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Article

Sustainable Consumption Pattern for Increased Food Security – Case Study Romania

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Abstract: Food security is a matter of global interest, as the provision of food resources is the primary determinant of human existence. Food is one of the basic needs, ensuring the survival of the species. The trend of globalization and development of the global economy has shifted the responsible local consumption patterns to an increased homogeneity of diets, food products being disconnected from their source. This disconnection led to two major results: (1) increased global consumption, with seasonal foods now available throughout the year, and a decrease in food prices on the global market, and (2) increased uncertainty in the supply chain, susceptible to disruptions, as was the case during the Covid-19 pandemic. The present study, based on the research and analysis of third-party data on food security, sustainable diets, consumption patterns and recommended actions to change the current unsustainable consumer behaviour towards a careful approach to food, environment and personal health, aims to identify consumption patterns that have the potential to increase the sustainability of the food system and a positive correlation with food security. Adopting sustainable dietary patters, based on short supply chains and mindful consumption, has great potential in restoring food security and resilience to adversity.

Keywords: food security; food waste; nutrition; overconsumption; sustainable and healthy food choices/systems

1. Introduction

In the last decades, the global agricultural production has grown at a faster rate than the human population, and today, the available food, in terms of macronutrients, exceeds the global requirements, offering the possibility to feed even more people [1,2]. The current global growing rate of human population is 1.05% per year, and is declining, while farmers today produce 262% more than in 1950 [3,4]. It is ironic, given the circumstances, that in 2020 three billion people are malnourished, of which between 720 and 811 million are undernourished [5]. Food security remains a global concern, despite all efforts and resources to end it, mainly because the level of food security is not only determined by the agricultural production. Food security represents a sum o interconnected factors, referred to in the literature as the four pillars of food security. Each pillar has a unique contribution to security, and any disruptions or issues manifested in one, reverberate in all others. The four pillars of food security are (Figure 1):

- Availability – related to food supply, dependent on production, imports, storage;
- Access – both physical and financial access to available food products;
- Utilization – quality and safety of food resources, nutritional value, preparation;
- Stability – availability, access and constant use of food resources over time [6].

In self-sufficient historical communities, food resources were provided locally, based on available environmental resources: land fertility, water sources, duration to exposure to sunlight. Food resources were provided from both agricultural practices and foraging, hunting and fishing. The agricultural systems of the historical communities

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have been closely linked to their territory, one of the main concerns being to ensure the viability of primary resources for many generations [7,8].

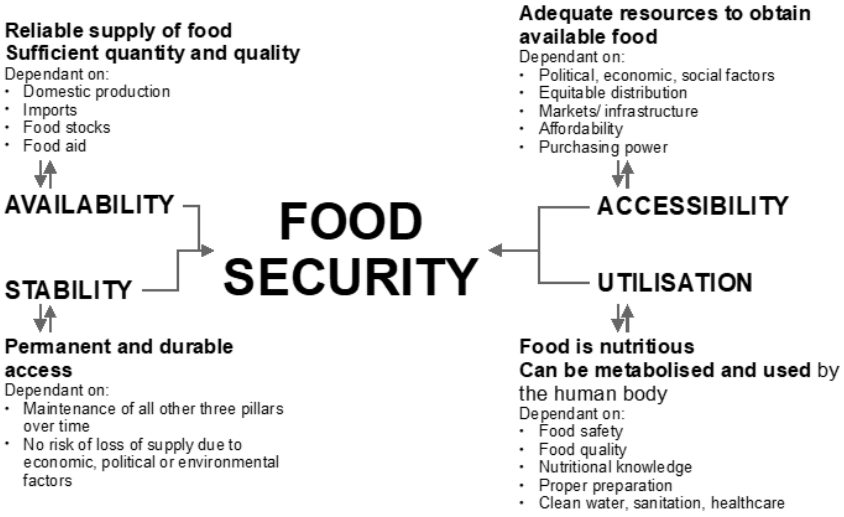

Figure 1. The four pillars of food security [6].

The knowledge system and the sustainable management of resources have ensured long-term practices aimed at conserving the environment, highlighting the importance of adapting agricultural systems to different environments. Such an agricultural micro-cosmos reflects people's ability and ingenuity to adapt to changes in their habitat, leaving long-standing evidence of their commitment to the conservation of the agricultural heritage. These management systems, combining ingenuity and time-tested practices, have ensured food security in the community, along with the conservation of biodiversity and natural resources [9,10,11,12].

The industrial revolution drastically changed the agricultural practices, introducing machinery, chemical inputs and standardized practices in rural areas, all to the benefit of increased production. With the developing of the industrial revolution, many communities have lost their agricultural heritage, the orientation towards increasing production and uniformity leading to a loss of biodiversity–and a change of perspective, from adapting production to the environment to adapting the environment to production [13].

In Romania, such an orientation towards increasing production manifested itself intensely during the communist regime, when agriculture became one of the main engine of economic growth, along with the metallurgical industry. The only problem with agricultural practices at that time was that while Romania was considered "the granary of Europe", its citizens suffered from food insecurity, nutrient deficits and many associated health conditions. Thirty years later, the disrupted food supply from the communist era still influences the dietary patterns of the population [14]. The "Romanian traditional diet" is largely based on meat, especially pork, bread and potatoes, a traditional tree-course menu exceeding 845 kJ (about 200 kcal) per 100 g per person. Given that the weight of such a menu is around 1000 g, based on the menus available online from Romanian restaurants, this means consuming at least 8450 kJ, or 2000 kcal, in one sitting. Not surprisingly, given the circumstances, that 51% of the country's adult population is overweight and 19.1% is obese [15]. In addition, given the prevalence of obesity and overweight in adult population, a diet that relies heavily on meat consumption is extremely unsustainable [1, 16].

Sustainable consumption pattern of food have beneficial effects not only on human health, but they can also positively influence the impact of human population on the environment. A global disruption of the current consumption pattern, leading to a healthier diet and the consumption of culturally appropriate and nutritious local, seasonal foods,

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at every stage of human development, has the potential to reverse the current global health crisis related to overweight and obesity, and to restore the natural environment, without endangering the security of food resources, for current and future generations [16].

2. Materials and Methods

The present study is based on the research and analysis of third-party data food security, sustainable diets, consumption patterns and recommended actions to change the current unsustainable consumer behaviour towards a careful approach to food, environment and personal health. The data collection process is focused on identifying relevant studies and official reports on the research topics mentioned above. The aim of the study is to identify consumption patterns that have the potential to increase the sustainability of the food system and a positive correlation with food security.

3. Results and discussion

"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." This widely accepted definition of food security was first formulated at World Food Summit in 1996, emphasizing the four dimensions that together contribute to a state of food security. After decades of fighting food insecurity and implementing measures to combat the threat factors, the global community is nowhere eradicating food insecurity [17].

Romania is no exception in this regard. Thirty years after the fall of the communist regime and the liberalization of the market, 13.9% of the population live in moderate or severe food insecurity, while 6.6% of children under 5 are affected by stunning due to malnutrition. The majority of the impoverished population – 75%, live in rural areas, the poverty rate in rural Romania being three times higher than in urban areas. However, for the Romanian population unaffected by food insecurity, the dietary pattern of choice is far from being sustainable, and healthy [15].

The modern world is facing "the double burden of malnutrition," which manifests itself as both malnutrition and overnutrition [18]. Malnutrition is defined as not only a lack of macro- and micronutrient consumption, but also an excess of intake, exceeding the human body's energy requirements. In the Western, developed world, overconsumption is a manifestation of malnutrition, leading to a variety of health problems linked to an unbalanced diet, such as coronary heart disease, cancer, diabetes, and overweight and obesity, all of which are symptoms of underlying health problems [18].

Regardless of the health problems caused by inadequate nutrition and the global cost of treating said health condition, the Western diet is extremely unsustainable. Overconsumption of meat and meat products, fatty and sugary foods and drinks, highly processed food products and low intake of fresh fruit and vegetable are the main characteristics of the modern diet. The post-war, post-industrial background, of over-production and overconsumption, generated serious economic and environmental issues, leading to a recurring discussion about food system sustainability and a challenge for food producers, as well as consumers, regarding the current consumption patterns. Recent studies in the field of sustainable practices in the food system reveal that one of the biggest contribution coming from the consumers could be the transition towards a plant-based, low-meat diet [16].

Consumers' attitudes towards meat consumption are oriented in two directions, in line with global trends: consumers who are resistant to the idea of reducing the amount of meat and meat products consumed and consumers who, aware of the health and environmental consequences of meat consumption, choose to reduce or even eliminate meat from their diet [19]. Consumers who have adopted an extreme attitude and elimi-

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nated all animal products (dairy, eggs, honey) from their diet, embracing a vegan lifestyle, fall into the second category.

The vast majority of Romanian consumers tend to fall into the first category, mainly for hedonistic and cultural reasons. Romanian cuisine is a testimony over centuries of countless influences, from different cultures, who interacted on the current territory of Romania (Dacians, Celts, Greeks, Romans, Byzantines, Slavs, Ottomans, Germans, Austrians, Hungarians, French, etc.) [20]. Many of the foods now considered traditional in the Romanian cuisine are in fact variations and adaptations of the cultures mentioned above. When it comes to meat consumption, preferences have evolved over the centuries, both under external influences and in the pedo-climatic conditions of the territory. In the Geto-Dacian period, the main meats consumed were beef and sheep, mainly due to the specific pastoral orientations of the population. In the following historic periods, as a result of the Roman occupation, meat consumption patterns shifted to pork in the winter, when the weather was cold and allowed meat to preserve longer, and poultry in the warm seasons. Beef, sheep and goat were also occasionally eaten, but their by-products (milk, wool) were considered more important to the household economy than meat. After the crystallization of the cuisine, meat and meat products remained basic ingredients, often accompanied by vegetable products [21]. Meat is usually eaten daily, several times a day: breakfast consists of a mix of processed meats (ham, sausages, salami) sometimes in combination with eggs and cheese (fresh or fermented), bread and some vegetables (onion, cucumbers, peppers, tomatoes). The usual adult lunch consists of a meat-based soup or broth, and a second course consisting of a side dish (potatoes, rice) and meat (pork or chicken, grilled, battered and fried, stewed) as well as a fresh salad or pickled vegetables. Sometimes the second course can be a stew of meat and vegetables, beans and sausages, meat cabbage rolls with sour cream, meatballs with sauce, meat stuffed peppers with sauce and some other dishes including meat. All of the above are usually accompanied by bread. Dinner may consist of leftovers from previous meals or any of the dishes listed above. The preference for meat consumption at all three main meals of the day is noticeable and is also a habit that strongly contradicts the principles of healthy eating. It is worth mentioning that sometimes the restaurants that serve daily lunch menus also offer desserts, in addition to the two main courses. Also, this pattern is not representative for the entire Romanian population, trends among younger consumers (20-35 years) and those with access to education, leaning towards healthier-habits. Given the Orthodox tradition of fasting in the months leading up to important religious holidays (Easter, Christmas, Saint Mary) and the large number of Orthodox people – 81% of the population, it can be considered that on rare occasions during the year, the diet of Romanians is plant-based and aims at a more diversified integration of plant based dishes. This beneficial habit does not continue, however, at the end of the fasting period imposed by religious tradition [21].

In order to understand how the current consumption pattern of the Western world affects both human health and environmental health, a review of the elements of the Western diet and their impact is needed. Characterized by energy-dense food products, overconsumption of meats and dairy products, foods with a high content of saturated fats and sugars, excessive snacks and a low share of micronutrients and fibre, the Western diet is known for its adverse effects on human health. High cholesterol levels, leading to coronary hearth disease, high acidity that can increase the risk of cancer, liver problems, kidney problems and heart failure, high sugar intake that causes high blood pressure, inflammation, weight gain, fatty liver disease and diabetes, all linked to an increased risk for heart attack or stroke are elements of a typical Western diet [16, 22, 23, 24].

The above mentioned characteristics, elements and impacts of this pattern not only affect human health, but also put a great deal of pressure on the environment, mainly due to the pollution and depletion of resources resulting from animal farming [16, 25]. The

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environmental impact of animal farming, expressed in carbon footprint, land use and water use per kilogram of food product is presented in Table 1.

Table 1. Environmental impact of animal farming – authors selection after [26].

Environmental impact – per kilogram of product	Beef (beef herd)	Beef (dairy herd)	Pig meet	Poultry meat	Lamb and mutton	Prawns (farmed)	Milk	Cheese	Eggs
Greenhouse gas emission ($kgCO_2eq$)	99.48	33.3	12.31	9.87	39.72	26.87	3.15	23.88	4.67
Land use (m^2)	326.21	43.24	17.36	12.22	369.12	2.97	8.95	87.79	6.27
Freshwater use (l)	1451	2714	1796	660	1803	3515	628	5605	578

Considered as a share of environmental impact of all anthropogenic activities, agriculture uses 50% of the total living area, of which animal farming uses 77%, providing only 18% of the global calorie intake and 37% of the global protein intake. The graphic representation of this data is delivered in the Figure 2 [26].

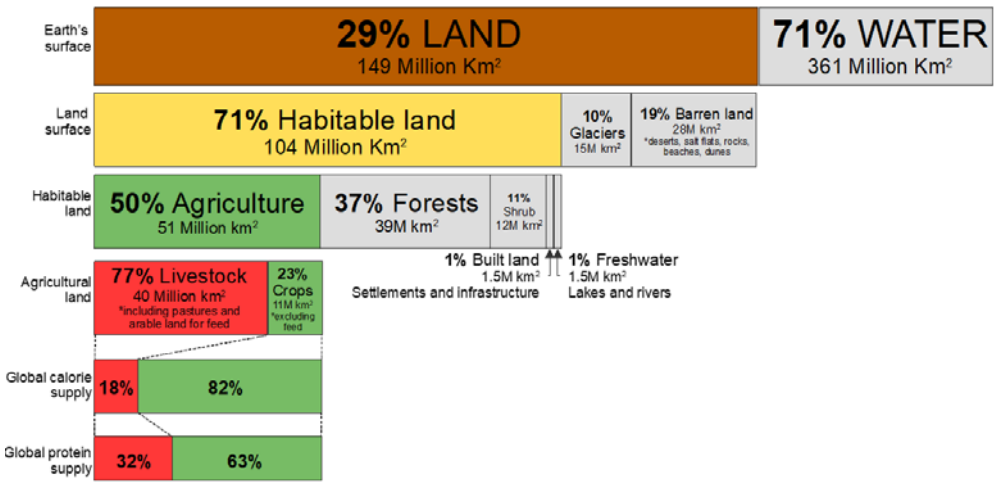

Figure 2. Land use per caloric outputs of animal farming as share of total [26].

In order to break this cycle of overconsumption and unsustainable dietary habits, the consumer society must be informed and adopt the alternative: a sustainable, healthy diet. This diet is not inherently new to society, with many communities relying on such a

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diet for centuries, with responsible food and environment behaviour being part of the cultural heritage of those communities [16].

As stated by the World Health Organization (WHO) in August 2018, a healthy diet provides protection against malnutrition, regardless of its manifestation (malnutrition or overnutrition) and against non-communicable diseases (NCDs) resulting from improper nutritional intake. For an increased impact of healthy dietary behaviour, it is necessary to start from the beginning of life, so the education of parents and children is necessary to improve the quality of nutrition. As for the exact configuration of a healthy, diverse and balanced diet, it can be tailored to individual characteristics - such as age, gender, physical activity, lifestyle and personal preferences, cultural context and eating habits and availability of local food products. Whatever this configuration is, the basic principles of a healthy diet are the same:

- energy input must remain within the limits of energy consumption;
- the intake of fats, sugars, salts and alcohol must be limited;
- the intake of micro- and macronutrients should be ensured from plant based foods;
- meat, dairy products and eggs should be consumed occasionally and in small quantities;
- there should be a variety of foods consumed to ensure an adequate supply of nutrients;
- fresh foods should be given priority reducing processed foods and ready-to-eat meals;
- the intake of liquids should be based on non-sugary drinks (water, natural fruit juices, tea, etc.) [18].

These principles are adopted by many of the WHO members states, which have committed themselves to combating malnutrition in all its forms. Many states have adapted these guidelines into graphic forms that can more easily understood by both adults and children. Such a graphical representation is the AID-Food Pyramid, designed by the German Consumer Information Agency, representing in a simplified form the basic information for a healthy diet (Figure 3):

- color coding for quantity - green means a lot of food, yellow is food that should be eaten in moderation and red is food that should be eaten sparingly;
- number of servings for each food;
- what foods to eat.

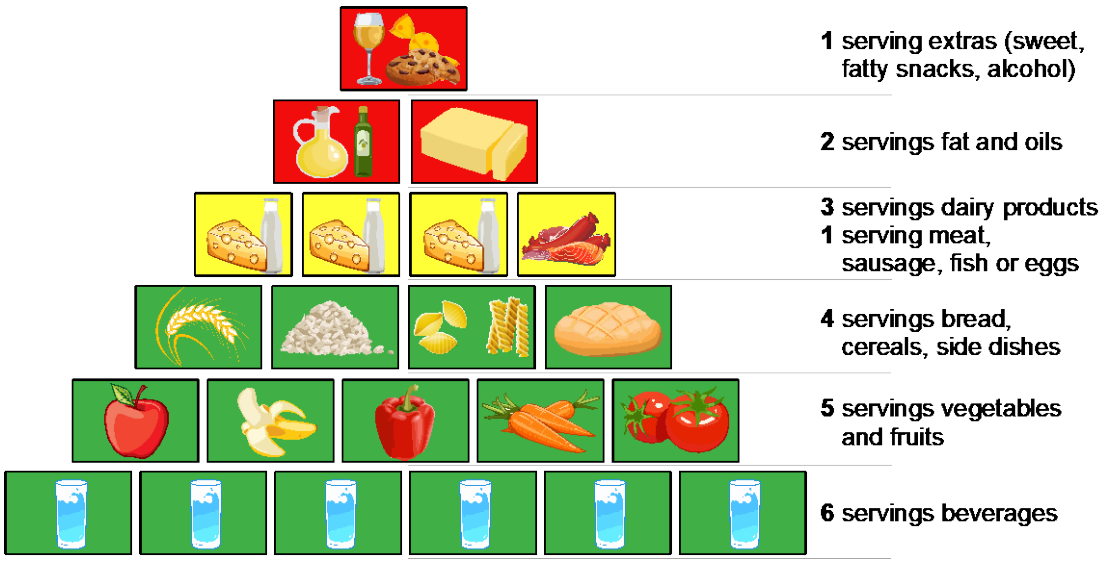

Figure 3. Recommended food intake (food pyramid) – authors adaption after [27].

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The first definition of sustainable diet was formulated by Gussow and Clancy in a paper from 1986. They considered sustainable those "food choices that support life and health within natural system limits into the foreseeable future." In 2010, The Food And Agricultural Organisation of the United Nations (FAO) together with WHO and Biodiversity International, at the "International Scientific Symposium on Biodiversity and Sustainable Diets United Against Hunger" defined sustainable diets as "those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources." It is easily to see that the definition also includes the elements from the definition of food security, which underlie the connection between food security, health and sustainability. One of the papers presented at the 2010 symposium clearly defines the key elements of a sustainable diet. As presented by the author, Denis Lairon, President of the Federation of European Nutrition Societies, the key elements of a sustainable diet, are presented in Figure 4 [28].

Figure 4. Key elements of a sustainable diet [28].

In 2019, the EAT-Lancet Commission, which brings together 19 commissioners and 18 co-authors from 16 countries, determined by the lack of scientific targets to help shape a sustainable food system, has taken on the desk of gathering the best evidence available for healthy diets and sustainable food systems and develop the necessary scientific goals. The Commission has succeeded in establishing the principles for a sustainable, healthy reference diet, adaptable to individual characteristics, social context and eating habits. According to the report, dietary changes from current consumption patterns to diets in line with the reference diet have the potential to prevent 10.8-11.6 million deaths per year, drive by a global reduction in the consumption of unhealthy foods. At least 50% of this reduction should be in the consumption of red meat and sugar, while the consumption of vegetables, legumes, nuts and fruits should be at least a doubling of the level of consumption [16].

Regarding the structure of a healthy and sustainable diet, as it is presented in Figure 5, in correlation with the guidelines provided by the Commission, one third of the total energy intake should be based on whole grains, followed by vegetable protein sources, with ¼ of the total energy intake. Foods of animal origin, such as meat and dairy products, must not exceed 12% of the total daily caloric intake for an adult. Sweeteners should be avoided, but if this is unrealistic, they should not exceed 31g of added sugars per day per capita. When it coms to fats and oils, it is recommended to eat unsaturated oils, while dairy fats should be avoided. The reference diet has a great advantage, due to its great ability to adapt to any type of consumption pattern, cultural environment and personal preferences [16].

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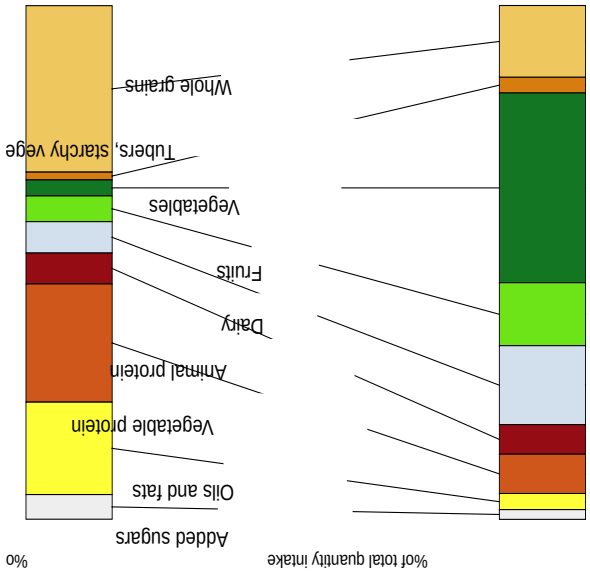

Figure 5. Caloric intake in relation to the quantity of different food groups - authors own interpretation of data from [16].

Correlating the data provided by numerous authors and public bodies mentioned above on the characteristics of a sustainable diet, and the available data on the composition of a healthy diet, it can be concluded that they have many features in common:

a) focus on a lot of plant-based foods;

b) small quantities of meat and meat products;

c) low amount of fats and oil, emphasis on vegetable oils;

d) reduced amount of processed foods, concentration on whole foods and increased consumption of fresh fruits and vegetables;

e) quantity optimization and focus on quality.

Although sustainable diets and healthy diets have certain characteristics, the concept of a sustainable diet is much broader than that of a healthy diet and incorporates the latter. A healthy diet is characterized by the importance of macro and micronutrients and the nutritional value of food consumed, resulting in increased well-being of the consumer, while a sustainable diet considers the impact of human dietary habits, healthy or unhealthy, on the environment as a whole, not only on human health [16,29].

4. Conclusions

This section is not mandatory but can be added to the manuscript if the discussion is unusually long or complex.

A sustainable diet has many benefits for both the environment and human health. As sustainable diets emerge from sustainable agricultural practices, many of the food products are healthier than conventional agricultural products due, among other reasons, to the lack of use of synthetic pest and herbicides control.

In addition to the "cleanliness" of food products, sustainable dietary practices requires the rational use of resources, including food resources. This rational use translates into:

- optimal quantity consumed and optimal combination for an increased nutritional intake correlated with the optimal caloric intake,
- the potential for reuse of food products, for example leftovers,
- reduction of food waste and the use of unavoidable waste in the production cycle – transformation of waste into compost, for example.

All the guidelines of a sustainable diet are in line with the recommendations for a healthy diet, and furthermore, the adoption of a sustainable diet has an impact not only on personal health but also on the environment.

Because our food resources are based primarily on the health of our environment, it is of paramount importance that we, as a species, adopt healthy and sustainable eating behavior. Ultimately, our future as humans and our food security depends solely on planet Earth.

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Data Availability Statement: Not applicable.

Authors Statement: The authors admit that each human body has its own characteristics in metabolizing nutrients and that the human food, as a national and regional cultural element, must meet consumer requirements for organoleptic characteristics specific to each consumer. However, the authors also acknowledge that all international organizations fighting against food waste, in all its forms, including metabolic food waste, have the right to take all necessary steps actions to make human food a means of subsistence, not a goal in itself, in the sense that we eat to live, we do not live to eat.

Conflicts of Interest: The authors declare no conflict of interest.

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