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EDITORIAL

The Cardio Oncology Metabolism Axis: A New Frontier in Cancer Research

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Introduction

Cancer research is undergoing a paradigm shift towards the convergence of science, molecular biology, inflammation, metabolic regulation, and cardiology into a holistic era. This editorial highlights the key contributions from the current issue of the **Journal of Biomedical Research & Environmental Sciences** (JBRES), and from the broader scientific community, focusing on the multi-integrated domains such as inflammation and molecular targets, exemplified by studies on COX-2 inhibitors, Cytochrome P-450 inductors, and phytomedicinal modulation with Ligaria cuneifolia, demonstrating the interconnectedness of cancer biology with neurological disorders. Cardio-metabolic oncology also known as cardio-onco-metabolism, is an emerging interdisciplinary field that explores the complex interactions between cancer, cardiovascular disease, metabolic health and integrative interventions.

Chronic inflammation is a well-established risk factor for cancer, promoting tumor initiation, growth, and metastasis by the formation of an inflammatory tumor microenvironment rich in cytokines, immune cells, and growth factors. This environment fosters genetic instability, immune suppression, and angiogenesis, all of which support malignant transformation and progression [1-5]. This similarly occurs in neurological disorders such as Alzheimer's, Parkinson's, multiple sclerosis, and epilepsy. Neuroinflammation is now recognized as a key pathological feature resulting in the activation of glial cells, recruitment of peripheral immune cells, and the release of inflammatory mediators which contribute to neuronal injury, neurodegeneration, and disease progression [6-11]. Systematically reviewed 20 animal studies on COX-2 inhibitors in epilepsy. These agents showed seizure reduction and neuroprotection, though efficacy varied by model and dosage. Gaps include lack of standardized protocols, chronic impact evaluation, and comparative effectiveness, and the study suggested COX-2 inhibitors are promising adjuncts for seizure control and neuroprotection, but further long-term, standardized studies are essential to clarify the therapeutic potential of how inflammatory pathways contribute to neuronal dysfunction, with direct translational implications for cancer-related neuroinflammation [12]. Additionally, investigated 46 cytochrome P-450 enzyme inducers using molecular docking, LDA, and QSAR models. Inducers were classified into Type I and II, with key binding residues identified

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(Glu301, Phe115, Ser294). Certain compounds showed strong induction potential. These findings provide structural insights into CYP induction and lay the groundwork for designing safer, more selective drugs targeting xenobiotic metabolism, highlighting the metabolic complexities of xenobiotic processing, reinforcing the need to consider drug metabolism as a determinant of therapeutic efficacy in cancer patients [13]. Furthermore, Francisco Pons MP, et al. [14], studied 12 patients with high cholesterol consuming Ligaria cuneifolia infusion for 31 days. Data showed significant LDL-C reduction and lowered ALT without affecting total cholesterol, HDL-C, kidney function, or other liver markers, which suggested that Ligaria cuneifolia may reduce LDL-C and hepatic steatosis risk, supporting its role as a potential natural adjunct in cardiovascular disease prevention. Demonstrating how natural compounds may influence inflammation and metabolic health, potentially reducing cancer risk through indirect modulation of systemic pathways. Together, these studies established that the biological foundation of inflammation and metabolism is a fundamental process in both cancer and neurological disorders, with significant mechanistic overlap. Therefore, the inflammation–metabolism axis, as shown figure 1 how inflammatory pathways (e.g., COX signaling) and metabolic enzymes (e.g., CYP450 family) are interlinked or interacting with dietary or environmental ligands to drive cancer progression while simultaneously exacerbating metabolic and cardiovascular dysfunction. Understanding these intertwined processes or pathways are crucial for developing targeted therapies and may offer new strategies for prevention and treatment in both fields.

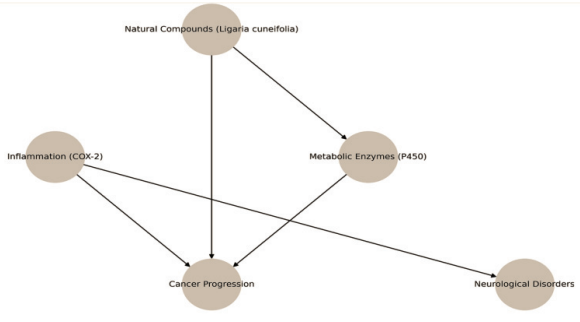

Figure 1 Inflammation–metabolism cancer/neurological disorders pathway: This schematic illustrates the interplay between inflammation, metabolic processes, natural compounds, cancer progression, and neurological disorders. Natural compounds such as Ligaria cuneifolia modulate metabolic enzymes (P450) and cancer progression, Inflammation (COX-2) contributes to both cancer progression and neurological disorders.

It is estimated that there are currently 15 million people suffering from cardiovascular disease and 14 million patients based on Cancer Therapeutics-Related Cardiovascular Dysfunction (CTRCD). The cancer and Cardiovascular Disease (CVD) are the two leading global causes of death due to shared risk factors like smoking, obesity, and hypertension which increasingly coexist as parallel global health burdens [15,16]. Cancer therapies (e.g., chemotherapy, radiation) contribute to heart issues like cardiomyopathy, arrhythmias, and heart failure, increasing the cardiovascular risk in cancer survivors [15-17]. About 20% of cancer patients over 70 year's age have been reported with CVD. This dual burden is growing rapidly in low and middle income countries [18] but treatment is limited due to the lack of comprehensive research with both conditions [19]. Furthermore, Abigail Santos JD, et al. [20], described the VALOR-QI program, a three-year initiative across 50 VA centers to optimize LDL-C in veterans with ASCVD. Strategies include health coaching, clinician networks, and tailored lipid management. Outcomes focus on LDL-C targets, adherence, and cost reduction, for which the **study indicates that** VALOR-QI aims to improve lipid control, reduce cardiovascular events, and inform broader healthcare systems about scalable quality-improvement models. Another study, **Mulijono D, et al.** [21], showed that major trials from COURAGE to ISCHEMIA failed to demonstrate survival or myocardial infarction benefit of Percutaneous Coronary Intervention (PCI) over Optimal Medical Therapy (OMT) in Chronic Coronary Syndrome (CCS). Key limitations include vulnerable plaques, incomplete revascularization, procedural risks, and long-term stent complications. In Indonesia, poor adherence and healthcare disparities magnify these issues. Bethsaida Hospital's integrated model drug coated balloons, OMT, and plant based diet achieved superior outcomes as detailed and illustrated in the clinical overlap between cardiovascular health and oncology, emphasizing shared risk factors such as dyslipidemia, hypertension, and chemotherapy-induced cardiotoxicity that define the emerging domain of cardio-oncology. Importantly, these overlaps are mechanistically linked to systemic metabolic dysregulation and chronic inflammation, which contribute both to cardiovascular disease and tumor progression (Figure 2) which is complementing with the figure 1. Furthermore, recent research and global health reports project that Cardiovascular Disease (CVD) deaths reported approximately 20.5

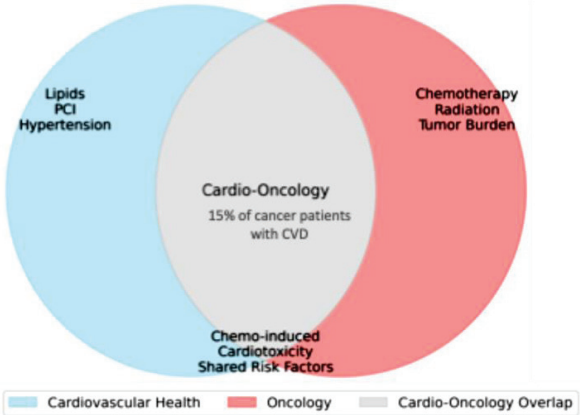

Figure 2 Overlap between cardiovascular health and oncology: Venn diagram illustrating the overlap between cardiovascular health and oncology, highlighting the emerging field of cardio-oncology. The left circle (blue) represents cardiovascular conditions such as lipid disorders, Percutaneous Coronary Interventions (PCI), and hypertension. The right circle (red) represents oncology-related factors including chemotherapy, radiation, and tumor burden. The overlapping area (gray) shows the shared domain of cardio-oncology, where approximately 15% of cancer patients also experience Cardiovascular Disease (CVD). This overlap includes chemo-induced cardiotoxicity and shared risk factors like smoking and obesity. Data reflect 2024 estimates from contemporary cardio-oncology research [17,29].

million worldwide in 2025, reflecting a continued rise driven by population aging and persistent risk factors [22,23], with Cancer Therapy-Related Cardiac Dysfunction (CTRCD) affecting up to 15% of treated cancer patients reported by most large studies and reviews cite a typical incidence of 10-25% for patients receiving anthracyclines, trastuzumab, or certain targeted therapies, with higher rates in high-risk groups or with combined treatments [24-28].

Conclusion

Across these five studies, a common theme emerges indicating that an intervention must extend beyond single therapeutic approaches to achieve meaningful outcomes. Somia, et al. [12] shows the promise of COX-2 inhibitors but emphasizes the need for standardization; Terzulum, et al. [13] encourages advance computational modeling for safer drug design; Francisco, et al. [14] validates a traditional herbal infusion as a natural option for cardiovascular risk; Abigail Santos JD, et al. [20], demonstrates the value of system wide quality improvement programs for lipid control; and Mulijono D, et al. [21], highlights the necessity of integrated strategies combining PCI, medical therapy, and lifestyle interventions. Collectively, these works underscore that sustainable improvements in neurological and cardiovascular health require **multifaceted, evidence-driven, and context specific approaches.**

Future Directions

Future research should build on these findings in several ways. In epilepsy, long term studies are needed to standardize COX-2 inhibitor protocols and evaluate their chronic effects for potential clinical translation. In drug design, computational models should be expanded with AI-driven analytics and multi-omics integration to refine cytochrome P-450 inducer selectivity and reduce adverse interactions. Herbal interventions such as *Ligaria cuneifolia* require larger randomized controlled trials to confirm lipid lowering benefits and ensure cardiovascular safety. Quality improvement programs like VALOR-QI should be extended beyond Veterans Affairs settings, incorporating digital health and telemedicine for broader adoption. Finally, cardiology research should focus on combining PCI with advanced imaging, drug coated balloons, and lifestyle medicine strategies, particularly within low resource healthcare systems. This triangulation emphasizes the cardio oncology metabolism axis, and the integration of inflammatory biology, metabolic pathways, and cardiovascular management paints a clear picture: Cancer cannot be understood or treated in isolation.

Relevance to JBRES

This editorial will be highly beneficial for the Journal of Biomedical Research & Environmental Sciences (JBRES). It integrates diverse fields like neurology, pharmacology, herbal medicine, cardiovascular science, and health systems research aligning perfectly with the journal's multidisciplinary vision. Covering contemporary topics such as epilepsy therapies, computational drug design, phytomedicine, lipid management, and PCI controversies ensures broad visibility and readership. The journal should launch thematic calls in trending areas like artificial intelligence in medicine, phytotherapy, and precision health, which are rapidly growing fields. Highlighting the success and visibility of previously published articles via publishing multiple editorials will inspire confidence among potential contributors.

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