SYNTHESIZING WELL-BEING AND ECOLOGICAL RESPONSIBILITY: A MOROCCAN EXAMPLE

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Abstract. This work highlights the potential of a specific dietary approach to lessen the negative impact of human activities on Earth. The study stresses the importance of medical expertise due to the complexity and variability of human health. This diet presents an effective climate change mitigation strategy as it is a personal choice, independent of government or state entities. Given the current population growth and warming projections, it is estimated that global warming will reach +2°C by 2040 and exceed +3°C by 2060, potentially causing extinctions. Leveraging the feedback from an experiment that began just before the start of this study was instrumental to the overall success of this work. The conduct of this experiment, as well as the collection and observation of results, were carried out in Morocco under conditions that adhered to medical advice.
Keywords: *greenhouse gas, health benefit, ecological benefits, energy benefits, advantages for citizens, experimental results*

Introduction

For those who appreciate objectivity, it is essential to understand that the current campaign to safeguard our planet, particularly against an inevitable ecological catastrophe (Cabane and Revet, 2015), can be characterized as a genuine race against time (Lloyd and Shepherd, 2020). This urgency stems from the need to avert a potential point of no return (Aengenheyster et al., 2018), given that many detrimental effects of pollution unfortunately exhibit irreversible traits (Manisalidis et al., 2020). To overcome these issues sincere commitment and goodwill are primary requisites (Löwy, 2020). However, a genuine intent to do what's right necessitates concrete, effective, and, most importantly, diverse proposals for solutions (Matić and Karleuša, 2022). This ensures the broad involvement of as many potential contributors as possible, whether through direct or indirect means (Park, 2022), either morally or financially.

In the subsequent phases, the scientific community is destined to assume a pivotal role in generating innovative ideas (Sarkar et al., 2022). These ideas are vital to present a varied array of solutions that resonate with individuals, inspiring them to become active participants in the fight against fossil fuels (Shabir et al., 2023). It is acknowledged that the devastating consequences of climate change predominantly affect future generations (Syropoulos and Markowitz, 2021). By being inactive and indifferent to the state of our planet, we might inadvertently become collaborators in a crime against humanity (Humphreys, 2022), particularly concerning the precarious situation that our future descendants could find themselves in (Gillespie, 2014).

That being said, the primary merit of this work is notably advantageous as it is geared toward the average person, thereby addressing a vast population. The primary

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objective of this study is to persuade people to embrace a very specific diet, the intricacies of which will be elucidated throughout the paragraphs of this scientific article. To achieve widespread persuasion, the multitude of advantages associated with this diet will be systematically enumerated as the study progresses.

The benefits of fasting extend beyond health considerations (Ganesan et al., 2018) to include environmental and energy-related aspects. It is precisely these latter two aspects that will be explored in detail in the subsequent sections through a comprehensive examination, both quantitative and qualitative, of the adoption of this dietary approach.

The goal of this study is thus unmistakably defined: to identify and evaluate both the beneficial and detrimental outcomes resulting from the implementation of this particular regime across multiple sectors. These sectors hold substantial, even vital, significance for each one of us, emphasizing the necessity for a thorough and discerning assessment of the regime's effects.

Materials and methods

The principal objective of this study section is to outline the measures employed to elucidate the role of this diet in potentially contributing to environmental preservation. This primarily entails mitigating the emission of harmful gases by individuals deemed capable of adhering to this specific nutritional regimen. However, before delving into these outcomes, it would be wise to provide a brief introduction to the diet examined in this work, specifically the 36-h fasting method. Subsequently, its benefits will be elaborated across various fields.

Therefore, in this methodology section, it was considered essential to start by explaining what intermittent fasting is, its various types, and its numerous benefits. This is particularly important for those who are not yet very familiar with this type of diet. Subsequently, still within the same section, dietary recommendations will be provided, along with several general data points related to the host country of this experiment. Additionally, other necessary data will be included to facilitate the acquisition of results later on. All of this will be conducted with the experiment serving as the primary reference to observe the results through this study.

Intermittent fasting

In contrast to famine (Séguy and Théré, 2016) or hunger strikes (Fayeulle et al., 2010), which have distinct meanings—one arising from a scarcity of food and the other involving a refusal to eat as a form of protest to make a lasting impact (Chalit Hernandez, 2022)—fasting represents a purposeful and intentional abstention from food for a defined period, driven by a specific goal.

Reasons for fasting

In the contemporary context, three primary factors drive the practice of fasting:

- Religious motivations play a significant role in fasting. Indeed, the five major religions—Judaism, Christianity, Islam, Hinduism, and Buddhism—have historically practiced or currently observe fasting as a religious ritual. The best-known are the fasts of Ramadan (Alsubheen et al., 2017) for the Muslim peoples and Yom Kippur for the Jewish community.

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- Health considerations challenge the common misconception that abstaining from eating inevitably leads to slimming down, weakness, or severe illness (Lagrange, 2010). In reality, fasting offers remarkable benefits for physical well-being by facilitating profound detoxification based on the chosen fasting method (Gustafson, 2014). Without delving too deeply into medical intricacies, it is essential to recognize that the body produces toxins as a result of cellular chemical reactions (Tinsley and La Bounty, 2015). To eliminate these toxins, organs such as the liver and kidneys are engaged. However, with continuous feeding, these organs lack sufficient time for self-maintenance, potentially leading to congestion and chronic diseases (Longo and Mattson, 2014). Another crucial aspect is that fasting significantly boosts the production of growth hormones, slowing down cell aging and contributing to a more enduring youthful appearance (de Cabo and Mattson, 2019). Equally important in terms of physical health is the role of fasting in reducing the risk of cardiovascular diseases, with studies indicating a potential 12% decrease in the likelihood of such diseases. Beyond these advantages, fasting offers therapeutic benefits, including increased insulin resistance (Isganaitis and Lustig, 2005), particularly relevant to the approximately 1 billion individuals dealing with pre-diabetes (Echouffo-Tcheugui and Selvin, 2021). Additionally, for those grappling with overweight issues—an affliction affecting a substantial portion of the global population according to the World Health Organization (WHO)—fasting presents a potential solution (Harris et al., 2018). For instance, over 22% of Moroccans and a staggering 33% of Americans are classified as obese, underscoring the urgent need for effective interventions against this widespread health concern (Murer et al., 2016).
- Another compelling motivation for individuals to embrace fasting, particularly the 36-h regimen, lies in its intellectual benefits. This facet involves a substantial enhancement of cognitive functions (Solianik et al., 2016). Historical narratives recount that the renowned mathematician Pythagoras engaged in a 40-day fast to stimulate his intelligence and successfully excel in a prestigious competition. Years later, he introduced fasting to his students. Fasting is also attributed to a notable improvement in concentration, driven by internal changes, specifically at the cellular level.

Types of fasting

Intermittent fasting can be categorized in two ways. Firstly, it can be classified based on the duration of the fast. Alternatively, it can be categorized according to the types of foods permitted during the fasting periods. Concerning the categorization based on the allowable types of food, there are four recognized categories:

- Water fasting entails the consumption of solely zero-calorie beverages, including tea, coffee, and, naturally, water (Gustafson, 2014).
- Buchinger fasting (Mesnage et al., 2019), created by the Marbella-based clinic bearing the same name, involves a daily caloric intake of 250-300 calories. This primarily consists of fruit or vegetable juices along with a small amount of honey.
- Dietary fasting involves reducing food intake to one-third of the regular requirements, specifically targeting 600 calories per day.
- Dry fasting strictly prohibits the intake of any form of food.

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Regarding classification based on duration, four types can be delineated:

- The 16/8 fasting method (Mengi Çelik et al., 2023) involves a routine of normal eating for 8 h followed by a 16-h period of abstaining from food.
- The 5/2 fasting approach (Hajek et al., 2021), commonly referred to as the "fast diet," entails two days per week with a restricted caloric intake, typically ranging from 500 to 600 calories per day.
- 1/2 fasting: Which consists of eating one day then reducing calorific intake, especially carbohydrates, during the following day.
- The 36-h fasting: This would entail eating once every other, with the resumption of food intake commencing at midday and extending until 23:00 of the same day, The optimal strategy for the recommencement phase would be to split one's food consumption into three meals, beginning with a light coffee break to signal the body that the resumption has started, followed by the main meal one or 2 h later, and concluding the day with a final meal acting as an aperitif dinner (Solianik et al., 2016).

Investigation, compilation, and deduction of essential data necessary for the advancement of the study

This paragraph's primary objective is to amass information crucial for establishing the foundational groundwork upon which the subsequent sections of this work will build. Within the array of fasting benefits, especially those associated with the 36-h fast, our specific interest lies in exploring the ecological, energetic, and, to a somewhat lesser extent, economic dimensions of fasting. Our attention will be directed towards examining the causal connection between food and energy, the portion size per meal, and the average cost of meals (Sobal et al., 1998).

Quantity of food per meal

Although the portion size of a meal depends essentially on gender, height, age and, above all, the intensity of physical activity performed by the individual in question, the fact remains that most ordinary people do not take these factors into consideration and often eat as they please (Davis et al., 2007).

To conduct this study effectively, adherence to a suitable legislative and health framework is imperative. It is highly advisable to align with dietary recommendations established by pertinent authorities, such as the French Ministry of Health—a pioneering institution in the health sector. According to these guidelines, a meal should consider two fundamental aspects: the quality of the products and the quantity of food consumed during the meal (Benton, 2015).

In terms of food quantity (Ello-Martin et al., 2005), the recommended portions are succinctly outlined by category in the provided *Table 1* according to the Federal Ministry of Food and Agriculture.

Despite the abundance of information, it is crucial to stay focused and maintain a clear objective for this segment, which is to understand the nutritional needs of an individual and quantify them as accurately as possible. In pursuit of this goal, a team of nutrition specialists, drawing on scientific studies, has determined that on a daily basis, we require:

- 3 servings from food category #4,
- 2 servings from food category #5,

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- 4 servings from food category #3,
- Serving from food category #1,
- Servings of fats and oils (corresponding to various categories in *Table 1*).

Table 1. *Recommended portions for each food type according to (Bundesministerium für Ernährung und Landwirtschaft, BMEL)*

Types	Food product	Servings in grams
N°1	Meat (chicken, steak, pork fillet)	150 to 180 g per serving
N°2	Carbohydrate-rich side dishes (potatoes, pasta, rice)	200 g per cooked portion
N°3	Side dish of vegetables (broccoli, zucchini, carrots)	200 g per cooked portion
N°4	Vegetables as main ingredient	300 to 400 g per serving
N°5	Fruits (bananas, apples, grapes)	120 to 150 g per serving
N°6	Salad (tomato salad, potato salad)	120 to 150 g per serving
N°7	Sweet dishes (cakes, pies, cookies)	120 to 150 g per serving

Potential average cost of nutritious eating

Building upon the preceding section, adopting a healthy eating pattern involves a daily regimen comprising "Corresponding to the maximum upper limit": 1200 g of vegetables +300 g of fruit + 1200 g of side dishes or cereals + a minimum of 180 g of meat + not less than two times 14 g of fat and oil. In alignment with this, the PNNS (National Nutrition and Health Plan) estimates that maintaining a healthy diet (Kindig and Stoddart, 2003) necessitates an expenditure of approximately €572 per month. If we narrow our focus to Morocco for this study, it becomes imperative to calculate the daily cost for a Moroccan individual, and *Table 2*, sourced from "numbeo.com" whose data is used by many of the world's leading companies, facilitates the determination of this right price.

Table 2. *World cost-of-living indexes*

Cost of living	Morocco	Belgium
	Cost of living in Morocco is, on average, 56.1% lower than in United States	Cost of living in Belgium is, on average, 109.7% higher than in Morocco

If we apply this calculation to Morocco, considering straightforward computations, we arrive at a total of €252, representing the expense of maintaining a healthy diet for a resident of this country.

Another way to calculate this amount involves examining the cost of the calories we consume. According to a study published in issue 12 of Nutrients magazine, a French individual would need to spend €1.55 for 100 kcal of farm-fresh or minimally processed food, while the same quantity of calories from ultra-processed food (Gaimard, 2008), (Fardet and Rock, 2020) would cost only €0.66. If we were to construct a diet exclusively from farm-fresh or minimally processed products using this method, it would amount to almost €30.1 per day, compared to just €19.3 per day using the previous approach. However, given the near impossibility of abandoning industrial products in our current era due to our habits, and lacking precise figures on this matter, our study will adopt the initial estimate provided by the PNNS.

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Causal connection between food and energy systems

Before food reaches our plates, a substantial amount of energy must be expended. This process encompasses key stages such as food processing and packaging, food consumption and waste disposal, and agricultural production, including the manufacture of fertilizers and weedkillers. According to the Food and Agriculture Organization of the United Nations, the food sector alone accounts for a significant 30% of global energy consumption (Guyomard et al., 2012). Also according to the Food and Agriculture Organization of the United Nations, and what is particularly noteworthy is that a staggering 85% of this energy is derived from fossil fuels. The breakdown of fossil fuel consumption at each stage is illustrated in *Figure 1*.

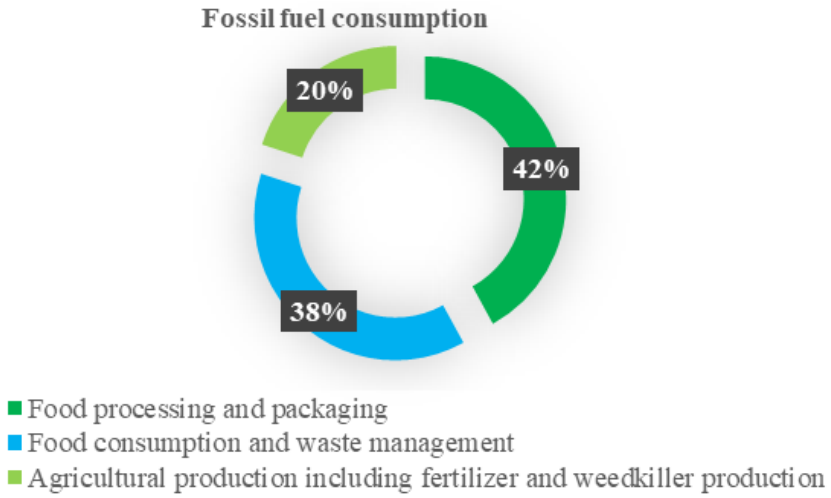

Figure 1. *Fossil fuel consumption of key stages in the alimentation system*

Here is where the significant contribution of this study becomes evident, as it directly affects the end product—the food itself—impacting all the preceding stages mentioned in this paragraph. Another noteworthy aspect is the Energy Return on Investment (ERR), representing the rate of return on investment in food. In the case of a food system like that of the USA, it requires 7.3 calories in the form of fossil energy to produce 1 calorie of food, resulting in an Energy Return on Investment (ERR) of 0.14, indicating a notably low efficiency (White and Kramer, 2019).

Results

The preceding section of this article delved into the substantial energy consumption of the food system, and this study has the potential to mitigate it. While the notion that fasting for 36 h could contribute to any form of savings might appear counterintuitive, the reality is that a comprehensive audit is required. This audit will yield quantifiable results, providing a more meaningful assessment of the efficacy of this diet. Such conclusive findings are crucial in persuading a substantial community, particularly one attuned to energy and ecological concerns, to embrace the 36-h fast as a new dietary practice. Naturally, achieving the desired outcomes necessitates several preparatory measures intricately linked to medical, nutritional, and statistical data associated with the 36-h fast.

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Significant data on 36-h fasting

In this part, we will closely examine the 36-h fasting method, as proposed for study in this article, shedding light on the different aspects of this dietary approach.

Amount of food for an individual practicing a 36-h fast

Theoretically, this type of eating plan requires consuming food for a quarter of the time and fasting for the other three quarters. Nevertheless, the recommencement of eating should be progressive, aimed at avoiding excessive stress on the digestive system. From a health standpoint, during this extended fasting period, dietary supplements containing sodium, potassium, magnesium, and calcium are crucial for optimal bodily functions. To preserve lean body mass, it is highly advisable to incorporate regular exercise and ensure an adequate protein intake.

Prior to delving into the primary inquiry of this specific section, it is crucial to understand the energy content of each meal. Therefore, the approximate proportions of the theoretical daily caloric intake are as follows: 25% for breakfast, 40% for lunch, 5% for tea, and 30% for dinner.

Upon resuming eating, as previously noted, it is crucial to adopt a gradual approach, implying the extension of the meal duration. Regarding the necessary quantity of food, one should attune themselves to their body's signals and provide what is due. In line with this, the current study, focused on "how much do we eat during the recovery period?", suggests that the maximum food considering the insights gained from experience feedback on the dietary plan intake in this 4 to 6-h span, contingent on individual preferences, should comprise two meals - lunch and breakfast - encompassing all the aforementioned food categories. The individual's post-fasting recovery diet, which aligns perfectly with his requirements is composed of 150% of a standard breakfast and 150% of a standard lunch. Based on the calculations, this would equate to: 97.5% of the Theoretical Energy Intake (TEI).

Situation analysis and study execution conditions

Personal health is an innate and highly diverse trait, and this research does not promote the adoption of the investigated practice. While statistical studies may not produce exact results, they can still offer valuable approximate data. The statistical study was conducted confidentially to maintain ethical standards and avoid potential biases. Moreover, the results, primarily obtained from feedback, are the product of an independent initiative, and the idea of evaluating intermittent fasting's environmental impact was only conceived months after the initiative's completion. It must be noted that the individual in question had gained the approval of a general practitioner.

Energetic, ecological and economic impact

At this point, the study has accumulated sufficient data to determine the actual effects of this kind of practice. The potential positive consequences would directly influence the individual Indeed; by considering the three elements outlined in *Figure 2*, we arrive at the first result indicated in the same figure.

Another notable advantage of extended fasting is the substantial amount of free time it provides. To illustrate more meaningful statistics, it is essential to recognize that for maintaining a healthy diet, it is crucial to consume meals at a measured pace to avoid

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overeating. The recommended meal duration is 20 to 30 min, averaging 25 min per meal. Based on the various data compiled in this study, the regained free time after a 36-h fast amounts to approximately 125 min every other day, totaling no less than 7 h and 17 min per week. Also, according to various studies and surveys offering general estimates, the average time to prepare a meal range from 30 min to 1 h, with an average of approximately 45 min. These estimates are published by renowned institutions such as the National Institute of Statistics and Economic Studies (INSEE) and the Organization for Economic Co-operation and Development (OECD).

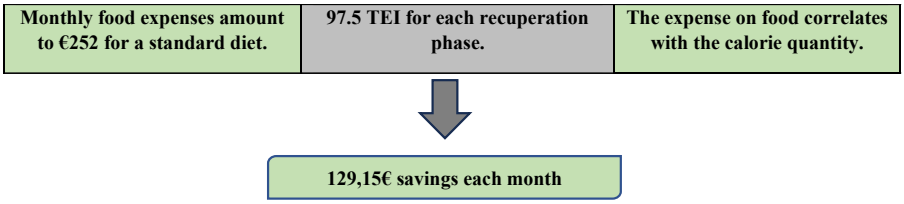

Figure 2. *The first benefit of this type of diet*

This huge amount of time could potentially be reinvested to enhance personal productivity, especially by eliminating midday meals. The broader aspect, encompassing government and state institutions, holds significant relevance for the current study. The focus here is to comprehend the impact of this regimen on energy and environmental systems.

Situation analysis and study execution conditions

Personal health is an innate and highly diverse trait, and this research does not promote the adoption of the investigated practice. While statistical studies may not produce exact results, they can still offer valuable approximate data. The statistical study was conducted confidentially to maintain ethical standards and avoid potential biases. Moreover, the results, primarily obtained from feedback, are the product of an independent initiative, and the idea of evaluating intermittent fasting's environmental impact was only conceived months after the initiative's completion.

The individual's motivation for undertaking a 36-h fast, which provided data for this study, was purely health-related. The individual had gained weight, experienced shortness of breath during light exercise, and received a doctor's warning about potential prediabetes. After finding no negative effects and consulting his doctor, the individual decided to incorporate this practice into his routine.

Energy benefits

As previously emphasized in this study, the food system consumes approximately 30% of total energy consumption. In a country like Morocco, where overall energy consumption is estimated at 244.7 TWh, this translates to a staggering 73,425 GWh of energy consumed by the agri-food system, which is designed to meet the food needs of the population. Food appears to be the main driver of this substantial energy demand. Therefore, modifying our food management practices could systematically influence all stages of the agri-food process, which can be very energy-intensive. The positive response and absence of detrimental health effects in our subject have led us to focus on

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Energy aspect of this type of fasting during our investigations. *Figure 3* illustrates the exact contribution of our subject in combating global warming and its associated impact.

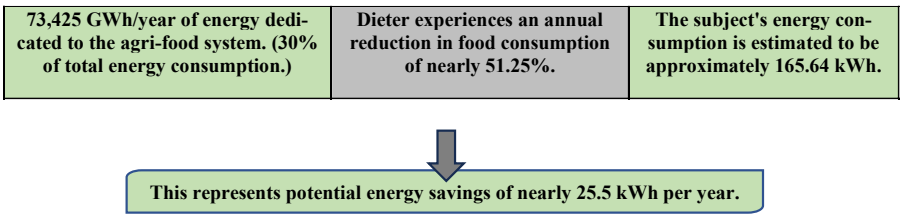

Figure 3. *Some of the economic and energy advantages of this dietary approach*

According to The World Health Organization (WHO), the global population is projected to reach 10.8 billion individuals in about fifty years. Even if only a small percentage of people are willing, motivated, and committed to following such a movement, the energy savings would be disproportionately large. This releases a notable quantity of energy and financial resources that might be redirected to various sectors, including industrial manufacturing and other vital elements. This redirection could spur accelerated economic growth in the country while simultaneously addressing the health concerns of the population, particularly against chronic diseases like obesity and diabetes.

Ecological benefits

The media, including the press and television, are actively engaged in discussions surrounding ecology and potential solutions to mitigate the concerning environmental forecasts for the future. This research indicates that altering our dietary habits, in light of the projected decrease in energy consumption, particularly fossil fuels, could have advantageous environmental outcomes. The allocation of energy consumption within the food system (see *Fig. 4*), is shaped by prevailing practices and technologies. The selection of energy sources for each sector of the food system, however, is contingent upon each nation's energy policy (*see Fig. 5*).

The present study utilized multiple datasets, including a significant one from the 2023 study by Echarradi et al. on the environmental landscape in Morocco (see *Fig. 6*). This data provided valuable insights into the CO2 emissions contribution of each energy source per kWh in Morocco (see *Fig. 7*). With this information, we can assess the environmental impact of adopting the aforementioned diet on our planet. Based solely on the contribution of the subject studied, we estimate that at least 15.6 kg of CO2 can be avoided annually, while preserving a superior state of health, the diet has proven effective with no significant loss of weight, despite a marked reduction in food intake. However, to achieve a healthier, or even ideal, weight, regular physical activity is highly recommended.

Discussion

Engaging in 36-h fasting is more than just a means to decrease CO2 emissions or enhance economic performance; it symbolizes a lifestyle that is in harmony with the

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current era. Moreover, there is a less conspicuous but equally vital benefit that indirectly supports our forests. With the global population projected to reach almost 10 billion in the coming years, the requirement for agricultural land to meet the rising demand for food will escalate. This is where the diet examined in this study plays a crucial role: lesser food consumption leads to a reduced need for farmland, which is advantageous for the world's forests. If a considerable segment of the population were to adopt this dietary pattern, in conjunction with other carefully planned initiatives, it could enable the planet to revert to a more sustainable and virtuous cycle.

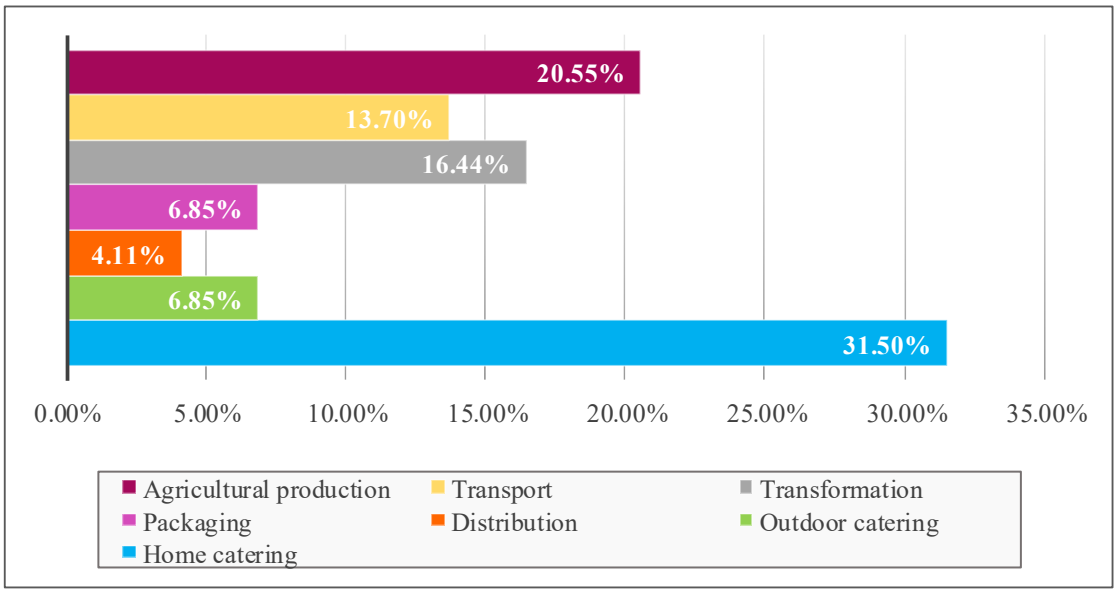
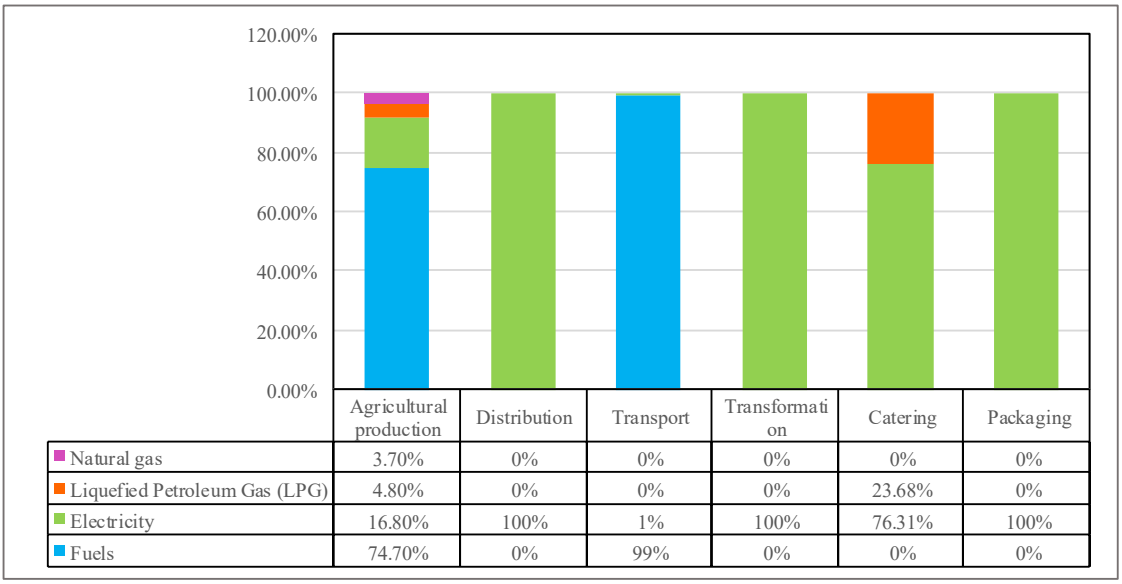


Figure 4. *Approximate percentage distribution of energy consumption between the different sectors of the food system, according to the study by Heller and Keoleian (2003)*



	Agricultural production	Distribution	Transport	Transformation	Catering	Packaging
Natural gas	3.70%	0%	0%	0%	0%	0%
Liquefied Petroleum Gas (LPG)	4.80%	0%	0%	0%	23.68%	0%
Electricity	16.80%	100%	1%	100%	76.31%	100%
Fuels	74.70%	0%	99%	0%	0%	0%

Figure 5. *Approximate percentage of each type of energy source used by each sector of the agri-food system according to the International Energy Agency (IEA), the Food and Agriculture Organization of the United Nations (FAO), and specific market studies*

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Figure 6. *Energy framework of the Moroccan food system*

Figure 7. *Contribution to CO2 emissions from each energy source per kWh in Morocco.*

Conclusion

The outcomes of this study are remarkably positive, to express it conservatively, and they all lead to conclusions that are beneficial for both the individual and the planet that we inhabit. Therefore, considering these impressive results, governments have a significant responsibility to champion this dietary practice. They should take proactive steps to promote and assist their citizens in embracing this new, somewhat unusual, yet multifaceted beneficial lifestyle. This could involve a multitude of initiatives, such as launching informative campaigns to educate the public about the benefits, providing financial support or tax incentives to encourage adoption, and creating community programs that make this dietary change more feasible and attractive for a broader audience. By doing so, governments can play a pivotal role in fostering a healthier and more sustainable future for both individuals and the environment.

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