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Research Article

From X to Z: Examining Generational Differences in Sustainable Food Consumption in Portugal

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Abstract
The main objective of this research was to analyze the attitudes and sustainable purchasing behaviors of food products among Portuguese consumers from different generations. The study sought to identify statistically significant differences regarding ecological awareness, understanding of ecological issues, adoption of ecologically conscious purchasing habits and conscious planning of these purchases. Consequently, the research aimed to reveal sustainable attitudes and behaviors during the food purchasing process considering the generational factor. In order to achieve these objectives, a quantitative and cross-sectional study was developed based on a questionnaire adapted from Kuźniar, Surmacz and Wierzbiński (2021). Between September 2022 and the first half of January 2023, the questionnaire was applied to a non-probabilistic sample of 686 Portuguese consumers. Statistical tools such as the Mann-Whitney and Kruskal-Wallis tests were used to discern statistically significant differences between two and three independent groups, respectively. The results confirm that generation is a differentiating factor of sustainable attitudes and behaviors. Obviously, the discernible existence of statistically significant differences between Generations Z, Y and X with regard to ecological awareness, ecologically oriented purchasing patterns, and the manifestation of sustainable attitudes and behaviors during food purchases serves as a robust validation of this assertion. Furthermore, it was observed that Generations X and Y exhibited congruent attitudes and behaviors, demarcating them from Generation Z. With regard to depth of understanding around ecological issues and conscious purchase planning, similar attitudes were consistently observed across the three generational spectra under analysis.

Keywords: Sustainability, Ecological knowledge, Food purchasing, Generations.

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Introduction

In the contemporary scenario, the social dynamic is a reflection of high modernity, which unfolds throughout the 20th and 21st centuries, outlining significant transformations in the interactions between generations X, Y and Z, as well as their relationship with the environment and consumer issues. As highlighted by Harari (2015), this context is a continuation of the changes initiated in the first civilizations, with the agricultural revolution that dated between 10,000 and 12,000 BC. This revolution allowed the sedentarization of the population and the demographic increase, culminating in the formation of city-states and civilizations. However, this progression also brought profound environmental changes, as increasing demographic pressure and the need for food resulted in the degradation of natural resources (Boserup, 1970; Mazoyer & Roudart, 2010).

The Industrial Revolution, led by England in the 18th century, marked another critical stage in the historical narrative. The era of human domination over nature (Harari, 2015) brought with it significant technological advances, but also triggered substantial environmental impacts. Although environmental impacts were often neglected in the name of progress, the occurrence of imminent environmental disasters in European industrial centers and transformations in production systems in European colonies revealed the real extent of socio-environmental damage (Friedmann & McMichael, 1989; McMichael, 2009). The European production model, which initially prevailed in agriculture and later in industry, was exported to other parts of the globe, a phenomenon known as "westernization". This process led to increasing pollution on a global scale, especially during and after the First and Second World Wars (Friedmann & McMichael, 1989; McMichael, 2009).

During these phases of conflict, unprecedented technological discoveries occurred, particularly in the area of chemical synthesis (Harari, 2015). Some of these discoveries, especially those related to the use of chemical substances in warfare, were later applied to agriculture (Harari, 2015). Rachel Carson, in her 1962 work "Silent Spring", was one of the first voices to denounce the harmful effects of phytopharmaceutical products, with emphasis on Dichloro-Diphenyl-Trichloroethane (DDT). Her concerns resonated and raised awareness among civil society and government officials about the importance of environmental protection (Carson, 2010). The environmental movements of the 1960s and 1970s, led largely by the baby boomer generation, marked the emergence of environmental awareness as a global problem facing society (Carson, 2010). The light of knowledge of the environmental impacts caused by human beings in the 1960s and 1970s continues to inspire generations, but what are generations?

The concept of generations is widely used in the areas of marketing and advertising to help identify consumer trends stratified by consumer taste and thus boost sales. In biology, generations are given by reproduction through degrees of kinship (grandfather, father and son), but from a historical-sociological point of view, a generation is understood as the number of people who were born in a certain temporal historical context and experienced it in a similar way (Mannheim, 1993; Forquin, 2003; Weller, 2010). However, a generation is not only made up of people of the same age or born at the same time, but also of people who were modeled at a given time, through the same type of educational, political or cultural influence, or who have experienced and been impressed by the same events, have developed, on the basis of a common or similar experience, the elements of an awareness of having bonds in common, which can be called "generational feeling" or even "generational consciousness" (Forquin, 2003).

Thus, the concept of generation implies a thorough analysis of the socioeconomic, cultural, and historical conditions of a group of people who may become a cohesive generation with typical

behaviors that are possible for generalization and identification of trends (Mannheim, 1993). Therefore, to formulate a generation, it must contain individuals who, in addition to being of a similar age, are inserted in social, environmental, and economic contexts that allow the sharing of similar experiences, as this will make it possible to have values and ideas in common between the subjects included in a given generation, creating its own identity that distinguishes it from others (Mannheim, 1993), as only a common historical-social sphere of life makes it possible for the position in chronological time due to birth to become sociologically relevant (Mannheim, 1993). In this way, the individual's social class should also be considered for their fit in a given generation, as social class delimits countless aspects of human life and its opportunities.

Currently, four generations are defined after the Second World War. The baby boomer generation, born between 1940 and 1960, which saw post-war growth and the Cold War. This generation was marked by the rise of market capitalism and mass culture. Although they sought financial stability and led civil and environmental rights movements, consumer choices were strongly influenced by social and environmental issues (Lepre et al., 2020). The subsequent generation, Generation X, born between 1960 and 1980, enjoyed economic stability but demonstrated greater individualism and skepticism. These individuals were particularly influenced by marketing and advertising, and sustainable consumption was not a major concern (Lepre et al., 2020). Generation Y, born between 1980 and 1990, grew up in an environment of growing social and environmental concerns. Events such as the mad cow epidemic (caused by the Bovine Spongiform Encephalopathy virus), in Europe, in 1980, raised questions about food production and consumption (Murdoch, 2000). Generation Y demonstrated sensitivity to socio-environmental issues related to consumption (Radons et al., 2016). Generation Z, born between 1990/95 and 2010, also known as "born digital", grew up in a completely globalized world, interconnected by telecommunications networks and digital technologies. This generation is marked by greater environmental awareness, due to constant exposure to information and the ease of reporting socio-environmental crimes, in addition to virtually mobilizing in favor of environmental causes. Concerned about the consequences of their consumption for the planet and future generations, Generation Z demonstrates strong trends towards sustainable consumption (Santos & Lisboa, 2013; Radons et al., 2016).

This context of changes in generations and their attitudes towards consumption and the environment deserves an in-depth analysis. This research aims to explore the transformations in the attitudes and consumption behaviors of Generations X, Y and Z in relation to socio-environmental issues. To understand the generational response to environmental challenges, it is essential to analyze not only the general trends, but also the nuances and contradictions within each of them. Furthermore, it is critical to consider the social, technological and economic influences that shaped the perceptions and actions of these generations. Therefore, this research aimed: (1) to determine the levels of interest and knowledge of ecological issues in Generations Z, Y and X; (2) to analyze ecological purchasing habits and conscious purchasing planning in Generations Z, Y and X; and (3) to verify whether there are differences in interest in ecological knowledge, level of knowledge about ecological issues, ecological purchasing habits, conscious purchasing planning and sustainable attitudes and behaviors between Generations Z, Y and X. Therefore, the following research question was formulated: are individuals from Generation Z, who perhaps, because they have greater interest and knowledge of ecological issues, have more positive sustainable attitudes and behaviors when purchasing food, compared to individuals from Generations Y and X?

This research analyzes the differences in attitudes towards consumption and sustainability in Generations X, Y and Z, highlighting how historical, social, and technological factors shaped their vision of the environment and individual and collective responsibility. Also, it investigates how these generations respond to environmental challenges through their consumption choices. The objective of the research is to provide a comprehensive and up-to-date analysis of the association between Generations X, Y and Z and the environment, providing important insights for

the development of effective environmental education strategies, public policies, and sustainable consumption practices in order to provide a clear vision of the changes and challenges faced by these generations in a world increasingly concerned about environmental sustainability. Thus, the originality of this research lies in presenting a new perspective on sustainable attitudes and behaviors when purchasing food by comparing Generations Z, Y and X, contributing to the debate on the association between consumer behavior and sustainability issues.

Therefore, this research is structured as follows. First, a literature review is made that focuses on the environmental concerns of successive generations. Secondly, the methodology used is described, including the type of study and sampling, the data collection instrument and the statistical treatment and ethical procedures. Thirdly, the results are presented taking into account the established objectives. Next, this study aligns and compares the results obtained with findings from existing literature and discusses the attitudes and behaviors of Generations Z, Y and X. Finally, the main conclusions are exposed, the limitations of this study are described and future research is suggested.

Literature Review

Achieving sustainable food systems is a complex challenge that requires structural and cultural efforts, as well as changes in consumption, such as the adoption of products that preserve the environment (Fernandes & Saraiva, 2022). Advocating the adoption of environmentally friendly food consumption behaviors, such as choosing products manufactured in an eco-friendly manner (Argyropoulos et al., 2013; Chua et al., 2016), is seen as a viable means of moving towards sustainable development (Thøgersen, 2010). However, consumers are often reluctant to adopt sustainable consumption practices, as these often imply personal sacrifices, such as reducing the convenience of their previous purchasing habits (Fernandes & Saraiva, 2022). This way, sustainable consumption emerges as an essential tool to achieve sustainability and the United Nations' development goals (United Nations, 2022) involving purchasing, using, and discarding products consciously, both at a social and environmental level (Wolff & Schönherr, 2011). This type of consumption is also seen as a practice carried out by conscious citizens, who actively consider ecological and social issues in the act of consuming (Lee, 2014).

Research conducted by Azzurra et al. (2019) and Bulut et al. (2017) reveals a greater inclination of younger generations towards sustainable and organic consumption habits. Generation Z, recognized for prioritizing sustainability in its purchasing options, is emerging as a potential market influencer in the coming years. More conscious and motivated by sustainability compared to previous generations, Generation Z shapes its consumption patterns and fundamental values based on this commitment (Gibson et al., 2023; Su et al., 2019).

In turn, several studies indicate that members of Generation Y (millennials) are inclined to adopt more sustainable consumption habits. This trend is often motivated by growing challenges linked to social, economic and environmental issues, combined with experiences faced during adult life (Mishra et al., 2023). Lo et al. (2020) researched millennial consumers on their attitudes and behaviors regarding their choice of meals in restaurants. According to the authors, the information on the menu most valued by customers was nutrition and sustainability. In the opinion of Kolnhofer-Derecskei et al. (2017), millennials are more pragmatic, support environmental protection and are self-confident and focused on achievements.

However, research conducted by Garai-Fodor and Popovics (2022) and Biresselioglu et al. (2023) reports that Generation X is fond of food of national and local origin. Older individuals show a greater inclination to purchase at butchers' and local producers' establishments. This behavior occurs, even more, so as age increases. Furthermore, older generations maintain this

preference, opting for local producers over large commercial areas. According to Biresselioglu et al. (2023), younger generations have a greater propensity to eat meals away from home or to eat meals at home purchased outside, while older generations show a preference for homemade meals, avoiding frozen, packaged, and/or ready-to-heat foods.

The research carried out by Gomez-Roman et al. (2021), which involved European samples and aimed to compare different environmental dimensions between Generations X and Y, demonstrated that there were no differences between environmental attitudes and behaviors. However, millennials (Generation Y) demonstrate less environmental attitudes compared to older generations in what concerns reduction energy consumption and efficiency. A study carried out in Poland by Parzonko et al. (2021) demonstrated that Generation Z is less involved in environmental practices than individuals from older age groups. Furthermore, this pattern was maintained in relation to several environmental behaviors.

Based on the above, it can be stated that there is no consensus in the literature regarding the existence of generational differences related to sustainable attitudes and behaviors. Instead, emerging evidence about Generation Z suggests that individuals from this generation possess strong environmental beliefs and attitudes, but tend to engage in limited ways in actual environmental practices (Parzonko et al., 2021; Giachino et al., 2022). In this sense, and taking into account the reality of Portuguese consumers, the following study hypotheses were formulated:

H_{01}: In Portugal, the level of environmental awareness is the same for all individuals, regardless of the generation they are part of.
H_{02}: Portuguese consumers of Generations Z, Y, and X show the same interest in ecological issues.
H_{03}: There are no differences between Generations Z, Y, and X regarding conscious planning of food purchases.
H_{04}: Portuguese consumers have the same ecological purchasing habits, whether they are part of Generations Z, Y or X.
H_{05}: The "Generation" factor does not differentiate sustainable attitudes and behaviors when purchasing food.

Methods

This quantitative and cross-sectional study analyzes socioeconomic data, attitudes and sustainable behaviors, when purchasing food based on responses to a questionnaire adapted from Kuźniar, Surmacz and Wierzbiński (2021). A non-probabilistic sample for convenience of 686 individuals was collected between September 2022 and the first fortnight of January 2023. The data collection was done using a questionnaire that was sent to participants, namely family, friends and acquaintances, via Google Docs Form. Their voluntary participation was requested and respondents were informed about the objectives and scope of the study. To guarantee anonymity, no personal or contact information was requested according to the Law 58/2019 on the Personal Data Protection.

The socioeconomic variables considered were gender, age, education level, monthly income level, household size and family financial comfort. Sustainable attitudes and behaviors included 17 statements that were later aggregated into four dimensions, namely, "Interest in ecological knowledge", "Level of knowledge of ecological issues", "Ecological purchasing habits" and "Conscious purchasing planning" (Table 1). For each statement, respondents used a Likert-type scale ranging from 1 (completely disagree) to 7 (completely agree).

The IBM SPSS Statistics software, version 29.0, was used to perform the data treatment. Firstly, the data analysis involved the calculation of absolute and relative frequencies for qualitative variables (nominal and ordinal) and central tendency (mean and median) and dispersion measures (standard deviation (SD), minimum and

maximum) for superior or quantitative variables (Pestana & Gageiro, 2014; Marôco, 2021). The internal consistency of the studied dimensions was assessed by calculating the Cronbach's Alpha coefficient (Nunnally & Bernstein, 1994). To identify statistically significant differences between Generations Z, Y and X (three independent samples) for the dimensions referred above, the Kruskal-Wallis test was used. Furthermore, the Mann-Whitney test was applied to perform the multiple median comparison (two independent samples) in order to identify which groups had similar and/or different sustainable attitudes and behaviors (Pestana & Gageiro, 2014; Marôco, 2021).

Table 1: Dimensions of sustainable food purchasing attitudes and behaviors

Dimension	Items
Interest in ecological knowledge	1. I am constantly looking to increase knowledge about green eating and to develop healthy eating habits. 2. In recent years, I have increased the level of knowledge and awareness in terms of developing healthy eating habits. 3. I try to keep up with ongoing social campaigns dedicated to healthy eating and put them into practice. 4. I increase my knowledge of eating habits regularly by consulting information presented by experts.
Knowledge of ecological issues	5. Beef production on a global scale leads to climate change to a great extent. 6. Purchasing local products eliminates greenhouse gas emissions related to food supply. 7. Diets rich in fruits and vegetables instead of meat and animal products have a positive impact on the environment. 8. Buying from local producers gives you the possibility to see if growing crops is beneficial to the environment.
Ecological purchasing habits	9. I always check the country of origin of the food products I buy. 10. I always check that the food products I buy have a high-quality certificate. 11. I buy food more often at stores dedicated to green products. 12. I prefer regionally/locally grown food products.
Conscious purchasing planning	13. When I buy food, I always use my own reusable bags. 14. I plan my meals in advance. 15. I cook with ingredients I have on hand. 16. Before buying, I look at what I have available in the cupboards and fridge. 17. When purchasing, I usually make a shopping list.

Source: Kuźniar, Surmacz and Wierzbiński, 2021.

Results

In this research, a total of 686 individuals accepted to participate in the study. They were distributed among the three generations according to the year of birth, namely, Generation X (1960-1980), Generation Y (1981-1990) and Generation Z (1991-2010). The results, in Table 2, provide a socioeconomic characterization of these generations, offering a comprehensive view of the characteristics and particularities of each group. These data are crucial for understanding the nuances and differences between these groups, which can be fundamental for planning policies and strategies that meet the specific needs of each generation.

When analyzing gender distribution, interesting variations between generations are observed. In fact, in Generation X, 64.1% of the respondents are female and 35.9% are male. In Generation Y, the majority of the participants are female,

representing 73.2% of the total, while in Generation Z, females make up 61.4% of the sample. It is worth mentioning that the "non-binary" category is only represented in Generation Z, with 0.8% of the participants identifying as such, demonstrating the diversity of gender identities (Table 2).

Table 2: Socioeconomic characterization of the sample

Variables	Categories	Generation		
		X (1960-1980)	Y (1981-1990)	Z (1991-2010)
Gender	Female	75 (64.1%)	60 (73.2%)	299 (61.4%)
	Male	42 (35.9%)	22 (26.8%)	184 (37.8%)
	Non-binary	---	---	4 (0.8%)
Marital status	Single	15 (12.8%)	28 (34.1%)	458 (94.0%)
	Married/cohabitation	79 (67.5%)	46 (56.1%)	27 (5.5%)
	Divorced/separated	18 (15.4%)	8 (9.8%)	2 (0.4%)
	Widow	5 (4.3%)	---	---
Education level	1st cycle	2 (1.7%)	---	---
	2nd cycle	3 (2.6%)	2 (2.4%)	2 (0.4%)
	3rd cycle	10 (8.5%)	10 (12.2%)	13(2.7%)
	Secondary education or equivalent	40 (34.2%)	20 (24.4%)	296 (60.8%)
	Higher education	62 (53.0%)	50 (61.0%)	176 (36.1%)
Family monthly income level (euros)	< 705	8 (6.8%)	8 (9.8%)	125 (25.7%)
	705 - 1410	36 (30.8%)	38 (46.3%)	186 (38.2%)
	1411 - 2115	43 (36.8%)	17 (20.7%)	111 (22.8%)
	2116 - 3525	24 (20.5%)	14 (17.1%)	47 (9.7%)
	> 3525	6 (5.1%)	5 (6.1%)	18 (3.7%)
Household size	1 person	12 (10.3%)	18 (22.0%)	62 (12.7%)
	2 people	27 (23.1%)	22 (26.8%)	79 (16.2%)
	3 people	34 (29.1%)	19 (23.2%)	137 (28.1%)
	4 people	36 (30.8%)	17 (20.7%)	152 (31.2%)
	> 4 people	8 (6.8%)	6 (7.3%)	57 (11.7%)
Family financial comfort	I live with great financial difficulties	1 (0.9%)	2 (2.4%)	11 (2.3%)
	I live with some financial difficulties			
	I live in some financial comfort	29 (24.8%)	25 (30.5%)	119 (24.4%)
	I live comfortably financially	79 (67.5%)	42 (51.2%)	302 (62.0%)
		8 (6.8%)	13 (15.9%)	55 (11.3%)

Regarding the marital status (Table 2), the differences between generations are notable. In both Generation X and Generation Y, a significant part of the participants is married or live in cohabitation, representing 67.5% and 56.1%, respectively. However, in Generation Z, the vast majority of the participants are single (94.0%), which may indicate that this generation is more focused on their independence and personal growth. The analysis of the education level reveals an upward trend towards higher education between the older generation and the intermediate generation. In Generation X, the majority of the participants have higher education (53.0%). This proportion increases to 61.0% in Generation Y. In Generation Z, this percentage decreases, reaching 36.1%. In fact, the predominant education level in this generation is the secondary education or equivalent (60.8%). Regarding the family monthly income level, the sample presents notable diversity. The most common income categories vary according to the

generation. In Generation X, most of the participants are included in the income category of 1411 to 2115 euros (36.8%). Among Generation Y, the category of 705 to 1410 euros is more common (46.3%). In Generation Z, the majority of the participants have a family monthly income level of less than 705 euros (25.7%), indicating a different economic reality between the generations. The three generations showed some differences in family structure, with Generation Y standing out for having the highest proportion of families with two people, while Generation Z had a substantial proportion of families with three people. Additionally, Generation Z reported a higher prevalence of "living comfortably financially", indicating a higher level of financial comfort compared to previous generations.

Finally, measures of central tendency and dispersion for age in each generation provide valuable information about age characterization. Generation X has an average age of 50.9 years old, while in Generation Y the average is 37.3 years old, and in Generation Z, as expected, the average age drops to 21.5 years old. These values, together with the medians and standard deviations, highlight the age diversity of each generation (Table 3).

Table 3: Measures of central tendency and dispersion for age factor

Generation	Mean	Median	SD	Minimum	Maximum
X	50.9	50.0	5.47	43	62
Y	37.3	37.0	3.02	33	42
Z	21.5	20.0	3.60	18	32

As shown in Table 4, the Cronbach's Alpha coefficient (α) values were satisfactory for all dimensions, indicating good internal consistency; varying between 0.7 and 0.8 for the dimensions "Knowledge of ecological issues", "Ecological purchasing habits", "Conscious purchase planning" and "Sustainable attitudes and behaviors", and very good with values greater than 0.9 for the dimension "Interest in the ecological knowledge".

With regard to "Interest in ecological knowledge", Generation X stands out the most, with a mean of 5.27, demonstrating a high level of involvement with ecological issues. Furthermore, Generation Z records the lowest average in this dimension, with 4.78, although the degree of interest in ecological knowledge is relevant. As for "Knowledge of ecological issues", Generation X, once again, leads with the highest mean, reaching 5.26. Generation Y, on the other hand, has the lowest knowledge, but still high, with a mean of 5.18. In what concerns "Ecological purchasing habits", Generation X stands out with a mean of 4.91, reflecting a high level of adoption of sustainable purchasing practices. Generation Z, in turn, has the lowest average in this dimension, with 4.19, although it still represents a moderate level. Within the scope of "Conscious purchasing planning", Generation X, again, presented the highest score, recording a mean of 5.47, which points to conscious purchasing planning at a very high level. Generation Z, although with the lowest average, maintains a good level of conscious planning, with an average of 5.23. Regarding the "Sustainable attitudes and behaviors" dimension, once again, Generation X stands out with an average of 5.19, indicating a very positive attitude towards sustainable attitudes and behaviors. Generation Z has the worst score in this dimension, but still good, with a mean of 4.71, showing an equally positive ecological attitude (Table 4).

Table 4: Dimensions level, mean ($\bar{x}$), standard deviation (SD) and Cronbach's Alpha (α)

Dimensions	Generation	$\bar{x}$	SD	Internal consistency		Level
				α	Classification	
Interest in the ecological knowledge	Z	4.78	1.465	0.910	Very good	High
	Y	5.17	1.544			High
	X	5.27	1.381			High
Knowledge of ecological issues	Z	5.20	1.414	0.882	Good	High
	Y	5.18	1.522			High
	X	5.26	1.356			High
Ecological purchasing habits	Z	4.19	1.579	0.870	Good	Moderate
	Y	4.66	1.545			High
	X	4.91	1.425			High
Conscious purchase planning	Z	5.23	1.349	0.877	Good	High
	Y	5.37	1.360			High
	X	5.47	1.224			High
Sustainable attitudes and behaviors	Z	4.71	1.284	0.896	Good	High
	Y	5.02	1.338			High
	X	5.19	1.204			High

Legend: 1-3.44: Low; 3.45-4.44: Moderate; 4.45-7: High

The analysis of Table 4 suggests that Generation X stands out positively, among Generations Y and Z, regarding sustainable attitudes and behaviors when purchasing food, revealing a greater interest in ecological issues and greater knowledge of issues and themes related to the environment. In this context, the hypotheses were tested in order to verify whether there were statistically significant differences between the three generations (X, Y and Z), when purchasing food, regarding the "Interest in ecological knowledge", "Level of knowledge of ecological issues", "Ecological purchasing habits", "Conscious purchase planning" and "Sustainable attitudes and behaviors" dimensions. The results are shown in Table 5.

Table 5: Comparison of the dimensions according to the generation factor

Dimensions	Generation	n	Mean ranks	p-value
Interest in the ecological knowledge	Z	487	322.74	0.000*
	Y	82	389.66	
	X	117	397.55	
Knowledge of ecological issues	Z	487	341.98	0.947
	Y	82	345.45	
	X	117	348.44	
Ecological purchasing habits	Z	487	319.06	0.000*
	Y	82	385.19	
	X	117	416.01	
Conscious purchase planning	Z	487	333.59	0.113
	Y	82	361.39	
	X	117	372.23	
Sustainable attitudes and behaviors	Z	487	321.50	0.000*
	Y	82	382.70	
	X	117	407.60	

** There are statistically significant differences at a 5% significance level*

As can be seen in Table 5, knowledge of ecological issues as well as conscious purchase planning are the same for the three generations (p-value > 0.05). However, there are statistically significant differences between the generations regarding the interest in ecological knowledge, ecological purchasing habits, and sustainable attitudes and behaviors (p-value = 0.000). Furthermore, the mean ranks revealed Generation X as the generation with greater interest in ecological knowledge, more ecological purchasing habits and more sustainable attitudes and behaviors, as opposed to Generation Z.

To identify the differences between groups, it was used the Mann-Whitney test, as mentioned before.

The results of the multiple median comparison, using all possible combinations of sample pairs, are shown in Table 6. Generations X and Y have equal interest in ecological knowledge, the same ecological purchasing habits and similar sustainable attitudes and behaviors when purchasing food (p-value > 0.05). However, differences were identified between Generations Z and Y (p-value < 0.05) as well as between Generations Z and X (p-value = 0.000). In summary, there are no statistically significant differences between Generations X and Y, but differences were identified between Generation Z and Generations Y and X. Based on the results, Generations X and Y are those with the greatest interest in ecological knowledge, with more ecological purchasing habits and better sustainable attitudes and behaviors.

Table 6: Multiple median comparison

Dimension	Generation	n	Mean ranks	p-value
Interest in the ecological knowledge	Z	487	277.30	0.006*
	Y	82	330.74	
Ecological purchasing habits	Z	487	277.07	0.005*
	Y	82	332.09	
Sustainable attitudes and behaviors	Z	487	277.75	0.010*
	Y	82	328.05	
Dimension	**Generation**	**n**	**Mean ranks**	**p-value**
Interest in the ecological knowledge	Z	487	289.44	0.000*
	X	117	356.85	
Ecological purchasing habits	Z	487	285.99	0.000*
	X	117	371.22	
Sustainable attitudes and behaviors	Z	487	287.75	0.000*
	X	117	363.39	
Dimension	**Generation**	**n**	**Mean ranks**	**p-value**
Interest in the ecological knowledge	X	117	100.42	0.931
	Y	82	99.71	
Ecological purchasing habits	X	117	94.6	0.267
	Y	82	103.79	
Sustainable attitudes and behaviors	X	117	96.14	0.428
	Y	82	102.71	

** There are statistically significant differences at a 5% significance level*

Discussion

Ensuring sustainability in consumption and production, especially in terms of the food supply chain (for example, reducing food waste), is one of the 17 goals of the 2030 Sustainable Development Agenda, established by the United Nations and adopted by world leaders, since September 2015 (United Nations, 2022). Sustainable food consumption and consumer behavior are essential for sustainability, especially if the carbon and water footprints resulting from food production and consumption are taken into account (Biresselioglu et al., 2023). In this regard, although the various generations have recorded the same level of knowledge about ecological issues, in reality and contrary to what would be expected, it is Generation Z that shows less interest in ecological knowledge and ecological purchasing habits, less positive sustainable attitudes and behaviors, when purchasing food, compared to Generations Y and X. Furthermore, it was found that Generations Y and X had identical attitudes and behaviors, differentiating them from Generation Z. These results are consistent with the findings of Gomez-Roman et al. (2021). The authors did not identify differences in environmental attitudes and behaviors between Generation Y and Generation X individuals. However, millennials demonstrated slightly less environmental attitudes compared to Generation X. Similar results were found by Kamenidou, Stavrianea and Bara (2020). According to the authors of the five generations analyzed, namely, the Silent Generation, the Baby Boomers, Generation X, Generation Y and Generation Z, Generation Z had the worst sustainable purchasing behavior and the Silent Generation the better. Another study involving Hungarian consumers from several generations revealed that Generation X individuals showed a greater inclination to enjoy foods of national and local

origin. Generation X perceives local foods as more reliable and of better quality. However, research also indicates a viable opportunity to persuade Generation Y and Z to purchase domestic food products through additional promotional campaigns (Garai-Fodor & Popovics, 2022).

Azzurra et al. (2019) and Bollani et al. (2019) report the existence of growing environmental sensitivity and awareness about sustainable eating among young people. In the literature, several studies indicate that younger people are much more knowledgeable about ecological issues than previous generations (Su et al., 2019). However, the results of this study show that the level of knowledge is the same in Generations Z, Y and X. Furthermore, the results found contradict the Radons et al (2016) and Santos and Lisboa (2013) findings. In fact, according to these authors, Generation Z shows strong trends towards sustainable consumption, often highlighting their concern for the planet and the environmental impact resulting from human action, mobilizing in person and virtually in favor of environmental causes all over the world. However, recent research indicates that, despite young people's strong inclination towards environmental and sustainability issues (Giachino et al., 2021), older people tend to have more pro-environmental attitudes (Sargisson et al., 2020) and to adopt more responsible and sustainable behaviors (Wang et al., 2021). Other studies suggest that environmental attitudes increase as age advances, peaking in middle age and declining at older ages (Lazaric et al., 2020; Wang et al., 2021), in part due to the accessibility of environmentally friendly products (Escario et al., 2020). Salonen and Tast (2013) suggest that older people exhibit more sustainable ways of living than younger citizens. In the opinion of Achón et al. (2017) and García-González et al. (2018), young people's lower interest in practicing sustainable eating may be a result of their limited involvement in culinary activities and purchasing for the home.

Although young people pay attention to the positive characteristics of ecological products and the positive impact of their production process on the ecosystem, positive attitudes do not always have an impact on behavior, that is, on purchasing decisions (Witek & Kuźniar, 2021). It is often argued that pro-environmental attitudes should lead to more sustainable behaviors, but emerging evidence suggests that this link does not always hold (Pintassilgo et al., 2023). For example, Dong et al. (2021) found that pro-environmental dispositions did not always predict pro-environmental behaviors. Giachino et al. (2022) argue that, although Generation Z individuals hold strong environmental beliefs and attitudes, they tend to engage in real environmental practices to a limited extent (Parzonko et al., 2021).

The studies developed by Witek (2019) and Moisés et al. (2023) demonstrated that there is an association between the consumers' age and their propensity to buy organic products. According to the authors, older consumers tend to be more likely to buy organic products and are willing to pay more for them. In the same context, the results of a study developed by Biresselioglu et al. (2023), in Turkey, emphasize the importance of sociodemographic factors, such as age, gender, education level, income level and household size. Generally, age is associated with the adoption of ecological consumption behaviors because health issues are significantly associated with age and income level. Furthermore, the preferences of older consumers still favor local producers when purchasing food in markets or grocery stores. They also prefer home-cooked meals that involve the consumption of less frozen, packaged, and/or ready-to-heat foods, in contrast to younger people who are more likely to eat out or buy meals prepared outside and eat them at home. In summary, although Generation Z values sustainability and the environmental impact of their purchasing decisions (Gibson et al, 2023; Su et al., 2019) and demonstrates knowledge and interest in ecological attitudes, it appears that this does not translate, in most cases, into behavior, with the most advanced age groups being the most likely to value environmental and social issues in their purchasing decisions. Given these facts, it is important to target interventions and awareness campaigns towards younger age groups. It is extremely important to understand

the sustainable food choices, diets and consumption patterns of Generation Z, as they will be the future parents and constitute the educational, political, social and financial elites that will influence sustainable consumption policies and the development of next generations (Kamenidou et al., 2019). Considering that a large part of Generation Z consumers is still in the school environment, whether at the undergraduate or postgraduate level, investing on the education of this group can present itself as a viable solution to form a future workforce capable of facing, in a comprehensive and socio-ecological way, the complex challenges existing in food systems (Pauley et al., 2019).

In this sense, as defended by Biresselioglu et al. (2023), interventions and awareness campaigns must be aimed at younger age groups as they will be the ones who will act as qualified labor for sustainable development, and they will be the future leaders of nations. Therefore, educators, politicians and others should focus on how sustainability can be emphasized with clear actions that Generation Z individuals can implement to improve sustainability (Gibson et al., 2023).

Conclusions

Promoting sustainability in production and consumption, particularly with regard to food, constitutes one of the main objectives of the 2030 Agenda for Sustainable Development, established by the United Nations in September 2015. This emphasizes the importance of addressing issues such as sustainable consumption to achieve global sustainability goals. In the present study, there were explored sustainable food purchasing attitudes and behaviors among Generations Z, Y and X, in Portugal. The results highlight a series of insights that can contribute to the accumulation of knowledge and the development of strategies and approaches that promote awareness and sustainable action, as well as sustainability in the context of food consumption. One of the main conclusions is that ecological knowledge, although an important factor itself, does not guarantee sustainable purchasing behaviors. Although all generations have demonstrated similar levels of knowledge, Generation Z demonstrates less sustainable attitudes and behaviors when purchasing food. This finding challenges the common assumption that younger generations are more committed to sustainability. Differences between generations also stand out, with Generation Z showing less interest in ecological issues compared to Generations Y and X. This suggests the need for specific awareness approaches for younger generations, focused on inspiring and motivating Generation Z to adopt more sustainable consumption practices. Awareness and education play crucial roles, along with creating practical incentives for adopting sustainable behaviors. To make this happen, educators, policymakers and sustainability advocates must focus their efforts on creating effective and relevant strategies that encourage more sustainable consumption practices among Generation Z and future generations. Ultimately, this research presents valuable contributions to understanding the dynamics of sustainable consumption in Portugal, pointing a path towards a more sustainable future. Promoting sustainability requires a multifaceted approach, sensitive to differences between generations and adapted to the needs of each one. Past, present and future generations must, as a society, contribute to a more sustainable and equitable world.

The use of convenience samples in the social sciences is a common practice. However, it is important to recognize that this procedure presents an intrinsic methodological limitation, as it makes it impossible to generalize the results to the population. This is due to the participant selection criteria, which is based on availability and accessibility, often without observing a random selection process. As a result, the sample subjects are not chosen randomly, which may compromise the sample's representativeness in relation to the study's target population. This lack of representation becomes a relevant concern when seeking to draw general conclusions. The results may be subject to systematic biases, as certain demographic groups or specific characteristics may be under or over-represented in the sample, which, in turn, may lead to distorted conclusions or conclusions that do not apply to the population.

In the future, the integration of quantitative analysis and qualitative approaches can substantially improve understanding of the underlying factors that influence consumers' sustainable attitudes and behaviors. Furthermore, it is recommended that future research consider longitudinal studies in order to examine the evolution of sustainable attitudes over time and to explore the cause-and-effect association between knowledge and sustainable behaviors. Finally, researching the impact of interventions, public policies, and marketing strategies on promoting sustainable behaviors among Portuguese consumers emerges as a research area of primary importance to encourage the adoption of more environmentally friendly practices.

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