

Dietary Patterns and Lifestyle Factors Influencing Health Outcomes Across the Life Course: Metabolic, Immunological, and Neuropsychological Pathways. A Mini-Review

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Abstract

Dietary patterns and lifestyle behaviors are key modifiable determinants of health across the life course. Mediterranean-like, minimally processed, fiber-rich patterns align with improved cardiometabolic profiles and lower inflammatory burden, whereas Western ultra-processed food (UPF)-dominant patterns align with obesity, insulin resistance, and cardiometabolic risk [4-8]. Mechanistically, diet-lifestyle exposures influence gut microbiota functions (short-chain fatty acids, bile acid signaling, barrier integrity) that modulate metabolic and immune pathways [9-12]. These effects are modified by physical activity, sleep/circadian alignment, and psychosocial stress via gut-immune-brain interactions [2,3,13]. Early-life determinants (delivery mode and antibiotic exposures) shape microbiota maturation and immune development and may influence long-term trajectories [14,15].

Keywords: *Dietary Patterns; Lifestyle Behaviors; Gut Microbiota; Cardiometabolic Risk; Inflammation; Insulin Resistance; Circadian Rhythm; Life Course*

Introduction

Dietary patterns and lifestyle behaviors jointly shape metabolic, immune, and neuropsychological trajectories across life stages [1-3]. Western/UPF-dominant patterns-high in refined carbohydrates, saturated fats, and added sugars and low in fiber-are consistently associated with obesity, insulin resistance, and chronic low-grade inflammation [4-6,11,12]. In contrast, Mediterranean-style patterns rich in plant foods, olive oil, and fish are associated with improved cardiometabolic profiles and lower mortality risk [7,8]. A converging mechanistic literature supports gut microbiota-mediated pathways linking these exposures to host physiology, including microbial fermentation/SCFA production, bile acid signaling, and barrier integrity [9,10].

Key evidence and pathways protective patterns: Mediterranean-style patterns show reproducible protective associations for cardiometabolic endpoints and mortality, plausibly mediated by fiber/polyphenols and improved fat quality, with enrichment of SCFA-related functions and lower inflammatory tone [7-10].

Adverse patterns: Western/UPF patterns are linked to obesity and insulin resistance and may promote metabolic inflammation through dysbiosis and barrier vulnerability; metabolic endotoxemia provides a coherent pathway for inflammatory metabolic phenotypes [4-6,11,12].

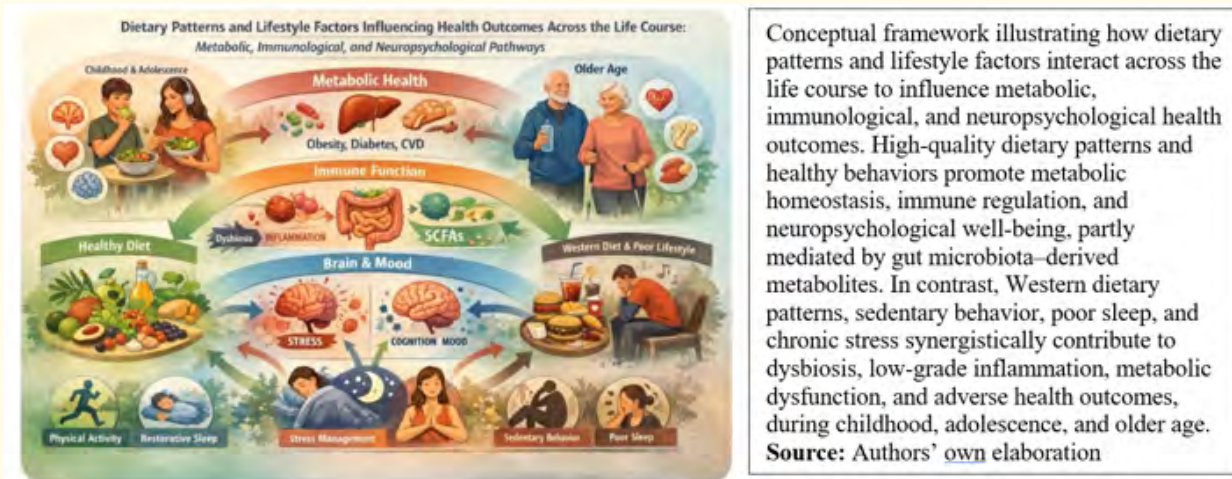


Figure 1: Integrated diet-lifestyle pathways across the life course (author's own elaboration) [4-15].

Lifestyle modifiers: Physical activity enhances metabolic regulation and physiological resilience and is associated with greater gut microbiome diversity and function, whereas sedentary behavior exerts independent negative effects [2,3]. Disruption of sleep and circadian rhythms, together with chronic psychosocial stress, interacts with dietary patterns through bidirectional gut-brain pathways, thereby modulating appetite control, eating behavior, systemic inflammation, and neuropsychological vulnerability [13].

Early-life foundations: Delivery mode and antibiotic exposures shape microbiota maturation and immune development and may influence sustained inflammatory propensity across the life course [14,15].

Conclusion

Health outcomes are determined not by isolated nutrients or behaviors but by integrated dietary and lifestyle patterns operating within biological and environmental contexts [1-3]. Mediterranean-like, minimally processed, fiber-rich patterns align with improved cardiometabolic and inflammatory profiles, whereas Western/UPF patterns align with obesity and insulin resistance risk [4-8]. Gut microbiota functions (SCFAs, bile acids, barrier integrity) and inflammatory pathways plausibly mediate these relationships [9-12]. Physical activity, sleep/circadian alignment, and stress regulation modify diet effects via metabolic and gut-brain mechanisms [2,3,13]. Early-life determinants of microbiota maturation and immune programming should be considered in life-course prevention strategies [14,15].

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