Faculty of Taroudant, Ibn Zohr University, Agadir, Morocco.

² Laboratory of Microbial Biotechnology and Plants Protection, Ibn Zohr University, Faculty of Science, Agadir, Morocco.

*mariam.sabri04@gmail.com

ABSTRACT : *Euphorbia officinarum*, an endemic medicinal plant of Morocco, represents a promising source of bioactive compounds with potential health applications. The present study aims to evaluate the antimicrobial potential of extracts obtained using two extraction techniques: conventional maceration and ultrasound-assisted extraction. Different solvents with increasing polarity (hexane, ethyl acetate and ethanol) are employed to assess their influence on the recovery of bioactive metabolites. The antimicrobial activity is investigated against selected pathogenic microorganisms using standard microbiological assays. This comparative approach seeks to determine the most efficient extraction conditions in terms of bioactivity and sustainability. The expected findings will contribute to the valorisation of Moroccan endemic medicinal plants and support their potential application in natural health products and complementary medicine.

Keywords: *Euphorbia echinus*, Ultrasound-Assisted Extraction, Antimicrobial Activity.



AZIZ SAFI

CHALLENGES OF ARTIFICIAL INTELLIGENCE–BASED MEDICAL DEVICES: A SYSTEMATIC LITERATURE REVIEW

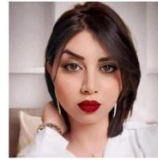
AZIZ SAFI*

MSc in Healthcare Quality & Services Management, Biomedical Engineering Specialist, AI Health Tech Enthusiast & Researcher, Provincial Hospital Centre Sidi Hssain Bennaceur, Ouarzazate, Morocco

*azo.safi@gmail.com

Abstract: Recent advances in artificial intelligence (AI) have stimulated significant interest in the healthcare sector, particularly through the development of AI-based medical devices aimed at improving clinical decision-making and healthcare system performance. Despite their potential benefits, the implementation of these devices remains limited due to multiple and complex challenges. This systematic literature review aims to analyse and synthesise the key barriers associated with the implementation of artificial AI-based medical devices in healthcare settings. A systematic search was conducted across PubMed, Scopus, Web of Science, and Google Scholar for studies published between 2018 and 2024, following the PRISMA guidelines. The findings reveal that implementation challenges are multidimensional. Technical barriers include issues related to data quality, interoperability with existing health information systems, and the reliability, transparency, and explainability of AI algorithms embedded in medical devices. Ethical and legal challenges are also prominent, particularly concerning data privacy, cybersecurity, algorithmic bias, and professional accountability. In addition, Organisational and human factors pose significant obstacles, including resistance to change, limited AI-related competencies among healthcare professionals, and difficulties integrating AI-based medical devices into established clinical workflows. Furthermore, the absence of clear regulatory frameworks and standardised evaluation and validation procedures represents a major barrier to large-scale adoption. This review highlights that addressing these challenges is critical to ensure the safe, ethical, and sustainable implementation of artificial intelligence–based medical devices in healthcare systems.

Keywords: *Artificial intelligence, Implementation challenges, Systematic review.*



TOUZAMI SANAA

STRENGTHENING COMMUNITY HEALTH NURSING IN LOW- AND MIDDLE-INCOME COUNTRIES: ROLES, BARRIERS, AND HEALTH-SYSTEM PRIORITIES

SANAA TOUZAMI^{1*}, BOUCHAIB BENCHARKI ², MINA JAAFAR ¹, EL HASSAN ROUSSI ¹, AMINA BARKAT ³, FATIMA ZAHRA LAAMIRI ¹

¹Higher Institute of Health Sciences, Laboratory of Health Sciences and Technologies, Hassan First University of Settat, Settat, Morocco.

²Laboratory of Agri-food and Health, Faculty of Sciences and Technologies, Hassan I University, Settat, Morocco.

³Research Team on Health and Nutrition of Mother and Child, Faculty of Medicine and Pharmacy, Mohammed V University, Rabat, Morocco.

* s.touzami.doc@uhp.ac.ma

Abstract: Community health nurses contribute substantially to the delivery of primary health care in low- and middle-income countries, particularly through preventive, promotive, supportive, and community-oriented activities. However, their contribution may be constrained by Organisational, professional, sociocultural, and policy-related factors. This work aimed to synthesize evidence concerning the principal functions of community health nurses, the barriers affecting their practice, and priorities for strengthening their contribution to health systems. This conference contribution is based on a previously published systematic integrative review conducted according to the Whittemore and Knafl framework and PRISMA guidance. PubMed, Scopus, Web of Science, and CINAHL were searched for studies published between January 2014 and March 2025. Among 1,047 records screened, 22 studies met the eligibility criteria and were included in the thematic synthesis. The evidence highlighted three interconnected dimensions. First, community health nursing practice encompassed health promotion and disease prevention, clinical and supportive care, care coordination, and community empowerment. Second, effective practice was limited by Organisational, sociocultural, educational, and policy-related constraints. Third, strengthening community health nursing requires clearer professional roles, appropriate competency development, adequate Organisational support, improved infrastructure, and stronger collaboration with communities. These findings emphasise the importance of Recognising and strengthening community health nursing within primary health care strategies, particularly in settings facing persistent inequalities in access to care.

Keywords: *Community health nursing; Primary health care; Low- and middle-income countries; Health workforce; Community engagement.*

Previous publication disclosure: This conference contribution is based on findings previously published in: Touzami S, Bencharki B, Jaafar M, Roussi EH, Barkat A, Laamiri FZ. Community Health Nurses in Low- and Middle-Income Countries: A Systematic Integrative Review of Roles, Barriers, and Improvement Perspectives. *International Nursing Review*. 2025;72(4):e70128. DOI: 10.1111/inr.70128.

TALHA LAMYAA

**MANAGERS' EMOTIONAL INTELLIGENCE AND THE
PROFESSIONAL AUTONOMY OF HEALTHCARE TEAMS: THE
CASE OF IBN ROCHD UNIVERSITY HOSPITAL CENTRE IN
CASABLANCA**

TALHA LAMYAA^{1*}, REGUIAI KHADIJA¹, DAFIR JAMAL¹ AND HALIMA LAHJAN¹,
BOUCHAIB BAHLAOUAN¹

¹Higher Institute of Nursing and Health of Casablanca, Morocco

*Lami18936@gmail.com

Abstract: Healthcare organisations increasingly recognise the importance of fostering favourable professional behaviours to enhance organisational performance and quality of care. In this context, structural empowerment and emotional intelligence have emerged as key determinants influencing leadership effectiveness and team performance. This study aimed to examine the relationship between nurses' structural empowerment and the emotional intelligence of their managers at Ibn Rochd University Hospital Centre in Casablanca. A descriptive cross-sectional study was conducted in 2023 among nurses and clinical managers working in the hospital's clinical departments. Data were collected using the Conditions of Work Effectiveness Questionnaire (CWEQ II) to measure nurses' structural empowerment and the Self-Report Emotional Intelligence Scale (SSREI) to assess managers' emotional intelligence. The findings revealed a moderate level of structural empowerment among nurses as well as a moderate level of emotional intelligence among managers. Statistical analysis indicated a positive correlation between nurses' structural empowerment and managers' emotional intelligence. These results suggest that emotionally intelligent leadership may contribute to strengthening nurses' empowerment within healthcare organisations. Promoting emotional intelligence among healthcare managers may therefore support effective human resource management and improve organisational performance in hospital settings.

Keywords: *Emotional intelligence, Structural empowerment, Nurses, Hospital management.*



RAJAA TESSE

ROLE OF ABSCISIC ACID IN IMPROVING IN VITRO SALINITY TOLERANCE OF ARGANIA SPINOSA L.

RAJAA TESSE^{1*}, BOUCHAIB BAHLAOUAN², NADIA BOUTALEB^{1**}

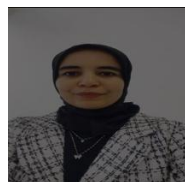
¹Hassan II University of Casablanca, Laboratory of Biochemistry, Environment and Agri-Food, LBEA URAC36, 20650 Morocco.

²ISPITS CASABLANCA

^{**}Nadia BOUTALEB nadia.boutaleb@fstm.ac.ma; * rajaatesse@gmail.com

Abstract: This study presents the first integrated evaluation of the combined effects of salinity stress and abscisic acid (ABA) on the in vitro multiplication of *Argania spinosa* L. using the Biocoupler™ temporary immersion system. Unlike previous research mainly centred on seed germination, this work investigates the physiological and biochemical responses of developing vitroplants exposed to increasing NaCl concentrations (0–150 mM). Salinity significantly reduced shoot proliferation, photosynthetic pigment content, and total protein levels, and promoted the accumulation of stress-related markers, including proline, malondialdehyde (MDA), and catalase activity. Supplementation with 5 µM ABA markedly alleviated salt-induced damage. ABA-treated cultures exhibited improved shoot growth, better maintenance of chlorophyll content, and lower oxidative stress indicators compared to untreated stressed plants. Principal Component Analysis (PCA) further confirmed the protective role of ABA under saline conditions by clearly discriminating between treated and untreated responses. Overall, the findings demonstrate the pivotal role of ABA in regulating salt stress tolerance in vitro and highlight the synergistic potential of combining hormonal regulation with the Biocoupler™ system. This strategy represents a promising biotechnological approach for the conservation, large-scale propagation, and sustainable use of this endemic species in arid and semi-arid environments.

Keywords: *Argania spinosa*, Absciscic acid, Temporary immersion system.



FATIMA TIZAR

ANTI-ADHESIVE EFFECTS OF *CHLORELLA* SP. ETHANOL EXTRACT ON FOODBORNE PATHOGENS ADHERING TO 316L STAINLESS STEEL

FATIMA TIZAR^{a,b*}, AZZEDDINE BECHAR^c, MOULAY SADIKI^b, MOHAMMED HASSI^{a,d}

^a Laboratory of Microbial Biotechnology and Plants Protection, Ibn Zohr University, Faculty of Science, Agadir, Morocco

^b Laboratory of Geo-Bio-Environment and Innovation Engineering, Polydisciplinary Faculty of Taroudant, Ibn Zohr University, Agadir, Morocco

^c Laboratory of Microbial Biotechnology and Bioactive Molecules, Faculty of Science and Technology, Sidi Mohamed Ben Abdellah University, Fez, Morocco

^d Polydisciplinary Faculty of Taroudant, Ibn Zohr University, Agadir, Morocco

*fatima.tizar@edu.uiz.ac.ma

Abstract: Food safety is a major priority for consumers and food producers. Although the food industry aims to provide safe and healthy products, this objective is challenged by bacteria that adhere to food contact surfaces and form biofilms. This study evaluates the anti-adhesive potential of an ethanol extract from a locally isolated *Chlorella* sp. against *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Salmonella enterica*. Antimicrobial activity was assessed using disc diffusion and broth microdilution methods, showing strong antibacterial effects against all tested bacteria. The effect of the extract on the physicochemical properties of 316L stainless steel was evaluated by contact angle measurements. Untreated steel was hydrophobic, whereas treated steel became hydrophilic with increased electron-donor properties. Bacterial adhesion was analysed using the extended Derjaguin–Landau–Verwey–Overbeek (XDLVO) theory, indicating favourable adhesion on untreated surfaces and unfavourable adhesion after treatment. Scanning electron microscopy confirmed dense colonisation of untreated surfaces, whereas treatment markedly reduced adhesion, exceeding 93% inhibition and achieving complete inhibition for *B. subtilis*, *E. coli*, *P. aeruginosa* and *S. enterica*. These findings highlight *Chlorella* sp. ethanol extract as a promising natural and environmentally-friendly approach for reducing dense colonisation on food contact materials.

Keywords: Foodborne pathogens, Anti-adhesive effect, *Chlorella* sp.



KHAWLA WADDI

TREATMENT OF HOSPITAL WASTEWATER USING A FUNGAL– MICROALGAL CO-CULTURE

KHAWLA WADDI¹, KARIMA JMAILI¹, SELMA SIHAM EL KHAYAT^{1,2}, SANAA DEBLIJ^{1,3},
MOHAMED LAHRAIRI¹, BOUCHAIB BAHLAOUAN^{1,3} & NADIA BOUTALEB^{1*}

¹Laboratory of Biotechnology, Agri-Food, Materials and Environment, Team: Biotechnologies, Resource Valorisation, Quality, Health and Ecotoxicology, Faculty of Science and Technology Mohammeda, Hassan II University of Casablanca

²Nephrology Department, Ibn Rochd University Hospital of Casablanca

³Laboratory of Care, Health and Sustainable Development 2S2D, Higher Institute of Nursing and Health of Casablanca

*nadia.boutaleb@fstm.ac.ma

Abstract: Hospital wastewater represents a major environmental concern because of the presence of pharmaceutical residues, pathogenic microorganisms, and various chemical contaminants. Conventional treatment systems are often insufficient to remove these pollutants completely before discharge into the environment. The development of sustainable and efficient treatment strategies is therefore essential. This study investigates the potential of a co-culture system combining fungi and microalgae for the treatment of hospital effluents. The synergistic interaction between these microorganisms may enhance pollutant removal through complementary mechanisms such as biosorption, biodegradation, and nutrient assimilation. In this system, fungi contribute to the degradation of complex organic compounds and improve biomass aggregation, and microalgae facilitate the uptake of nutrients such as nitrogen and phosphorus and contribute to oxygen production through photosynthesis. The performance of the fungal–microalgal co-culture was evaluated using key physicochemical parameters, including chemical oxygen demand, nutrient removal, and overall pollutant reduction. The results demonstrate that this biological approach offers a promising and environmentally friendly alternative for the treatment of hospital wastewater. The integration of fungal–microalgal systems could contribute to improving wastewater management in healthcare facilities and promote sustainable environmental practices.

Keywords: Hospital wastewater, Fungal–microalgal co-culture, Wastewater treatment.



KHAWLA WIFAK

ISOLATION AND IDENTIFICATION OF EFFICIENT PHOSPHATE-SOLUBILIZING FUNGI FROM PHOSPHATE-RICH SOILS TOWARD THE DEVELOPMENT OF A NOVEL PHOSPHORUS BIOFERTILISER

KHAWLA WIFAK^a, YOUNES ESSAMLALI^b, OTHMANE AMADINE^c, MOHAMED ZAHOUILY^{a,d*}

^a Laboratory of Biotechnology, Agrifood, Materials & Environment, Faculty of Science and Technology, Hassan II University, Casablanca, Morocco

^b MAScIR Foundation, VARENA Centre, Mohammed VI Polytechnic University, Ben Guerir, Morocco

^c Chemical and Biochemical Sciences (CBS), Mohammed VI Polytechnic University, Ben Guerir, Morocco

^d Fert-Explorer, Mohammed VI Polytechnic University, Ben Guerir, Morocco

* mohamed.zahouily@um6p.ma

Abstract: Phosphorus (P) is a vital macronutrient for plant growth, yet its deficiency severely limits crop yields. Conventional chemical fertilisers provide P inefficiently, often leading to substantial nutrient losses. Rock phosphate presents a sustainable alternative, but its low solubility restricts immediate nutrient availability. This study aimed to enhance rock phosphate effectiveness through microbial biosolubilization. Four fungal isolates were obtained from soils and purified on Potato Dextrose Agar (PDA). Macroscopic and microscopic analyses identified these isolates as belonging to the *Aspergillus* genus, displaying variations in colony morphology, pigmentation, and sporulation. Their phosphate-solubilizing ability was assessed qualitatively on Pikovskaya's agar, showing clear halo formation, and quantitatively in liquid medium containing tricalcium phosphate (TCP). Results revealed notable differences in pH reduction and soluble P release, with one isolate demonstrating superior solubilization efficiency. This strain is considered a promising candidate for the development of a rock phosphate-based biofertiliser. Integrating microbial activity with controlled nutrient release offers a sustainable approach to agriculture, supporting regenerative farming and reducing dependency on synthetic fertilizers, and improving soil fertility and crop productivity.

Keywords: *Aspergillus niger*, rock phosphate, biofertiliser, agriculture.

ZINEB ZAIMI

**STRESS MANAGEMENT INTERVENTIONS FOR NURSES:
SYNTHESIS OF APPROACHES AND THEIR EFFECTIVENESS**

ZINEB ZAIMI^{1,2}, MOUNIR RAI², SANAE JEBBAR¹, AHD OULAD LAHSEN¹

¹Clinical Immunology, Infection and Autoimmunity Laboratory (LICIA), Faculty of Medicine and Pharmacy,
Hassan II University, Casablanca, Morocco

²Higher Institute of Nursing and Health, Casablanca, Morocco

* zaimizineb175@gmail.com

Abstract: Occupational stress among nurses represents a major global occupational health concern. Prolonged exposure to high emotional demands, heavy workload, and complex organisational constraints promotes burnout, anxiety disorders, and reduced quality of care. In this context, numerous interventions have been developed to prevent or mitigate the effects of stress in hospital settings. This narrative review of the international scientific literature identifies the main stress management interventions implemented for nurses and analyses general trends regarding their effectiveness. The selected studies addressed individual, organisational, or multimodal interventions aimed at reducing stress among nurses. The identified interventions fall into three main categories. Individual approaches, including cognitive behavioural therapy, mindfulness, relaxation, and emotional regulation programmes, show significant reductions in perceived stress. Resilience-building programmes and psychoeducational interventions strengthen coping strategies and self-efficacy. Organisational interventions, such as improved managerial support, workload optimisation, and promotion of teamwork, appear to produce more sustainable effects when integrated into an overall institutional policy. Overall, available evidence suggests that stress management interventions for nurses are generally effective, particularly when individual and organisational strategies are combined. Nevertheless, methodological heterogeneity and the limited availability of long-term evaluations highlight the need for further research, especially in resource-limited settings.

Keywords: *Occupational stress, Nurses, Interventions, Occupational health.*

YASSINE ZNAKI

A SURVEY ON BLOCKCHAIN BASED PHARMACEUTICAL SUPPLY-CHAIN MANAGEMENT AND DRUG DISTRIBUTION

ZNAKI YASSINE^{1*} AND ENNEFFAH WAFAA¹

¹Faculty of Medicine and Pharmacy, Mohammed V University in Rabat, Rabat, Morocco.

* yassine_znaki@um5.ac.ma

Abstract: The pharmaceutical supply chain management is facing numerous challenges that had led in the past and still today to issues in the distribution of drugs and their availability in the market. Different parameters affirm the issue does not involve the scarcity or lack of production, but indeed inventory allocation. The complexity of the drug supply chain fabric and the critical nature of these synergies' request for a holistic solution that should be able to assure both the validity of the data and the durability of the records. Blockchain appeals to be the right solution for this problem. In this paper, we will be conducting a systemic review on the use of blockchain technology in the proper management of pharmaceutical supply chain. We will be pointing out the main current challenges such approaches face, and finally, we will be projecting the on the feasibility and underlining the applicability to the case of a pharmaceutical supply chain.

Keywords: *Blockchain, Pharmacy, Supply-chain*



ZAKIA ZOUAOU

BIOTECHNOLOGICAL POTENTIAL OF *SCHINUS TEREBINTHIFOLIUS* RADDI: A NATURAL STRATEGY TO MITIGATE OXIDATIVE STRESS AND GLYCATION IN DIABETES MANAGEMENT

ZAKIA ZOUAOU^{1*}, REDA BEN MRID², SARA EL ASRI¹, NAIMA NHIRI³, KHALID LAIRINI¹
AND MOHAMED NHIRI¹

¹Laboratory of Biochemistry and Molecular Genetics, Faculty of Sciences and Technologies of Tangier,
University Abdelmalek Essaadi, Tetouan, Morocco

²Institute of Biological Sciences (ISSB-P), Mohammed VI Polytechnic University (UM6P), 43150 Ben- Guerir,
Morocco

³Institute for the Chemistry of Natural Substances, CNRS, Paris Saclay University, 91190, Gif-Sur-Yvette,
France

*Zakia.zouaoui@etu.uae.ac.ma

Abstract: In the scope of plant biotechnology and its role in human health, this study investigates the therapeutic potential of pink pepper (*Schinus terebinthifolius* Raddi) leaves in managing diabetes-related complications. The research evaluates the effects of *Schinus terebinthifolius* methanolic extract from leaves (150 and 250 mg/kg) over twenty-one days in diabetic mice by analysing markers of hyperglycaemia, lipid profile, and oxidative stress. Diabetic mice showed significant elevations in blood glucose, total cholesterol, low-density lipoprotein, hepatic malondialdehyde, and renal advanced glycation end products. At the same time, a decrease in high-density lipoprotein and antioxidant enzymes (catalase, glutathione reductase, glutathione peroxidase, and superoxide dismutase) was observed. Treatment with *Schinus terebinthifolius* methanolic extract markedly reduced glucose, total cholesterol, low-density lipoprotein, malondialdehyde, and advanced glycation end product levels and increased hepatic redox-regulating enzymes. These findings highlight the capacity of the extract to mitigate hyperglycaemia and oxidative stress. This research positions *Schinus terebinthifolius* as a promising biotechnological resource for developing sustainable anti-diabetic treatments, aligning with the "One Health" approach for a sustainable future.

Keywords: Plant Biotechnology, *Schinus terebinthifolius*, Diabetes.



ZINEB SEKKOUT

MODULATION OF LEUKOCYTE RECRUITMENT BY ALKALOIDS ISOLATED FROM *SMYRNIUM OLUSATRUM* IN ACUTE INFLAMMATION

SEKKOUT ZINEB*, BOUDAIA OMAIMA, RADALLAH DRISS, EL AMRANI NAJAT AND EL
HAMSAS EL YUBI AMAL

Laboratory of Biology and Health, Faculty of Sciences Ben M'Sik, University Hassan II, Casablanca, Morocco

* zineb.sekkout-etu@etu.univh2c.ma

Abstract: Inflammation alters leukocyte trafficking and promotes chronic inflammatory disorders. Monocytes and other leukocytes migrate towards inflamed tissues in response to local signals, and this process intensifies under pathological conditions. Limitations of conventional anti-inflammatory drugs support the search for safer natural alternatives. This study evaluates the anti-inflammatory potential of alkaloids extracted from *Smyrniium olusatrum* L., focusing on their capacity to modulate leukocyte migration. Alkaloids were isolated from powdered seeds by methanolic extraction, followed by acid–base partitioning and solvent fractionation. Anti-inflammatory activity was evaluated using a carrageenan-induced leukocyte migration model in mice. Peritoneal exudates were stained with Turk's solution and leukocytes were quantified using a Malassez haemocytometer. Alkaloids inhibited leukocyte migration in a dose-dependent manner. At $20 \text{ mg} \cdot \text{kg}^{-1}$, leukocyte counts declined to $1.53 \times 10^5 \text{ cells} \cdot \text{mL}^{-1}$, approaching the effect observed with diclofenac. Microscopy confirmed reduced leukocyte accumulation. These findings indicate that *S. olusatrum* alkaloids exert anti-inflammatory activity through suppression of leukocyte recruitment and constitute promising natural modulators of inflammatory responses.

Keywords: *Alkaloids, Inflammation, Leukocyte migration.*



DARIA SIHAME

MALNUTRITION IN DIGESTIVE SURGERY

DARIA SIHAME^{1*}, KHALID KHALEQ²

¹Laboratory of Chemistry, Biochemistry, Environment, Nutrition and Health, Hassan II University, Casablanca, MAR

²Anesthetist, Intensive Care, CHU Ibn Roched. Hassan II University, Casablanca, Maroc.

*Sihame.daria-etu@etu.univh2c.ma

Abstract: Malnutrition is now a major issue in digestive surgery, not only because it reflects the patient's physiological condition prior to surgery, but also because it strongly influences the postoperative course. Long considered a secondary consequence of disease or surgery, it is now recognised as a key determinant of prognosis, capable of influencing healing, immune response, and overall tolerance to surgical stress. Digestive surgery occurs within a specific metabolic context, with systemic inflammation, protein catabolism, and hormonal changes acting together to compromise nutritional balance, which is often already precarious in patients with chronic or oncological conditions. This situation explains why nutritional status has become a cornerstone of modern strategies for enhanced recovery after surgery, in which nutrition is no longer regarded as simple support but as a therapeutic intervention in its own right. Recent studies show that malnutrition is associated with a significant increase in postoperative morbidity, length of hospital stay, and healthcare costs, reinforcing the need for a clear understanding of its mechanisms and consequences.

Keywords: *Denutrition, Digestive Surgery, Malnutrition, Pronostic.*

Poster Presentations



BARAE ABAIDA

TERROIR PRODUCTS IN MOROCCO: A BIBLIOMETRIC ANALYSIS

BARAE ABAIDA¹, BOUCHAIB BAHLAOUAN², RAJAA TASSE ¹, & NADIA BOUTALEB^{1*}

¹Hassan 2 University of Casablanca, Laboratory of Biochemistry, Agri-Food, Materials and Environment, LBAME URAC36, 20650 Morocco.

²Higher Institute of Nursing and Health of Casablanca 22500, Morocco

*Nadia.boutaleb@fstm.ac.ma

Abstract: Moroccan terroir products represent a significant wealth, stemming from the country's biological diversity, local production conditions, and the traditional knowledge of rural communities. These products play a key role in the economic and social development of rural areas. Yet, their valorisation remains limited by several constraints, including the lack of suitable technologies, the weak structuring of value chains, and the impacts of climate change. This study comprehensively surveys scientific work on the valorisation of Moroccan terroir products, with a focus on the contribution of biotechnology as a tool for improving quality, preservation, and sustainability. A systematic literature review was conducted following the PRISMA method, covering the period 2001–2025. The selected publications were analysed to identify the main sectors studied, the technological approaches used, and research trends, in order to ensure the sustainable valorisation of Moroccan terroir products and support the development of rural areas.

Keywords: *Water, Irrigation, verbena, Quality, Physicochemical, Composition.*



RIDOUANE ABDELOUAHID

**SOCIODEMOGRAPHIC AND EPIDEMIOLOGICAL PROFILE OF
TUBERCULOSIS PATIENTS IN THE MARRAKECH-SAFI REGION:
ANALYSIS OF CDTMR DATA**

RIDOUANE ABDELOUAHID^{1,2}, BENKSIM ABDELHAFID¹, HACHIMI ABDELHAMID²

¹ Higher Institute of Nursing and Health, Marrakech, Morocco.

² Morpho-Sciences Research Laboratory, Faculty of Medicine and Pharmacy of Marrakech, Marrakech, Morocco.

*Corresponding author e-mail address: ridabel2023@gmail.com

Abstract: Tuberculosis (TB) is a major public health problem, with nearly 10 million new cases worldwide each year, according to the WHO. In Morocco, approximately 36 000 cases are recorded annually, with an incidence of 103 per 100,000 inhabitants, resulting in nearly 3300 deaths. In the Marrakech-Safi region, approximately 2500 cases are reported annually, primarily in the provinces of Safi and Marrakech. In 2023, Marrakech recorded 965 cases, representing 34.8% of regional cases, mainly affecting individuals aged 15–44. Pulmonary tuberculosis is more common than the extrapulmonary form, accounting for 52.56% of new cases. Tuberculosis severely impacts patients' quality of life, affecting their physical, psychological, and social well-being. This study aims to describe the sociodemographic and epidemiological profile of patients in the region's CDTMR and to identify the major determinants. The results reveal a significant concentration of cases in Safi and El Youssoufia, with comorbidities such as HIV and diabetes, as well as socioeconomic factors and stigma, all impacting patients' quality of life. Integrating quality-of-life indicators into patient monitoring could improve patient management.

Keywords: *Tuberculosis, Epidemiology, Quality of life, Marrakech-Safi.*

RAJAA ADNANE

**QUALITY MANAGEMENT AND WATER-RELATED RISK
PREVENTION IN MOROCCAN HOSPITALS**

RAJAA ADNANE^{1*}, FATIMA HOUSNI¹, YASSINE EL MATOUGUI¹

¹Higher Institute of Nursing and Health of Casablanca, Morocco

*rajaa.adnane20@gmail.com

Abstract: Hospital water systems can act as reservoirs for pathogenic microorganisms, representing a significant source of healthcare-associated infections (HAIs), especially in units with immunocompromised or critically ill patients. In Morocco, studies conducted in hospitals in Rabat, Casablanca, and Taza have demonstrated bacterial contamination, including *Pseudomonas* spp., *Legionella* spp., and *Enterococcus* spp., with a substantial proportion of samples failing to meet microbiological standards. This review explores the role of quality management in mitigating water-related risks and enhancing patient safety. By analyzing national studies, microbiological surveys, and international recommendations on water safety and hospital quality management, it was found that the implementation of Water Safety Plans, combined with systematic monitoring, audits, maintenance, and continuous staff training, effectively reduces the risk of waterborne infections. Integrating these measures into hospital quality management systems is essential to prevent HAIs, improve overall care quality, and strengthen patient safety in Moroccan healthcare facilities.

Keywords: *Hospital Water, Patient Safety, Healthcare-Associated Infections, Quality Management, Morocco*

NOURA AOUSSAR

USE OF MEDICINAL PLANTS IN THE MANAGEMENT OF GYNECO-OBSTETRIC DISORDERS IN THE PROVINCE OF ESSAOUIRA
(MOROCCO): AN ETHNOBOTANICAL SURVEY

AOUSSAR NOURA^{*1,2}, ACHMIT MOHAMED^{2,3}, SEDDAOUI NARJISS⁴, JABRI BRAHIM¹,
ALAMI MERROUNI ILYASS⁵ and MELLOUKI FOUAD²

¹ Higher Institute of Nursing and Health, Rabat, Morocco

²RU Microbiology, Biomolecules and Biotechnology, Laboratory of Chemistry-Physics and
Biotechnologies of Biomolecules and Materials, FST Mohammedia, Hassan II University of
Casablanca, Mohammedia 20650, Morocco

³ Higher Institute of Nursing and Health, Casablanca, Morocco

⁴ Laboratory of Process Engineering and Environment, Faculty of Sciences and Techniques, Hassan II
University of Casablanca, P.A. 146., Mohammedia, Morocco

⁵ Higher Institute of Nursing and Health, Oujda, Morocco

*noura.aoussar@gmail.com

Abstract: Medicinal plants play a crucial role in women's healthcare, particularly in rural Moroccan communities. This study aimed to document traditional knowledge on the use of medicinal plants for gynecological disorders in the province of Essaouira. Structured interviews were conducted with 800 women across multiple localities.

A total of 119 species from diverse botanical families were identified, *Artemisia herba-alba* (Asteraceae) and *Lavandula angustifolia* (Lamiaceae) were the most frequently cited. The majority of plants were employed to alleviate postpartum pain and dysmenorrhea. Aerial parts were predominantly used, with decoction and infusion as the main preparation methods, and oral administration as the primary route.

While traditional remedies are widely used, some adverse effects, including vomiting and hypertension, were reported, highlighting the need for safety assessment.

These findings provide a valuable record of ethnobotanical knowledge in Essaouira and emphasise the potential of Moroccan medicinal flora as a source of novel bioactive compounds. The dataset offers a scientific foundation for future phytochemical and pharmacological research targeting women's reproductive health.

Keywords: Ethnobotany, Medicinal plants, Gynecological disorders, Women's health, Essaouira, Traditional knowledge.



DANYA ARGUIG

TRANSFORMATION OF THE LANDSCAPE OF THE ÉTANG DE LA GALIOTTE: SPATIAL DYNAMICS AND TERRITORIAL ISSUES

DANYA ARGUIG^{1,2*}, KHAWLA WADDI², DAVID BLANCHON¹ AND NADIA BOUTALEB²

¹ Paris Nanterre University, UFR SSA - Department of Geography

² Hassan II University of Casablanca, Laboratory of Biotechnology, Agrifood, Materials and Environment, LBAME, URAC 36, 20650 Morocco

*adanyahiba4@gmail.com

Abstract: Wetlands located in urban areas are shaped by urban expansion. The challenges in terms of water security, environmental sustainability, and territorial planning are major. The Étang de la Galiotte, located in Carrières-sous-Poissy, in the heart of the Peuple de l'Herbe Departmental Park in Yvelines, illustrates this dynamic. It is a former industrial site, previously a sand quarry, transformed into an artificial pond (fed by the Seine and groundwater). This space has evolved into a multifunctional landscape that is both natural, urban, and recreational, representing the dynamics of development and preservation in the wetlands of the Seine valley. This study analyses how the evolution of the Étang de la Galiotte, marked by urbanisation, renaturation, and environmental management processes, has transformed the relationships between water, uses, and the landscape. It adopts a geographical and socio-spatial approach to highlight the spatial contrasts between the south bank, which is more natural, and the north bank, which is more urbanised. It also considers planning strategies and policies, particularly those aimed at preserving wetlands, supporting sustainable water management, and applying One Health principles in urban areas.

Keywords: *Wetlands; Urbanisation; Landscape Planning; Renaturation; Water Policy.*



FATIMA ASLAOU

**PUBLIC SERVICE MOTIVATION AND WORK PERFORMANCE OF
HEALTH PROFESSIONALS**

FATIMA ASLAOU^{1*}, HALIMA IBRAHIMI¹, HEFDHALLAH ALAIZARI¹, IMANE
HALIMI², MOHAMMED OUHSSINE¹

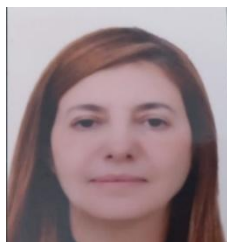
¹Department of Biology, Laboratory of Natural Resources and Sustainable Development, Faculty of Science,
Ibn Tofail University, Morocco

²ISPITS (Ex IFCS) de Rabat, Avenue Hassan II, Km 4, 5, B.P 4502 Rabat. Morocco

* aslaoufatima@gmail.com

Abstract: Resource scarcity, staff instability, high skill turnover (15%), and difficulties in retaining health professionals affect public service performance in hospitals in the Laâyoune region. In this context, the study examined the influence of public service motivation (PSM) on work performance. It identified the determinants of PSM and analysed its association with human resource performance at the Regional Hospital Centre of Laâyoune (CHRL). This research adopted a mixed descriptive and correlational design, using a questionnaire, two measurement instruments, and interviews. Quantitative data were analysed using SPSS 17.0 for exploratory factor analysis and EQS 6.1 for confirmatory factor analysis. The findings indicated no overall correlation between PSM and performance. Significant associations emerged within specific professional groups. Among physicians, PSM correlated with organisational confidence ($r = .46$; $p < .05$). Among nurses, PSM was associated with job satisfaction ($r = .26$; $p < .05$). Among administrators, PSM correlated with organisational climate ($r = .57$; $p < .05$). These results suggest that the relationship between public service motivation and work performance varies across professional categories. Assessing this relationship at national level may support strategies to strengthen the effectiveness of health professionals in public hospitals.

Keywords: *Public Service Motivation, Performance, Hospital Health Professionals.*



FATIMA ASLAOU

HEALTH RISK ASSESSMENT OF NITRATE CONTAMINATION IN SURFACE WATER OF THE NADOR CANAL, MOROCCO

FATIMA ASLAOU^{1*}, HALIMA IBRAHIMI¹, HEFDHALLAH ALAIZARI¹, MOHAMMED
OUHSSINE¹

¹Department of Biology, Laboratory of Natural Resources and Sustainable Sevelopment, Faculty of Science, Ibn Tofail University, Morocco.

[*aslaoufatima@gmail.com](mailto:aslaoufatima@gmail.com)

Abstract: Surface water contamination by nitrates presents significant environmental and public health challenges in agricultural regions worldwide. In Morocco, the Nador Canal serves as a critical surface water resource for the Oriental Region, supporting agricultural irrigation, livestock watering, and community needs. This study conducts a comprehensive health risk assessment of nitrate contamination in the surface waters of the Nador Canal, addressing a critical knowledge gap in regional water quality management. During the summer of 2023, surface water samples were collected from 22 strategic locations along the Nador Canal. Nitrate concentrations (NO_3^-) were analysed using standard spectrophotometric methods. Health risk assessment followed the US Environmental Protection Agency (EPA) methodology, calculating hazard quotients (HQ) for multiple population groups: children (1–6 years), infants (<1 year), adult men, and women. Exposure scenarios considered both direct ingestion and incidental consumption during recreational activities, with parameters adapted to Moroccan demographic and behavioural patterns. Nitrate concentrations in surface water ranged from 0.27 to 37.90 mg/L, with a mean concentration of 5.68 mg/L. Station S1 exhibited the highest concentration (37.90 mg/L), exceeding the World Health Organisations

guideline value of 10 mg/L. Health risk assessment revealed that at Station S1, children faced significant non-carcinogenic risk ($\text{HQ} = 1.579$), and infants were at extreme risk ($\text{HQ} = 3.55$). All other stations presented acceptable risk levels for adult populations ($\text{HQ} < 0.5$). Spatial analysis identified agricultural runoff as the primary contamination source, with elevated nitrate levels correlating with adjacent farmland density.

Keywords: *Surface water quality, Nitrate contamination.*



ASMA AZEKOUR

BIOTECHNOLOGICAL VALORISATION OF ORGANIC RESIDUES FOR SUSTAINABLE SOIL RESTORATION AND ENHANCED WATER RETENTION

ASMA AZEKOUR^{1*}, HOURIA ABDELGHAFAR¹, NADIA BOUTALEB¹, MERIEM MAHMOUDI¹

¹Hassan II University of Casablanca, Laboratory of Biotechnology, Agri-Food, Materials and Environment, Team: Biotechnologies, Resource Valorisation, Quality, Health and Ecotoxicology, Faculty of Science and Technology Mohammedia, BP 146, Mohammedia 20650, Morocco

*asmaazekour@gmail.com

Abstract: Soil degradation and limited water availability represent major challenges for agricultural sustainability and food security, particularly under increasing climatic variability. This doctoral research investigates biotechnological strategies aimed at restoring essential soil functions and enhancing water retention capacity. The study focuses on the mechanisms through which targeted interventions can optimise the physical, chemical, and biological properties of soils, improve soil structure, and support crop resilience under water stress. It also integrates sustainability and circular economy principles, aiming to promote efficient resource use while minimising environmental impact. Framed within a One Health perspective, this research considers the interconnectedness of soil health, water management, and ecosystem balance. The objective is to develop integrated biotechnological solutions capable of simultaneously enhancing agricultural productivity, supporting sustainable water management, and preserving soil and ecosystem health. By exploring these approaches, the study seeks to provide holistic strategies that address multiple sustainability challenges and contribute to resilient agro-ecosystems in a changing climate.

Keywords: *Biotechnological soil restoration, Water retention, Sustainable agriculture, Soil health, Circular economy, Agro-ecosystem resilience.*



RIM BENHIDA

PREVALENCE OF IRRITABLE BOWEL SYNDROME: RESULTS OF A CROSS-SECTIONAL STUDY IN MOROCCO

RIM BENHIDA^{1*}, MOHAMED TAHIRI^{1,2}

¹Faculty of Medicine and Pharmacy of Casablanca - Casablanca Hassan II University – Morocco

²Ibn Rochd University Hospital Centre, Casablanca, Morocco.

*rim.benhida@gmail.com

Abstract: Background and Aim: Irritable bowel syndrome (IBS) is a disorder of the digestive tract. It is 10% prevalent worldwide, according to the Rome IV criteria. It manifests itself through digestive and extradigestive symptoms, leading to an altered quality of life and a deterioration in general health.

Our aim is to determine the prevalence of irritable bowel syndrome and its subtypes. **Methods:** A descriptive cross-sectional epidemiological study was carried out in various health Centres in Casablanca. Data were collected using a questionnaire covering participants sociodemographic variables and dietary habits, in addition to the Rome IV criteria for diagnosing IBS. Findings were analysed using SPSS software, with qualitative variables described as absolute and relative frequencies and quantitative variables as means with one standard deviation. Comparisons were made using the Chi2 or Fisher's Exact test. **Results:** A total of 411 participants were included in the study, with a female predominance of 72%. The prevalence of IBS was 23% (CI95% [19%-27%]). According to Rome IV criteria, the percentages of subtypes were as follows: IBS-C 48%, IBS-D 18%, IBS-M 33%, with IBS-C the most frequent subtype at 49.5 (CI95% [39.4%-59.5%]). IBS was more frequent in women than in men (27% versus 13%, $p=0.003$). **Conclusion:** This study showed a high prevalence of irritable bowel syndrome. The predominant subtype is constipation. Actions based on targeted prevention, education, and awareness-raising of the population, with medical and dietary management adapted to each profile, are essential.

Keywords: IBS, Diet, Nutrition, RomeIV.



BELARREM FATIMA EZZAHRA

**A DECISION-SUPPORT FRAMEWORK FOR ECONOMIC LEAKAGE
MANAGEMENT IN LARGE URBAN WATER DISTRIBUTION
SYSTEMS**

BELARREM FATIMA EZZAHRA^{1*}, BEN HACHMI MOHAMMED KARIM² AND NELSON
CARRICO³

^{1,2} Faculty of Science and Technology Mohammedia, Hassan II University of Casablanca, Morocco

³ School of Technology of Barreiro, Polytechnic Institute of Setúbal, Lavradio, Portugal

* Corresponding author e-mail address: fatima.belarrem-etu@etu.univh2c.ma

Abstract: Establishing the Economic Level of Leakage (ELL) is a significant difficulty in the management of urban water distribution systems, especially when intervention costs and operational limitations generate intricate nonlinear interactions. This study offers a decision-support framework that integrates operational and economic factors under resource constraints to assist in developing cost-effective leakage management solutions in large-scale water networks. A case study utilising operational data from a large-scale urban water distribution system is employed to illustrate the proposed methodology. Several population-based optimization techniques were implemented under consistent computational settings to explore their capacity to identify cost-effective leakage management strategies. Multiple simulation runs were conducted to evaluate convergence behaviour and robustness, and statistical and comparative analyses were applied to assess the stability of the obtained solutions. Findings demonstrate that the choice of optimization algorithm can significantly affect economic results and solution stability in leakage management issues. The work emphasises the significance of robust optimization approaches in supporting strategic decision-making and contributes to the development of effective leakage control measures in large urban water distribution systems.

Keywords: *Leakage management, Water distribution systems, Economic optimization.*



NISRINE BLIL

BEYOND PHRAGMITES: A BIBLIOMETRIC ANALYSIS FOR DIVERSIFYING MACROPHYTES IN CONSTRUCTED WETLANDS

NISRINE BLIL^{1*}, ZAKARIA SAHBANI², KHADIJA MANHOU¹, DOHA BOUMALIK¹, ZINEB GUESSOUS¹

¹ Laboratory of Natural Resources and Sustainable Development, Department of Biology, Faculty of Sciences, Ibn Tofail University, Kenitra 14000, Morocco;

² Laboratory of Advanced Systems Engineering, Department of Computer Science, Logistics and Mathematics, National School of Applied Sciences, Ibn Tofail University, Kenitra 14000, Morocco;

* nisrine.blil@uit.ac.ma

Abstract: The use of Constructed Wetlands (CWs) for wastewater treatment is severely constrained by the overreliance on a small number of conventional macrophyte species. The consequent lack of resilience and adaptability of these nature-based systems is further amplified when addressing more complex wastewater streams. In this context, this study maps the worldwide research landscape (1969–2025) through a large-scale bibliometric analysis of 37,379 documents to assess the number of species that are research-saturated and to identify under-researched ‘pioneer’ species. The analysis revealed an overwhelmingly large volume of research on *Phragmites australis* (877 papers) and *Typha latifolia* (370). In contrast, several potentially promising pioneers exhibiting stressor resilience, such as *Mentha aquatica* and *Salicornia persica*, receive minimal research attention, with citations frequently below 10. This analysis provides the first data-driven basis for the strategic diversification of plant types in phytoremediation. It offers a structured framework for the experimental validation of these pioneering species, supporting the development of more versatile and robust CWs designed to function across a broader range of environmental conditions.

Keywords: *Phytoremediation, Wastewater Treatment, Pioneer Species.*

ADNANE BOUCHAMA

**HAEMODIALYSIS WATER SYSTEMS: PURIFICATION
PERFORMANCE, BIOMEDICAL SAFETY AND ONE HEALTH
CONSIDERATIONS**

ADNANE BOUCHAMA^{1*}, RADOUANE EL HABBANI², KHADIJA FRITAH³, ABDEL FATAH BOUCHAMA¹, MUSTAPHA TAHAKAIT¹

¹Advanced Materials and Process Engineering Laboratory, Ibn Tofail University, Kenitra, Morocco

²Biochemistry Laboratory, Faculty of Medicine and Pharmacy, Sidi Mohamed Ben Abdellah University, Fez, Morocco

³Biology and Health Laboratory, Faculty of Sciences, Ibn Tofail University, Kenitra, Morocco

*adnane963@gmail.com

Abstract: Water used in chronic haemodialysis is a critical element of patient safety, as it becomes part of the fluid to which the patient is exposed for extended periods during each session. In daily practice, dialysis centres rely on several purification stages, including prefiltration, softening, activated carbon, and reverse osmosis, in addition to a continuous distribution loop to minimise chemical contaminants and prevent microbial growth. Dialysis water can be considered a point of convergence between clinical, environmental, and microbiological aspects, making it relevant to the concept of ‘One Health’. In this work, we evaluated the performance of the water treatment system in a regional public hospital with a single dialysis room containing 30 machines. Measured laboratory parameters were compared to reverse osmosis simulation outputs generated using the WAVE industrial software. The evaluation included pretreatment stages, reverse osmosis settings, distribution loop design, room workflow, and microbiological analyses. The simulation showed a rejection rate of 99.06% and a conductivity of 4.3 $\mu\text{S}/\text{cm}$, consistent with measured values (3.8 $\mu\text{S}/\text{cm}$). Microbiological analyses revealed no bacterial contamination, and the endotoxin level was very low (<0.06 EU/ml), which may be associated with the continuous distribution loop and the unified treatment configuration. Overall, the results demonstrated agreement between simulation outputs and real-world performance, highlighting the importance of integrating engineering, biomedical, and public health approaches to dialysis water quality within the ‘One Health’ framework.

Keywords: *Haemodialysis, Water Quality, Safety, One Health.*



ZAKARIA BOUZAR

**BIOCHEMICAL CHARACTERISATION AND TRADITIONAL USES
OF *CITRUS AURANTIUM* WITHIN A CIRCULAR ECONOMY
FRAMEWORK: PERSPECTIVES ON WASTE AND WASTEWATER
VALORISATION**

ZAKARIA BOUZAR^{1*}, HAFSA BOUZAR¹, WALID BOUSSIF¹, WALID AIT YAHIA¹ AND
WAFA TEROUZI¹

¹Laboratory of Engineering and Applied Technology, Higher School of Technology of Beni Mellal, Sultan
Moulay Slimane University, 23000- Beni Mellal, Morocco

*zakaria.bouzar@usms.ma

Abstract: *Citrus aurantium* (bitter orange) is widely used in traditional practices for food, medicinal, and aromatic purposes, generating significant amounts of organic waste and wastewater. This study investigates the biochemical characterisation and traditional use of *Citrus aurantium* within a circular economy framework, with a focus on waste and wastewater valorisation. Biochemical analyses revealed that peels are rich in phenolic compounds (32.5–48.7 mg GAE/g dry matter) and flavonoids (18.2–26.4 mg QE/g), and that essential oil yields reached 1.1–1.8% (w/w), dominated by limonene (>85%). Antioxidant activity showed high radical scavenging capacity, with DPPH inhibition values ranging from 65 to 78%. Traditional uses, including herbal remedies and food preservation, were found to align with these biochemical properties. Valorisation pathways demonstrated that citrus processing residues can be efficiently converted into bioactive extracts, compost, and bioenergy. Moreover, wastewater derived from processing exhibited a chemical oxygen demand (COD) reduction of up to 60% after bio-based treatment, enabling potential reuse for irrigation. These results highlight the strong potential of *Citrus aurantium* by-products in supporting sustainable waste management, wastewater recycling, and circular economy strategies.

Keywords: *Citrus aurantium*, Circular economy, Waste valorisation.



MAROUANE CHAHBOUNI MICROWAVE-ASSISTED HYDRODISTILLATION OF LAVANDULA MULTIFIDA: CHEMICAL PROFILE AND BIOLOGICAL ACTIVITIES

MAROUANE CHAHBOUNI^{*1}, MOHAMED AZIZI¹, HAFSA ELAINOUS¹, KARIMA
MAJDOULI¹, ASSIA DARDOURI¹, HAFIDA ELHICHOU DBILEN¹, WAFAA HERRADI¹,
NOUHAILA SAMINE¹, ABDESSAMAD AMINE¹

¹ Laboratory of Biochemistry, Environment and Agri-Food, Faculty of Science and Technology of
Mohammadia, Hassan II University Casablanca

*marouane.chahbouni-etu@etu.univh2c.ma

Abstract: This study aims to valorize *Lavandula multifida*, an aromatic and medicinal plant native to southern Morocco, through a comparative assessment of the chemical composition and biological activities of its essential oil (EO) and hydrosol (HD) obtained by microwave-assisted hydrodistillation. The essential oil yield reached 1.94%. Phytochemical screening revealed a higher concentration of phenolic compounds and flavonoids in the EO compared to the hydrosol, reflecting the lipophilic nature of the oil fraction. In the DPPH assay, the EO exhibited significantly stronger antioxidant activity ($IC_{50} = 4.82$ mg/mL) than the HD ($IC_{50} = 64.3$ mg/mL). The EO also demonstrated pronounced antimitotic activity, inhibiting both seed germination and root growth at low concentrations. Antimicrobial evaluation showed inhibitory effects of the EO against six bacterial strains, with minimum inhibitory concentrations (MICs) of 0.781% for *Escherichia coli* and 1.562% for *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Enterococcus faecalis*. Acute oral toxicity studies in mice indicated dose-dependent adverse effects above 1000 mg/kg, with 80% mortality observed at 2000 mg/kg. Overall, the essential oil represents the most biologically active fraction of *L. multifida*; its application requires careful consideration of dosage and safety parameters.

Keywords: *Lavandula multifida*, Essential oil, Antioxidant activity.



OTMANE DARBAL

**DETECTION OF CRITICAL SURFACE WATER POLLUTION ZONES
USING UNSUPERVISED LEARNING: APPLICATION OF SELF-
ORGANISING MAPS (SOM) TO THE INAOUEN WATERSHED
(MOROCCO)**

OTMANE DARBAL^{1*}, RACHID EL CHAAL², HAMID DALHI²

¹ENSA of Kenitra, Engineering Sciences Laboratory, Data Analysis, Mathematical Modelling and Optimization Team, Ibn Tofail University, Kenitra, Morocco.

* otmane.darbal@usmba.ac.ma

Abstract: The degradation of surface water quality represents a major challenge for the sustainable management of water resources, particularly in watersheds exposed to increasing socio-economic pressures. In this context, advanced data-driven approaches are required to efficiently analyse complex and multidimensional environmental datasets. This study proposes an unsupervised learning approach to detect critical surface water pollution zones in the Inaouen watershed, located in northeastern Morocco. A dataset consisting of 100 surface water samples collected between 2014 and 2015 was analysed. Each sample was characterised by 16 physicochemical parameters, including major ions, nutrients, and general water quality indicators. Kohonen's Self-Organising Maps (SOM) were applied to classify and visualize the data, preserving their topological structure. The SOM results were further refined using hierarchical clustering based on Ward's method, leading to the identification of five distinct clusters with specific chemical signatures. The analysis revealed the presence of a highly polluted cluster marked by extreme concentrations of ammonium, sodium, electrical conductivity, and total dissolved solids, indicating severe and localized anthropogenic contamination. The proposed methodology demonstrates strong potential as a decision-support tool for environmental monitoring, pollution assessment, and sustainable water resource management in semi-arid regions worldwide.

Keywords: *Self-Organising Maps (SOM), Surface Water Quality, Hierarchical Clustering.*



HANAA DBILIJ

**PREVENTION OF INFECTIOUS RISK IN TRAUMA AND
ORTHOPEDICS: A CRITICAL REVIEW OF ASEPTIC PRACTICES IN
THE OPERATING THEATRE**

HANAA DBILIJ^{1*}, MOHAMMED BOUHOUCHE^{1,2}, NISRINE GRIBA², NIHAD ELMAHILI,
MOHAMED RAFAI^{1,2}, SAMIR IBEN MOUSSA¹, MOHAMED RAHMI^{1,2}

¹Faculty of Medicine and Pharmacy, Hassan II University of Casablanca, Morocco.

²Department of Traumatology and Orthopedics, ward 32. Ibn Rochd University Hospital. Casablanca, Morocco.

*hanaa.dbilij-etu@etu.univh2c.ma

Abstract: Surgical site infections represent a serious complication in trauma and orthopaedic surgery, potentially compromising functional outcomes and increasing morbidity and healthcare costs. Although international guidelines strictly regulate aseptic protocols, variations in their implementation persist. This review aims to analyse the scientific evidence regarding the effectiveness of key aseptic practices in the operating theatre. A narrative literature review was conducted using recognised biomedical databases, including PubMed, Cochrane, and Science Direct. Recent publications, institutional guidelines, and high-level evidence studies focusing on hand hygiene, surgical attire, the use of sterile gloves, and surgical draping were selected and analysed. The evidence indicates that strict adherence to aseptic protocols is associated with a significant reduction in the incidence of surgical site infections. Hand hygiene and the standardisation of surgical attire emerge as high-impact measures. Variation in practices remains evident across institutions and surgical teams. These findings highlight the need to strengthen professional training, practice evaluation, and continuous quality improvement initiatives. Promoting a culture of safety and fostering the adoption of evidence-based recommendations are essential strategies for optimising quality of care and achieving a sustained reduction in infectious risk.

Keywords: *Surgical site infections, Aseptic practices, Infection prevention.*



SALMA DOUMAOUI

HEALTHCARE ASSOCIATED INFECTIONS

DOUMAOUI SALMA^{1*}, CHKIRATE KARIM¹ AND FAHSI KARIM²

¹ Laboratory of Heterocyclic Organic Chemistry, Department of Chemistry
Faculty of Science, Mohammed V University in Rabat, Morocco.

² Higher Institute of Nursing and Health Technology Professions, Rabat.

*Doumaouisalma2@gmail.com

Abstract: Healthcare-associated infections represent a persistent challenge to global health systems, threatening patient safety and contributing to extended hospitalization, adverse clinical outcomes, and escalating healthcare expenditures. The increasing prevalence of antimicrobial-resistant organisms further complicates prevention and management efforts, particularly within highly specialized and technology-driven care environments. Addressing this issue requires structured and evidence-based interventions that integrate surveillance systems, risk assessment, and standardised infection prevention protocols. This work is based on a bibliographic study conducted through a critical analysis of published scientific literature addressing healthcare-associated infections and prevention approaches. The objective is to synthesize current knowledge regarding their epidemiology, clinical consequences, and implications for healthcare quality. Special attention is given to infection prevention and control programs, compliance with hygiene practices, and institutional strategies aimed at reducing transmission. Strengthening structured prevention frameworks and promoting multidisciplinary collaboration are essential to achieve sustainable improvements in patient safety and overall healthcare performance.

Keywords: *Healthcare-Associated Infections, Infection Prevention and Control , Antimicrobial Resistance Healthcare, Quality Improvement, Public Health.*

FATIMA EL ASRI
EVALUATING ECOLOGICAL QUALITY, BIODIVERSITY, AND
SPATIOTEMPORAL CHANGES OF MACROZOOBENTHIC
ASSEMBLAGES IN DAKHLA BAY, MOROCCO

EL ASRI FATIMA^{1*}, ERRHIF AHMED¹, TAMSOURI MOHAMED-NAOUFAL², EL FIHRI
FATIMAZAHRA¹, ELGARINI MERYEM¹, MARTIN DANIEL³, ZIDANE HAKIMA⁴

¹Health and Environment Laboratory, Faculty of Sciences Ain Chock, University Hassan II, B.P. 5366 Maârif,
20100 Casablanca, Morocco.

²Specialized Center in Zootechny and Marine Aquaculture Engineering, National Institute of Fisheries
Research, BP. 31, 93200 M'diq, Morocco.

³Centre for Advanced Studies of Blanes (CEAB-CSIC), Accés a la Cala St. Francesc, 14 Blanes 17300, Girona,
Catalunya, Spain.

⁴Departement of fish, Prospection of Littoral Resources Laboratory, National Institute for Fisheries Research
(INRH), Road Sidi Abderrahmane Club Equestre Ould Jmel – Casablanca, Morocco.

* fatimaelasri25@gmail.com

Abstract: The benthic macrofauna of Dakhla Bay plays a key role in the functioning of this highly productive semi-enclosed ecosystem, this study provides a comprehensive assessment of both spatial and temporal structure of macrozoobenthos and their relationships with environmental factors. Samples collected in spring 2013 and winter 2014 yielded 94 species, mainly mollusks, polychaetes, and crustaceans. Mollusks dominated in abundance – particularly in spring– followed by crustaceans, and polychaetes. Species richness and densities were higher in spring, and the assemblages showed a marked south-north gradient, while winter assemblages were less diverse and more spatially homogeneous. Eight trophic-functional groups were identified, with surface deposit feeders being the most abundant. Multivariate analysis revealed three assemblages in both seasons. These assemblages represent a continuum from organically enriched, fine-grained inner-bay habitats dominated by opportunistic species to coarser, well-oxygenated outer-bay environments supporting more diverse and mature communities. The overall ecological status of the bay assessed through M-AMBI, ranged from "good" to "very good", although localized degradation was observed near anthropogenically impacted areas. This study expands the current understanding of Dakhla Bay's benthic ecosystem, confirming its high biodiversity and highlighting the need for long-term monitoring and integrated management to safeguard its ecological integrity and services.

Keywords: *Macrozoobenthos, Community structure, Spatial-temporal variation, Ecological status, Dakhla Bay, Morocco.*



ZAKARIA EL FATOUAKI

PHYSICAL PROPERTIES OF NOVEL Sr_2BNbO_6 (B = AL, GA) DOUBLE PEROVSKITE OXIDES: AN *AB INITIO* STUDY ZAKARIA EL FATOUAKI^{1*}, ABDERAHHIM JABAR^{2,3}, ABDELLAH TAHIRI^{4,5} AND MOHAMED IDIRI¹

¹LCMP, Laboratory of Condensed Matter Physics, Hassan II University, Faculty of Sciences Ben M'Sik, B.P. 7955, Casablanca, Morocco

² LMHEP, Faculty of Sciences Ain Chock, Hassan II University, B.P. 5366 Casablanca, Morocco

³ LPHE-MS, Science Faculty, Mohammed V University in Rabat, Rabat, Morocco

⁴ LPMC Laboratory, Theoretical Physics Group, Faculty of Sciences, Chouaib Doukkali University, 24000 El Jadida, Morocco

⁵ LPAIS, Faculty of Sciences, Sidi Mohamed Ben Abdellah University, B.P.1796, Fez Atlas, Morocco

* zakariaelfatouaki5@email.com

Abstract: First-principles density functional theory (DFT) calculations were performed to investigate the structural, mechanical, electronic, optical, and phononic properties of the cubic double perovskite oxides $\text{Sr}_2\text{AlNbO}_6$ and $\text{Sr}_2\text{GaNbO}_6$. Structural stability was evaluated using the Goldschmidt tolerance factor, confirming the formation of stable cubic perovskite structures. The calculated negative formation energies (-3.059 eV for $\text{Sr}_2\text{AlNbO}_6$ and -3.367 eV for $\text{Sr}_2\text{GaNbO}_6$) indicate strong thermodynamic stability. Mechanical stability was verified through elastic constants satisfying the Born–Huang stability criteria for cubic crystals. Phonon dispersion calculations revealed the absence of imaginary frequencies, confirming the dynamical stability of both compounds. Elastic anisotropy analysis indicates mechanically anisotropic and brittle behaviour, supported by anisotropy factors deviating from unity and Poisson's ratio values below 0.26. Electronic band structure calculations show that both materials are direct band gap semiconductors, with band gap values of 2.860 eV for $\text{Sr}_2\text{AlNbO}_6$ and 3.027 eV for $\text{Sr}_2\text{GaNbO}_6$. Optical property analysis reveals strong absorption in the energy range of 0–12 eV, highlighting their potential for optoelectronic applications. Overall, the combination of structural robustness, thermodynamic and dynamical stability, favourable electronic properties, and strong optical response suggests that Sr_2BNbO_6 (B = Al, Ga) double perovskite oxides are promising candidates for optoelectronic devices and high-temperature applications.

Keywords: Double perovskite oxides; Optoelectronic properties.



SANAA ELMAHDAOUI

**SOFT SKILLS AND RISK MANAGEMENT: A PROFESSIONAL
CENTRED APPROACH**

ELMAHDAOUI SANAA^{1*}, BOUZINI GHIZLAN², SBAI HICHAM³

¹Laboratory of Life and Health Sciences Research, Faculty of Medicine and Pharmacy of Tangier (FMPT), Abdelmalek Essaâdi University (UAE), Tangier, Morocco.

²Research Laboratory on Cancer and Chronic Diseases, Faculty of Medicine and Pharmacy of Tangier, Abdelmalek Essaâdi University (UAE), Morocco.

³Laboratory of Life and Health Sciences Research, Tangier Sim Centre, Faculty of Medicine and Pharmacy of Tangier (FMPT), Department of Anaesthesia and Intensive Care A, Mohammed VI University Hospital Centre of Tangier, Abdelmalek Essaâdi University (UAE), Morocco.

* sanaa.elmehdaoui@etu.uae.ac.ma, elmahdaouisanaa1@gmail.com

Abstract: Risk management in healthcare has traditionally focused on technical skills. Soft skills are now recognised as critical determinants of effective risk management, particularly in high-risk clinical care. This study explored nurse anaesthetists' (IADE) perceptions of the importance of soft skills in risk management and patient safety. An observational study was conducted among IADE at Tangier University Hospital (CHU). Data were collected using a self-administered Likert-scale questionnaire assessing training in soft skills, perceived importance, and impact on risk management. Descriptive and inferential statistical analyses were performed. More than half of participants (56.1%) reported no formal training, although 75.6% rated soft skills as very important. Nearly 97.6% believed that deficiencies compromise patient safety. Reported difficulties concerned interprofessional communication (25%) and stress management (20.7%). Most participants had witnessed errors linked to communication failures (78.1%), teamwork deficiencies (43.9%), or inadequate task management (65.9%). These findings highlight a gap between the recognised importance of soft skills and insufficient structured training. Soft skills are essential for effective risk management in critical care practice. Structured educational strategies, particularly simulation-based training, could strengthen these competencies and promote a sustainable safety culture.

Keywords: *Soft skills, Risk management, Perception, Critical care.*



HAJAR ELMOURABIT

GENOMIC EVIDENCE OF CIPROFLOXACIN RESISTANCE IN MOROCCAN SALMONELLA ENTERITIDIS: A NEW CONCERN?

ELMOURABIT HAJAR^{1,4}, SORAA NABILA², GERMAN KOPPRIO³, KARRAOUAN BOUCHRA⁴, BOUCHRIF BRAHIM⁴, ELJAOUAHIRY SOUKAINA⁵, ELMEHRACH KHADIJA^{1,6}

^{1,3}Laboratory of Plant Biotechnology, Faculty of Sciences, Ibn Zohr University, Agadir, Morocco

²Microbiology Laboratory, University Hospital Mohamed VI, Marrakesh, Morocco

³Robert Koch Institute, Berlin, Germany

⁴Laboratory of Food Microbiology, Pasteur Institute, Casablanca, Morocco

⁵Laboratory of Chemistry-Biochemistry, Environment, Nutrition and Health, Faculty of Medicine and Pharmacy of Casablanca, Hassan II university, Morocco.

⁶Department of Environment and Life Sciences, Faculty of Applied sciences, Ait Melloul, University of Ibn Zohr, National Road N°. 10, Box 6146, Agadir-Morocco

* hajar.elmourabit.94@edu.uiz.ac.ma

Abstract: *Salmonella enterica* serovar Enteritidis is a leading cause of foodborne and invasive infections worldwide, and ciprofloxacin remains a key treatment option; fluoroquinolone resistance represents an increasing public health concern. In Morocco, ciprofloxacin-resistant *S. Enteritidis* confirmed by molecular analysis has not previously been documented. This study aimed to characterise the first ciprofloxacin-resistant *S. Enteritidis* isolate recovered from a human clinical case. Between 2018 and 2024, sixty *Salmonella* isolates were collected at the Mohammed VI University Hospital Centre in Marrakech, identified by MALDI-TOF MS, serotyped using the Kauffmann–White scheme, and tested for antimicrobial susceptibility. Whole-genome sequencing revealed that 5% of isolates were ciprofloxacin-resistant, including one *S. Enteritidis* strain carrying a D87Y mutation in *gyrA* and efflux pump genes (*mdsA/mdsB*), together with virulence determinants within SPI-1 and SPI-2. These findings highlight the need for strengthened molecular surveillance in Morocco.

Keywords: Ciprofloxacin, *Salmonella*, *gyrA* mutation; Whole-genome sequencing

KHADIJA ELWARDI

QUALITY MANAGEMENT AND PATIENT SAFETY SYSTEM AT THE REGIONAL HOSPITAL CENTRE IN NORTHERN MOROCCO

KHADIJA ELWARDI^{1*}, HAJAR OUAKOUROU^{1,2}, NADIRA MOURABIT², MOHAMMED BAKKALI¹, AMIN LAGLAOUI¹

¹Research Team in Biotechnology & Biomolecules Engineering (ERBGB), Faculty of Science and Technology of Tangier, Abdelmalek Essaâdi University, Tangier, Morocco.

²Laboratory of Research and Development in Engineering Sciences, Faculty of Science and Technology-Al Hoceima, Abdelmalek Essaâdi University, Al Hoceima, Morocco.

*Khwardi17@Gmail.Com

Abstract: Hospital systems are currently evolving in a complex, dynamic and constantly changing environment, leading to continuous transformations. Their performance depends on their agility and ability to meet the requirements of different stakeholders. The implementation of a quality and patient safety management system has therefore become a major concern for decision-makers and provides responses to numerous issues that currently represent significant challenges for hospitals. In this context, the present study aims to empirically assess the quality and risk management system implemented at a regional hospital centre in northern Morocco (RHC), in order to identify its managerial and technical contributions and constraints.

For this study, the perceptions of 77 managers and responsible stakeholders (67 from the RHC, 2 from the provincial delegation and 8 from the regional directorate) were collected through a qualitative study conducted over seven months, using pre-tested semi-structured individual face-to-face interviews. Despite the contributions of this quality and risk management system, its implementation encountered several cultural, managerial and organisational difficulties. Among the 70 hospital managers surveyed, 51 (73.33%) reported that this approach had not achieved its intended objectives at the RHC, which had been considered a pilot site. This was attributed to several barriers related to hospital leadership, internal communication, resource management, staff engagement, the development of a safety culture, and other technical challenges. Strong commitment from hospital management, together with staff motivation, therefore remains a key factor in the successful implementation of quality and patient safety systems.

Keywords: *Public hospital; Patient safety; Management; Quality of care; Quality management.*



MERIEM FEDOUI

IMPLEMENTATION OF THE ISO 15189:2022 QUALITY APPROACH IN PRE-ANALYTICAL AND ANALYTICAL PHASES: CASE OF THE PASTEUR INSTITUTE OF MOROCCO

FEDOUI MERIEM^{1,2*}, SIHAM BENNANI², HICHAM MOHAMMADI², JOUMANA EL TURK³,
ILHAM BADREDDINE¹

¹ Biochemistry Laboratory, Neurosciences, Natural Resources and Environment, Faculty of Sciences and
Technology of Settat, Hassan I University, Settat, Morocco.

² Pasteur Institute of Morocco

³ Faculty of Health Sciences, Department of Fundamental Sciences, International University of Casablanca,
Casablanca, Morocco

*meriamfedoui@gmail.com

Abstract: Quality in medical biology is a fundamental pillar for ensuring patient safety. This work presents the transition to the ISO 15189:2022 standard within the biochemistry department of the Pasteur Institute of Casablanca, aiming for operational excellence and accreditation. A structured approach based on the PDCA cycle was adopted. We performed an initial self-assessment using the SEMAC grid to evaluate compliance. Critical risks were identified through the FMEA (AMDEC) method, followed by the development of an action plan including the creation of a specific documentary system. The initial audit revealed an overall compliance rate of 54.57%. Key actions focused on documented information control, management of transport anomalies, and technical validation of analytical methods. The quality system was strengthened by introducing non-conformity forms and risk registers to ensure better traceability. Implementing this approach harmonises practices and increases the reliability of results. This project highlights that staff involvement and risk management are key success factors for achieving accreditation.

Keywords: ISO 15189:2022, Medical biology, Quality management, Risk assessment.

MAROINE FLOUCHI

**PHYTOCHEMICAL PROFILE AND ANTIOXIDANT,
ANTIMICROBIAL, AND ANTIDIABETIC POTENTIALS OF
MOROCCAN MYRTUS COMMUNIS L. ESSENTIAL OIL THROUGH
IN VITRO AND IN SILICO TESTS**

MAROINE FLOUCHI*¹, KAWTAR FIKRI-BENBRAHIM², RACHID FLOUCHI^{2,3}, KARIM
CHKIRATE¹, REDOUANE ACHOUR¹, KARIM FAHSI^{1,4}

¹Laboratory of Heterocyclic Organic Chemistry URAC 21, Pharmacochemistry Competence Centre, Av. Ibn Battouta, BP 1014, Faculty of Sciences, Mohammed V University in Rabat, 10010 Rabat, Morocco.

²Laboratory of Microbial Biotechnology and Bioactive Molecules, Sciences and Technologies Faculty, Sidi Mohamed Ben Abdellah University, Fez, P. O. Box 2202, Morocco

³Ministry of Health and Social Protection, Higher Institute of Nursing and Health, Fez, Annex Taza B.P. 35000, Morocco

⁴Ministry of Health and Social Protection, Higher Institute of Nursing and Health, Rabat B.P 4502, Morocco

*maroine.flouchi@um5.ac.ma

ABSTRACT: *Myrtus communis* L. (myrtle) is a Mediterranean medicinal plant traditionally used for infectious and metabolic disorders. This study characterised the phytochemical profile of *M. communis* essential oil (MCEO) from Northern Morocco and evaluated its antioxidant, antimicrobial, and antidiabetic activities using in vitro and in silico approaches. Aerial parts collected in Ghafssai (Taounate, Morocco) yielded 0.65% (v/w) essential oil by hydrodistillation. GC–MS analysis identified 17 constituents representing 98% of the oil, mainly eucalyptol (54.84%), p-cymene (19.42%), and α -pinene (6.57%). MCEO demonstrated antioxidant activity, with DPPH and FRAP IC₅₀ values of 77.21 ± 1.28 and 80.12 ± 2.85 μ g/mL, comparable to butylated hydroxytoluene. It exhibited broad antimicrobial activity against Gram-positive and Gram-negative bacteria and yeasts, with MIC values ranging from 0.0195 to 0.0781% (v/v) and predominantly bactericidal or fungicidal effects. Enzyme inhibition assays indicated antidiabetic potential, with IC₅₀ values of 0.179 ± 0.091 mg/mL for α -amylase and 0.086 ± 0.017 mg/mL for α -glucosidase. ADMET and drug-likeness analyses predicted favourable oral absorption and no major toxicity alerts for the principal compounds. Molecular docking confirmed favourable binding of dominant monoterpenes to oxidative, microbial, and carbohydrate-hydrolysing enzyme targets. Moroccan MCEO represents a promising multi-target natural source for antioxidant, antimicrobial, and antidiabetic applications, supporting further in vivo investigation.

Keywords: *Myrtus communis*, Essential oil, Antioxidant, Antimicrobial, Antidiabetic.



AMINA GIHBID

SEXUALLY TRANSMITTED INFECTIONS AMONG MOROCCAN WOMEN: ASSESSMENT OF KNOWLEDGE AND ASSOCIATED DETERMINANTS

GIHBID AMINA^{1,2*}, SOUALI MANAL³, BABA HANÂ², NARJIS MYRIEM¹, NOUADI BADREDDINE^{4,5}, ABIDI OMAR¹, KHYATTI MERIEM²

¹Higher Institute of Nursing and Health, Ministry of Health and Social Protection, Casablanca-Settat, Morocco.

²Institut Pasteur du Maroc, Casablanca, Morocco.

³Private University of Marrakech (PUM), Marrakech, Morocco

⁴ Higher Institute of Nursing and Health, Ministry of Health and Social Protection, Marrakech-Safi, Morocco.

⁵ Laboratory of Integrative Biology, Faculty of Sciences Aïn Chock, Hassan II University of Casablanca, Morocco

*gihbidamina@gmail.com

Abstract: Effective control of sexually transmitted infections (STIs) relies on prevention, awareness, and improved population knowledge. STIs remain a major public health concern in Morocco, yet data on women's knowledge remain limited. This study aimed to assess Moroccan women's level of knowledge regarding STIs and to identify associated factors. A cross-sectional study was conducted among 170 women, mainly from the Casablanca–Settat region, using an anonymous questionnaire between March and May 2025. Group comparisons were performed using the Chi-square test. The findings showed that 45% and 30% of participants had low and moderate knowledge levels, respectively. HIV/AIDS was the most recognised infection (86.5%). Most women were unaware of STI screening programmes (68.8%), and 84.1% had never been tested. Nearly 45% reported no knowledge of STI symptoms; others identified signs such as abnormal vaginal discharge and genital itching. Social barriers were frequent: 67.8% reported difficulty discussing STIs, and 55.3% lacked access to sexual health information. Area of residence, marital status, and education level were significantly associated with knowledge ($p < 0.05$). In conclusion, culturally adapted education and improved access to information are needed to strengthen STI prevention and management in Morocco.

Keywords: Sexually transmitted infections, Knowledge, Women, Morocco.

SAAD HARRIZI

BULMA: A STRESS-RESPONSIVE ATLAS OF ATP-BINDING CASSETTE TRANSPORTERS IN *SACCHAROMYCES CEREVISIAE* USING ACTIVE LEARNING AND CAUSAL INFERENCE

SAAD HARRIZI^{1*}, EDDOUMY SALMA², JARJINI SOUKAYNA², IMANE NAIT IRAHAL¹, MOSTAFA KABINE¹

¹Laboratory of Health, Environment and Biotechnology (LSEB), Faculty of Sciences Ain Chock, Hassan II University of Casablanca, BP 5366 Maarif, Casablanca 20100, Morocco

²Laboratory of Health, Environment and Biotechnology, Team of Physiopathology, Molecular Genetics and Biotechnology, Faculty of Sciences Ain Chock, Hassan II University of Casablanca, 20100 Casablanca, Morocco

*saadharrizi0@gmail.com

Abstract: ATP-binding cassette (ABC) transporters regulate yeast stress responses and drug resistance, yet their function remains context-dependent and incompletely understood. Traditional screening methods cannot distinguish causal effects from simple associations between stress conditions and transporter activity. We developed BULMA, an integrative computational framework combining active learning with Gaussian Process models across 260 ligands and 28 transporters, doubly robust causal inference, and gradient boosting for predictive modelling, with bootstrap validation and comparison with independent datasets. BULMA achieved strong predictive performance ($R^2 = 0.83$, RMSE = 0.42 μM) and revealed marked stress-specific behaviour. SNQ2 shifted function depending on stress type, acting as a xenobiotic pump under oxidative stress but showing reduced activity under osmotic stress. Within the PDR family, energy-related trade-offs emerged, with PDR5 and YOR1 maintaining resistance, whereas PDR10, PDR11, and PDR18 reduced fitness under nutrient limitation. ATM1 was identified as a regulator coordinating MDL1 and MDL2, and causal analysis separated 47 true relationships from 83 correlations. BULMA provides a causally grounded, stress-aware atlas of ABC transporter function in yeast. Transporter activity must be interpreted within its stress context, challenging single-condition screening in drug discovery and supporting the engineering of stress-tolerant strains and prediction of antifungal resistance.

Keywords: ABC transporters, *Saccharomyces cerevisiae*, Causal inference.



NOZHA KACHI

**QUALITY OF LIFE OF HAEMODIALYSIS PATIENTS: A
COMPARATIVE STUDY OF PUBLIC AND PRIVATE DIALYSIS
CENTRES**

KACHI NOZHA^{1*}, DERKAOU TOURIA², ASSEM MARYAM³

¹Life and Health Sciences Research Laboratory, CED in Science and Technology and Medical Sciences (CED-STSM), Faculty of Medicine and Pharmacy of Tangier (FMPT), Abdelmalek Essaâdi University (UAE), Higher Institute of Nursing and Health, Tangier, Morocco.

²Higher Institute of Nursing and Health of Tangier, Ministry of Health, Tangier, Morocco.

³Life and Health Sciences Research Laboratory, Faculty of Medicine and Pharmacy of Tangier (FMPT), Nephrology Department, Mohammed VI University Hospital of Tangier, Morocco.

* kachinozha1@gmail.com, *nozha.kachi@uae.ac.ma

Abstract: Chronic kidney disease represents a major public health challenge, affecting patients' quality of life, which may be influenced by several factors, including the structure of care in private or public settings. An observational cross-sectional study was conducted to compare the quality of life of 80 haemodialysis patients in public and private centres using the validated KDQOL-SF questionnaire, taking into account disease-specific constraints. Patients undergoing dialysis were more satisfied in the private centre regarding walking ability (51%; $p = 0.007$) and travel (48%; $p = 0.034$). The type of sector did not influence satisfaction with overall health or the impact of chronic kidney disease on daily life. A majority (63%) reported significant financial difficulties in the public sector ($p = 0.001$), largely associated with employment status, as 63% of patients in the public sector were unemployed ($p < 0.001$). Social support and support from the care team were comparable in both sectors. Beyond the structure of care, multiple constraints related to disease severity continue to shape quality of life.

Keywords: *Chronic kidney disease, Quality of life, Haemodialysis.*



BOUTAINA KASDI

DIAGNOSIS AND COMPLICATIONS OF SARCOPENIC OBESITY IN OLDER ADULTS

BOUTAINA KASDI^{1*}, ABDELLATIF BOUR¹, SOUAD KHAL LAYOUN¹ AND FATINE EL ARABI²

¹Natural Resources and Sustainable Development Laboratory, Department of Biology, Nutrition, Food and Health Sciences Research Team, Faculty of Sciences of Kenitra, Ibn Tofail University, Kenitra, Morocco

²Nursing and Health Biology Research Team, Higher Institute of Nursing and Health Techniques, Casablanca, Morocco

*boutainakasdi@gmail.com

Abstract: Sarcopenic obesity is an emerging geriatric condition defined by the coexistence of excessive adiposity and a significant reduction in both muscle mass and muscle function. This multifactorial syndrome, frequently observed in older adults, represents a dual metabolic and functional burden, contributing to accelerated health deterioration. Diagnosis is based on an integrated assessment of several components: a body mass index (BMI) ≥ 30 kg/m², reduced muscle strength, impaired physical performance, and low appendicular skeletal muscle mass, measured using dual-energy X-ray absorptiometry or bioelectrical impedance analysis. Clinically, sarcopenic obesity is associated with a wide range of complications, including an increased risk of falls and fractures, reduced functional capacity, cognitive decline, insulin resistance, chronic low-grade inflammation, and increased vulnerability to cardiovascular disease. It is also considered an independent predictor of disability, recurrent hospitalisation, and premature mortality. This synthesis highlights the urgent need for early detection based on validated and accessible screening tools and underscores the importance of a multidisciplinary preventive and therapeutic approach combining nutrition, physical activity, and metabolic monitoring to mitigate the functional and systemic impact of this often under-recognised condition

Keywords: *Sarcopenic obesity, Older adults, Geriatric complications.*



IBTISSAM KHOUDIRI

**DIFFERENCES IN PHYSICAL QUALITIES AND LOWER-LIMB
ASYMMETRIES IN FEMALE SOCCER PLAYERS WITH A HISTORY
OF ANKLE SPRAIN: A COMPARATIVE STUDY**

KHOUDIRI IBTISSAM¹, NANI SAMIRA^{1,2}, BENDAHOU KARIMA^{1,2}, LMIDMANI FATIMA¹

¹Laboratory of Cellular and Molecular Pathophysiology of Inflammatory, Degenerative and Oncological Diseases, Faculty of Medicine and Pharmacy, Hassan II University, Morocco;

²Epidemiology Laboratory, Faculty of Medicine and Pharmacy, Hassan II University, Morocco

ibtissam.khoudiri-etu@etu.univh2c.ma (KI); nanisamira@hotmail.com (NS); bendahhou.karima@gmail.com (BK); flmidmani@gmail.com (LF)

Abstract: Ankle sprains are among the most prevalent injuries in female soccer and are associated with a high risk of recurrence and persistent functional deficits. Lower-limb asymmetries and impairments in physical qualities have been identified as potential contributors to injury recurrence; evidence focusing specifically on female soccer players remains limited. The purpose of this study is to compare physical qualities and inter-limb asymmetries between female soccer players with a history of ankle sprain and those without previous ankle injury. This comparative study will involve two groups of competitive female soccer players: a group with a previous ankle sprain and a control group without a history of ankle injury. Participants will undergo a battery of standardised physical tests assessing strength, power, agility, balance, and functional performance. Inter-limb asymmetries will be calculated based on performance differences between dominant and non-dominant lower limbs. Statistical analyses will be conducted to identify differences in physical performance outcomes and asymmetry indices between groups. This study aims to enhance understanding of the long-term effects of ankle sprain on physical qualities and lower-limb asymmetries in female soccer players. The findings are expected to provide practical insights for injury prevention strategies, rehabilitation protocols, and return-to-sport decision-making, with particular consideration of the specific demands of women's soccer.

Keywords: *Female soccer, Ankle sprain, Lower-limb asymmetry.*



MANAR MAKHLOUK

BREASTFEEDING DURING THE FIRST 1000 DAYS: A MAJOR PREVENTIVE LEVER AGAINST METABOLIC AND NEUROCOGNITIVE DISORDERS IN CHILDREN

MAKHLOUK MANAR^{1*}, BOUR ABDELLATIF¹, KHAL LAYOUN SOAD¹ AND EL ARABI FATINE²

¹Laboratory of Natural Resources and Sustainable Development, Department of Biology, Nutrition, Food and Health Sciences Research Team, Faculty of Sciences of Kenitra, Ibn Tofail University, Kenitra, Morocco

²Nursing and Health Biology Research Team, Higher Institute of Nursing and Health Techniques, Casablanca, Morocco

[*manarmakhlouk@gmail.com](mailto:manarmakhlouk@gmail.com)

Abstract: The first 1,000 days of life represent a critical window for the short- and long-term programming of child health. During this sensitive period, early-life exposures can have lasting effects on metabolic, immunological, and neurodevelopmental outcomes. Among postnatal determinants, breastfeeding plays a central role given its distinctive nutritional, biological, and functional nature. Numerous studies indicate that breastfeeding contributes to early metabolic programming by promoting improved energy homeostasis and appetite self-regulation, which are associated with a reduced risk of childhood obesity. Breast milk also plays a major role in the establishment and diversification of the infant gut microbiota, particularly through its high content of human milk oligosaccharides that selectively promote beneficial bacterial growth and support immune system maturation. In addition, the provision of essential fatty acids, including DHA and ARA, together with various bioactive compounds present in human milk, supports optimal brain development and enhances neurocognitive potential, notably through interactions along the gut–brain axis. Taken together, these effects highlight the central role of breastfeeding during the first 1,000 days of life as a major preventive lever in health promotion strategies and in the long-term programming of child health.

Keywords: *First 1,000 days; Breastfeeding; Metabolic programming; Gut microbiota.*



FEDWA MELAYLOU MAPPING THE EVOLUTION OF MOLECULAR TECHNIQUES FOR DETECTING METHICILLIN-RESISTANT *STAPHYLOCOCCUS* *AUREUS*: A BIBLIOMETRIC PERSPECTIVE

FEDWA MELAYLOU^{1*}, MANAL NAFI^{2,3}, HAJAR OUAKOUROU^{2,3}, NADIRA MOURABIT³,
RAJAA CHAHBOUNE¹

¹Research Laboratory of Life and Health Sciences, Department of Fundamental Pre-clinical Sciences, Faculty of Medicine and Pharmacy, Tangier, Abdelmalek Essaâdi University, Tetouan, Morocco, fedwa.melaylou@uae.ac.ma, chahboune82raja@yahoo.fr.

²Research Team in Biotechnology & Biomolecules Engineering (ERBGB), Faculty of Science and Technology of Tangier, Abdelmalek Essaâdi University, Tangier, Morocco, Nafaimanal@gmail.com, ouakourouhajar29@gmail.com.

³Laboratory of Research and Development in Engineering Sciences, Faculty of Science and Technology-Al Hoceima, Abdelmalek Essaâdi University, Al Hoceima, Morocco, nadirauniver@gmail.com.

*fedwa.melaylou@uae.ac.ma

Abstract: Methicillin-resistant *Staphylococcus aureus* (MRSA) is a pathogen of major global concern because of its high level of antibiotic resistance and its involvement in severe hospital-acquired infections. To examine the evolution and structural dynamics of research on the molecular identification of MRSA, a bibliometric analysis was conducted using publications indexed in the Scopus database between 2005 and 2025. The analysis was performed using the Biblioshiny interface of the R/Bibliometrix package and included 435 scientific documents. The results indicate a relatively stable research output over the two-decade period, with a modest annual growth rate of -1.43%. Scientific production peaked between 2007 and 2014, reflecting a period of heightened interest in developing and validating molecular detection strategies for MRSA. The most frequently cited publication was authored by Köck *et al.* (2009) and published in the *European Journal of Clinical Microbiology & Infectious Diseases*, accumulating 174 citations. Geographically, China emerged as the leading contributor to the field, followed by the United States, France, and Japan. Keyword analysis revealed a strong emphasis on diagnostic and experimental dimensions, with recurrent terms such as “Methicillin-resistant *Staphylococcus aureus*”, “*Staphylococcus aureus*”, “nonhuman”, and “polymerase chain reaction”. Source analysis further showed a concentration of publications in a limited number of specialized microbiology and infectious disease journals. Overall, this study highlights the main trends, influential actors, and thematic priorities shaping research on the molecular identification of MRSA.

Keywords: *Staphylococcus aureus*, MRSA, Antibiotic resistance, Molecular identification.



OUTHMAN MOUSSI

**QUALITY AND RISK MANAGEMENT IN MEDICAL AND
PHARMACEUTICAL WASTE HANDLING: ASSESSMENT OF
HOSPITAL PRACTICES AND IMPROVEMENT PERSPECTIVES**

OUTHMAN MOUSSI^{1*}, KARIM FAHSI^{2,1}, KARIM CHKIRATE¹

¹Laboratory of Heterocyclic Organic Chemistry, Faculty of Sciences of Rabat, Mohammed V University, Morocco

²Higher Institute of Nursing and Health, Rabat, Morocco

*outhmanmoussi127@gmail.com

Abstract: Medical and pharmaceutical waste management is a key component of healthcare quality and risk management. Inadequate handling of this process compromises patient safety, exposes healthcare workers to biological and chemical hazards, and increases environmental risks. This study aims to assess medical and pharmaceutical waste management practices at the Provincial Hospital of Kenitra from a quality and risk management standpoint and to evaluate their compliance with Moroccan regulations and international guidelines. A mixed descriptive and analytical methodology was adopted. The quantitative component was based on a questionnaire administered to 186 healthcare professionals working in various care units. The qualitative component included direct observation of internal waste circuits, analysis of collection and storage processes, and semi-structured interviews with hospital managers. The results highlight several dysfunctions affecting quality and safety, including incomplete waste segregation according to service activity, insufficient traceability, irregular labelling, lack of appropriate transport carts, and storage facilities that do not comply with hygiene, ventilation, and safety standards. These shortcomings increase occupational and environmental risks and weaken the hospital quality approach. The study emphasises the need to integrate medical waste management into a structured quality improvement and risk prevention strategy within healthcare institutions.

Keywords: *Quality management, Medical and pharmaceutical waste, Risk management.*



MANAL NAFI

UROPATHOGEN SPECTRUM AND ANTIMICROBIAL RESISTANCE PATTERNS IN HOSPITALS AND COMMUNITY-ACQUIRED URINARY TRACT INFECTIONS AT AL HOCEIMA HOSPITAL CENTRE, MOROCCO

MANAL NAFI^{1,2*}, HAJAR OUAKOUROU^{1,2}, FADWA MELAYELOU³, ASSIA BOUHOUDAN², RAJAE CHAHBOUN³, MOHAMMED BAKKALI¹, NADIRA MOURABIT²

¹ Research Team in Biotechnology & Biomolecules Engineering (ERBGB), Faculty of Science and Technology of Tangier, Abdelmalek Essaâdi University, Tangier, Morocco.

² Laboratory of Research and Development in Engineering Sciences, Faculty of Science and Technology-Al Hoceima, Abdelmalek Essaâdi University, Al Hoceima, Morocco.

³ Biology Molecular Unit, Life and Health Sciences Laboratory, Faculty of Medicine and Pharmacy of Tangier, Abdelmalek Essaâdi University, Tangier, Morocco.

* nafaimanal@gmail.com

Abstract: Urinary tract infections (UTIs) are among the most frequent bacterial infections in both hospital and community settings, and rising antimicrobial resistance increasingly limits empirical treatment options. This study describes the distribution of uropathogens and their antimicrobial resistance patterns among hospitalised and community patients at Al Hoceima Hospital Centre, Morocco. A prospective observational study was conducted over one year using routine urine culture (ECBU) data from the microbiology laboratory. Bacterial identification and antimicrobial susceptibility testing were performed according to EUCAST guidelines. Pathogen distribution and resistance profiles were compared between hospital-acquired and community-acquired UTIs. A total of 104 non-duplicate urinary isolates were analysed. Gram-negative bacteria predominated, representing 93.3% (97/104) of isolates. *Escherichia coli* was the most common pathogen (58.7%, 61/104), followed by *Klebsiella* species (23.1%, 24/104). Other Enterobacterales accounted for 11.5% (12/104), and Gram-positive cocci represented 6.7% (7/104). Among *E. coli* isolates, resistance to β -lactams, particularly third-generation cephalosporins, was observed in 31.1% (19/61). Resistance to ciprofloxacin and trimethoprim sulfamethoxazole reached 50.8% (31/61) and 44.3% (27/61), whereas resistance to carbapenems and amikacin remained low (6.6% and 4.9%). Higher resistance rates and multidrug-resistant profiles were observed among hospital-derived isolates. These findings support the need for continuous local surveillance to guide empirical therapy, particularly in hospital settings.

Keywords: *Urinary tract infections; antimicrobial resistance; uropathogens; Escherichia coli; hospital and community acquired infections*



HAJAR OUSGHIR

**DEVELOPMENT OF A STANDARD SHAVING CREAM
FORMULATION AS A REFERENCE MODEL FOR ECO-FRIENDLY
COSMETIC BIOFORMULATIONS FROM MOROCCAN BIOMASS
BY-PRODUCTS**

HAJAR OUSGHIR^{1*}, YAHYA BACHRA¹, AZ-EDDINE EL MANSOURI¹, MINA AADIL¹ AND
MOHAMED ZAHOUILY^{1**}

¹Laboratory of Biotechnology, Agri-food, Materials, and Environment, Faculty of Sciences and
Techniques Mohammedia, University Hassan II of Casablanca, Morocco

* hajarousghir02@gmail.com, ** mzahouily@gmail.com

Abstract: The cosmetic industry is increasingly oriented towards the development of ecological and safe formulations. As part of a broader thesis aiming to valorize Moroccan biomass by-products in cosmetic bioformulations, this study focuses on the elaboration and characterisation of a conventional shaving cream. This standard formulation serves as a reference baseline for future comparisons with eco-friendly prototypes incorporating bioactive ingredients from biomass. The shaving cream was prepared following a classical emulsion protocol: the oily phase (stearic acid and paraffin oil) and the aqueous phase (glycerin, sodium borate, triethanolamine, and distilled water) were heated separately to 70°C, then mixed under high mechanical agitation (2000 rpm) until cooling. The resulting product was subjected to key quality controls. Its viscosity was measured using a viscometer at different speeds to determine its rheological behaviour. The emulsion type was identified, and the microstructure was analysed via microscopy to assess globule size distribution. The results confirmed the formation of a stable and homogeneous emulsion with suitable textural properties for shaving applications. This foundational work establishes a reproducible protocol and provides essential data on a standard formulation, against which the performance and safety of novel, biomass-enriched ecological shaving creams will be evaluated in subsequent studies.

Keywords: *Shaving cream, emulsion, cosmetic formulation, rheology, stability, reference model.*



KHAWLA RACHMOUNE

**CHITOSAN-BASED BIOENGINEERED FILMS AS SUSTAINABLE
RADIOPROTECTIVE MATERIALS FOR HUMAN HEALTH WITHIN
A ONE HEALTH FRAMEWORK**

KHAWLA RACHMOUNE^{1,2,3,4,*}, ABDELGHANI IDDAR¹, MOHAMMED RHAZI³,
EL HASSAN EL MOUDEN⁴, ADEM GHARSALLAOUI², ADNANE
MOUTAOUAKKIL¹

¹Biotechnology and Biomolecules Engineering Unit, National Centre for Nuclear Energy, Science and Technology (CNESTEN), Rabat, Morocco

² Claude Bernard Lyon 1 University, CNRS, LAGEPP UMR 5007, F-69100 Villeurbanne, France

³ Interdisciplinary Laboratory in Bio-Resources, Environment and Materials, Higher Normal School, Cadi Ayyad University, Marrakech, Morocco

⁴Laboratory of Water Science, Microbial Biotechnology and Sustainability of Natural Resources, Faculty of Science Semlalia, Cadi Ayyad University, Marrakech 40000, Morocco

*k.rachmoune.ced@uca.ac.ma

Abstract: Within the One Health framework, which integrates human health, environmental sustainability, and biotechnology, the development of eco-friendly and biocompatible protective materials has become increasingly important. Exposure to ionising radiation poses significant risks to human health, mainly through the induction of oxidative stress and disruption of cellular functions. In this study, chitosan-based bioengineered films were fabricated using the Layer-by-Layer (LbL) assembly technique, providing a sustainable and highly controllable biotechnological approach. This method enables precise control over film architecture, thickness, and surface properties. Chitosan, a renewable natural polysaccharide, was selected because of its intrinsic antioxidant properties, high biocompatibility, biodegradability, and low environmental impact. The radioprotective performance of the films was evaluated in vitro using an irradiated cellular model. Oxidative stress markers, antioxidant enzyme activities, and cell viability were assessed to determine protective efficacy. The results demonstrate that chitosan-based bioengineered films significantly reduce radiation-induced oxidative stress while preserving enzymatic activity and cellular viability. Overall, this work highlights the potential of chitosan-based bioengineered films as sustainable radioprotective materials aligned with One Health principles, with promising applications in healthcare technologies and radiation safety.

Keywords: Chitosan, Bioengineered films, Radioprotection, One Health.



BOUCHRA TARCHOUN

EARLY ADIPOSITY REBOUND AS A PREDICTOR OF METABOLIC PROGRAMMING DURING THE FIRST 1,000 DAYS: IMPLICATIONS FOR LIFELONG HEALTH

BOUCHRA TARCHOUN*, SOAD KHAL-LAYOUN, ABDELLATIF BOUR

Faculty of Sciences, Ibn Tofail University

* bouchra.tarchoun2000@gmail.com

Abstract: Early adiposity rebound (EAR), defined as an abnormally early increase in body mass index following its physiological nadir, has emerged as a robust early-life marker of future obesity and cardiometabolic risk. Although EAR typically occurs after infancy, it is considered a proxy indicator of metabolic programming established during the first 1,000 days of life—a critical window recognised by international organisations such as the World Health Organisation (WHO) and UNICEF. The importance of this period was further emphasised in 2015 at the World Congress of the Developmental Origins of Health and Disease (DOHaD) Society in Cape Town, with the adoption of the Cape Town Manifesto, which advocates for its integration into research and health policies. A narrative review was conducted using indexed databases (PubMed, Scopus, and Web of Science), covering publications from 1990 to 2025. The review examined the biological and environmental determinants of EAR, including maternal nutrition, breastfeeding practices, complementary feeding, gut microbiota, early growth trajectories, and lifestyle behaviours. The evidence consistently indicates that EAR is strongly associated with an increased risk of obesity and chronic non-communicable diseases later in life. Identifying EAR as a marker of early metabolic vulnerability offers a unique opportunity for early preventive strategies aimed at optimising growth trajectories and reducing long-term metabolic risk.

Keywords: Early adiposity rebound, Metabolic programming, Cardiometabolic risk.

AMAL TAZZITE

**GENETIC RISK OF CARDIOTOXICITY IN BREAST CANCER
MANAGEMENT**

AMAL TAZZITE^{1,2*}, RACHIDA HABBAL³, FATIMA MAAROUF⁴, SARAH BERRADA^{1,4},
WAFAA BOUZROUD⁵, HIND DEHBI^{1,4}

¹Laboratory of Cellular and Molecular Pathology, Faculty of Medicine and Pharmacy of Casablanca, Hassan II University, Casablanca, Morocco.

²Laboratory of Care, Health, and Sustainable Development (2S2D), Research Team: Health Sciences, Education and Management (2SEM), Higher Institute of Nursing Professions and Health Techniques of Casablanca, Casablanca, Morocco.

³Cardiology Department, Ibn Rochd University Hospital, Casablanca, Morocco.

⁴Laboratory of Medical Genetics, Ibn Rochd University Hospital, Casablanca, Morocco.

⁵Faculty of Medicine and Pharmacy of Beni Mellal, Morocco.

*amal_tazzite@yahoo.fr

Abstract: Cardiotoxicity is a major complication of breast cancer therapies, particularly anthracyclines and trastuzumab. Beyond established cellular mechanisms, interindividual variability suggests a potential contribution of genetic factors that modulate treatment response. These include variants in genes encoding anthracycline-related transporters and receptors (ABCB1, SLC28A3, RARG), enzymes involved in oxidative stress (NQO1, CYBA, GSTP1), and genes associated with response to anti-HER2 therapies (HER2). Pharmacogenetics offers a strategy for better understanding and prediction of these adverse effects. The present study aims to investigate the association between these genetic variants and the risk of cardiotoxicity. Integrating these findings into clinical practice could improve prevention, monitoring, and management strategies, including the use of cardioprotective agents or therapeutic alternatives. Further prospective, multicentre validation studies are required, particularly in genetically diverse populations such as the Moroccan population.

Keywords: *Breast cancer, Chemotherapy, Cardiotoxicity, Genetics.*



YOLANDA VALCARCEL HASNA AHYAYAUCH

PFAS IN TAP WATER: A COMPARATIVE STUDY BETWEEN MADRID AND MOROCCAN CITIES

Y. VALCÁRCEL^{1*}, H. AHYAYAUCH², I. DORADO¹, AND B. GONZÁLEZ-GAYA^{3,4}

¹Chemical Risk Groups for Health and the Environment. Rey Juan Carlos University. Madrid, Spain

²Higher Institute of Nursing and Health, Rabat, Morocco

³Department of Analytical Chemistry and Research Centre for Experimental Marine Biology and Biotechnology, University of the Basque Country (PiE-UPV/EHU), Spain

⁴IKERBASQUE, Basque Foundation for Science, Spain

* yolanda.valcarcel@urjc.es

Abstract: The European Drinking Water Directive (2021) established a maximum limit of 0.5 µg/L for “total PFAS” or 0.1 µg/L for the “sum of 20 PFAS” in drinking water since January 2026. These persistent and widely distributed compounds are associated with adverse effects such as immune system alterations, low birth weight, increased cancer risk, liver damage, and endocrine disorders. Despite global concern, information on PFAS in drinking water in African countries remains scarce. Although Morocco regulates water quality according to its national standards and WHO guidelines, there is a data gap on the assessment of population exposure to PFAS. This study analysed PFAS in tap water from five localities in Madrid (Spain) and four Moroccan cities (Tanger, Rabat, Casablanca, and Kenitra) using UPLC-HRMS. PFAS were detected in every sample, with concentrations from a few to several dozen ng/L, always below European limits. GenX was the predominant compound both in Madrid and Morocco, reaching particularly high levels in the latter. Given the limited evidence on its toxicity, these results underscore the urgent need to strengthen monitoring of GenX and include it in future regulations, as well as to expand surveillance in Morocco, where this study represents the first available assessment.

Keywords: PFAS, drinking water, risk assessment, GenX, UPLC-HRMS



SOUFIANE YASSARA

**BRAF MUTATION PROFILE IN MOROCCAN COLORECTAL
CANCER: A LARGE NORTH AFRICAN SERIES**

SOUFIANE YASSARA^{1*}, CHAIMAE MOUJAHID², BASMA EL KHANNOUSSI¹

¹ Faculty of Medicine and Pharmacy, Mohammed V University in Rabat, Rabat, Morocco 2) Medical
biotechnology research Laboratory (MEDBIOTECH), Rabat, Morocco

²Sciences and Engineering of Biomedicals, Biophysics and Health Laboratory,
Higher Institute of Health Sciences, Hassan First University, Settat,

Morocco

*syassara@gmail.com

Abstract

Introduction: BRAF mutations are important biomarkers in colorectal cancer (CRC), yet data in Moroccan and other low- and middle-income populations are limited. This study investigates the frequency of BRAF mutations and their correlation with clinicopathological features, providing insights to improve diagnostic and therapeutic strategies.

Methods: Archived FFPE tissue samples from Moroccan CRC patients, collected between January 1, 2020, and December 31, 2023, at the National Institute of Oncology in Rabat (Pathology Department), were analysed using the Biocartis Idylla™ platform. Real-time PCR was employed for qualitative detection of BRAF mutations.

Results: A total of 320 tumors were analysed. BRAF mutations, particularly V600E, were detected in 8.2% of cases. Significant correlations were found between BRAF mutation status and primary tumor site as well as histological type, while no associations were observed with gender, age, or degree of differentiation.

Conclusion: This study demonstrates that high-quality molecular testing is feasible in low- and middle-income countries, contributing to scientific progress in Africa. The findings provide valuable epidemiological data for the global CRC research community and may guide future diagnostic and therapeutic strategies.

Keywords: *Colorectal cancer, BRAF, V600E mutation, Molecular testing, Morocco, Cancer epidemiology.*



NISRINE YASSINE

PHYTOTHERAPY AND DRUG INTERACTIONS IN OLDER ADULTS WITH TYPE 2 DIABETES: EVIDENCE SYNTHESIS AND CLINICAL RECOMMENDATIONS

YASSINE NISRINE^{1*}, BOUR ABDELLATIF¹, KHAL LAYOUN SOAD¹, AND EL ARABI FATINE²

¹Laboratory of Biology and Health, Department of Biology, Nutrition, Food and Health Sciences Research Team, Faculty of Sciences, Ibn Tofail University, Kenitra, Morocco.

²Health Care and Biology, Health Research Team, Higher Institute of Nursing and Health, Casablanca, Morocco.

*yasinenisrine84@gmail.com

Abstract: Type 2 diabetes (T2D) in older adults is frequently associated with polypharmacy and multiple comorbidities, increasing the risk of adverse events. Concurrently, the use of phytotherapy remains common and may coexist with antidiabetic treatments. This review synthesises recent evidence on phytotherapy–drug interactions in older adults with T2D and provides safety recommendations. A structured literature search (2018–2025) was conducted across PubMed, Scopus, Web of Science, and Google Scholar, including systematic reviews, clinical trials, observational studies, and relevant case reports. Reported interactions are primarily pharmacodynamic, potentially enhancing hypoglycaemic effects and increasing the risk of hypoglycaemia. Pharmacokinetic interactions affecting drug absorption or metabolism were also described, with heterogeneous levels of evidence. Older adults with renal impairment, polypharmacy, or a history of hypoglycaemia constitute particularly vulnerable populations. Systematic assessment of herbal use, tailored glycaemic monitoring, and strengthened pharmacovigilance are recommended to ensure patient safety.

Keywords: *Type 2 diabetes, Older adults, Phytotherapy.*