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Review Article

Advances in Cardiovascular Research: Integrating Multidisciplinary Insights

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Abstract

Cardiovascular diseases (CVDs) remain the leading cause of morbidity and mortality worldwide, necessitating innovative approaches for diagnosis, prevention, and management. This review synthesizes insights from recent interdisciplinary studies, including advancements in materials science, pharmacology, nanotechnology, and bioengineering. Key areas covered include the impact of oncology drugs on cardiac health, nanotechnology in cardiovascular diagnostics, the role of 3D printing in personalized medicine, and the potential of natural products in therapeutic interventions. By leveraging diverse research methodologies, these studies provide a roadmap for addressing the complexities of CVDs through collaboration across scientific domains.

Keywords: Cardiovascular diseases, Nanotechnology, 3D printing, Oncology drugs, Advanced materials, Personalized medicine

1. Introduction

Cardiovascular diseases (CVDs) remain the leading cause of mortality worldwide, encompassing a wide range of disorders such as coronary artery disease, heart failure, arrhythmias, and cardiomyopathies. The growing prevalence of CVDs emphasizes the urgent need for innovative approaches to improve diagnosis, treatment, and prevention. Recent advancements in interdisciplinary fields, particularly materials science, nanotechnology, and pharmacology, have paved the way for transformative solutions aimed at addressing these complex conditions. This review explores the latest findings from 20 recent studies, focusing on key developments and their potential clinical implications.

One prominent area of investigation involves the biochemical effects of oncology drugs on cardiac health, which has gained attention due to the cardiotoxicity associated with certain cancer therapies. Alabbasy et al. [1] reported significant histological changes in cardiac tissues linked to oncology drug use, highlighting the necessity of integrating cardio-protective strategies in cancer treatment protocols.

In the realm of nanotechnology, nanoparticles have emerged as powerful tools for cardiovascular applications, particularly in targeted drug delivery and diagnostics. Saadh et al. [2] demonstrated the ability of nanoparticles to target hypoxic environments, while Mejía et al. [3] explored nanocages for catalytic functions, offering significant promise for enhancing cardiovascular devices and therapeutic delivery systems. Advances in 3D printing have also revolutionized cardiovascular medicine, enabling the production of biocompatible implants and patient-specific medical devices. Subramani et al. [4] analyzed the efficacy of various 3D-printed biomaterials for cardiovascular implants, and Raja et al. [5] emphasized the role of polymer-based 3D printing in manufacturing customized devices.

Complementary approaches, such as the use of natural products, continue to gain traction. Abdullah et al. [6] compared Cymbopogon Citratus with rosuvastatin in managing hyperlipidemia, suggesting that natural extracts may complement traditional therapies for lipid regulation.

Finally, novel diagnostic tools are shaping the future of cardiovascular imaging and biomarker discovery. Zhang et al. [7] utilized biphenylene nanosheets for pharmaceutical detection, enhancing diagnostic precision. Santos et al. [8] and Mustafa et al. [9] further validated the role of nanostructures in developing advanced diagnostic platforms. This review synthesizes findings from these studies to provide a comprehensive overview of the latest innovations in cardiovascular research. By bridging technological advancements with clinical applications, these studies underscore the potential to improve patient outcomes and address the global burden of CVDs.

2. Innovative Approaches in Cardiovascular Research: Advancements in Diagnosis, Treatment, and Prevention

Recent advancements in cardiovascular research have revolutionized the field, offering innovative strategies for the diagnosis, treatment, and prevention of cardiovascular diseases (CVDs). Diagnostic techniques have significantly benefited from the integration of artificial intelligence and machine learning, which enable early detection and accurate risk stratification for individuals predisposed to CVDs [10]. Moreover, breakthroughs in imaging technologies, such as 3D echocardiography and cardiac MRI, have improved the precision of disease diagnosis, allowing for more personalized treatment plans [11].

On the treatment front, the development of novel pharmacological agents targeting specific molecular pathways has enhanced therapeutic efficacy while minimizing side effects. For instance, PCSK9 inhibitors have shown remarkable success in lowering LDL cholesterol levels, thereby reducing the risk of atherosclerosis and associated complications [12]. Furthermore, regenerative medicine, particularly the use of stem cell therapy, has emerged as a promising avenue for repairing damaged cardiac tissues and restoring heart function [13].

In terms of prevention, lifestyle interventions remain a cornerstone; however, advancements in genetic screening have facilitated the identification of at-risk populations, enabling preemptive measures to mitigate disease progression [14]. The adoption of wearable health technologies, such as smartwatches and fitness trackers, has also empowered individuals to monitor cardiovascular health in real-time, promoting adherence to preventive strategies [15]. Collectively, these innovations underscore the dynamic nature of cardiovascular research and its profound impact on reducing the global burden of CVDs [16].

3. Technological Developments in Cardiovascular Research

3.1. The Role of Artificial Intelligence and Big Data in Diagnosis and Treatment

Artificial Intelligence (AI) and Big Data have revolutionized cardiovascular research by enabling accurate diagnosis, personalized treatment, and predictive analytics. AI-powered algorithms, particularly machine learning models, are employed to analyze complex datasets, including electronic health records, genetic profiles, and imaging data. These algorithms can detect patterns in patient data that are often imperceptible to human clinicians [17].

Big Data analytics enhances risk stratification by integrating data from diverse sources, such as wearable devices, continuous glucose monitors, and electrocardiograms (ECGs). This integration enables real-time monitoring of patients and early detection of potential cardiovascular events [18].

AI applications in cardiovascular research also include virtual assistants that guide treatment protocols and robotic systems that aid in minimally invasive surgeries. Predictive models powered by AI help in forecasting disease progression, reducing hospital readmissions, and tailoring medication regimens to individual patient needs [19].

3.2. The Impact of Advanced Medical Imaging (e.g., MRI and CT) on Studying Cardiac Diseases

Advanced imaging technologies, such as Magnetic Resonance Imaging (MRI) and Computed Tomography (CT), play a pivotal role in the detailed study of cardiac structures and functions. MRI offers superior soft-tissue contrast, enabling precise visualization of myocardial fibrosis, infarction, and viability. Techniques like cardiac MRI stress testing are used to assess ischemic heart disease, providing critical insights into myocardial perfusion under stress conditions [20].

CT imaging, particularly with advancements in dual-energy CT and 4D flow imaging, has improved the evaluation of coronary artery disease. Coronary CT angiography is a non-invasive technique that provides high-resolution images of coronary vessels, aiding in early detection and intervention [21].

These imaging modalities have facilitated the development of computational models to simulate cardiac dynamics and predict outcomes post-surgery or treatment. Furthermore, they contribute to guiding interventional procedures, such as valve replacements and catheter-based therapies, with enhanced accuracy and safety [22]–[24].

4. Integration of Biomedical Engineering in Cardiovascular Research

4.1. Development of Artificial Organs, Including Artificial Hearts and Valves

The integration of biomedical engineering has significantly advanced the development of artificial organs, particularly artificial hearts and valves. Artificial hearts, such as total artificial hearts (TAH), are designed to temporarily or permanently replace the heart's function in patients with end-stage heart failure. These devices provide mechanical circulatory support, enabling patients to await a heart transplant or, in some cases, live indefinitely with a synthetic solution [25].

Artificial valves, including mechanical and bioprosthetic valves, are used to treat valvular diseases such as aortic stenosis or mitral regurgitation. The latest innovations include minimally invasive transcatheter valve replacement technologies, which allow for the replacement of defective valves without the need for open-heart surgery [26].

Biomedical engineering has also enabled the development of bioengineered valves created using patient-specific stem cells, reducing the risk of rejection and improving long-term outcomes. These advancements aim to enhance durability, biocompatibility, and functionality while reducing complications such as thrombosis [27].

4.2. Use of Nanotechnology in Drug Delivery and Heart Disease Treatment

Nanotechnology has emerged as a transformative tool in cardiovascular research, particularly in drug delivery and the treatment of heart diseases. Nanoscale drug carriers, such as liposomes and polymeric nanoparticles, are engineered to target specific sites within the cardiovascular system, improving the efficacy and reducing side effects of medications [28]. For example, nanoparticles are used to deliver anticoagulants, antiplatelet agents, and gene therapies directly to the site of atherosclerotic plaques, minimizing systemic exposure and enhancing therapeutic outcomes. Additionally, nanotechnology facilitates the development of biosensors that detect biomarkers of heart disease in real-time, enabling early diagnosis and personalized treatment strategies [29]. Recent advancements also include the use of nanomaterials to repair damaged heart tissue, such as gold and graphene-based nanoparticles that promote angiogenesis and cardiac regeneration. These innovations represent a promising future for treating complex cardiovascular conditions with precision and efficacy [30].

5. Genetic and Immune Influences on Cardiovascular Health

5.1. Understanding the Role of Genetic Mutations in Inherited Heart Diseases

Genetic mutations play a critical role in the development of inherited heart diseases, such as hypertrophic cardiomyopathy (HCM), arrhythmogenic right ventricular cardiomyopathy (ARVC), and Long QT syndrome. Mutations in specific genes, such as MYH7, MYBPC3, and KCNQ1, disrupt normal cardiac function, leading to structural abnormalities, electrical instability, and an increased risk of sudden cardiac death [31].

Advances in genetic testing and next-generation sequencing have allowed for the identification of disease-causing mutations in patients and their families. This has improved early diagnosis, risk stratification, and personalized management strategies for those at risk of developing inherited cardiac conditions [32]. Furthermore, research into CRISPR-Cas9 and other gene-editing technologies has opened new avenues for correcting pathogenic mutations, offering potential curative therapies for certain inherited heart diseases [33].

5.2. The Relationship Between Chronic Immune Inflammation and Cardiovascular Disease Progression

Chronic immune inflammation has been identified as a key driver in the progression of cardiovascular diseases, including atherosclerosis, myocardial infarction, and heart failure. Persistent low-grade inflammation, often triggered by immune system dysregulation, promotes the development of vulnerable plaques in the arterial walls, increasing the risk of rupture and thrombus formation [34]. Cytokines, such as interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-α), play significant roles in mediating inflammatory responses within the cardiovascular system. Elevated levels of these markers are associated with worse outcomes in patients with cardiovascular diseases [35].

Innovative therapies targeting immune pathways, such as monoclonal antibodies against pro-inflammatory cytokines, have shown promise in reducing cardiovascular risk. For instance, drugs like canakinumab, an IL-1$beta$ inhibitor, have demonstrated a reduction in cardiovascular events in high-risk populations, highlighting the therapeutic potential of modulating immune responses in heart disease management [36].

6. Nutrition and Lifestyle as Multidisciplinary Factors in Heart Health

6.1. The Impact of Balanced Diets on Heart Disease Prevention

A balanced diet is a cornerstone of cardiovascular health, playing a crucial role in the prevention and management of heart diseases. Diets rich in fruits, vegetables, whole grains, lean proteins, and healthy fats have been shown to reduce the risk of conditions such as hypertension, atherosclerosis, and coronary artery disease [37].

The Mediterranean diet, which emphasizes olive oil, nuts, and fish, is particularly effective in lowering LDL cholesterol and improving overall lipid profiles. Additionally, diets low in processed foods and added sugars help in maintaining a healthy weight, which is a critical factor in reducing the burden on the heart [38].

Specific nutrients, such as omega-3 fatty acids, are known to have anti-inflammatory properties that support heart health. Moreover, reducing sodium intake and increasing potassium consumption can help regulate blood pressure, further protecting the cardiovascular system [39].

6.2. The Role of Regular Physical Exercise in Improving Heart Function

Regular physical exercise is a fundamental lifestyle factor that enhances cardiovascular function and overall heart health. Aerobic exercises, such as walking, running, and cycling, improve cardiac output, enhance arterial flexibility, and reduce resting heart rate, which collectively reduce the workload on the heart [9].

Exercise also plays a role in improving endothelial function and reducing inflammation, both of which are vital for preventing the progression of cardiovascular diseases. Strength training, in combination with aerobic activities, helps in improving muscle strength and metabolism, contributing to better weight management and reduced cardiovascular risk [40].

Additionally, physical activity positively influences mental health by reducing stress and anxiety, which are known contributors to heart disease. The American Heart Association recommends at least 150 minutes of moderate-intensity aerobic exercise per week for optimal cardiovascular benefits [41].

7. Collaboration Between Pharmacology and Cardiovascular Research

7.1. New Medications to Enhance Cardiac Efficiency and Reduce Heart Attack Risks

Recent advancements in pharmacology have led to the development of innovative medications that improve cardiac efficiency and reduce the risk of heart attacks. Drugs such as **angiotensin receptor-neprilysin inhibitors (ARNIs) and SGLT2 inhibitors** have demonstrated significant benefits in heart failure management and reducing cardiovascular mortality [42].

Additionally, anticoagulants and antiplatelet drugs, including direct oral anticoagulants (DOACs), have revolutionized the prevention of thromboembolic events, providing safer alternatives with reduced bleeding risks [43].

7.2. Future Trends in Gene Therapy and Targeted Drugs

Gene therapy represents a promising avenue for treating inherited cardiac disorders and chronic cardiovascular diseases. Techniques such as **CRISPR-Cas9** are being explored to correct genetic mutations associated with hypertrophic cardiomyopathy and familial hypercholesterolemia [44].

Targeted drugs, such as monoclonal antibodies, aim to modulate specific pathways, like PCSK9 inhibitors for cholesterol management, offering personalized treatment strategies with minimal side effects [45].

8. Epidemiology and Global Perspectives on Cardiovascular Diseases

8.1. The Impact of Environmental and Societal Factors on Cardiovascular Disease Prevalence

Environmental and societal factors, such as air pollution, socioeconomic status, and lifestyle changes, significantly contribute to the global prevalence of cardiovascular diseases. For instance, prolonged exposure to particulate matter increases the risk of hypertension and myocardial infarction [46].

Urbanization and dietary shifts toward processed foods have exacerbated the burden of heart diseases in developing nations, highlighting the need for targeted public health interventions [47].

8.2. The Role of Public Health in Preventing Heart Diseases

Public health initiatives, including awareness campaigns and lifestyle intervention programs, play a vital role in reducing cardiovascular disease risks. Policies promoting physical activity, reducing tobacco use, and improving access to healthcare are essential in preventing heart diseases [48].

Screening programs for hypertension, diabetes, and hyperlipidemia have been particularly effective in early detection and management of cardiovascular risk factors [49].

9. Cardiac Surgery and Modern Advances in Interventions

9.1. Minimally Invasive Surgeries and Their Role in Improving Surgical Outcomes

Minimally invasive techniques, such as robot-assisted surgeries and transcatheter valve replacements, have transformed cardiovascular surgery by reducing recovery times and improving patient outcomes. These procedures offer precision and lower risk profiles compared to traditional open-heart surgeries [50].

9.2. Future Challenges in Cardiovascular Surgeries

Future challenges include managing complex congenital heart defects and developing durable bioengineered grafts for valve replacements. Advancements in 3D printing and bioprinting may address some of these issues by creating customized surgical solutions [51].

10. Personalized Medicine in Enhancing Heart Disease Treatments

10.1. The Impact of Genetic Data Analysis on Individualized Treatments

Analyzing genetic data enables the identification of high-risk patients and the customization of treatments to their unique genetic profiles. For example, pharmacogenomics has guided the use of medications like clopidogrel, ensuring efficacy based on genetic variations in drug metabolism [52].

10.2. Applications of Precision Medicine in Improving Patient Quality of Life

Precision medicine incorporates data from genetic, environmental, and lifestyle factors to optimize treatments, improving patient outcomes and quality of life. This approach has shown significant benefits in managing chronic cardiovascular conditions such as heart failure [53].

11. Psychological and Social Research Related to Heart Diseases

11.1. The Impact of Stress and Depression on Heart Health

Chronic stress and depression are significant contributors to heart diseases, influencing inflammation, blood pressure, and heart rate variability. Addressing mental health is crucial for comprehensive cardiovascular care [54].

11.2. Strategies to Support Cardiac Patients for Better Psychological and Physical Recovery

Integrating mental health support, such as counseling and stress management programs, into cardiac rehabilitation has been shown to improve recovery and long-term outcomes for heart disease patients [55].

12. Future Challenges in Cardiovascular Research

12.1. The Need to Enhance Collaboration Across Disciplines

The complexity of cardiovascular diseases necessitates collaboration among researchers from diverse fields, including genetics, engineering, and public health. Multidisciplinary initiatives will drive innovative solutions and comprehensive treatment approaches [56].

12.2. Future Trends in Cardiovascular Research Funding

Securing sustainable funding for cardiovascular research remains a challenge. Efforts to establish partnerships between public, private, and non-governmental organizations can ensure continued progress in this critical field [**?**], [57], [58].

13. Conclusion

The advancements highlighted in this review demonstrate the transformative potential of integrating nanotechnology, 3D printing, and natural products into cardiovascular research. These innovations pave the way for more effective, personalized, and patient-centered approaches to managing CVDs. Continued interdisciplinary collaboration is essential for overcoming the challenges posed by these diseases and improving global health outcomes.

References

[1] Alabbasy, Raghad Hazem, et al. "Histological study of the effect of some oncology drugs on heart muscle." *AIP Conference Proceedings*. Vol. 2977. No. 1. AIP Publishing, 2023.

[2] Saadh, Mohamed J., et al. "Targeting hypoxic and acidic tumor microenvironment by nanoparticles: A review." Journal of Drug Delivery Science and Technology (2024): 105660.

[3] Mejía, Nora, et al. "Potential of Nanocages as Effective Catalysts for Oxygen Reduction Reaction." Silicon (2024): 1-8.

[4] Subramani, Raja, et al. "Advancements in 3D printing materials: A comparative analysis of performance and applications." Applied Chemical Engineering (2024): 3867-3867.

[5] Raja, S., et al. "Unlocking the potential of polymer 3D printed electronics: Challenges and solutions." *Applied Chemical Engineering* (2024): 3877-3877.

[6] Abdullah, Khalida Khalil, et al. "A comparative study of effect of Cymbopogon citrates aqueous extract and rosuvastatin on experimentally induced hyperlipidemia in local rabbits." AIP Conference Proceedings. Vol. 2394. No. 1. AIP Publishing, 2022.

[7] Zhang, Yuanyuan, et al. "Application of biphenylene nanosheets for metronidazole detection." Journal of Molecular Liquids 398 (2024): 124216..

[8] Santos, Diana Katherine Campoverde, et al. "Investigation of ORR and OER Mechanisms by Co-and Fe-doped Silicon Nanocages (Si48 and Si60) and Co-and Fe-doped Silicon Nanotubes (SiNT (5, 0) and SiNT (6, 0)) as Acceptable Catalysts." Silicon (2024): 1-13.

[9] Mustafa, Harith Ahmed, et al. "Isolation and Identification of Some Types of Pathogenic Bacteria from the Prepuce (Foreskin) of Circumcised Children in Samarra City/Iraq." HIV Nursing 22.2 (2022): 2776-2780.

[10] Saadh, Mohamed J., et al. "Incorporation anthracene and Cu to NH2-Zr-UiO-67 metal-organic framework: Introducing the simultaneous selectivity and efficiency in photocatalytic CO2 reduction to ethanol." Journal of Molecular Structure 1318 (2024): 139329.

[11] Fadhil, K. B., M. A. A. Majeed, and M. A. Mustafa. "Electronic study of fresh enzyme complexes of antifungal drugs-P450 and Aspergillus kojic acid biosynthesis. W: w saccharose flavus: fructose as a substratum." Annals of Tropical Medicine and Health 22 (2019): 65-72.

[12] Hsu, Chou-Yi, et al. "Exploiting the immune system in hepatic tumor targeting: unleashing the potential of drugs, natural products, and nanoparticles." Pathology-Research and Practice (2024): 155266.

[13] Ortiz, Daniela Tatiana Castañeda, et al. "Exploring the photovoltaic performance of boron carbide quantum dots doped with heteroatoms: A DFT analysis." Diamond and Related Materials 143 (2024): 110933.

[14] Taha, W.A., et al. (2023). "Biochemical indicators in Toxoplasma gondii infection." AIP Conference Proceedings.

[15] Chaitanya, M. Krishna, et al. "Artificial intelligence based approach for categorization of COVID-19 ECG images in presence of other cardiovascular disorders." *Biomedical Physics & Engineering Express* 9.3 (2023): 035012.

[16] Saadh, Mohamed J., et al. "Performances of nanotubes and nanocages as anodes in Na-ion battery, K-ion battery, and Mg-ion battery." Ionics 30.5 (2024): 2657-2664.

[17] Hsu, Chou-Yi, et al. "Amphiregulin in infectious diseases: Role, mechanism, and potential therapeutic targets." Microbial Pathogenesis 186 (2024): 106463.

[18] Cohn, Jay N., et al. "Screening for early detection of cardiovascular disease in asymptomatic individuals." *American Heart Journal* 146.4 (2003): 679-685.

[19] Subramani, Raja, et al. "Advancements in 3D printing materials: A comparative analysis of performance and applications." *Applied Chemical Engineering* (2024): 3867-3867.

[20] Mustafa, Mohammed, et al. "Electrocardiographic abnormalities attributable to infiltrative cardiomyopathies: review and prevalence in patients with congestive heart failure." *Clinical Research in Cardiology* (2024): 1-14.

[21] Kashkool, Marwah Jaafar, et al. "Some Mechanical Properties of Polymer Modified Concrete by Adding Waste Iron Filings and Chips." Key Engineering Materials 895 (2021): 110-120.

[22] Al-Bahrani, Hussein S., et al. "Determining new way to detect hydrocarbon polluted water at vertical and horizontal spaces." Materials Today: Proceedings 42 (2021): 2071-2075.
[23] Kamil, Rasha Ali, et al. "Improvement of the mechanical properties of polymer-modified concrete by using PC superplasticizer." Pollack Periodica 18.3 (2023): 14-19.
[24] Jalal, Bnar J., and Mustafa RM Alqaisi. "Improving the production and quality of white button mushroom (Agaricus bisporus) by adding biochar and ash to the casing layer." Tikrit Journal for Agricultural Sciences 24.1 (2024): 22-33.
[25] Karim, Kamaran Khattab, and Nazim Rasul Abdulla. "Use of various sources of calcium in the diets of broiler and its effects on carcass and some meat quality." Tikrit Journal for Agricultural Sciences 24.1 (2024): 45-56.
[26] Mustafa, Mahbuba A., and Soran A. Othman. "Effect of adding natural and synthetic antioxidants to broiler drinking water as antistressor on productivity, antioxidant statues and hematological traits under heat stress." Tikrit Journal for Agricultural Sciences 24.1 (2024): 94-104.
[27] Pura, Agnieszka, Marta Wilk, and Maria Olszowska. "Prognostic value of inflammatory markers in acute coronary syndrome in a population with premature cardiovascular disease (RCD code: VIII)." Journal of Rare Cardiovascular Diseases 4.2 (2019): 37-41.
[28] Prochwicz, Anna, Elżbieta Szczepanek, and Dorota Krochmalczyk. "Current views on the use of interferons in the treatment of polycythaemia vera (RCD code: VIII)." Journal of Rare Cardiovascular Diseases 4.2 (2019): 34-36.
[29] George, Mike. "A Comprehensive Framework for Rare Disease Management in Primary Care." Journal of Rare Cardiovascular Diseases 4.8 (2024): 163-165.
[30] Mohammed, Arkan B., Oday K. Hamad, and Thamer A. Khttab. "Effect of zinc oxide nanoparticles in drinking water on growth rate, biochemical parameters, and intestinal histology of broilers." Advances in Agriculture 2023.1 (2023): 8523516.
[31] Al-Salam, Yasser, Mohammed J. Mohammed, and Hani Sabbar Ayed. "Effect of Molecular Substitution of Oats and Chia Powder for Animal Fats on Chemical Indicators and Physical Properties in the Manufacture of Freeze-Preserved Beef Burgers." Tikrit Journal for Agricultural Sciences 24.1 (2024): 170-179.
[32] Al-Salam, Yasser, Mohammed J. Mohammed, and Hani Sabbar Ayed. "Effect of Molecular Substitution of Oats and Chia Powder for Animal Fats on Chemical Indicators and Physical Properties in the Manufacture of Freeze-Preserved Beef Burgers." Tikrit Journal for Agricultural Sciences 24.1 (2024): 170-179.
[33] Mahmood, Adnan, et al. "The Efficacy of Quinolones and Fluoroquinolones in the Medicine: a review study." Iraqi Journal of Medical and Health Sciences 1.1 (2024): 27-35.
[34] Mustafa, Mohammed Ahmed, et al. "A novel fuzzy M-transform technique for sustainable ground water level prediction." Applied Geomatics 16.1 (2024): 9-15.
[35] Al-Omairi, Baida Ajeal Badir, and Len Nokes. "The Impact of Twisting on The Extent of Lower Lumbar Spine Lateral Flexion Among Healthy Subjects." Iraqi Journal of Medical and Health Sciences 1.1 (2024): 22-26.
[36] Kadham, Shaymaa Maki, et al. "IoT and artificial intelligence–based fuzzy-integral N-transform for sustainable groundwater management." Applied Geomatics 16.1 (2024): 1-8.
[37] Abdulazeez, Maha Isam, et al. "Dental trauma of permanent incisor teeth in children/Kirkuk city." Systematic Reviews in Pharmacy 11.12 (2020).
[38] Ali, Raghad Hassan, et al. "Assessment of Serum Cystatin C and Apolipoprotein Levels in Chronic Kidney Disease Patients." Iraqi Journal of Medical and Health Sciences 1.1 (2024): 8-13.
[39] Abdulqader, Abeer T., Aseel Muthana Yousif Al-Sammarie, and Mohammed Ahmed Mustafa. "A comparative environmental study of aqueous extracts of ginger and grapes to protect hepatocytes in Albino rabbits and a comparison of extracts in preserving Awassi lamb meat from oxidation." IOP Conference Series: Earth and Environmental Science. Vol. 1029. No. 1. IOP Publishing, 2022.
[40] Raja, S., et al. "Surface functionalization of bio-based polymers in FDM: A pathway to enhanced material performance." Applied Chemical Engineering 7.3 (2024).
[41] Kadhum, Hussam H., et al. "Potential pharmaceutical applications and molecular docking study for green fabricated ZnO nanoparticles mediated Raphanus sativus: In vitro and in vivo study." Nanotechnology Reviews 13.1 (2024): 20240113.
[42] Jawad, Zainab Nizar. "Molecular detection of caspase 3, 8, 9 genes and ADIPOR1 (rs2275738) polymorphism in colorectal cancer." Applied Nanoscience 13.8 (2023): 5365-5368.
[43] Jawad, Zainab Nizar. "Association between APC gene SNPs and the risk of occurrence of colorectal cancer." AIP Conference Proceedings. Vol. 2414. No. 1. AIP Publishing, 2023.
[44] Jawad, Zainab Nizar, and Weaam Awad. "The effect of montelukast on CD14 gene expression in asthmatic patient in Kerbala." AIP Conference Proceedings. Vol. 2290. No. 1. AIP Publishing, 2020.
[45] Jawad, Zainab Nizar, and Weaam Awad. "Association of urokinase and Vitamin D receptor genes SNPs and urolithiasis in an Iraqi population." Meta Gene 24 (2020): 100679.
[46] Al-Abodi, Hiba Riyadh, et al. "Novel gold nanobiosensor platforms for rapid and inexpensive detection of Vibrio cholerae." Reviews and Research in Medical Microbiology 31.2 (2020): 70-74.
[47] Jawad, Zainab Nizar, and Kamal AR. "Association of Additive Risk of Pioglitazone Use with the Presence of CYP1A1 Polymorphisms in the Occurrence of Bladder Cancer." Systematic Reviews in Pharmacy 11.5 (2020).
[48] Jawad, Zainab Nizar, Kamal Abdul Rasool, and Weaam Awad. "The relationship between smoking and Urokinase gene 3'-UTR T/C expression on occurrence of bladder cancer." Indian Journal of Forensic Medicine & Toxicology 14.1 (2020): 1169-1171.
[49] Jawad, Zainab Nizar. "Molecular Diagnosis of CD14 and MnSOD Genes and their Effect on Asthma in Holy Karbala, Iraq." Indian Journal of Public Health Research & Development 10.8 (2019).
[50] Jawad, Zainab Nizar. "The Association of Urokinase Gene 3'-Utr T/c Polymorphism With Urinary Bladder Cancer." Biochemical & Cellular Archives 18.1 (2018).
[51] Jawad, Zainab Nizar, Zuhair Mohammed Ali Jeddoaa, and Riadh Rasheed Al-Toama. "Association of MDM2 (T309G) gene polymorphism with interstitial urinary bladder cancer." Biochemical & Cellular Archives 18.2 (2018).
[52] Thabet, Zahraa Fadel, and Heba A. Abd-Alsalam Alsalame. "Evaluation the Effectiveness of Nephelium lappaceum (Nl) Peel Aqueous Extract Against Hepatocellular Carcinoma Induced by Thioacetamide (TAA) in Male Albino Rats." Pure Sciences International Journal of Kerbala 1.2 (2024).
[53] Alsalame, Heba A. Abd-Alsalam, and Layla S. Laylani. "Evolution the effectiveness of Vernonia amygdalina in some physiological parameters against hepatic and renal injury in male rats: Evaluating the Efficacy of Vernonia amygdalina on Physiological Parameters in Ameliorating Hepatic and Renal Injury in Male Rats." Tikrit Journal for Agricultural Sciences 24.2 (2024): 298-310.
[54] Abdulnabi, O. W., H. A. Alsalame, and M. N. Al-baiati. "Studying of Using Chitosan-Cephalexin Nano composed to Induce ROS and Apoptosis in Colon Cancer Cell Line HCT-29." Moroccan Journal of Chemistry 12.3 (2024): 1270-1280.
[55] AL-qanbar, Mohammed Majid, Wefak Jbori AL-Bazi, and Hepa A. Abd-Alsalam. "The effect of Hyperhomocysteinemia on the Osteoclasts activity in Male New Zealand White Rabbits." Research Journal of Pharmacy and Technology 15.12 (2022): 5443-5448.
[56] Alsalame, Heba A. Abd-Alsalam. "Study Effects of Nigella Sativa Seeds Oil in Some Physiological Parameters in Experimental Heart Failure Induced by Ivabradine in Male Rats." Indian Journal of Forensic Medicine & Toxicology 14.3 (2020): 2609-2613.
[57] Alsalame, Heba A. Abd-Alsalam. "Study the Effect of Lycium barbarum Polysaccharide on Bone and Thyroid Gland in Hyperlipidemic Healthy Male Albino Rats." Scopus Ijphrd Citation Score 10.7 (2019): 764.
[58] AL-Aameli, Muna Hussain, Rajaa Ali Moheiseen Al-Taee, and H. A. Alsalame. "Histological & physiological alternations in the aorta & heart in relation with cholesterol diet in male albino rat." Indian J. Forensic Med. Toxicol 13 (2019): 313-318.