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Human diets in transition: evolutionary legacies, cultural change and modern food environments

Marco Capocasa[1], Cinzia Battaggia[1], Monica Dinu[2] & Marilena Vitale[3]

1) Istituto Italiano di Antropologia, Piazzale Aldo Moro 5, Rome, Italy
email: marco.capocasa2@gmail.com

2) Department of Experimental and Clinical Medicine, University of Florence, Largo Brambilla 3, 50134, Florence, Italy

3) Department of Clinical Medicine and Surgery, Federico II University, Via Pansini 5, 80131, Naples, Italy

Summary - *This conference paper synthesizes selected perspectives from the interdisciplinary lecture series "Il Cibo Siamo Noi: biologia, società, evoluzione" ("Food Is Who We Are: Biology, Society, Evolution"; April–May 2025), organized by the Istituto Italiano di Antropologia. Its aim is to examine human diet as a biocultural phenomenon, shaped by the long-term interaction between biological evolution, cultural practices, subsistence strategies, and changing food environments. Adopting a diachronic perspective, the paper considers how major dietary transitions have influenced human physiology, genetic adaptation, and the gut microbiota, while also contributing to contemporary forms of biological and cultural mismatch. It then discusses the Mediterranean diet as a historically rooted dietary model in which health, cultural heritage, and environmental sustainability remain closely connected, despite growing pressures from urbanization, convenience foods, and industrialized dietary patterns. Selected contemporary dietary models, including therapeutic and popular diets, are considered to illustrate how scientific evidence, adherence, cultural appeal, and sustainability interact in current nutrition debates. Finally, the paper addresses the circulation of nutrition misinformation and the role of open access and the "third mission" of academia in improving public engagement with nutrition science. By integrating evolutionary, cultural, biomedical, and environmental perspectives, the paper argues for dietary approaches that reconnect health promotion with biological history, cultural meaning, and sustainability.*

Keywords - *Human diet, Genetic adaptation, Subsistence strategies, Mediterranean diet, Contemporary diets, Nutrition misinformation.*

Introduction

Human nutrition represents one of the most complex interfaces between biology, culture, health, and environment, encompassing the physiological ingestion and metabolism of nutrients as well as the social and symbolic practices through which communities organize subsistence, construct identities, transmit knowledge, and respond to ecological constraints (Fieldhouse 1995). From an anthropological and biocultural perspective, food systems can therefore be understood as historically situated adaptive strategies, emerging from the interaction between environmental conditions, technological innovation, social organization, and biological change (Capocasa and Venier 2024a). This framework helps to explain why diet has represented a central dimension of human history and why it remains closely linked to public health, sustainability, and social well-being today.

This conference paper originates from the online lecture series "Il Cibo Siamo Noi: biologia, società, evoluzione" ("Food Is Who We Are: Biology, Society, Evolution"; April 29–May 20, 2025), organized by the Istituto Italiano di Antropologia. The paper develops a thematic synthesis of selected issues discussed during the series. Its rationale is to bring together perspectives that are often treated separately: evolutionary adaptation, traditional food systems, contemporary dietary models, nutrition misinformation, and the public communication of scientific knowledge. The conference-paper format is used as an opportunity to connect these themes within a shared biocultural framework. The aim is conceptual integration across evolutionary, nutritional, cultural, and communicative domains, rather than systematic evidence mapping. While this paper builds on the biocultural framework previously developed by Capocasa and Venier (2024a), its specific contribution lies in extending that approach through the interdisciplinary lecture series, incorporating additional contributions.

The paper is organized into four interconnected sections. The first examines how long-term interactions between diet, environment, genes, physiology, and microbiota can inform present-day nutritional challenges. The second considers the Mediterranean diet as a traditional dietary system in which health-related, cultural, and ecological dimensions remain closely intertwined. The third discusses selected contemporary dietary models as examples of the complex relationship between scientific evidence, clinical purpose, cultural appeal, adherence, and sustainability. The fourth addresses the cultural and informational dimensions of nutrition, with particular attention to traditional food knowledge, misinformation, open access, and the "third mission" of academia.

Taken together, these sections situate nutrition within the broader relationships among biological heritage, cultural practices, environmental change, and knowledge dissemination. This integrated perspective is particularly relevant in contemporary societies, where dietary transitions, ecological pressures, and fragmented information environments increasingly shape how people understand and practice food.

Environment, nutrition and genetic adaptations: the modern dietary incoherence

This section expands and updates evolutionary and genetic concepts previously discussed by the authors (Capocasa and Venier 2024a), integrating recent evidence on microbiota and inflammatory pathways. As already described, throughout human evolution, the food environment has undergone significant changes to meet both biological requirements and cultural transformations. Humans have frequently been the primary agents of dietary innovation. Notably, the ability to cook meat, following the discovery of fire, enabled early hominins to consume a nutritionally improved diet with enhanced digestibility. However, the most profound shift occurred approximately 10,000 years ago, with the advent of agriculture and animal husbandry. This transition led to a diet primarily based on starches derived from cultivated crops. Such dietary practices have left a measurable imprint on our genome, as natural selection has favored genetic mutations such as the duplication of the salivary amylase gene, which results in increased enzymatic production (Luca et al. 2010). Another well-documented example is lactase persistence, where gene variants enabling lactase expression in adulthood became widespread in pastoralist populations (Enattah et al. 2002). These examples illustrate how natural selection has adapted us to the dietary modifications initiated by cultural evolution.

In more recent history, humanity has continued to adopt novel dietary patterns. In post-industrial societies, the typical diet, characterized by an excessive intake of ultra-processed and ultra-refined foods, poorly fits the genetic blueprint shaped by our evolutionary past. According to the thrifty genotype hypothesis proposed by James Neel (1962), natural selection historically favored alleles that promoted adipose tissue accumulation, providing an adaptive advantage during periods of intermittent food scarcity. Although Neel's original hypothesis concerned inherited genetic variation, subsequent models have extended this evolutionary framework to epigenetic processes and host–microbiota interactions (Stöger 2008; Suzuki 2026). The rapid pace of industrialization has outstripped the capacity of natural selection to facilitate biological adaptation, generating an evolutionary mismatch implicated in the rise of obesity and related non-communicable diseases (González Olmo et al. 2021).

Beyond obesity, several conditions have been investigated in relation to modern dietary patterns. Emerging evidence suggests that some neurodegenerative and neurological conditions may be associated with gut microbiota dysbiosis, a condition potentially influenced by diets high in ultra-processed and fiber-deficient foods. Reduced fiber intake is associated with a decline in the production of short-chain fatty acids (SCFAs) by the gut microbiota. These SCFAs may exert neuroprotective effects by modulating neuroinflammation and mitigating obesity, the latter now recognized as a chronic inflammatory condition of adipose tissue. These mechanisms have been investigated as potential contributors to inflammatory and age-related processes.

The microbiota

These observations underscore the role of the gut microbiota in shaping both health and disease, highlighting its deep-rooted connections with human evolution and physiological resilience. The human intestinal microbiota can be understood as a complex ecological system whose composition and functions have been shaped, in part, by host dietary choices and subsistence patterns (Schnorr et al. 2014; Carmody et al. 2015). Diet is among the dominant factors influencing microbial community structure, often exerting effects that may exceed those of host genetics. In turn, microbial diversity and functional plasticity may have contributed to host adaptation by supporting metabolism, immune function, ecological stability, and resilience to fluctuations in food availability (Shapira 2016; Gupta et al. 2017).

Within this framework, modern industrialized diets can be interpreted as a further expression of evolutionary mismatch. Diets characterized by high intakes of refined carbohydrates, fats, animal proteins, and low fiber may disrupt host–microbiota relationships that evolved under different nutritional conditions, contributing to reduced microbial diversity, altered metabolic functions, and greater vulnerability to obesity and related metabolic disorders (Suzuki and Worobey 2014; Gupta et al. 2017). Evidence from comparative and population studies suggests that major dietary transitions can influence microbial diversity and metabolic function. More broadly, cooking, agriculture, and industrialization may be understood as successive phases in the long-term interaction between human populations, dietary practices, and gut microbial ecosystems (Davenport et al. 2017; Shahab and Shahab 2022; Zahavi et al. 2023).

Environmental changes: the thrifty genotype hypothesis

Given these associations, researchers in the fields of nutrition, medicine, and evolutionary biology are increasingly investigating whether targeted nutritional strategies can reduce disease incidence and promote healthy longevity. Specifically, caloric restriction has been associated with improved immune and metabolic markers and may contribute to lower risk profiles for some age-related conditions, with effects that depend on biological context and long-term adherence (Hahm et al. 2023). Within this interdisciplinary framework, molecular anthropology has taken on a key role in elucidating how microevolutionary mechanisms, especially natural selection, have shaped our genomic response to dietary transitions driven by cultural and environmental changes.

One such environmental shift occurred during the Miocene, when global cooling and aridification led to forest regression and the expansion of savannah ecosystems marked by pronounced seasonality (Plana 2004; Rossie and MacLatchy 2013; Green et al. 2022; Dagallier et al. 2024; Hullot et al. 2024). Such environmental fluctuations have provided the basis for several evolutionary hypotheses concerning energy storage and contemporary metabolic vulnerability. A related but distinct evolutionary hypothesis concerns uricase pseudogenization and fructose metabolism. According to this model, uricase loss may have influenced energy and lipid metabolism, while fructose-related pathways have been proposed as a possible underlying mechanism (Kratzer et al. 2014; Gregorio et al. 2015; Johnson et al. 2022; see Figure 1). However, the adaptive interpretation of uricase loss remains

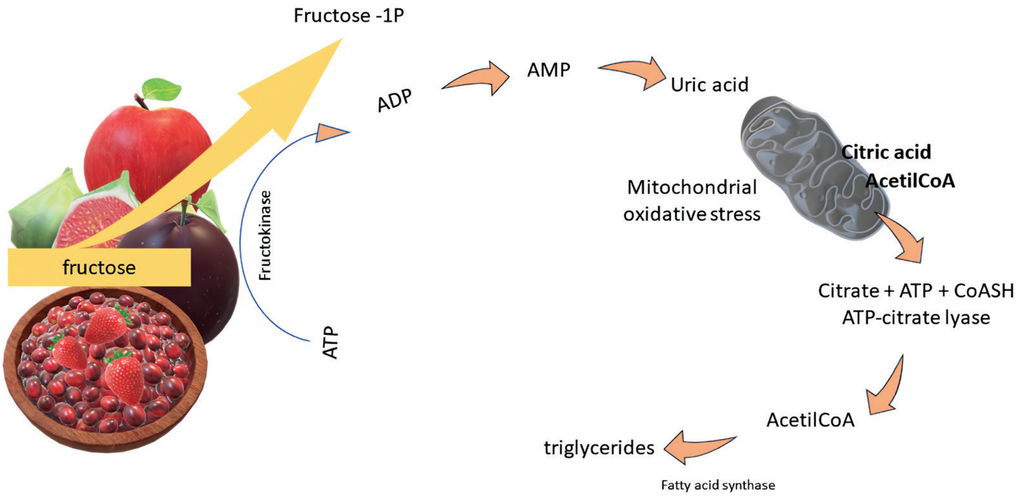

***Fig. 1** - Synthesis of triglycerides from fructose.*

contested, and alternative explanations have also been proposed (Ames et al. 1981).

Previous work (Capocasa and Venier 2024a) addressed the thrifty genotype hypothesis in the context of evolutionary dietary adaptations. The present section briefly summarizes its main criticisms and alternative interpretations. Speakman and colleagues questioned whether recurrent famine generated selective pressures strong enough to favor the spread, but not fixation, of fat-storage alleles across human populations (Speakman 2008; Speakman and Westerterp 2013). Fertility-based explanations have also been considered insufficient to account for the heterogeneous distribution of obesity susceptibility. Alternative interpretations include genetic drift and the possible relaxation of predation-related constraints on adiposity (Speakman 2008; Speakman and Westerterp 2013). Genetic drift may contribute to this susceptibility alongside climatic and thermoregulatory adaptations and their interactions with contemporary dietary, behavioral, and environmental conditions (Sellayah et al. 2014). These considerations support a multifactorial interpretation of obesity susceptibility, integrating natural selection, genetic drift, climatic adaptation, and contemporary dietary and social environments.

Gene-culture-microbiota interactions

This interplay between environment, culture, and genes is also evident in other human adaptations. Cultural evolution has consistently interacted with genetic adaptation. The emergence of pastoralist lifestyles and the widespread distribution of lactase persistence alleles offer compelling examples. Multiple distinct mutations [all located upstream of the lactase gene (LCT) in its regulatory region] converge functionally to sustain lactose digestion into adulthood (Ségurel and Bon 2017; Anguita-Ruiz et al. 2025). This phenomenon represents a textbook case of convergent evolution, whereby unrelated genetic changes result in similar adaptive outcomes.

Lactase persistence variants display heterogeneous frequencies across populations. These variants are most frequent in groups with a longstanding tradition of consuming fresh milk, such as those in Central and Northern Europe, African pastoralists, and certain Arab populations who rely on milk as a water source in arid environments. In contrast, populations in Central Asia and Southern Europe tend to consume fermented dairy products with lower lactose content. Consequently, these regions have experienced weaker selective pressure, resulting in a less widespread distribution of lactase-persistence variants (Ségurel and Bon 2017). In such cases, specific taxa within the gut microbiota capable of metabolizing residual lactose may have increased in prevalence, thereby supporting lactose tolerance indirectly (Duijghuijsen et al. 2024).

These examples show that a comprehensive understanding of human dietary adaptations requires the integration of genetic variation with cultural practices, microbial ecologies, and local food environments.

Preserving tradition: the Mediterranean diet in a changing world

The evolutionary perspective outlined above raises a central question: whether traditional dietary systems, shaped through long-standing interactions among local environments, cultural practices, and human biology, can offer useful frameworks for interpreting contemporary nutritional transitions. The Mediterranean diet represents a particularly relevant case study in this regard.

The term "Mediterranean diet" entered scientific and public discourse in the mid-twentieth century, catalyzed by the work of Ancel Keys and colleagues during and after the Seven Countries Study (Keys and Keys 1975). Observing communities in Italy and Greece during the 1950s and 1960s, Keys described eating patterns characterized by abundant vegetables, fruits, legumes, nuts, and whole grains; olive oil as the principal fat; moderate consumption of fish and fermented dairy (e.g., yogurt and cheese) and limited red and processed meats; and modest wine with meals when culturally appropriate. These patterns correlate with low rates of coronary heart disease and all-cause mortality during long-term follow-up, launching decades of research and informing healthy dietary guidance (Keys 1980; Keys et al. 1986; Kromhout et al. 1989; UNESCO 2008; Riccardi et al. 2022).

Contemporary evidence supports the health benefits of these features. A comprehensive review in Cardiovascular Research concluded that low salt intake, limited foods of animal origin, especially red and processed meats, and higher intakes of plant foods are associated with lower atherosclerotic risk; replacing animal or tropical fats with olive oil and other unsaturated oils is favored (Riccardi et al. 2022). The same review highlights emerging nuances: poultry shows neutral relationships with cardiovascular outcomes at moderate intakes; moderate dairy, particularly cheese in small amounts and yogurt regularly, appears compatible with cardiometabolic health; and low-GI cereals and whole grains are preferable (Riccardi et al. 2022) (Tab. 1). These findings clarify the cardiometabolic rationale for considering the Mediterranean diet as a reference model in contemporary nutrition. From an anthropological perspective, the Mediterranean diet is relevant for its health profile and for its characteristics as a historically situated food system, shaped by local ecologies, agricultural practices, commensality, intergenerational transmission, and shared cultural meanings.

Italy, like many high-income countries, has undergone profound dietary transitions over the last three decades. Urban living and dual-income households reduce time for cooking; digital platforms have scaled delivery of ready-to-eat meals; and retail environments have expanded shelf-stable, hyper-palatable products. These forces contribute to increased eating away from home and greater reliance on convenience foods. Household expenditure data from ISTAT for 2023 show that many families have adjusted both the quantity and quality of food purchases, reporting efforts to limit spending on foods and beverages (ISTAT 2024). In parallel, analyses of out-of-home consumption point to a robust rebound post-pandemic, reflecting structural shifts in lifestyle and work patterns (Bain & Company 2023; Beverfood 2023).

The availability of ultra-processed foods (UPFs) plays a central role in this transition. Using the NOVA classification, Italian data from the INHES survey indicate that UPFs provide ~17% of daily energy among adults and ~26% among children and adolescents; higher intake of UPFs is inversely associated with adherence to the Mediterranean diet (Monteiro

***Tab. 1** - Association between consumption of foods of animal origin and risk of atherosclerosis. Legend: ↑ increase in risk; ↓ decrease in risk; → neutral association. Single arrow ≈ ≤10% change in relative risk; double arrows >10%. Consistency: + moderate evidence; ++ high evidence.*

FOOD ITEM	CHD INCIDENCE/ MORTALITY	CVD INCIDENCE/ MORTALITY	CONSISTENCY OF EVIDENCE
Meat	↑↑	↑	+
Processed meat	↑↑	↑↑	++
Unprocessed red meat	↑↑	↑↑	+
White meat	→	→	++
Eggs	→	→	++
Fish	↓	↓	++
Dairy products	→	→	++
Full fat dairy	→	→	+
Low fat dairy	→	→	+
Milk	→	→	+
Yogurt	→	↓	+
Cheese	↓	↓	+

et al. 2019; Ruggiero et al. 2021; Dinu et al. 2022). Although those shares are lower than in some countries, the trend is concerning given prospective evidence linking higher UPFs consumption with incident obesity, type 2 diabetes (T2D), hypertension, lipid disorders, and, in several cohorts, cardiovascular disease (CVD). A 2024 systematic review and meta-analysis led by Vitale et al. (2024) reported significantly elevated risks for T2D (+37%), hypertension (+32%), and dyslipidemia (e.g., hypertriglyceridemia +47%), while noting heterogeneity related to how ultra-processed food intake is assessed. Overall, these findings raise public health concerns, although the extent to which the observed associations reflect processing per se rather than nutrient composition and broader dietary patterns remains debated (Juul et al. 2022; Dinu et al. 2026).

Beyond processing, specific food groups show divergent health associations. An umbrella review of prospective cohorts found that red and processed meat intakes were dose-dependently associated with higher T2D incidence (e.g., RR ≈1.22 per 100 g/day red meat; 1.30 per 50 g/day processed meat), while white meat at 50 g/day showed a smaller association (RR ≈1.04). In contrast, total dairy (200 g/day), low-fat dairy, milk, and yogurt were associated with small risk reductions for T2D (Giosuè et al. 2022a). For fish, a meta-analysis differentiating fatty from lean species reported that 1–2 portions/week of fatty fish was associated with lower coronary heart disease incidence and mortality, whereas lean fish showed no clear benefit (Giosuè et al. 2022b). A meta-analysis focusing on white meat found an inverse association with all-cause mortality and neutral associations with CVD outcomes, suggesting that white meat can be a healthier alternative to red and processed meats within a Mediterranean diet-like pattern (Lupoli et al. 2021).

Impacts on health and the environment

The relevance of the Mediterranean diet also extends to the environmental implications of contemporary food systems. Food systems account for roughly one-quarter of global greenhouse gas emissions, occupy half of the world's habitable land, and use about 70% of freshwater withdrawals. The most resource-intensive footprints are typically associated with animal products, especially ruminant meat, where even the lowest-impact producers often exceed the impacts of plant alternatives (Poore and Nemecek 2018; Ritchie et al. 2022). Within the EU, food waste amounts to ~59 million tonnes annually (≈132 kg per person), with households responsible for over half; food waste contributes an estimated ~16% of total GHG emissions from the EU food system (Eurostat 2024). Reducing the carbon and resource intensities of diets requires both demand-side shifts (e.g., more legumes and whole grains, fewer red/processed meats and sugary drinks) and supply-side improvements.

Global targets for Mediterranean diet principles

The EAT-Lancet Commission's planetary health diet proposes global targets that broadly mirror MD principles: double intakes of fruits, vegetables, nuts, and legumes and reduce red meat and sugar by >50% (Willett et al. 2019).

However, sustainability is not synonymous with vegetarianism or a single macronutrient profile; it is context-dependent. Fatty fish, for instance, confers cardioprotective benefits when consumed 1–2 times weekly, but sustainability hinges on species, stock status, and fishing methods; guidance should therefore steer consumers toward low-impact, certified options (e.g., small pelagics from well-managed fisheries) (Willett et al. 2019; Giosuè et al. 2022b). Similarly, dairy can fit within sustainable patterns if portions are moderate and production practices improve, while fermented dairy may offer additional health benefits (Giosuè et al. 2022a; Riccardi et al. 2022).

These convergences between Mediterranean diet principles and planetary-health targets have also informed recent national guidance. Most recently, the Italian Ministry of Health, in collaboration with leading national health organizations including the Fondazione Dieta Mediterranea, the Società Italiana di Nutrizione Artificiale e Metabolismo (SINPE), the Società Italiana per la Prevenzione Cardiovascolare (SIPREC), and the Istituto Superiore di Sanità (ISS), has published the Mediterranean Diet Guidelines. In parallel, the Italian Society of Human Nutrition (SINU) has released an updated version of the Mediterranean Diet Pyramid, which reflects the latest scientific evidence and highlights the importance of integrating food choices with lifestyle factors such as physical activity, conviviality, seasonality, and sustainability (Sofi et al. 2025). Together, these initiatives provide a coordinated national framework for the practical application of current Mediterranean diet evidence.

Potential pathways for multi-level implementation

Public procurement (schools, hospitals, municipal canteens) may provide opportunities to incorporate Mediterranean diet–aligned menus: daily vegetables and seasonal fruit, regular legumes, whole grains, nuts, weekly fish (preferably fatty, low-impact species), yogurt or milk as main dairy, and limited red/processed meat. Rotating regional dishes can support local producers, while front-of-pack labeling and restrictions on advertising UPFs, especially to children, may reduce unhealthy choices (Willett et al. 2019; Lichtenstein et al. 2021; Juul et al. 2022; Angelino et al. 2024; Eurostat 2024; Vitale et al. 2024; Di Veroli et al. 2025).

Clinicians and community health workers may support adherence through simple habits: replace refined grains with whole grains, eat legumes and fatty fish weekly, choose yogurt or fruit instead of desserts, cook with olive oil, and limit red/processed meat. Tools such as goal setting, meal planning, shopping lists, and quick cooking classes with affordable staples can support adoption (Lichtenstein et al. 2021; Lotti et al. 2024; Di Veroli et al. 2025).

Retailers and foodservice operators may facilitate dietary choices by making Mediterranean options the default: price whole grains competitively, promote legumes and seasonal vegetables, offer yogurt or unsweetened dairy as sides, and prioritize white-meat or legume dishes over processed meats. Clear seafood labeling and procurement favoring lower-waste, lower-GHG suppliers can further support sustainability goals (Willett et al. 2019; Dinu et al. 2021; Eurostat 2024; Di Veroli et al. 2025). These considerations position the Mediterranean diet as a nutritional model and as a food system in which health promotion, cultural continuity, and environmental sustainability remain closely interconnected.

Contemporary diets: scientific evidence, cultural context, and public health implications

Having considered the Mediterranean diet as a historically rooted dietary model, the paper next examines a range of contemporary dietary approaches that differ in their scientific basis, clinical purpose, feasibility, cultural appeal, and integration into everyday food practices. From an anthropological perspective, these approaches are relevant not only as nutritional interventions but also as cultural constructs through which ideas about the body, self-control, naturalness, risk, purity, modernity, and personal responsibility for health are expressed.

Such dietary models emerge from the interaction of scientific research, cultural traditions, commercial interests, and evolving societal expectations surrounding health, body image, and longevity. Some are grounded in longstanding food practices or supported by clinical research, whereas others gain popularity through simplified narratives that promise health benefits despite limited scientific validation.

Plant-based diets exemplify historically grounded models, with longstanding cultural and religious roots in regions including India, the Mediterranean basin, and East Asia. Their persistence and coherence with regional ecologies suggest a degree of evolutionary plausibility and adaptability (Bragazzi et al. 2024). Other approaches, including the Dietary Approaches to Stop Hypertension (DASH), Portfolio, and low-FODMAP diets, are modern therapeutic constructs developed through nutritional research and clinical trials to support the management of hypertension, hypercholesterolemia, and irritable bowel syndrome.

Many popular dietary approaches, by contrast, are defined by macronutrient manipulation, as in low-carbohydrate or high-protein diets, by the timing of food intake, as in intermittent fasting, or by claims of alignment with ancestral eating patterns, as in the Paleolithic diet. Although often promoted for weight loss or disease prevention, evidence regarding their long-term effectiveness, safety, and sustainability remains limited or inconsistent (Dinu et al. 2023; Gardner et al. 2023). Fad diets represent a more extreme expression of this tendency, offering rapid and apparently simple solutions to complex conditions such as obesity and metabolic disease. They are frequently commercialized with limited empirical support and often rely on restrictive frameworks that are neither sustainable nor nutritionally balanced (Tahreem et al. 2022; Anderson 2023). Table 2 provides an overview of selected contemporary diets, focusing on those that have undergone scientific evaluation to some degree. This perspective frames contemporary dietary prescriptions as socially circulating narratives through which people negotiate identity, trust, expertise, and belonging within changing food environments.

Health effects and clinical outcomes

This subsection extends the evaluation of dietary interventions beyond weight loss to include broader clinical outcomes, disease prevention, and nutrient adequacy. Issues of long-term adherence and sustainability are addressed separately in the following subsection. Figure 2 provides a comparative overview of major diet categories across these domains.

Contemporary diets differ substantially in their evidential basis, clinical purpose,

***Tab. 2** - Classification and key features of contemporary diets evaluated in the scientific literature. Abbreviations: ADF = Alternate-day fasting; DASH = Dietary Approaches to Stop Hypertension; FMD = Fasting-mimicking diet; MIND = Mediterranean-DASH Intervention for Neurodegenerative Delay; FODMAP = fermentable oligosaccharides, disaccharides, monosaccharides, and polyols; Low GI/GL diet = low glycemic index/glycemic load diet; TRF = Time-restricted feeding.*

	DESCRIPTION
PLANT-BASED DIETS	
Vegan	Excludes all animal products including meat, fish, dairy, eggs, and honey.
Vegetarian	Excludes meat and fish. May include dairy (lacto), eggs (ovo), or both (lacto-ovo).
Pescatarian	Primarily vegetarian, but includes fish and seafood.
Flexitarian	Mostly plant-based with occasional inclusion of meat and animal products. Flexible approach.
MACRONUTRIENT-BASED DIETS	
Low-carb	Restricts carbohydrate intake to <26% of daily energy (≤130 g/day); very low-carb diets provide <10% (20-50 g/day); moderate-carb diets provide 26%-44% (130-225g/day).
High-protein	Emphasizes protein (>25-30% of total calories), often at the expense of carbohydrates.
Atkins	High-protein, high-fat, very low-carb diet developed in the 1960s. Carbohydrates are severely restricted.
Ketogenic	There are several versions of the ketogenic diet, but the most studied is the standard version, which is a very low-carb (10%), high-fat (70%), and moderate-protein (20%) diet. Originally developed for epilepsy, it is now widely used for weight loss. Long-term safety is still debated.
Zone	40% carbs, 30% protein, 30% fat. Limits high-fat and high-carb foods. Considered high-protein. The American Heart Association does not recommend its use as one of the dietary patterns most closely aligned with its cardiovascular health guidance (Gardner et al. 2023; Lichtenstein et al. 2026).
Paleolithic	Emulates pre-agricultural diets. Excludes grains, legumes, dairy, and processed foods. Based on evolutionary assumptions, it lacks historical context.
FASTING AND TIME-RESTRICTED DIETS	
TRF	Daily fasting for 14-16 hours; eating window of 8-10 hours (e.g., 16/8 method).
ADF	Fasting every other day. May allow 0% (no food) or 25% of usual calorie intake on fast days.
5:2 fasting	Two days/week of very low-calorie intake (500-600 kcal); normal eating the other five days.
FMD	Plant-based, low-calorie, low-protein diet (34-54% of usual calories) for 5 days. Used in cycles every few weeks to months. Commercially available as a packaged meal program.
THERAPEUTIC DIETS	
DASH	Aimed at reducing blood pressure. Emphasizes fruits, vegetables, whole grains, and limits salt, red meat, and added sugars.
MIND	Combines DASH and Mediterranean diet. Focuses on brain-healthy foods (e.g., leafy greens, berries, fish) and foods to be limited (e.g., red and processed meat, sweets, fast food).
Portfolio	Plant-based cholesterol-lowering diet including plant sterols, viscous fiber, soy protein, and nuts.
Low-FODMAP	Eliminates fermentable carbs (FODMAPs) for 2-3 weeks, followed by a reintroduction phase to identify triggers. Used for digestive disorders.
Low GI/GL	Reduces intake of high glycemic index/load foods. Used in diabetes management. Practical application can be challenging.

DIET CATEGORY	WEIGHT LOSS	HEALTH OUTCOMES	EVIDENCE FOR DISEASE PREVENTION	LONG-TERM ADHERENCE & SUSTAINABILITY
 **Traditional & plant-based diets**	Modest, gradual; largely adherence-dependent	Improved cardiometabolic profile; reduced risk of cardiovascular disease, type 2 diabetes, cancer, neurodegenerative diseases	Strong and consistent evidence from large prospective cohorts and meta-analyses	Generally high; culturally adaptable; nutritionally adequate if well planned; environmentally sustainable
 **Macronutrient-based diets**	Pronounced short-term loss; plateau after 6-12 months	Short-term metabolic changes; no clear long-term advantage	Limited/inconsistent evidence for long-term disease prevention	Declining adherence; restrictive patterns; concerns over saturated fat intake and cardiometabolic risk; low long-term sustainability
 **Fasting and time-restricted diets**	Variable; generally not superior to continuous energy restriction	Heterogeneous effects on cardiometabolic and inflammatory outcomes	Insufficient/heterogeneous evidence for long-term disease prevention	Often low adherence in free-living populations; feasibility highly context-dependent
 **Therapeutic diets**	Not a primary endpoint	Targeted clinical benefits (blood pressure, lipid lowering, cognitive protection, GI symptom relief)	Consistent evidence for specific clinical indications, supported by RCTs	Effective when medically indicated; some require professional supervision; scalability and long-term use vary

***Fig. 2** - Comparative overview of major dietary approaches for weight management, health outcomes, disease prevention, and long-term sustainability*

long-term feasibility, and cultural coherence. Traditional and plant-based dietary patterns are generally supported by robust evidence for the prevention of non-communicable diseases, including cardiovascular disease, type 2 diabetes, some cancers, and selected neurodegenerative outcomes, particularly when they are nutritionally adequate and based on minimally processed plant foods (Agnoli et al. 2017; Wang et al. 2024; Capodici et al. 2024; Lv et al. 2025; Zhang et al. 2025). Low-carbohydrate, high-protein, fasting, and time-restricted diets may produce short-term weight loss or metabolic improvements. Evidence concerning their long-term superiority, safety, and adherence remains less consistent, especially when these approaches involve restrictive rules, high saturated-fat intake, or limited compatibility with everyday food practices (Dinu et al. 2020; Ge et al. 2020; Fanti et al. 2021; Tahreem et al. 2022; Gardner et al. 2023; Hamsho et al. 2025; Semnani-Azad et al. 2025).

Therapeutic diets occupy a different position. Dietary patterns such as DASH, MIND, Portfolio, and low-FODMAP diets are indication-specific tools developed for defined clinical purposes. Their use may be appropriate when supported by clinical evidence and professional supervision, but their broader translation into public dietary advice requires attention to nutritional adequacy, feasibility, and cultural acceptability (Chiavaroli et al. 2018; Huang et al. 2023; Kuźmin et al. 2025; Pouladi et al. 2025).

Overall, the clinical value of contemporary dietary models depends on the strength and consistency of the supporting evidence, the specific health outcomes considered, and the appropriateness of each approach for its intended population. These clinical considerations provide the basis for examining whether dietary interventions can also be maintained over time and integrated into everyday food practices.

Long-term efficacy, adherence, and sustainability considerations

Long-term appraisal requires attention to behavioral feasibility, nutritional adequacy, and alignment with established dietary guidance. The 2023

American Heart Association scientific statement provides a useful example of this approach by comparing ten popular dietary patterns with its 2021 cardiovascular health recommendations (Gardner et al. 2023). In this framework, dietary patterns that preserve fruits, vegetables, whole grains, legumes, nuts, and unsaturated plant oils align more closely with cardiovascular guidance. Patterns that restrict major plant-food groups or promote high saturated-fat intake show lower levels of alignment.

Evidence consistently indicates that most diet-induced weight loss plateaus after 6-12 months and that adherence is the most critical predictor of long-term success (Ge et al. 2020). Diets that are overly restrictive, culturally incongruent, or nutritionally unbalanced tend to have higher dropout rates and lower effectiveness over time. Moreover, the environmental implications of dietary choices are increasingly relevant (Willett et al. 2019). Diets high in animal products, especially red and processed meat, have been associated with increased GHG emissions, land use, and water consumption. In contrast, plant-based and traditional diets tend to be more sustainable, both ecologically and economically (Alves et al. 2024).

Taken together, these considerations indicate that the long-term relevance of contemporary dietary models depends on their nutritional adequacy, clinical appropriateness, behavioral feasibility, cultural compatibility, and environmental implications. When translated into public discourse, these dietary models may be represented through simplified or commercially appealing messages, thereby increasing the risk of oversimplification and misinformation, as discussed in the following section.

Human nutrition, culture, and the challenges of misinformation

Nutrition operates as a biocultural practice in which biochemical processes are continuously shaped by habit, memory, family routines, social expectations, and informational environments that influence how dietary meanings and advice circulate. The shared practices through which communities have historically made food safe, meaningful, and socially valued therefore provide an important bridge between the evolutionary and dietary perspectives discussed above and the contemporary challenges of nutrition communication. In this sense, the biological mismatch associated with modern food environments may be accompanied by a cultural and informational mismatch, in which traditional food knowledge is increasingly exposed to fragmentation, simplification, and distortion through digital media.

Throughout history, communities have developed ways to transform raw ingredients into dishes that are both safe and nutritious. Techniques such as cooking (boiling, frying, steaming, roasting and grilling) and preservation methods (smoking, salting, drying, refrigeration and freezing) emerged as vital means of extracting maximum value from available resources, allowing food to be stored, shared, and consumed across different seasons. These methods reflect a profound understanding of the natural world and a strong connection to it. In many traditional cultures, the making and sharing of food became communal rituals that strengthened social bonds and reaffirmed collective identities (e.g. see Corr 2002 and Yadav et al. 2025). The choices we make about what to eat have always been influenced by a range of factors beyond biology, from psychology and socioeconomic status to heritage and collective memory (Enriquez and Archila-Godinez 2022).

The interplay between culture, biology, and environment is especially evident in certain traditional processing methods, where ingenuity and empirical knowledge have long shaped safe and nutritious ways of eating. An example that captures this dynamic is the fermentation of cassava, a practice that emerged in West Africa and transformed a potentially toxic root into a vital dietary staple. Cassava (*Manihot esculenta*), a root crop native to South America, became a cornerstone of diets across African nations after its introduction from the Americas (Halake and Chinthapalli 2020). Its rise came with a critical trade-off: while rich in calories, the root contains cyanogenic glycosides that can release toxic cyanide if not properly processed (McMahon et al. 2022). Traditional fermentation techniques developed by African

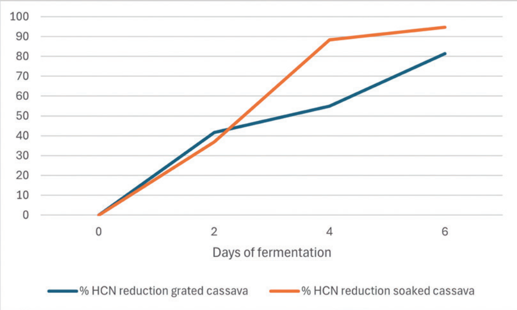

Fig. 3 - Reduction of HCN content during fermentation of grated and soaked cassava (in percentages). Data source: Iwuoha et al. 2013.

communities effectively reduce cyanide content in cassava products, thereby enabling its safe and widespread consumption (Iwuoha et al. 2013; McMahon et al. 2022; see Figure 3). Through soaking, grating, pressing, drying, cooking, and fermentation, it is converted into foods such as *gari* and *fufu*, with improvements in digestibility, flavor, texture, and nutrient availability (Anyiam et al. 2023). More importantly, this process shows how traditional food processing functions as an embodied form of ecological knowledge, transmitted through practice, observation, and community memory and embedded within wider cultural and ecological systems.

In this way, fermentation becomes a lens through which we can understand the role of traditional food practices. These methods represent living expressions of communal resilience, technical adaptation, and intergenerational knowledge, enabling populations to adapt their diets to challenging environments. As globalized food systems and industrial processing methods increasingly dominate, such heritage practices risk being forgotten or replaced by foods that bear little relation to the ecosystems and traditions from which they originated.

The cultural and nutritional consequences of modern food processing

Traditional methods such as cassava fermentation emerged from context-specific knowledge of local ecologies and contributed to food safety, nutrition, and cultural meaning. Modern industrial systems are commonly organized around different priorities. Many contemporary technologies prioritize shelf life, mass production, and consumer appeal (Jatoi et al. 2025). This shift combines technological evolution with a profound cultural transformation, placing market efficiency and global uniformity at the center of processing systems and reducing the prominence of practices rooted in community, resilience, and environmental knowledge.

Modernity has profoundly reshaped food systems, expanding food availability, enabling technological innovation, and transforming the cultural conditions through which foods are produced, understood, and shared. Industrial agriculture, food technology, and global supply chains have introduced innovations, such as artificial intelligence, robotics, gene editing, and vertical farming, with the potential to improve food quality, safety, nutrition, and sustainability (McClements et al. 2021). As food processing becomes increasingly oriented toward shelf life, standardization, convenience, and market expansion, it may weaken the local knowledge systems through which communities have historically selected, prepared, preserved, and shared foods. Traditional practices such as fermentation illustrate the cultural embeddedness of food processing. Many industrial products and routines have progressively become detached from local ecologies and communal meanings.

This distinction is particularly important for nutrition communication. In public discourse, the term "processed" often functions as a simplified marker of risk or artificiality. The nutritional, cultural, and technological implications of processing vary substantially according to context, purpose, and degree of transformation. Highly processed products, central to the so-called "Western diet", have already been associated with adverse cardiometabolic and cardiovascular profiles, particularly when diets are characterized by high intakes of refined carbohydrates, saturated and trans fats, and low-quality protein sources (Capocasa and Venier 2024a,b; Venier and Capocasa 2025). In the present section, this epidemiological evidence is extended by considering such products as cultural and communicative objects, promoted through narratives of convenience, pleasure, modernity, affordability, and individual choice.

The spread of “Westernization”, encompassing industrial, cultural, and dietary trends, has been linked to gut microbiota vulnerability, chronic inflammation, and disorders affecting cardiovascular, metabolic, and gastrointestinal health (Adolph and Tilg 2024). Its broader significance also concerns the reshaping of food meanings, eating occasions, taste preferences, and expectations about what constitutes a normal meal. The expansion of globalized and industrial dietary alternatives may reduce the continuity of culinary skills, shared rituals, intergenerational knowledge, and symbolic links connecting food, place, and identity. This cultural displacement also creates a more fragile informational environment, in which simplified claims, commercial messages, and nutrition misinformation can more easily shape how people understand food and health.

The importance of open access and the “third mission” of academia

The transformation of contemporary food systems also raises questions about how nutritional knowledge is produced, shared, and made accessible beyond specialist audiences. Open access (OA) publishing contributes to this process by reducing paywall barriers and enabling researchers, health professionals, educators, and the public to engage more directly with scientific evidence (Fecher and Friesike 2014; Rentier 2019). In nutrition and dietetics, OA publishing has increased substantially in recent years, reflecting the broader movement toward open science and more transparent research practices (Anagnostou et al. 2021; Maedche et al. 2024; Capocasa et al. 2025; see Figure 4).

Access to scientific literature remains closely linked to the need for effective knowledge translation. Scientific findings may be difficult for non-specialist audiences to interpret because of technical language, methodological complexity, and uncertainty in evidence appraisal (Plavén-Sigray et al. 2017). The “third mission” of academia is therefore particularly relevant, as universities and research institutions are increasingly expected to translate knowledge into forms that are understandable, socially useful, and responsive to public needs (Compagnucci and Spigarelli 2020; Schnurbus and Edvardsson 2022). In nutrition, this requires support for public communication, education, and nutrition literacy, together with careful attention to the risk of oversimplification.

The challenge of misinformation and the need for critical thinking

Reliable public understanding of nutrition depends on access to scientific literature together with effective interpretation, contextualization, and communication of its findings. In digital environments, evidence-based information circulates alongside inaccurate, decontextualized, or commercially motivated claims, making the quality and credibility of nutrition information a central public-health issue. Social media platforms and websites have created a space where evidence-based knowledge and unfounded myths compete for attention, making it increasingly challenging for people to discern fact from fiction. The sheer volume of online information allows nutrition myths to spread rapidly, gaining a stronghold in the public mindset long before scientists can respond.

Common examples of this trend include claims that certain foods can “burn fat or detox the body”, “brown sugar is healthier than white sugar”, or that “eating carbohydrates in the evening makes you gain weight” (Capocasa and Venier 2023a,b; Capocasa et al. 2026). The spread of these narratives is driven by several factors, including misinterpretation of scientific findings, media sensationalism, and commercial interests that take advantage of public confusion for profit. In this context, social media play a pivotal role, accelerating the dissemination of inaccurate or misleading dietary claims (Diekman et al. 2023). Moreover, the internet provides a platform for self-proclaimed health experts who present personal opinions and anecdotes as if they were scientific evidence, further complicating efforts to establish a clear and evidence-based discourse on nutrition (Lynn et al. 2020; Rowe and Alexander 2022).

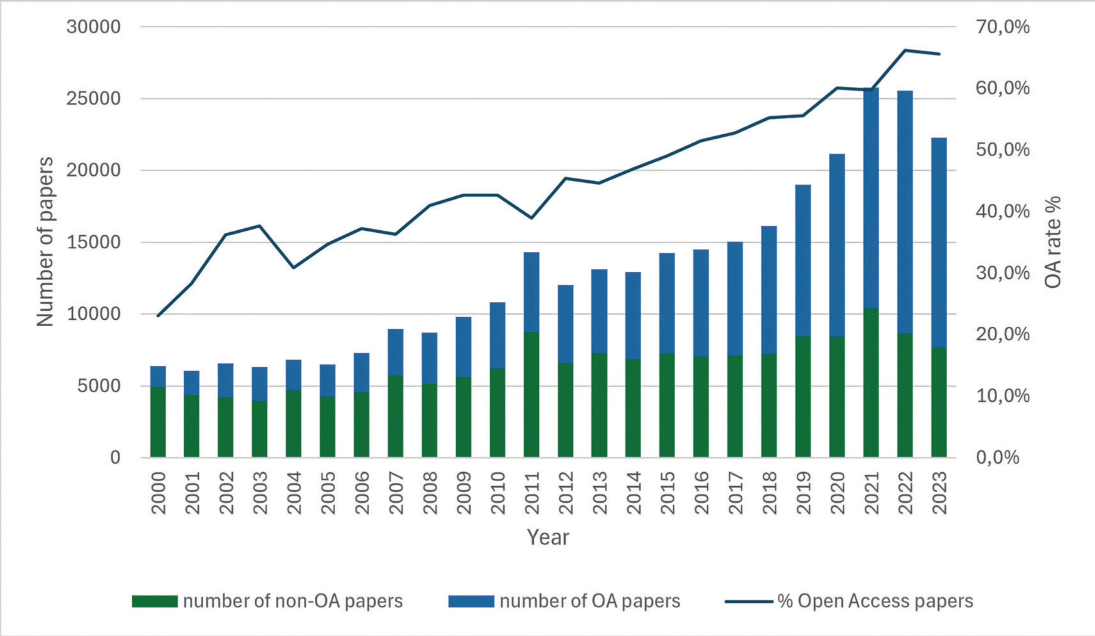

***Fig. 4** - Open Access (OA) in the Web of Science category "Nutrition & Dietetics" (2000–2023). Stacked bars show the annual number of indexed papers (OA vs non-OA), while the line indicates the OA rate (OA papers/total papers per year, %). Data source: Capocasa et al. 2025.*

Nutrition misinformation appeals to emotion, reduces complex biological questions to simplistic slogans, and often rejects mainstream nutrition as elitist or out of touch (Capocasa and Venier 2023a,b; Topham and Smith 2023). This tendency to reduce complex nutritional processes to reductive messages closely parallels the logic underlying many contemporary fad diets reviewed in the section on "Contemporary diets: scientific evidence, cultural context, and public health implications", which promise rapid health benefits while neglecting long-term biological, cultural, and environmental coherence. Fake news fills a psychological need for quick, easy answers, regardless of their accuracy. Developing nutrition literacy, the ability to understand, evaluate, and apply nutrition information, is an essential tool for addressing this challenge. This competence encompasses the comprehension of factual information together with the biological, cultural, and social contexts in which dietary knowledge is interpreted and applied. Helping people make informed choices involves creating a deeper understanding of nutrition as an integrative and communal endeavor, rooted in heritage and personal experience.

The problem becomes even more pressing when one considers the sheer quantity of nutrition-related fake news available online. Simple searches can yield unfounded claims, such as certain tropical fruits being a "cure-all" for belly fat or assertions about the benefits of "natural" versus "processed" sugars. These ideas have a disproportionate impact when people are in a state of transition, trying to adopt new habits, making them more likely to accept information that confirms their hopes or fears (Castellini et al. 2021). To combat the influence of nutrition myths, health professionals and institutions must intensify their efforts (Capocasa and Venier 2023a,b; Capocasa et al. 2026). Addressing these dynamics requires source evaluation, contextualization of evidence, transparency about uncertainty, and the ability to distinguish scientific consensus from anecdotal or commercially driven claims.

At the same time, focusing on motivational and empowerment-based approaches can help people build resilience against disinformation and adopt healthier dietary patterns.

By fostering critical thinking and promoting a holistic understanding of nutrition, we can create an environment where evidence-based knowledge guides choices, making it harder for disinformation to take root.

Future implications

These implications operate across multiple levels. Evolutionary and microbiota-based evidence suggests that preventive nutrition may benefit from a stronger focus on dietary patterns, food environments, and long-term biological adaptation, with isolated nutrients and short-term interventions interpreted within this broader biological and ecological context. Traditional dietary systems, particularly the Mediterranean diet, offer useful models because they integrate health-promoting food choices with cultural continuity, conviviality, seasonality, and lower environmental impact. Many contemporary popular diets require cautious interpretation when they rely on restrictive rules, commercial appeal, or simplified narratives that neglect adherence, nutritional adequacy, cultural feasibility, and sustainability.

At the level of public health communication, open access, nutrition literacy, transparent science communication, and the 'third mission' of academia can be viewed as complementary elements of a wider strategy connecting scientific evidence, public understanding, and culturally meaningful food practices. Future discussions may benefit from integrating evolutionary biology, cultural anthropology, clinical nutrition, environmental sustainability, and public communication. From this angle, food and nutrition education, dietary guidelines, public-health campaigns, procurement policies, food environments, and the preservation of traditional food knowledge emerge as interconnected areas through which nutrition may contribute to disease prevention, health equity, cultural resilience, and the long-term sustainability of food systems.

Concluding remarks

Taken together, the contributions synthesized in this conference paper support the central message that emerged throughout the "Il Cibo Siamo Noi" lecture series: human nutrition is a deeply biocultural phenomenon, shaped by the long-term interplay between evolutionary processes, cultural innovations, ecological constraints, and social organization. Food has acted as a major driver of human adaptation by exerting selective pressures on diet-related genes and host–microbiota relationships and by generating culinary traditions, symbolic practices, and shared forms of ecological knowledge. Contemporary dietary transitions reveal a growing disconnection between biological heritage, cultural practices, and modern food environments. The spread of industrialized and Westernized dietary patterns, the increasing availability of UPFs, and the erosion of traditional food systems have contributed to a complex burden of obesity, type 2 diabetes, cardiovascular disease, gut dysbiosis, and other chronic conditions. These transformations have also weakened the social, symbolic, and ecological dimensions of food, indicating that the contemporary nutrition crisis should be understood as a biomedical, cultural, and environmental issue. Reconnecting these dimensions is therefore essential for interpreting human diets in transition.

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Authors' contributions

M.C. conceived the study, coordinated the lecture series and drafted the section "Human nutrition, culture, and the challenges of misinformation". C.B. drafted the section "Environment, nutrition and genetic adaptations: the modern dietary incoherence". M.V. drafted the section "Preserving tradition: the Mediterranean diet in a changing world". M.D. drafted the section "Contemporary diets: scientific evidence, cultural context, and public health implications". All authors drafted the "Introduction", "Future implications" and "Concluding remarks" sections, critically revised and approved the final version of the manuscript.

References

Adolph TE, Tilg H (2024) Western diets and chronic diseases. Nat Med 30:2133–2147. https://doi.org/10.1038/s41591-024-03165-6

Agnoli C, Baroni L, Bertini I, et al (2017) Position paper on vegetarian diets from the working group of the Italian Society of Human Nutrition. Nutr Metab Cardiovasc Dis 27:1037-1052. https://doi.org/10.1016/j.numecd.2017.10.020

Alves R, Perelman J, Chang K, et al (2024) Environmental impact of dietary patterns in 10 European countries; a cross-sectional analysis of nationally representative dietary surveys. Eur J Public Health 34:992-1000. https://doi.org/10.1093/eurpub/ckae088

Ames BN, Cathcart R, Schwiers E, et al (1981) Uric acid provides an antioxidant defense in humans against oxidant- and radical-caused aging and cancer: a hypothesis. Proc Natl Acad Sci USA 78:6858–6862. https://doi.org/10.1073/pnas.78.11.6858

Anagnostou P, Capocasa M, Brisighelli F, et al (2021) The emerging complexity of Open Science: assessing intelligent data openness in genomic anthropology and human genomics. J Anthropol Sci 99:135-152. https://doi.org/10.4436/JASS.99016

Anderson K (2023) Popular fad diets: an evidence-based perspective. Prog Cardiovasc Dis 77:78-85. https://doi.org/10.1016/j.pcad.2023.02.001

Angelino D, Nucci D, Rabica F, et al (2024) Nutritional quality and level of processing of food items broadcasted on Italian television in advertisements targeted to children. Int J Food Sci Nutr 75:475-485. https://doi.org/10.1080/09637486.2024.2343924

Anguita-Ruiz A, Vatanparast H, Walsh C, et al (2025) Alternative biological functions of lactose: a narrative review. Crit Rev Food Sci Nutr 65:7444–7457. https://doi.org/10.1080/10408398.2025.2470394

Anyiam PN, Nwuke CP, Uhuo EN, et al (2023) Effect of fermentation time on nutritional, antinutritional factors and in-vitro protein digestibility of macrotermes nigeriensis-cassava mahewu. Measurement: Food 11:100096. https://doi.org/10.1016/j.meafoo.2023.100096

Bain & Company (2023) Italia: nel 2023 consumi fuori casa in aumento, nonostante l'incertezza per i rincari. https://www.bain.com/it/about-bain/media-center/press-releases/italy/2023/Italia-nel-2023-consumi-fuori-casa-in-aumento-nonostante-incertezza-per-i-rincari/

Beverfood (2023) I consumi alimentari fuori casa in Italia sono in forte ripresa e si punta a 99 Mrd € nel 2023. URL: https://www.beverfood.com/i-consumi-alimentari-fuori-casa-italia-ripresa-e-99-mrd-2023-wd/

Bragazzi NL, Del Rio D, Mayer EA, et al (2024) We are what, when, and how we eat: the evolutionary impact of dietary shifts on physical and cognitive development, health, and disease. Adv Nutr 15:100280. https://doi.org/10.1016/j.advnut.2024.100280

Capocasa M, Venier D (2023a) Assurdità alimentari. Dalle fake news alla scienza della nutrizione, Castelvecchi, Roma.

Capocasa M, Venier D (2023b) Opening scientific knowledge to debunk myths and lies in human nutrition. Eur J Nutr 62:3447-3449. https://doi.org/10.1007/s00394-023-03228-3

Capocasa M, Venier D (2024a) A bio-cultural tale of the past, present and future of human nutrition. J Anthropol Sci 102:87-104. https://doi.org/10.4436/JASS.10206

Capocasa M, Venier D (2024b) Food, culture and health: an anthropological perspective. Anthropol Today 40:15-18. https://doi.org/10.1111/1467-8322.12927

Capocasa M, Venier D, Destro Bisol G (2025) Open access publishing in nutrition and dietetics: state of the art and future directions. Nutr Bull 50:533-538. https://doi.org/10.1111/nbu.70031

Capocasa M, Venier D, Venier B, et al (2026) Exploring nutritional myths and fake news: impact and counteractions. Clin Nutr ESPEN 72:102947. https://doi.org/10.1016/j.clnesp.2026.102947

Capodici A, Mocciaro G, Gori D, et al (2024) Cardiovascular health and cancer risk associated with plant based diets: An umbrella review. PLoS One 19:e0300711. https://doi.org/10.1371/journal.pone.0300711

Carmody RN, Gerber GK, Luevano JM Jr, et al (2015) Diet dominates host genotype in shaping the murine gut microbiota. Cell Host Microbe 17:72-84. https://doi.org/10.1016/j.chom.2014.11.010

Castellini G, Savarese M, Graffigna G (2021) Online fake news about food: self-evaluation, social influence, and the stages of change moderation. Int J Environ Res Public Health 18:2934. https://doi.org/10.3390/ijerph18062934

Chiavaroli L, Nishi SK, Khan TA, et al (2018) Portfolio dietary pattern and cardiovascular disease: a systematic review and meta-analysis of controlled trials. Prog Cardiovasc Dis 61:43-53. https://doi.org/10.1016/j.pcad.2018.05.004

Compagnucci L, Spigarelli F (2020) The Third Mission of the university: a systematic literature review on potentials and constraints. Technol Forecast Soc Change 161:120284. https://doi.org/10.1016/j.techfore.2020.120284

Corr R (2002) Reciprocity, communion, and sacrifice: food in Andean ritual and social life. Food and Foodways 10:1-25. https://doi.org/10.1080/07409710212482

Dagallier LPMJ, Condamine FL, Couvreur TLP (2024) Sequential diversification with Miocene extinction and Pliocene speciation linked to mountain uplift explains the diversity of the African rain forest clade Monodoreae (*Annonaceae*). Ann Bot 133:677-696. https://doi.org/10.1093/aob/mcad130

Davenport ER, Sanders JG, Song SJ, et al (2017) The human microbiome in evolution. BMC Biol 15:127. https://doi.org/10.1186/s12915-017-0454-7

Di Veroli JN, Capruzzi S, Scognamiglio U, et al (2025) The 15-year trend in adherence to dietary recommendations and ultra-processed food consumption in Italy. Front Nutr 12:1623827. https://doi.org/10.3389/fnut.2025.1623827

Diekman C, Ryan CD, Oliver TL (2023) Misinformation and disinformation in food science and nutrition: impact on practice. J Nutr 153:3-9. https://doi.org/10.1016/j.tjnut.2022.10.001

Dinu M, Lotti S, Asoudeh F, et al (2026) Ultra-processed food exposure and health outcomes: current evidence, controversies, and future perspectives. EXCLI Journal 25:1037-1069. https://doi.org/10.17179/excli2026-9423

Dinu M, Pagliai G, Giangrandi I, et al (2021) Adherence to the Mediterranean diet among Italian adults: results from the web-based Medi-Lite questionnaire. Int J Food Sci Nutr 72:271-279. https://doi.org/10.1080/09637486.2020.1793306

Dinu M, Martini D, Sofi F, et al (2023) Comparison of Modern-Millennial Diets. In: Bray GA, Katzmarzyk PT, Kirwan JP, et al (eds) Handbook of Obesity - Volume 2, 5th Edition, CRC Press, Boca Raton. https://doi.org/10.1201/9781003432807-23

Dinu M, Tristan Asensi M, Pagliai G, et al (2022) Consumption of Ultra-Processed Foods Is Inversely Associated with Adherence to the Mediterranean Diet: A Cross-Sectional Study. Nutrients 14:2073. https://doi.org/10.3390/nu14102073

Dinu M, Pagliai G, Angelino D, et al (2020) Effects of popular diets on anthropometric and cardiometabolic parameters: an umbrella

review of meta-analyses of randomized controlled trials. Adv Nutr 11:815-833. https://doi.org/10.1093/advances/nmaa006
Duijghuijsen LJ, Looijesteijn E, van den Belt M, et al (2024) Changes in gut microbiota and lactose intolerance symptoms before and after daily lactose supplementation in individuals with the lactase nonpersistent genotype. Am J Clin Nutr 119:702-710. https://doi.org/10.1016/j.ajcnut.2023.12.016
Enattah NS, Sahi T, Savilahti E, et al (2002) Identification of a variant associated with adult-type hypolactasia. Nat Genet 30:233-237. https://doi.org/10.1038/ng826
Enriquez JP, Archila-Godinez JC (2022) Social and cultural influences on food choices: a review. Crit Rev Food Sci Nutr 62:3698-3704. https://doi.org/10.1080/10408398.2020.1870434
Eurostat (2024) Food waste and food waste prevention - estimates. Eurostat. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Food_waste_and_food_waste_prevention_-_estimates
Fanti M, Mishra A, Longo VD, et al (2021) Time-restricted eating, intermittent fasting, and fasting-mimicking diets in weight loss. Curr Obes Rep 10:70-80. https://doi.org/10.1007/s13679-021-00424-2
Fecher B, Friesike S (2014) Open Science: one term, five schools of thought. In: Bartling S, Friesike S (eds) Opening Science, Springer, Cham, p. 17–47.
Fieldhouse P (1995) Food and nutrition. Customs and culture, Springer, New York.
Gardner CD, Vadiveloo MK, Petersen KS, et al (2023) Popular dietary patterns: alignment with American Heart Association 2021 dietary guidance: a scientific statement from the American Heart Association. Circulation 147:1715-1730. https://doi.org/10.1161/CIR.0000000000001146
Ge L, Sadeghirad B, Ball GDC, et al (2020) Comparison of dietary macronutrient patterns of 14 popular named dietary programmes for weight and cardiovascular risk factor reduction in adults: systematic review and network meta-analysis of randomised trials. BMJ 369:m696. https://doi.org/10.1136/bmj.m696
Giosuè A, Calabrese I, Riccardi G, et al (2022a) Consumption of different animal-based foods and risk of type 2 diabetes: an umbrella review of meta-analyses of prospective studies. Diabetes Res Clin Pract 191:110071. https://doi.org/10.1016/j.diabres.2022.110071
Giosuè A, Calabrese I, Lupoli R, et al (2022b) Relations between the consumption of fatty or lean fish and risk of cardiovascular disease and all-cause mortality: a systematic review and meta-analysis. Adv Nutr 13:1554-1565. https://doi.org/10.1093/advances/nmac006
González Olmo BM, Butler MJ, Barrientos RM (2021) Evolution of the human diet and its impact on gut microbiota, immune responses, and brain health. Nutrients 13:196. https://doi.org/10.3390/nu13010196
Green DR, Ávila JN, Cote S, et al (2022) Fine-scaled climate variation in equatorial Africa revealed by modern and fossil primate teeth. Proc Natl Acad Sci USA 119:e2123366119. https://doi.org/10.1073/pnas.2123366119
Gregorio F, Sudano M, Gregorio D, et al (2015) Stile di vita ancestrale e collisione evolutiva. Parte 3 – L'acido urico: un'amicizia finita male. MeDia 15:72-83.
Gupta VK, Paul S, Dutta C (2017) Geography, ethnicity or subsistence-specific variations in human microbiome composition and diversity. Front Microbiol 8:1162. https://doi.org/10.3389/fmicb.2017.01162
Hahm JH, Seo HD, Jung CH, et al (2023) Longevity through diet restriction and immunity. BMB Rep 56:537-544. https://doi.org/10.5483/BMBRep.2023-0095
Halake NH, Chinthapalli B (2020) Fermentation of traditional African Cassava based foods: microorganisms' role in nutritional and safety value. J Exp Agric Int 42:56-65. https://doi.org/10.9734/jeai/2020/v42i930587
Hamsho M, Shkorfu W, Ranneh Y, et al (2025) Is isocaloric intermittent fasting superior to calorie restriction? A systematic review and meta-analysis of RCTs. Nutr Metab Cardiovasc Dis 35:103805. https://doi.org/10.1016/j.numecd.2024.103805
Huang L, Tao Y, Chen H, et al (2023) Mediterranean-dietary approaches to stop

hypertension intervention for neurodegenerative delay (MIND) diet and cognitive function and its decline: a prospective study and meta-analysis of cohort studies. Am J Clin Nutr 118:174-182. https://doi.org/10.1016/j.ajcnut.2023.04.025
Hullot M, Martin C, Blondel C, et al (2024) Evolutionary palaeoecology of European rhinocerotids across the Oligocene-Miocene transition. R Soc Open Sci 11:240987. https://doi.org/10.1098/rsos.240987
ISTAT (2024) Household consumption expenditure 2023 – Report (10 Oct 2024). https://formatresearch.com/wp-content/uploads/2024/10/REPORT_Spese-per-consumi_2023.pdf
Iwuoha GN, Ubeng GG, Onwuachu UI (2013) Detoxification effect of fermentation on cyanide content of Cassava tuber. J Appl Sci Environ Manage 17:567-570.
Jatoi AS, Iqbal A, Nasir BO, et al (2025) History and importance of food processing. In: Jatoi AS (ed) Integrated Food and Bioprocessing, Springer, Cham, p. 3-12.
Johnson RJ, Sánchez-Lozada LG, Nakagawa T, et al (2022) Do thrifty genes exist? Revisiting uricase. Obesity (Silver Spring) 30:1917-1926. https://doi.org/10.1002/oby.23540
Juul F, Deierlein AL, Vaidean G, et al (2022) Ultra-processed Foods and Cardiometabolic Health Outcomes: from Evidence to Practice. Curr Atheroscler Rep 24:849-860. https://doi.org/10.1007/s11883-022-01061-3
Keys A, Menotti A, Karvonen MJ, et al (1986) The diet and 15-year death rate in the seven countries study. Am J Epidemiol 124:903-915. https://doi.org/10.1093/oxfordjournals.aje.a114480
Keys A (1980) Seven countries: a multivariate analysis of death and coronary heart disease, Harvard University Press, Cambridge (MA).
Keys A, Keys M (1975) How to eat well and stay well the Mediterranean way, Doubleday, Garden City.
Kratzer JT, Lanaspa MA, Murphy MN, et al (2014) Evolutionary history and metabolic insights of ancient mammalian uricases. Proc Natl Acad Sci USA 111:3763-3768. https://doi.org/10.1073/pnas.1320393111
Kromhout D, Keys A, Aravanis C, et al (1989) Food consumption patterns in the 1960s in seven countries. Am J Clin Nutr 49:889-894. https://doi.org/10.1093/ajcn/49.5.889
Kuźmin L, Kubiak K, Lange E (2025) Efficacy of a low-FODMAP diet on the severity of gastrointestinal symptoms and quality of life in the treatment of gastrointestinal disorders-a systematic review of randomized controlled trials. Nutrients 17:2045. https://doi.org/10.3390/nu17122045
Lichtenstein AH, Appel LJ, Vadiveloo M, et al (2021) 2021 Dietary guidance to improve cardiovascular health: a scientific statement from the American Heart Association. Circulation 144:e472-e487. https://doi.org/10.1161/CIR.0000000000001031
Lichtenstein AH, Khera A, Anderson CAM, et al (2026) 2026 Dietary guidance to improve cardiovascular health: a scientific statement from the American Heart Association. Circulation 153:e1285-e1295. https://doi.org/10.1161/CIR.0000000000001435
Lotti S, Napoletano A, Tristan Asensi M, et al (2024) Assessment of Mediterranean diet adherence and comparison with Italian dietary guidelines: a study of over 10,000 adults from 2019 to 2022. Int J Food Sci Nutr 75:336-343. https://doi.org/10.1080/09637486.2024.2313979
Luca F, Perry GH, Di Rienzo A (2010) Evolutionary adaptations to dietary changes. Annu Rev Nutr 30:291-314. https://doi.org/10.1146/annurev-nutr-080508-141048
Lupoli R, Vitale M, Calabrese I, et al (2021) White meat consumption, all-cause mortality, and cardiovascular events: a meta-analysis of prospective cohort studies. Nutrients 13:676. https://doi.org/10.3390/nu13020676
Lv M, Mao J, Wang S, et al (2025) Effects of vegetarian or vegan diets on glycemic and cardiometabolic health in type 2 diabetes: a systematic review and meta-analysis. Nutr Rev 83:1438-1449. https://doi.org/10.1093/nutrit/nuaf011
Lynn T, Rosati P, Leoni Santos G, et al (2020) Sorting the healthy diet signal from the social media expert noise: preliminary evidence from the healthy diet discourse on twitter. Int

J Environ Res Public Health 17:8557. https://doi.org/10.3390/ijerph17228557
Maedche A, Elshan E, Höhle H, et al (2024) Open science: towards greater transparency and openness in science. Bus Inf Syst Eng 66:517-532. https://doi.org/10.1007/s12599-024-00858-7
McClements DJ, Barrangou R, Hill C, et al (2021) Building a resilient, sustainable, and healthier food supply through innovation and technology. Annu Rev Food Sci Technol 12:1-28. https://doi.org/10.1146/annurev-food-092220-030824
McMahon J, Sayre R, Zidenga T (2022) Cyanogenesis in cassava and its molecular manipulation for crop improvement. J Exp Bot 73:1853-1867. https://doi.org/10.1093/jxb/erab545
Monteiro CA, Cannon G, Levy RB, et al (2019) Ultra-processed foods: what they are and how to identify them. Public Health Nutr 22:936-941. https://doi.org/10.1017/S1368980018003762
Neel JV (1962) Diabetes mellitus: a "thrifty" genotype rendered detrimental by "progress"? Am J Hum Genet 14:353-362.
Plana V (2004) Mechanisms and tempo of evolution in the African Guineo–Congolian rainforest. Philos Trans R Soc Lond B Biol Sci 359:1585-1594. https://doi.org/10.1098/rstb.2004.1535
Plavén-Sigray P, Matheson GJ, Schiffler BC, et al (2017) The readability of scientific texts is decreasing over time. Elife 6:e27725. https://doi.org/10.7554/eLife.27725
Poore J, Nemecek T (2018) Reducing food's environmental impacts through producers and consumers. Science 360:987–992. https://doi.org/10.1126/science.aaq0216
Pouladi A, Arabpour E, Bahrami O, et al (2025) Impacts of the long-term low-FODMAP diet in patients with irritable bowel syndrome: a systematic review and meta-analysis. J Hum Nutr Diet 38:e70105. https://doi.org/10.1111/jhn.70105
Rentier B (2019) Open Science, the Challenge of Transparency. Académie royale de Belgique, Brussels.
Riccardi G, Giosuè A, Calabrese I, et al (2022) Dietary recommendations for prevention of atherosclerosis. Cardiovasc Res 118:1188-1204. https://doi.org/10.1093/cvr/cvab173
Ritchie H, Rosado P, Roser M (2022) Environmental impacts of food production. Our World in Data. https://ourworldindata.org/environmental-impacts-of-food
Rossie JB, MacLatchy L (2013) Dentognathic remains of an Afropithecus individual from Kalodirr, Kenya. J Hum Evol 65:199-208. https://doi.org/10.1016/j.jhevol.2013.05.001
Rowe S, Alexander N (2022) Fighting nutrition and health misinformation: enlisting the public's help. Nutr Today 57:34-37. https://doi.org/10.1097/NT.0000000000000521
Ruggiero E, Esposito S, Costanzo S, et al (2021) Ultra-processed food consumption and its correlates among Italian children, adolescents and adults from the Italian Nutrition & Health Survey (INHES) cohort study. Public Health Nutr 24:6258-6271. https://doi.org/10.1017/S1368980021002767
Schnorr SL, Candela M, Rampelle S, et al (2014) Gut microbiome of Hadza hunter-gatherers. Nat Commun 5:3654. https://doi.org/10.1038/ncomms4654
Schnurbus V, Edvardsson IR (2022) The third mission among Nordic universities: a systematic literature review. Scand J Educ Res 66:238–260. https://doi.org/10.1080/00313831.2020.1816577
Ségurel L, Bon C (2017) On the evolution of lactase persistence in humans. Annu Rev Genomics Hum Genet 18:297-319. https://doi.org/10.1146/annurev-genom-091416-035340
Sellayah D, Cagampang FR, Cox RD (2014) On the evolutionary origins of obesity: a new hypothesis. Endocrinology 155:1573-1588. https://doi.org/10.1210/en.2013-2103
Semnani-Azad Z, Khan TA, Chiavaroli L, et al (2025) Intermittent fasting strategies and their effects on body weight and other cardiometabolic risk factors: systematic review and network meta-analysis of randomised clinical trials. BMJ 389:e082007. https://doi.org/10.1136/bmj-2024-082007
Shahab M, Shahab N (2022) Coevolution of the human host and gut microbiome: metagenomics of microbiota. Cureus 14:e26310. https://doi.org/10.7759/cureus.26310
Shapira M (2016) Gut microbiotas and host evolution: scaling up symbiosis. Trends Ecol

Evol 31:539-549. https://doi.org/10.1016/j.tree.2016.03.006
Sofi F, Martini D, Angelino D, et al (2025) Mediterranean diet: Why a new pyramid? An updated representation of the traditional Mediterranean diet by the Italian Society of Human Nutrition (SINU). Nutr Metab Cardiovasc Dis 35:103919. https://doi.org/10.1016/j.numecd.2025.103919
Speakman JR (2008) Thrifty genes for obesity, an attractive but flawed idea, and an alternative perspective: the 'drifty gene' hypothesis. Int J Obes (Lond) 32:1611-1617. https://doi.org/10.1038/ijo.2008.161
Speakman JR, Westerterp KR (2013) A mathematical model of weight loss under total starvation: evidence against the thrifty-gene hypothesis. Dis Model Mech 6:236-251. https://doi.org/10.1242/dmm.010009
Stöger R (2008) The thrifty epigenotype: an acquired and heritable predisposition for obesity and diabetes? BioEssays 30:156–166. https://doi.org/10.1002/bies.20700
Suzuki TA (2026) The missing thriftiness. Science 393:49. https://doi.org/10.1126/science.aej2367
Suzuki TA, Worobey M (2014) Geographical variation of human gut microbial composition. Biol Lett 10: 20131037. https://doi.org/10.1098/rsbl.2013.1037
Tahreem A, Rakha A, Rabail R, et al (2022) Fad diets: facts and fiction. Front Nutr 9:960922. https://doi.org/10.3389/fnut.2022.960922
Topham J, Smith N (2023) One day of eating: tracing misinformation in 'What I eat in a day' videos. J Sociol 59:682-698. https://doi.org/10.1177/14407833231161369
UNESCO (2008) Representative list of the intangible cultural heritage of humanity. Criteria Intangible Heritage, Paris. https://ich.unesco.org/en/lists#2008
Venier D, Capocasa M (2025) Macronutrients and cardiovascular diseases: A narrative review of recent scientific literature. Clin Nutr ESPEN 68:32-46. https://doi.org/10.1016/j.clnesp.2025.04.022
Vitale M, Costabile G, Testa R, et al (2024) Ultra-processed foods and human health: a systematic review and meta-analysis of prospective cohort studies. Adv Nutr 15:100121. https://doi.org/10.1016/j.advnut.2023.09.009
Wang XJ, Voortman T, de Crom TOE, et al (2024) Healthy and unhealthy plant-based diets and the risk of cardiovascular diseases: the Rotterdam study and updated meta-analysis. Prog Cardiovasc Dis 87:8-15. https://doi.org/10.1016/j.pcad.2024.10.008
Willett W, Rockström J, Loken B, et al (2019) Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems. Lancet 393:447-492. https://doi.org/10.1016/S0140-6736(18)31788-4
Yadav A, Srivastava AK, Chandra V (2025) Ritual meals of Chaṭha: exploring gastronomical activities in a religious and festive setting. Orient Anthrop 25:182-203. https://doi.org/10.1177/0972558X241288155
Zahavi L, Lavon A, Reicher L, et al (2023) Bacterial SNPs in the human gut microbiome associate with host BMI. Nat Med 29:2785-2792. https://doi.org/10.1038/s41591-023-02599-8
Zhang S, Jiang Y, Wang H, et al (2025) Associations between plant-based diets and cardiovascular disease, frailty, and cognitive dysfunction in middle and old age: a systematic review and meta-analysis of cohort studies. Food Funct 16:4061-4084. https://doi.org/10.1039/d4fo03384a

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