INCREASING RESILIENCE OF FOOD SYSTEMS AND THE MEDITERRANEAN DIET IN TIMES OF CRISIS, USING THE SOCIOTYPE FRAMEWORK

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ABSTRACT This article uses the Sociotype framework to present insights and suggestions related to issues of food security and food systems, as they pertain to the resilience of a Mediterranean Dietary (MedDiet) pattern. The Sociotype framework was developed as a summary ecological construct to organize the multiple, dynamic, reciprocal inputs from the envi¬ronment that interact with the genotype to determine the expression of phenotypic behaviours, such as coping with stress. It has three domains - Individual, Relationships and Context - which are discussed in this article using specific food systems-related examples, processes and research. Topics covered include the impact of crises on the general food supply and implications for policy; the novel idea of a Planeterranean Diet as a global extension of the MedDiet; strategies involving women to overcome diet-related stressors in challenging times; consumer attitudes and knowledge about sustainable fisheries and seafood consumption; and a potential MedDiet curriculum focusing on responsibility, frugality, creativity, and enjoyment. The article concludes with recommendations for policy action to promote food security and resilience by facilitating the consumption of a MedDiet within sustainable food systems.

Keywords Mediterranean Diet - Sociotype framework - Food systems - Resilience.

ACCROÎTRE LA RÉSILIENCE DES SYSTÈMES ALIMENTAIRES ET DU RÉGIME MÉDITERRANÉEN PAR TEMPS DE CRISE, EN UTILISANT LE CADRE CONCEPTUEL DU SOCIOTYPE

Résumé *Dans cet article, nous allons nous appuyer sur le cadre conceptuel du sociotype pour présenter des réflexions et des propositions concernant les enjeux liés à la sécurité alimentaire et aux systèmes alimentaires, notamment la résilience d'un mode d'alimentation basé sur le régime méditerranéen. Le cadre conceptuel du sociotype est développé en tant que construction écologique sommaire pour organiser les apports multiples, dynamiques et réciproques de l'environnement qui interagissent avec le génotype pour déterminer l'expression des comportements phénotypiques tels que l'adaptation au stress. Trois niveaux - individu, relations et contexte - sont retenus en évoquant des exemples, des processus et des recherches liés aux systèmes alimentaires. Les sujets abordés incluent l'impact des crises sur l'ensemble de la chaîne d'approvisionnement alimentaire et les implications pour les politiques, l'idée novatrice d'un régime « Planéterranéen » comme extension mondiale du régime méditerranéen, les stratégies mobilisant les femmes pour faire face aux facteurs de stress liés à l'alimentation dans des périodes de difficulté, les attitudes et les connaissances des consommateurs par rapport à la pêche durable et à la consommation de poisson et de produits de la mer, et un éventuel cursus sur le régime diète méditerranéen spécialement tourné vers la responsabilité, la frugalité, la créativité et la convivialité. En conclusion, des recommandations sont avancées pour des actions politiques visant à promouvoir la sécurité alimentaire et la résilience en encourageant l'adhésion au régime méditerranéen dans des systèmes alimentaires durables.*

Mots-clés *Régime méditerranéen - Cadre conceptuel du sociotype - Systèmes alimentaires - Résilience.*

1. SOCIO-ECOLOGICAL THEORY TO SOCIOTYPE FRAMEWORK

Human beings live, work and play in many contexts throughout the day, throughout the year and throughout their lifecycle. These contexts are complex and shaped by a multitude of factors which come into play continuously or at particular moments. They are laden with reciprocal interactions between people and different environments, both of which are characterised by many features. This is the essence of Bronfenbrenner's (2006) socio-ecological theory presented as a human eco-system where individuals function within a series of nested environments.

Over the years, this idea of multifactorial influences on choices and behaviours within a background of environments, has been adjusted and applied to different scenarios, with one example being the MedDiet 4.0 structure developed by Dernini et al (2017). In this framework, the MedDiet is proposed as a healthy, sustainable diet promoting human and planetary health where the four socio-cultural, economic, environmental, health-nutritional elements are addressed appropriately to facilitate timely, concrete and effective actions for short-term and long-term well-being. Donini and Berry (2023) took the MedDiet 4.0 one step further by overlaying it with the Sociotype framework and its three dimensions – individual, society and context – to show that one needs to involve individual commitment, interventions engaging the social environment, and the institutional context in order to enhance individual and population-wide adherence to the MedDiet. The sociotype interacts with the genotype to shape the phenotype which is the outward expression of a person's characteristics and behaviour. The Sociotype has been introduced as a theoretical ecological framework to help identify and underline the bio-psycho-social and environmental factors involved in understanding and coping with life challenges, such as times of major economic and social disruption (e.g. COVID-related shutdown) (Peng & Berry, 2021), as well as food insecurity (Peng et al, 2018) and other health issues (Berry et al, 2017).

This article, will have food security and resilience as its focus. Food security exists when "all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life." (FAO, 2008). In contrast, food insecurity exists when food is unavailable, inaccessible physically and economically, or not utilised efficiently. Drivers of food insecurity can be both natural and man-made and include conflicts, extreme weather events, earthquakes, floods and pests and diseases among others.

The article, therefore, aims to use the Sociotype framework to provide structure for a critical discussion and set of solutions for managing food insecurity and the erosion of the MedDiet in times of crisis, as happened during the COVID pandemic and as typified by the current ongoing conflicts. As an ecological framework embracing human functioning as individuals with personal traits, having multiple social interactions and bound by different institutional structures, the Sociotype will be used to explain and propose the strengthening of resilience of food systems in the Mediterranean. The article will focus on key elements along the food production- supply- consumption-retrieval/reuse cycle, ranging from the revisioning of the traditional MedDiet, to ecological footprint analysis related to aquatic foods, to the role of women in food security, to the need for education from an early age yet ongoing throughout the lifespan, all within a world of turmoil and distressing problems.

2. THE SOCIOTYPE FRAMEWORK: CONTEXT LEVEL WELLBEING AND FOOD SYSTEMS AS IMPACTED BY CONFLICTS AND WARS

Conflicts and wars can shape the world beyond the setup of geo-political boundaries and have a lasting influence that echoes into the generations to come. They have contributed to improvements in trauma and injury management, many of which are included in today's care of civilians. It is now time to have a wider vision, looking at health and well-being, including food security and nutrition, and use the lessons learned from conflicts and wars to improve our planetary health.

The COVID-19 pandemic and the war in Ukraine have highlighted the need to include food systems on the "action lists" for a better future. A war should be recognised as a disease in its own "right": it injures, disables and kills more people in a shorter period of time than any other known disease. The attacks

on health care, interrupted supply chains, broken logistics, lack of funds and loss of infrastructure and workforce, further unbalance the ability of health systems to provide the necessary care in times when it is most needed. Exposure to all hazards put people in vulnerable situations. They may suffer from direct injuries and face outbreaks of communicable diseases through disruption in sanitation. Many do not have access to diagnosis and care for non-communicable diseases and they may face decreased preventive measures, including immunizations. The high demand for care of the increased patient load among refugees, internally displaced, and other conflict-affected people, including mental health treatment, social support, and rehabilitation, further burden the already overstretched health services.

An important factor that is often ignored in the above risk-laden scenario is the failure of food systems to ensure food and nutrition security. At times, the 'weaponization' of food (and energy) adds into the pull-and-push vectors, contributing to poor nutritional and health status among the conflict-affected people and beyond. The war in Ukraine and the Middle East are the latest examples. Whereas records show thousands of injured individuals and casualties, the figures are believed to be considerably higher since they do not include the indirect impacts of the war in and outside the battle areas, particularly the major implications for local, regional and global food security and nutrition. According to the World Bank (2022), before the war broke out in the Ukraine, Ukraine and Russia accounted for 29% of global wheat exports and 62% of sunflower oil. The war exacerbated food price inflation in emerging markets and developing economies and impacted some of the poorest and most vulnerable countries. Yet, the war in Ukraine has shaken the food system globally, as the "global food road" passes through Ukraine, depends on its products and feeds other areas, including countries in the Mediterranean basin. Dependency on cereals and other food importation from Ukraine has revealed the Mediterranean region's dependency and lack of resilience and this vulnerability has been highlighted in high-level fora. (FAO, 2022)

At the same time, assessing the impact of the most recent global crisis, the COVID-19 pandemic, shows that even some countries with the most sophisticated medical care were overwhelmed by the pandemic. The countries that were able to save lives and livelihoods were those that provided access to universal health care and invested in health, wellness and preparedness at all times. Unequivocally, populations that experience pandemics, wars and conflict in a good health and nutrition status can withstand and respond to the crisis better. These are the characteristics of resilient communities and it is evident that health, food, socio-cultural and economic systems need to work in tandem.

Recovery starts with the emergency preparedness. Resiliency can be an outcome of the emergency. Building on the lessons learned from the war in Ukraine and the COVID-19 pandemic calls for bringing everyone to the 'family table'. This can be seen as a great opportunity to 'step outside' and set up 'Mediterranean food systems without borders'. Countries in the Mediterranean region should enhance policy and governance aimed at nurturing our future generations using the food systems and One Health (OHHLEP, 2022) approaches to foster resilience. In turn, all actors within the food systems and One Health should cooperate, basing their harmonious actions on inclusion, equity and sustainability values. Preparing for a better future requires investing in enhanced research and innovation, allowing the "spicing" up of systems, structures and resources. Using a value-based criterion should increase local production and ethical exports to those in need, beyond borders, respecting food cultures and leaving no one behind.

3. SHIFTING FROM A MEDITERRANEAN TO A PLANETERRANEAN DIET

Conventionally, nutritional epidemiology has been concerned with individual nutrients and their impact on health and disease of population groups. (Thornton & Villamor, 2015) However, dietary pattern

analysis shows complex food interactions and health benefits, with emerging research in metabolomics and microbiome analysis enhancing our understanding of this complexity. In relation to this micro-level understanding, the impact of external factors on physiological status, as well as on food-related behaviours requires attention. To improve capturing the impact of diets as a whole, future dietary pattern analysis should include additional factors, embracing the various dimensions of sustainability as has already been recommended for the MedDiet. (Dernini, 2017)

The MedDiet, rooted in local cultures, embodies culinary evolution and cultural heritage. Traditional, locally sourced foods play a vital role in preserving this diversity. Voted the 'Best Diet' in 2023 and for six consecutive years by US News (2023), it is ironic that many Mediterranean populations are shifting away from this traditional diet (Grosso& Galvano, 2016; Obeid et al, 2022), leading to environmental challenges and health problems like obesity and non-communicable diseases. It is even more ironic that the influential EAT-Lancet Commission on Healthy Diets from Sustainable Food Systems acknowledges the consistent evidence of the benefits of the MedDiet. (Willett et al, 2019) The Eat-Lancet's universal (and somewhat controversial) healthy reference diet has many components which are similar to the traditional MedDiet which highlight the importance of preserving it in its nascent region and beyond. The MedDiet stands as a sustainable example, prioritising whole, minimally processed or unprocessed foods, promoting local and sustainable agriculture and reducing food waste, and stimulating local food production and economies. Its emphasis on plant-based foods (including pulses and wholegrains) reduces environmental impact and natural resource consumption compared to modern diets reliant on animal agriculture and highly-processed and ultra-processed foods.

Resilience to the potential demise of the MedDiet in the Mediterranean region could be partially bolstered by adopting the MedDiet beyond the Mediterranean shores, thus adding to its valorisation. At the same time, the traditional MedDiet offers potential solutions to modern food system challenges. Adopting a so-called 'Planeterranean diet' (Colao et al., 2022) could extend the beneficial effects of the MedDiet worldwide. If countries could identify locally sourced foods with similar qualities to those consumed in the MedDiet, this would be a first step toward a global Planeterranean diet. Promoting this diet could address challenges faced by populations moving away from healthy food patterns and help in reaching UN Sustainability Goals. Indeed, the UNESCO Chair on Health Education and Sustainable Development is backing the Planeterranean initiative. A preliminary research study involves gathering data on dietary habits and indigenous crops in five major regions: North America, Latin America, Africa, Asia, and Australia. This data will serve as the foundation for creating region-specific nutritional guidance that mirrors the nutritional qualities and health advantages of the MedDiet using local foods that are readily available in each of these regions. Whilst acknowledging the need for complex dietary shifts and collaboration among stakeholders, embracing the transferability of the MedDiet to a Planeterranean diet can lead to a healthier future, aligning food systems with sustainability goals and disseminating Mediterranean culinary heritage worldwide.

4. THE SOCIOTYPE FRAMEWORK: A SOCIAL TO INDIVIDUAL CONTINUUM FOOD SECURITY AND WOMEN'S EMPOWERMENT IN TIMES OF CRISIS

Food lies at the intersection of biodiversity, climate change, culture, human health and livelihoods. (Berry, 2022) Thus, even at the best of times unsustainable food production and consumption patterns are major drivers of environmental deterioration, directly and indirectly affecting the food security of populations. This situation is exacerbated by demographic and infrastructural pressures in times of crisis, with interruption of the food supply chain, such as happened due to the COVID pandemic, resulting in higher

food prices, inflation and falling incomes. Specifically, the pandemic caused shortage of farm workers, restriction in the transportation of farm commodities, shutdown of food production facilities, uncertainty of food quality and safety, food trade policies restriction, delays in transportation of food products, limitation to food accessibility, and changes in consumer demand and acquisition of food among others. (Alabi & Ngwenyama, 2023) Consequently, the prevalence of food insecurity, undernourishment and vulnerability to infections increased, especially among people already suffering from diet-related diseases (such as obesity, diabetes, cardiovascular diseases and some cancers).

It is well accepted that women are the predominant food producers, provisioners, preparers and preservers in normal times in many cultures. (FAO, 2023) Research has also shown that women are often key players in challenging periods with respect to assuring and managing the provisioning and preparation of food; and this task is influenced by multiple personal factors together with factors outside the home at the institutional and bio-physical level. Dinella et al, 2023). In different countries, and congruent to the UN sustainable Goal 5: Achieve gender equality and empower all women and girls, gender equality is acknowledged as a necessary foundation for a peaceful, prosperous and sustainable world. (United Nations, online). With amelioration of food security as a focus, and appreciating the potential significant role of women and the need to safeguard their well-being for a positive ripple effect, Morocco adopted a number of policies and measures to address the crisis situations. These included rethinking food sovereignty, providing agricultural support, establishing social safety nets, and introducing commodity subsidies. Empowerment and education of women and their involvement in agricultural policies, strengthened their role in protecting resources and biodiversity, with impacts on personal and household income and in safeguarding culinary heritage, as well as personal and family health benefits.

5. EXPLORING AND LEVERAGING CONSUMER ATTITUDES AND PRACTICES IN RELATION TO FISH AND SEAFOOD

The UN Sustainable Development Goal 14 focuses on Life Below Water and how we need to simultaneously protect our waters and their ecosystems whilst also using marine resources and fishing practices more efficiently, in a sustainable manner for human flourishing. Indeed, the ultimate characteristic of a resilient food system is the co-existence of human and planetary benefits: co-benefits.

A resilient food system is thus one that supports human health and well-being while staying within planetary limits. Against this set goal, the current reality in the Mediterranean is that of primarily unsustainable (highly industrialised and relying on long supply chain), unfair (in proving appropriate revenue to food producers), unequal (in securing short and long term access to food to all), unbalanced (towards ultra-processed, land animal-protein-based and sugar-rich foods) and linear (in terms of food waste and loss) food systems.

Considering dietary choices as the ultimate indication of the sustainability of food systems, and that dietary decisions by consumers can cause a positive cascade effects throughout the whole food chain, a study was conducted in 3 countries to explore the role of consumers' attitudes towards, and knowledge of, fish and seafood alternatives as possible levers to help transitioning towards more sustainable food systems. Results from the 3 pilot countries, Croatia, Italy and Turkey indicate the need to increase efforts particularly at the Individual and Relationships levels of the Sociotype framework to ease a shift towards more fair, sustainable and resilient food systems.

Opinions about the most important aspects of seafood sustainability – whether fishing practices, seasonal consumption, or fish stock health - differed across countries. The biggest barriers to consumption of unfamiliar fish and seafood were price, unknown flavours and poor knowledge of potential cooking methods. Some consumers reported they would consider trying less familiar fish after they had learnt about the role and status of small-scale fisheries.

Key conclusions from this study were that any effort to increase the market penetration rate of sustainable fish and seafood (products) should involve improved public and targeted communication on the sustainability of these foods and artisanal small-scale fisheries, strengthening Fishers-Consumers and Fishers-Chefs reconnection via local markets, and education to raise curiosity about fish and seafood and enhance related cooking skills.

6. THE SOCIOTYPE FRAMEWORK: THE INDIVIDUAL COMMITMENT AND RESPONSIBILITIES BUILD FOOD SYSTEMS RESILIENCE THROUGH FOOD AND NUTRITION EDUCATION USING A SOCIO-TYPE APPROACH

For food systems transformation with the goal of building healthy, sustainable, flourishing and resilient foodways and dietary patterns, a promising point of departure is the concept of food literacy. Sumner (2012) defines food literacy as

"... the ability to 'read the world' in terms of food, thereby recreating it and remaking ourselves. It involves a full-cycle understanding of food – where it is grown, how it is produced, who benefits and who loses when it is purchased, who can access it (and who can't) and where it goes when we are finished with it. It includes an appreciation of the cultural significance of food, the capacity to prepare healthy meals and make healthy decisions, and the recognition of the environmental, social, economic, cultural and political implications of those decisions." (p.321)

Within this definition once can see the presence of resiliency in multiple ways – whether it is building personal resiliency to reduce health risk through consuming a more nutritious and sufficient diet, to resiliency as manifested by learning to carry out traditional food preservation techniques.

Yet these food literacy resiliency promoting skills should not be limited to adult populations. The values, attitudes and behaviours required for building responsible, empathic and healthy citizens can be nurtured via school-based food and nutrition education (SFNE) as envisioned by FAO (2020). SFNE replicates the main tenets of food literacy and is competency-based. The main goal is to help students develop and learn to take charge of their diet as feasible – both for their own health and for the health of others, and of the environment (now and in the future).

A potential strategy for reaching this goal is through developing a MedDiet curriculum based on a Sociotype approach whereby inter-related factors at different levels of the environment (Context, Social and Individual) are considered when planning the teaching and learning on a MedDiet type of healthy, sustainable eating. The curriculum will emphasise resiliency by basing it on the four elements of responsibility, frugality, creativity and enjoyment. Responsibility is about choosing to maintain and improve one's health, to protect others' well-being and to nurture /conserve planetary health. Frugality is concerned with appreciating the concept of sufficiency, maximising use of available food resources, avoiding waste and sharing excess food. Creativity can be manifested in ensuring sustainability of traditional dishes, exploring alternatives in a circular economy for food, food innovation and eating on a low budget. And enjoyment can focus on sensually appreciating a

diversity of food, growing and harvesting food and producing healthy snacks and drinks.

Each of the four elements will be presented in such a way so as to develop in young children the desired aptitude for demonstrating personal resilience whilst also supporting and sustaining resilience initiatives and structures embracing healthy, sustainable Mediterranean dietary foodways. The Sociotype framework will give structure to the complexity of the different food choices and behaviours involved. Table 1 presents examples of how responsibility and frugality could appear in this proposed curriculum.

The 'Mediterranean Diet curriculum emphasising resiliency' is a works in progress and will revolve around situated, experiential, entrepreneurial and pleasurable learning. Its ultimate goal is to nurture children and future youth and adults who have the competences to adopt, support and promote a healthy, sustainable MedDiet, showing resilience and agency based on responsibility, frugality, creativity and enjoyment. Meanwhile, a recent study with Israeli kindergarten children (Jakobovich et al, 2023) showed how skills-based interventions promoting healthier choices and practices, and implemented by trained teachers, are a promising approach to tackling childhood obesity and nurturing health-enhancing dietary and physical activity behaviours.

Focus Element	Skills	Intrapersona(Child)	Interpersonal (Family)	Context, Community (School and beyond)	Global
Responsibility	Choosing to maintain and improve one's health, to protect others' well-being, to nurture /conserve planetary health	Eating all one's packed lunch and not wasting	Asking parents to buy seasonal and local vegetables and fruit	Contributing to school kitchen gardens where food grown is used in class, or to prepare food for homeless shelters	Learning about how food is grown in other countries and what is fair trade
Frugality	Appreciating the concept of sufficiency, maximising use of available food, avoiding waste, sharing excess food	Keeping a diary of amount of food eaten at each meal for a day and learning to read body cues and stop eating when one is full	Helping parents to plan the food shopping list by checking what is left in the cupboard and fridge and what is really needed	Interviewing a chef or famer on how to make full use of different parts of vegetables and fruits	Investigating food banks and their value to help people be food secure whilst avoiding food waste

Table 1: Examples of how the proposed curriculum can integrate foci elements with skills and the Sociotype framework

7. CONCLUSIONS

The concepts discussed in this article may be translated into policy decisions (in the context sociotypic domain) to promote adherence to a Mediterranean dietary pattern as part of sustainable food systems. Policymakers need (to be helped) to recognise food systems as complex adaptive systems, and take action as follows:

- Set up multi-stakeholder partnerships for designing systemic food policies and developing the knowledge base and infrastructure for implementation.
- Ensure that food systems are sustainable along the entire food chain—from production to consumption
- and reduce food losses and waste.
- Adopt the One Health approach for promoting resilient and sustainable fishing and farming.
- Facilitate agriculture which implements the best sustainable ecosystem services and practices, drastically reducing use of water and energy and of potentially harmful pesticides and fertilisers.
- Utilise cereals, pulses and aquatic foods more efficiently and revive and promote traditional recipes.
- Ensure the right of all members of the population to healthy, adequate, affordable and culturally acceptable food.
- Develop systems for continuing provision of free school meals to children even in times of crises.
- Monitor regularly the safety of the food supply chain to be free of pathogens.
- Legislate (and incentivize) the food industry to produce healthy (minimally processed foods), with less added sugars, trans fats, salt and additives, and which are reasonably priced.
- Consider price control of basic healthy sustainable foods which fit a MedDiet eating pattern.
- Regulate for informative food and nutrition labelling on packaging and food provision contexts.
- Legislate for honest and transparent marketing, especially prohibiting advertising of high fat, high, sugar, high salt ultra-processed foods to children.
- Provide certification programmes for journalists trained in quality science communication for the general public.
- Improve the provision of education on healthy lifestyles (including physical activity), nutrition and sustainable MedDiet food preparation for public health, education and culinary professionals and trainees, as well as in lifelong learning and active aging programmes, and for students throughout compulsory schooling and in post-secondary and higher institutions.

Once these policies are set in place, then implementation will follow by improving the living/social environment (relationships) and ensuring a healthy, safe external environment (institutional context) to affect the individual and, thereby, enhance adherence to a healthy, sustainable MedDiet. Finally, we note that diets should not be a list of do's and don'ts, but rather a pleasurable and tasty experience which will support our health potential (Individual) and through which we respect traditional and cultural preferences (Social Environment). In true Mediterranean 'Diaita' spirit, we should strive to collectively put both mind and heart into our food systems and lifestyle choices for resiliency and sustainability.

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