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Short Communication

Biomarkers for High Metabolic Burden in Neurologic Disease

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Abstract

Neurologic diseases are recognized to have multifactorial origins well beyond mere genetic predisposition. Nutritional burdens have been identified to contribute to neurodegeneration. Healthy diets are becoming increasingly appreciated to potentially play key roles in both the developing and developed world of reducing incidences of neurologic diseases, while unhealthy diets are acknowledged to be contributing to their rise.

More Information

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Introduction

Biomarkers may have utility in diagnosing and treating, as well as in predicting and preventing, many neurologic diseases, such as bipolar disorder, major depressive disorder, and schizophrenia [1,2]. Biomarkers may be particularly useful when information on psychiatric symptoms is unavailable, as in underreporting, and for assessing intermediate treatment thresholds, as well as for evaluating uncertain diagnoses, such as typical in accurately identifying those presenting with symptoms of mania as a component of bipolar disorder [3,4].

Nutritional burdens

While we typically focus on the role of nutritional deficits contributing to neurologic diseases, excessive levels of substances, including respective nutrients, may be problematic as well. For instance, high levels of oleic acid, a type of omega-9 monounsaturated fatty acid (MUFA) that comprises about 80% of all MUFAs in blood plasma, may be associated with disorder pathogenesis as fatty acids can impact neurotransmission, neuroinflammation, and neuronal survival, thereby altering immune response regulation and metabolism, both of which have been implicated as risks for major depressive disorder and bipolar disorder [5]. Peripheral cholesterol levels, as linked to nutritionally-based conditions like diabetes [6] and obesity, have been associated with the risk of neurologic diseases such as Alzheimer's [7] and Parkinson's disease [8]. Overnutrition, generally, is recognized as contributing to cognitive impairment [9]. Alcohol consumption increases the risks of chronic diseases and mental health problems by escalating anxiety and depression, as well as suppressing immune system response [10,11], as does tobacco use [12,13] and exposure to secondhand and thirdhand tobacco smoke [14]. A better understanding of these sorts of associations can potentially lead to the use of new biomarkers to enhance preventive and therapeutic approaches. Biomarkers, like, for instance, sirtuin 1, are progressively becoming crucial to the prevention and treatment of neurodegenerative diseases [15]. Further, inter-professional healthcare team members should consider assessing high metabolic burdens, such as serum oleic acid levels, at least when clinically relevant in patients.

Lead toxicity

Lead toxicity has been speculated to have contributed to the fall of the Roman Empire. As lead has no physiological role in the human body its presence disrupts multiple enzyme systems, such as those involved in heme synthesis, like ferrochelatase, and with antioxidants, like catalase, glutathione peroxide, and superoxide dismutase. Lead binds to calcium-activated proteins, which can cause abnormally high calcium levels impacting calcium-dependent functions, particularly the release of neurotransmitter substances as implicated in myriad psychiatric conditions. Lead also disrupts an array of cellular, intracellular, and molecular neurological functions [16], such as cortical synaptogenesis, dendrite density, myelin deposition, and synaptic pruning; all implicated in numerous neurologic diseases and generalized neurodegeneration, such as decreased volume of neurologic aspects like frontal and total gray matter, parietal white matter, and total brain volume [17]. Lead poisoning has traditionally been associated with neuromuscular motor neuropathy, such as results initially in weakness of wrist and finger extensions and then spreads to

other muscular areas [18]. Lead levels have been associated with certain dietary habits, such as fish consumption [19,20].

Conclusion

More focused use of biomarkers of high metabolic burdens has potential to dramatically improve prevention and treatment of neurologic diseases, like major depressive disorder and bipolar depression [21]. There is also the additional benefit of such practices aiding in identifying and addressing associated comorbidities, such as diabetes mellitus and Alzheimer's disease [22-24]. It is recognized that high metabolic burdens can result from multiple factors, including unhealthy lifestyles [25], lack of access to quality healthcare, and adverse pharmacological effects. Nevertheless, additional research that will enable wider utilization of biomarkers to prevent and treat neurologic diseases is highly encouraged and promises to be more valid and reliable than self-report and clinician-assessed evaluative approaches.

References

1. Brunkhorst-Kanaan N, Klatt-Schreiner K, Hackel J, Schröter K, Trautmann S, Hahnefeld L, Wicker S, Reif A, Thomas D, Geisslinger G, Kittel-Schneider S, Tegeder I. Targeted lipidomics reveal derangement of ceramides in major depression and bipolar disorder. Metabolism. 2019 Jun; 95:65-76. doi: 10.1016/j.metabol.2019.04.002. Epub 2019 Apr 5. PMID: 30954559.
2. Lin S, Liu R, Zhang Z, Liu F, Qin S, Wei Y, Wang F. Sex-specific immune-inflammatory markers and lipoprotein profile in patients with anhedonia with unipolar and bipolar depression. BMC Psychiatry. 2023 Nov 27;23(1):879. doi: 10.1186/s12888-023-05378-4. PMID: 38012724; PMCID: PMC10680275.
3. Stolberg VB. Issues in mental health assessment. In A. Scull (Ed.). Cultural sociology of mental illness. Thousand Oaks, CA: SAGE Publications. 2014; 49-53.
4. Tomasik J, Harrison SJ, Rustogi N, Olmert T, Barton-Owen G, Han SYS, Cooper JD, Eljasz P, Farrag LP, Friend LV, Bell E, Cowell D, Bahn S. Metabolomic Biomarker Signatures for Bipolar and Unipolar Depression. JAMA Psychiatry. 2024 Jan 1;81(1):101-106. doi: 10.1001/jamapsychiatry.2023.4096. PMID: 37878349; PMCID: PMC10600716.
5. Yin J, Li S, Li J, Gong R, Jia Z, Liu J, Jin Z, Yang J, Liu Y. Association of serum oleic acid level with depression in American adults: a cross-sectional study. BMC Psychiatry. 2023 Nov 16;23(1):845. doi: 10.1186/s12888-023-05271-0. PMID: 37974120; PMCID: PMC10652490.
6. Stolberg VB. Diabetes. In J. M. Duquaine-Watson (Ed.), Women's health: Understanding issues and influences. Santa Barbara, CA: ABC-CLO/Greenwood. 2022a; 193-195.
7. Stolberg VB. Alzheimer's disease. In J. M. Duquaine-Watson (Ed.), Women's health: Understanding issues and influences. Santa Barbara, CA: ABC-CLO/Greenwood. 2022b; 35-37.
8. Martins IJ. Overnutrition Determines LPS Regulation of Mycotoxin Induced Neurotoxicity in Neurodegenerative Diseases. Int J Mol Sci. 2015 Dec 10;16(12):29554-73. doi: 10.3390/ijms161226190. PMID: 26690419; PMCID: PMC4691133.
9. Zhang Q, Jin K, Chen B, Liu R, Cheng S, Zhang Y, Lu J. Overnutrition Induced Cognitive Impairment: Insulin Resistance, Gut-Brain Axis, and Neuroinflammation. Front Neurosci. 2022 Jul 6; 16:884579. doi: 10.3389/fnins.2022.884579. PMID: 35873818; PMCID: PMC9298971.
10. Stolberg VB. Alcohol\ism and alcohol abuse. In J. M. Duquaine-Watson (Ed.), Women's health: Understanding issues and influences. Santa Barbara, CA: ABC-CLO/Greenwood. 2022c; 31-33.
11. Stolberg VB. Expert commentary: Substance availability and abuse. In R. V. Crume, Urban health issues: Exploring the impacts of big-city living. Santa Barbara, CA: ABC-CLIO/Greenwood. 2019; 79-80.
12. Stolberg VB. Tobacco. In B. S. Walter (Ed.), Wellness around the world: An international encyclopedia of health indicators, practices, and issues. Santa Barbara, CA: ABC-CLO/Greenwood. 2023; 360-362.
13. Stolberg VB. Tobacco use. In J. M. Duquaine-Watson (Ed.), Women's health: Understanding issues and influences. Santa Barbara, CA: ABC-CLO/Greenwood. 2022d; 677-679.
14. Stolberg VB. Tobacco smoke, secondhand and thirdhand. In R. V. Crume (Ed.), Environmental health in the 21st century: From air pollution to zoonotic diseases. Santa Barbara, CA: ABC-CLO/Greenwood. 2018a; 581-583.
15. Martins IJ. Sirtuin 1. A diagnostic protein marker and its relevance to chronic disease and therapeutic drug interactions. EC Pharmacology and Toxicology. 2018; 6(4): 209-215.
16. Mason LH, Harp JP, Han DY. Pb neurotoxicity: neuropsychological effects of lead toxicity. Biomed Res Int. 2014; 2014:840547. doi: 10.1155/2014/840547. Epub 2014 Jan 2. PMID: 24516855; PMCID: PMC3909981.
17. Stewart WF, Schwartz BS, Davatzikos C, Shen D, Liu D, Wu X, Todd AC, Shi W, Bassett S, Youssem D. Past adult lead exposure is linked to neurodegeneration measured by brain MRI. Neurology. 2006 May 23;66(10):1476-84. doi: 10.1212/01.wnl.0000216138.69777.15. PMID: 16717205.
18. Thomson RM, Parry GJ. Neuropathies associated with excessive exposure to lead. Muscle Nerve. 2006 Jun;33(6):732-41. doi: 10.1002/mus.20510. PMID: 16477615.
19. Castro-González MI, Méndez-Armenta M. Heavy metals: Implications associated to fish consumption. Environ Toxicol Pharmacol. 2008 Nov;26(3):263-71. doi: 10.1016/j.etap.2008.06.001. Epub 2008 Jun 18. PMID: 21791373.
20. Stolberg VB. Fish consumption advisories. In R. V. Crume (Ed.), Environmental health in the 21st century: From air pollution to zoonotic diseases. Santa Barbara, CA: ABC-CLO/Greenwood. 2018b; 239-240.
21. Stolberg VB. Mood disorders. In J. M. Duquaine-Watson (Ed.), Women's health: Understanding issues and influences. Santa Barbara, CA: ABC-CLO/Greenwood. 2022e; 447-451.
22. Bai YM, Su TP, Chen MH, Chen TJ, Chang WH. Risk of developing diabetes mellitus and hyperlipidemia among patients with bipolar disorder, major depressive disorder, and schizophrenia: a 10-year nationwide population-based prospective cohort study. J Affect Disord. 2013 Aug 15;150(1):57-62. doi: 10.1016/j.jad.2013.02.019. Epub 2013 Mar 16. PMID: 23510547.
23. Chen MH, Li CT, Lin WC, Wei HT, Chang WH, Chen TJ, Pan TL, Su TP, Bai YM. A predisposition for allergies predicts subsequent hypertension, dyslipidemia, and diabetes mellitus among patients with schizophrenia or bipolar disorder: a nationwide longitudinal study. Schizophr Res. 2014 Oct;159(1):171-5. doi: 10.1016/j.schres.2014.07.029. Epub 2014 Aug 10. PMID: 25115406.
24. SayuriYamagata A, Brietzke E, Rosenblat JD, Kakar R, McIntyre RS. Medical comorbidity in bipolar disorder: The link with metabolic-inflammatory systems. J Affect Disord. 2017 Mar 15; 211:99-106. doi: 10.1016/j.jad.2016.12.059. Epub 2017 Jan 4. PMID: 28107669.
25. Stolberg VB. Lifestyle diseases. In J. M. Duquaine-Watson (Ed.), Women's health: Understanding issues and influences. Santa Barbara, CA: ABC-CLO/Greenwood. 2022f; 400-403.