Proceedings of the Nutrition Society

cambridge.org/pns

The 49th Annual Scientific Meeting of the Nutrition Society of Australia, 3-5 December 2025

Cite this article: Kalu KA, Ataguba G, and OrjI R (2026). Big data, nutrition, and mental health: implications for artificial intelligence interventions. *Proceedings of the Nutrition Society* **85**(OCE2): E197. doi: 10.1017/S0029665126104388

Big data, nutrition, and mental health: implications for artificial intelligence interventions

K.A. Kalu[1], G. Ataguba[2] and R. Orjl[2]

[1]Food Science and Nutrition, Western Sydney University, Sydney, NSW, Australia and [2]Faculty of Computer Science, Dalhousie University, Halifax, Nova Scotia, Canada

Big data analytics, a process of examining large and complex datasets to uncover hidden patterns, correlations, and other insights, has shown the relationship between nutrition and mental well-being(1). Accordingly, big data is transforming public-health understanding and enabling artificial intelligence (AI)-driven interventions. We synthesise evidence from 12 original studies spanning cohorts, cross-sectional surveys, and clinical trials to examine how dietary patterns relate to depression, anxiety, stress, and mood disorders, and how these insights inform personalized, AI-driven interventions. We asked: (i) To what extent has big data shown the relationship between dietary intakes and mental health outcomes? (ii) What are the impacts across diverse populations? (iii) How do these results inform AI-driven personalization? We conducted a PRISMA-guided search(2)of 2022–2025 publications in PubMed, Scopus, and ScienceDirect using '*big data*' *AND (nutrition OR diet) AND (mental health OR anxiety OR depression OR stress OR bipolar)*. We retrieved 3,628 records and screened titles, abstracts, and full texts against English-language original-research criteria. Twelve studies met eligibility for extraction and in-depth analysis; descriptive frequencies summarized findings. Across adolescents, adults, and older adults 25% (3/12) of studies that examined ultra-processed foods (UPF) reported adverse associations—higher depressive/anxious symptoms and lower perceived well-being. Outcomes included depression in 67% (8/12), anxiety in 42% (5/12), stress in 17% (2/12), well-being or flourishing in 33% (4/12), mentally unhealthy/anxious days or composite symptoms in 17% (2/12), and perceived mental health (SF-36 MCS) in 8% (1/12). For example, studies have linked adolescent cohorts' higher UPF intakes to more frequent poor mental-health symptoms, and the Moli-sani cohort observed lower SF-36 mental component scores with greater shares of processed and ultra-processed foods(3). Also, higher sugar-sweetened beverage intake predicted higher depression/anxiety and lower flourishing at follow-up. Conversely, adherence to nutrient-rich patterns (e.g., Mediterranean diet) and higher fruits, vegetables, and micronutrients, magnesium, and B-vitamins (including folate), aligned with lower anxiety, reduced stress, and improved mood stability, including among individuals with mood disorders(4). Studies leveraged knowledge-graph construction (e.g., GENA), machine-learning recalibration of dietary indices (e.g., Planetary Health Diet Index), and large analyses of national surveys(5), enabling hypothesis generation, sharper dietary-pattern recognition, and broader inference. AI-driven interventions translate these insights into precision nutrition by integrating dietary, behavioural, and environmental inputs to guide mental well-being. AI supports predictive monitoring of diet-related mental-health risks and scalable interventions via real-world data streams (social-media sentiment and large health databases). Chatbots employing natural-language processing can enhance engagement and adherence through tailored dietary plans. Ethical deployment remains imperative, prioritising privacy, transparency, and equitable access to ensure benefits across populations for individuals and communities worldwide.

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