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Article

Can Health and Environmental Concerns Meet in Food Choices?

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Abstract: The objective of the study is to analyze if there is a relationship between health and environmental sustainability concerns in food choices. We used data of 300 Italian consumers collected through a *vis-à-vis* survey. We performed cross-tabulations and chi-square tests for a selected set of variables measuring both types of concerns, segmenting the sample by age, gender and education. Our results suggest that the association between health and environmental concerns is often statistically significant, though we observe a high variable specificity of the associations. Socio-demographic conditions seem to play a role in determining the association between the two concerns, with middle-aged and/or highly-educated respondents showing a stronger association between health and environmental concerns.

Keywords: health concerns; environmental sustainability; food economics; consumer choices

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1. Introduction

Health and environmental concerns linked to food production and consumption have become crucial issues for society. On the one side, in Western society, being overweight and obesity are considered major public health issues [1]. Indeed, WHO estimates that in 2015, two billion adults will be overweight, and 700 million obese. The diffusion of excess weight conditions, mainly caused by unhealthy diets and sedentary lifestyles, generates an increase in healthcare expenditure due to the negative consequences that such conditions have on health [2–4].

On the other side, the interest regarding the environmental sustainability of food consumption and production is due to the high pressure that the agri-food system poses on scarce environmental resources [5]. Indeed, food-related activities already cover 30% of all ice-free land, consume 70% of available freshwater and 20% of energy [6] and are responsible for 10%–20% of the world's greenhouse emissions [7]. In addition, with the world population approaching nine billion people in 2050, the food system will have to be able to produce 70% more food, increasing further the pressure on the environment [8].

The interest for issues concerning health and environmental sustainability has grown among consumers of industrialized countries, impacting their food consumption choices. Indeed, some consumers are becoming increasingly careful about what they eat, giving value to the impacts of everyday food choices on their health and on the environment [9–14]. This is confirmed by recent trends in labelling that show an increase in the diffusion of health and environmental sustainability claims or logos. In this direction, EU Regulation No. 432/2012 specifies the list of health claims admitted on food labels, to avoid opportunistic behavior by producers. At the same time, sustainability certification initiatives and labels are spreading (Dolphin Safe, Rainforest Alliance, *etc.*) [15]. Particular emphasis is also given to the concept of food miles, which favors the purchase of locally-produced food to reduce the carbon footprint of food consumption. Data from Eurobarometer show that 77% of EU citizens are prepared to pay more for environmentally-friendly products [16].

The macro (society) and the micro (consumer) perspectives [17] outlined above are both crucial and need to be taken into consideration.

Our work focuses on the consumer perspective analyzing concerns towards healthy and environmentally-sustainable food consumption. The objective of the study is to observe if there is a relationship between health and environmental sustainability concerns in food choices. There have been few studies that have jointly analyzed these consumption patterns and that have looked for their association. For example, some authors focus on organic food to find a positive relationship between health concerns and organic food consumption [18]. This is consistent with the studies finding that organic food products are perceived by consumers as more healthy and safe, besides being environmentally friendly [19–21].

This study investigates factors that determine food choices and whether those motivated by environmental sustainability are associated with those motivated by health concerns. In addition, the research aims at determining if gender, age and education affect this type of food-related behavior. For this purpose, we use data from 300 consumers in charge of their household grocery shopping in Milan (Italy), collected through a *vis-à-vis* survey outside supermarkets and hypermarkets of the city. To test

the association between health and environmental concerns, we performed cross-tabulations and chi-square tests for a selected set of variables measuring both types of concerns.

The paper is organized as follows: in the next section, we analyze the recent economic literature on health and environmental sustainability issues related to food choices. In the section "Data and Methodology", we present the empirical approach used in order to test the association between healthy and environmentally-sustainable food choices. We then highlight the results of the analysis for the whole sample and for different groups of consumers according to the selected socio-economic variables. In the last sections, we discuss the results and the limitations of our work and we draw our conclusions.

2. A Consumer Perspective of Health and Environmental Sustainability in Food Choice

From a macro (societal) point of view, unhealthy food-related habits, such as high consumption of red meat, energy-dense food and soft drinks, low consumption of fruit and vegetables, in addition to sedentary lifestyles, are important determinants of being overweight and obesity [1,22]. These behaviors have adverse consequences on human health by increasing the risk of cardiovascular diseases, high blood pressure, raised blood cholesterol, type 2 diabetes, cancer and metabolic syndrome [3,4]. With the spreading of the obesity epidemic in many industrialized countries, the economic sustainability of the public-health system is threatened as a result of increasing medical expenditures due to these diet-related diseases [23,24].

At the same time, there is a body of literature that recognizes the salient role of the agri-food system in threatening the environmental sustainability of the Earth. Indeed, it is estimated that, in Europe, food consumption may have a greater impact on global warming than does housing or transport [25]. In particular, livestock and dairy production play a pivotal role in such environmental impact due to the high amount of required inputs (e.g., fresh water, land, feed) and polluting output (e.g., methane, nitrous oxide, ammonia and nitrate leaching) [7,25–28].

In light of these considerations, the literature underlines the need for change in consumer diets in order to achieve improvements in both public health and environmental sustainability [26,29–31]. In other words, the authors propose a diet that favors cereals, fruit and vegetables over red meat and dairy products in order to reduce the negative impact both on health and on the environment. Therefore, they advocate eating lower on the "food chain". This literature is supported by the work of Tukker *et al.* [32] and Wolf *et al.* [33] that quantitatively estimate the environmental impact of a shift to healthier diets in Europe, finding significant environmental improvements.

Moving to the micro (consumer) perspective, consumer-related environmental and health issues in food choices are usually treated separately in the literature. From the environmental sustainability perspective, the authors investigating the drivers of environmentally-friendly food choices tend to focus on issues linked to consumer value-priorities, finding that universalistic values may explain environmentally-sustainable consumption patterns [34–36]. In this context, environmentally-friendly food choices include: consumption of food products with environmental certifications, organic food and low red meat consumption for environmental reasons. At the same time, other authors focus on the effectiveness of eco-labelling in shaping consumer environmental food choices, pointing out the importance of variables, such as: information asymmetry and eco-labelling credibility; time constraints and difficulty in understanding correctly environmental certifications; and differences in price and

taste [37–39]. Instead, the literature studying the economic variables that influence healthy food choices focuses on variables, such as: the relative cheapness of energy-dense food with respect to healthy products; time preference; time constraints; nutritional knowledge; and the effectiveness of health-related labelling, such as nutrition and health claims [22,40–46].

Only a few studies have investigated the existence of an association between health and environmental sustainability concerns related to food consumption. Saba *et al.* [18] found a positive relationship between health concerns and organic food consumption. This is in line with the literature highlighting that health concerns and food safety play a major role in the decision to consume organic food [19–21]. Using a different approach, Avermaete *et al.* [47] analyzed the links between consumer health concerns and those related to a broader concept of sustainability that includes economic, environmental and social aspects. Indeed, they considered as sustainable three categories of products: fair trade, local products and seasonal goods. The authors found a significant and positive relationship between healthy food consumption patterns and sustainable food choices. This result is consistent with the previous findings of Robinson *et al.* [48], who reported that individuals with a higher self-reported health consciousness also tended to have positive attitudes about sustainably-produced food and considered themselves as environmentally-conscious consumers.

Our study aims at analyzing if there is a relationship between consumer healthy food choices and environmentally-sustainable ones. In other words, we focus on observing if consumers that pay attention to health in their diets are also the ones that care about the environmental sustainability of food products. For this purpose, on the one hand, we consider healthy food choices, like fruit and vegetables, as opposed to junk food; on the other hand, we consider environmentally-certified products (note that for environmentally-certified or eco-labeled products, we refer to a broad range of certifications regarding the environmental sustainability of food products and not to the EU eco-label scheme, which does not apply to food products) and seasonal products that are purchased soon after leaving the farm (note that we consider the choice of seasonal products to be a sustainable behavior when the environmental reason is explicitly stated by the respondents) as an expression of environmentally-sustainable choices.

3. Data and Methodology

3.1. Methodological Approach

In order to evaluate consumption patterns, we used data collected through *vis-à-vis* interviews on 300 consumers, in charge of their household grocery shopping, in Milan (Italy). Considering the population size of Milan, the chosen sample size allows us to incur a relative error of about 6% [49]. The selection of the retail stores was based on a geographically-stratified systematic sampling with a random starting point. We listed all super and hypermarkets of the Milan area on the basis of their postcode. The first store was identified by means of a randomly-extracted number between 1 and the sampling fraction. We selected the remaining stores by adding the sampling fraction to this number. Consumers were randomly approached in front of 14 supermarkets and 8 hypermarkets. To take into consideration the store size, 10 consumers were recruited at each supermarket and 20 at each hypermarket. Interviews were done at different times during the day to reach different types of consumers.

The questionnaire included queries related to the food consumption aimed at measuring health and environmental sustainability concerns of consumers when making food choices, collecting also socio-economic information. Even if we are aware of the difficulties of capturing the healthfulness or the environmental sustainability of food choices by means of a few questions, in this paper, we focus on a few broad proxies to start to explore these inclinations jointly. More specifically, in order to measure the health concerns related to food consumption, we evaluate a stated frequency of consumption of healthy and junk food, in line with Drewnowski *et al.* [22] and Organisation for Economic Co-operation and Development—OECD [1], namely: fruit, vegetables, energy-dense snacks, soft drinks and fried food. In energy-dense snacks category we included pre-packed and pre-processed small portions of food with a high content of sugar/salt, additives and preservatives; we did not include items made from fresh ingredients at home. Even if we recognize that no single food is unhealthy, *per se*, but that it is more an issue of diet [50], we have chosen specific types of food that are quite widely accepted as being among the more/less healthy in the literature. Indeed, recent WHO guidelines suggest to "eat more fruits and vegetables and less highly-processed foods, especially junk foods" [51]. There is no clear definition on what junk food is exactly, but studies consistently refer to food items that are high in fat, sugar and salt (HFSS), like: soft drinks, confectionaries, crisps/savory snacks, fast food, pre-sugared breakfast cereals and pre-prepared convenience foods [50]. Furthermore, nutrient profile models are going in the direction of giving healthfulness scores to single food items and not only to diet [52]. They also tend to focus on the so-called "qualifying" nutrients (mostly vitamins and minerals) and "disqualifying" nutrients, such as fats, sugar and sodium [53]. In line with both these approaches, in our framework, we choose fruit (Variable i) and vegetables (Variable ii) as healthy food and energy-dense snacks (Variable iii), soft drinks (Variable iv) and fried food (Variable v) as junk food.

To take into account the differences in the "appropriate" levels of consumption of healthy and junk food, we measured their consumption frequency on two different scales (Table 1). Moreover, for the construction of the variables of the analysis, such scales are inverted, so that the healthier behavior is always associated with the highest value (however, in the questionnaire, the possible answers were ordered from the lowest level of consumption to the highest one for all types of food in order to avoid increasing error due to social desirability bias.). With fruit and vegetables, responses were grouped in a 3-point-category scale assessing low (a few times a week or less, value of 1), medium (once a day, value of 2) and high (more than once a day, value of 3) consumption. For junk food, the scale was instead: high (habitually, value of 1), medium (a few times a month, value of 2) and low (rarely, value of 3) consumption.

In order to measure the environmental sustainability concerns of consumers when making food choices, we evaluated two binary variables assessing the stated consumption of food products with: (i) environmental certifications (e.g., Dolphin Safe, Rainforest Alliance, food miles, *etc.*); and (ii) the choice of seasonal fruit and vegetables (F&V) explicitly for environmental reasons. The choice of the first variable is related to the fact that preferences towards eco-labelled products (and the related willingness to pay) are often used in the literature to evaluate consumer environmental attitude [12,39]. The choice of the second variable is in line with a stream of literature that focuses on food miles, highlighting the environmental impacts of seasonal/unseasonal and local/imported-from-far-away products [54–56]. In this perspective, the consumption of seasonal fruit and vegetables can be considered as a signal of interest for low environmental impact production, especially in terms of carbon footprint.

The stated environmental motivation behind seasonal consumption of F&V was explicitly asked as such consumption can be motivated also by other reasons, like, for example, a "better taste" and a "lower price" [57]. In order to collect this information we asked consumers if they tend to choose seasonal fruit and vegetables, and if so, if they do it for price, better taste, culinary custom or concerns about the environmental impact. Anyhow, such a choice has some limitations, and other variables could have been selected (see Section 5 for the analysis of the limitations).

Table 1. Description of variables and main statistics. F&V, fruits and vegetables.

Variable Name	Description	Variable Type	N	Entropy Measure
HEALTH CONCERNS				
Fruit	Frequency of consumption (a few times a week or less, once a day, more than once a day)	scale (1–3)	300	0.06
Vegetables	Frequency of consumption (a few times a week or less, once a day, more than once a day)	scale (1–3)	300	0.08
Energy-dense snacks	Frequency of consumption (habitually *, a few times a month, rarely)	scale (1–3)	300	0.09
Soft drinks	Frequency of consumption (habitually *, a few times a month, rarely)	scale (1–3)	300	0.11
Fried food	Frequency of consumption (habitually *, a few times a month, rarely)	scale (1–3)	300	0.08
ENVIRONMENTAL CONCERNS				
Environmental certification	If the individual usually consumes eco-labelled products, value of 1, otherwise 0	dummy (0–1)	300	1.17
Seasonal F&V (environmental reasons)	If the individual usually consumes seasonal fruit and vegetables for environmental reasons, value of 1, otherwise 0	dummy (0–1)	300	1.56

* By the term "habitually", we refer to a consumption frequency of at least once a week.

Concerning socio-economic variables, we collected the gender, age (<25; 26–40; 41–65; >65), and education level (primary school, secondary school, high school and university degree) of the respondents.

To evaluate if there was a statistically significant association between healthy and environmentally-sustainable food choices, we performed a Pearson's chi-square test of independence between variables, focusing on the whole sample and on more specific categories of population, segmenting by age, gender and education. Given the fact that we have ordinal data, we also computed Goodman and Kruskal's gamma test to evaluate the strength of association between variables. All hypotheses were tested at the 0.10, 0.05 and 0.01 levels of significance.

3.2. Sample Description

The sample has 300 consumers (138 males (46%) and 162 females (54%)). Educational attainment was as follows: 30.7% have a university degree, 43.7% have a high school diploma, while 25.7% have a lower level of education (18.0% secondary school and 7.7% primary school). The mean age is

46.3 years (SD 18.2) with the greatest proportion being in the age group 41–65 years (39.7%). The age group 26–40 years is represented by 24.7% of the sample, while 18.3% and 17.3%, respectively, are >65 and <26 years. Table 2 presents the summary statistics of the socio-economic variables compared to the Italian and Lombardy region census.

Table 2. Socio-demographic variables.

	2011 Italy Census	2011 Lombardy Census	Surveyed Sample
		%	
Gender			
Male	47.9	48.0	46.0
Female	52.1	52.0	54.0
Education			
Primary school	22.5	19.9	7.7
Secondary school	31.9	32.0	18.0
High school	34.5	35.9	43.7
University degree	11.1	12.2	30.6
Age			
18–25	9.8	8.8	17.3
26–40	24.2	24.6	24.7
41–65	42.4	43.1	39.7
>65	23.6	23.5	18.3

With respect to gender, the sample is representative of the population of the Lombardy region, to which Milan belongs. The sample is also representative of the Lombardy population for the age category 26–40, while there is an over-representation of young individuals (18–25) and an under-representation of older ones (>65). This could be due to the fact that Milan is a university city and there are many students who live in the city, but are not actually residents. Our sample also shows an over-representation of individuals with a university degree and high school diplomas with respect to both Lombardy and the whole country.

4. Results

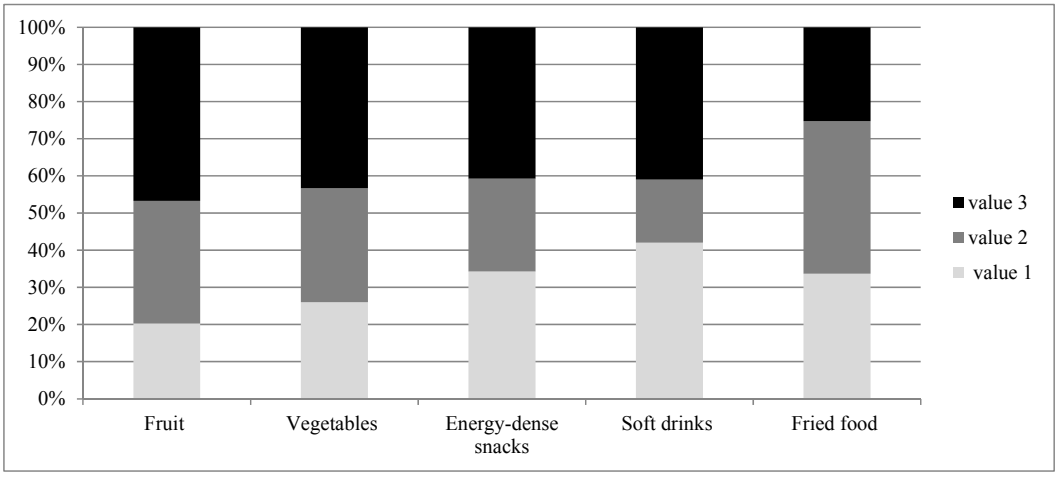
4.1. Health and Environmental Concerns

Focusing on the variables selected to measure healthy food consumption, Figure 1 reports the percentage of respondents for each of the stated consumption levels in the sample (note that the levels of consumption for the first two variables, defined as "healthy", were measured on a different scale than those for the other three food items, defined as "junk food"; dark colors are associated with a healthier frequency of consumption for all food items).

Our findings indicate that 46.7% of respondents eat fruit more than once a day, and a similar percentage (43.3%) eat vegetables more than once a day. Therefore, more than 40% of our sample consumes at least two portions per day of fruit and/or vegetables. With respect to junk food, a large minority of respondents rarely consume energy-dense snacks and soft drinks (40.7% and 41.0%, respectively). However, a lower proportion of respondents rarely consumes fried food (25.3%), though 41% state that

they eat those foods a few times a month. Thus, we can observe quite a good tendency towards healthy consumption habits. This fact could be partially linked to cultural factors and specifically to the wide diffusion of the Mediterranean diet in Italy.

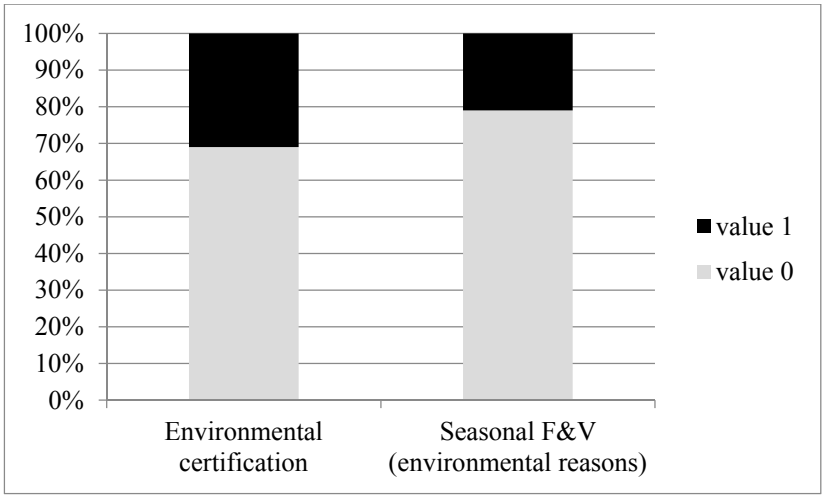
Figure 1. Percentage of respondents for the different scorings for the variables used to measure the healthfulness of food choices.



Note: value specification: 1 = a few times a week or less; 2 = once a day; 3 = more than once a day for the fruit and vegetables variables; 1 = habitually; 2 = a few times a month; 3 = rarely for the variables related to energy-dense snacks, soft drinks and fried food.

With respect to the variables selected as indicators of environmentally-sustainable consumption, Figure 2 reveals a low attention for environmental concerns: 31% of the sample declared that they consume eco-labelled food products, whereas 21% stated that they consume seasonal F&V for environmental reasons.

Figure 2. Percentage of respondents for the different scorings for the variables used to measure the environmental concerns related to food choices.



Note: value specification: 0 = no concern; 1 = concern.

This qualitative analysis suggests that in our sample, consumers give higher priority to health concerns than to environmental ones.

4.2. Analysis of the Association

A chi-square test of independence was performed to verify the null-hypothesis of no association between consumer health and environmental concerns. Table 3 reports for each cross tabulation the Pearson's chi-square statistics, with the stars indicating their significance. Between brackets, we report the gamma values of Goodman and Kruskal's gamma test. We observed that the consumption of eco-labelled products is significantly, positively and moderately associated with the scoring related to fried food, fruit and vegetables consumption (recall that the scale for F&V and junk food are inverted; therefore, the same sign of the statistics for these two categories of food indicate opposite effects). This suggests that consumers of eco-labelled food products tend to consume fried food less frequently and fruit and vegetables more frequently. In other words, for these categories of products, consumer environmental and health concerns are associated. No significant associations were found between the consumption of eco-labelled food products and the consumption of energy-dense snacks and soft drinks. Indeed, for these variables, we cannot reject the null hypothesis of no association between environmental and health concerns.

Table 3. Contingency table between environmental and health concerns for the whole sample (n = 300).

ENVIRONMENTAL CONCERNS	HEALTH CONCERNS				
	Fruit	**Vegetables**	**Energy-Dense Snacks**	**Soft Drinks**	**Fried Food**
Environmental certification	6.67 ** (0.13)	4.64 ** (0.02)	4.47 (0.22)	2.01 (0.10)	14.88 ** (0.31)
Seasonal F&V (environmental reasons)	7.66 ** (0.22)	7.55 ** (−0.13)	0.54 (0.05)	8.07 ** (−0.31)	9.57 *** (0.20)

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

With respect to the association between seasonal F&V consumption for environmental reasons and the health dimension, results were confirmed for fried food and fruit consumption, while a moderate negative significant association was found for the scoring related to soft drinks and vegetable consumption, suggesting that for vegetables, it is more difficult (than for fruit) to integrate a high consumption with the environmental motivation for seasonal products. No significant association was found between seasonal F&V consumption and the consumption of energy-dense snacks.

4.3. Analysis of the Association by Socio-Demographic Variables

Results concerning gender-specific inclinations were tested. In general, we note a decrease (with respect to Table 3) in the statistical significance of the associations. Indeed, there are four significant associations (out of ten) in each sub-sample (male and female) with respect to the seven detected for the whole sample. This result could be partly due to the decrease in the number of observations for each test (sample sizes: n = 162 for females and n = 138 for males). Indeed, the analysis by gender highlights a different pattern of significant associations for females and males. The only common result is connected to the fried food variable, which is positively and significantly associated

with environmental certifications (p-value = 0.012 for males, p-value = 0.031 for females). For males, this is also associated with seasonal F&V (p-value = 0.032), as in the whole sample.

Other significant associations within the two sub-samples are identified. For males, we find a positive and significant association also between environmental certification and the consumption of fruit (p-value =0.045) and vegetables (p-value = 0.036). For females, we find a positive association between environmental certification with energy-dense snacks (p-value = 0.098) and two negative ones between the choice of seasonal F&V and vegetable consumption in general (p-value = 0.053) and soft drinks (p-value = 0.008).

We also tested the associations for different age categories: <25 (n = 52), 26–40 (n = 74), 41–65 (n = 119), >65 (n = 55) (recall that n is the subsample size). The age category 41–65 is the one with the highest number of respondents (119) and of significant associations: four chi-square tests out of ten are significant at the 0.05 level (six at the 0.10 level). In particular, the consumption of eco-labelled food products is positively and significantly associated with vegetables (p-value = 0.002), energy-dense snacks (p-value = 0.067) and fried food consumption (p-value = 0.011). Moreover, seasonal F&V consumption for environmental reasons is positively and significantly associated with the consumption of fruit (p-value = 0.051) and fried food (p-value = 0.010). Again, a negative significant association is instead found with the consumption of vegetables (p-value = 0.013).

For the other age categories (that have lower sample sizes) the statistically significant associations are very few.

Associations were also tested considering different levels of education: primary school (n = 23), secondary school (n = 54), high school (n = 131) and degree (n = 92). Results show a high number of positive significant associations in the sub-sample corresponding to the most educated people (university degree), with six significant associations at the 0.05 level (eight if we consider at the 0.10 level). Of particular note, we found that environmental certification is positively associated with all variables: fruit (p-value = 0.010), vegetables (p-value = 0.022), energy-dense snacks (p-value = 0.069), soft drinks (p-value = 0.082) and fried food (p-value = 0.015). Seasonal F&V consumption for environmental reasons is positively associated with the consumption of fruit (p-value = 0.020), vegetables (p-value = 0.061) and fried food (p-value = 0.017). The fact that all of these associations have a positive sign suggests that people with a degree tend to be influenced by both environmental and health concerns (or unconcern) when making food choices.

The subsample with lower levels of education show very few significant associations, except for the subset representing individuals with a high-school diploma (the largest group), where there are three significant tests concerning seasonal F&V: negative with vegetables (p-value = 0.009) and soft drinks (p-value = 0.000) and positive with fried food (p-value = 0.094).

5. Discussion and Limitations

A general result that emerged from our analysis is that consumers state that they have more interest in selecting food for health reasons than for environmental ones. More than 40% of subjects stated that they consume at least two portions of fruit and/or two portions of vegetables a day (more than 80% of these respondents state that they eat fruit and/or vegetables for health concerns), whereas 21%–31% of consumers indicated that their food choices are influenced by environmental concerns.

The association between health and environmental concerns within the whole sample is often statistically significant, as reported in Table 3. Indeed, we observe that seven out of ten chi-square tests are statistically significant at the 0.05 level. Nevertheless, the analysis suggests caution in the interpretation of the results, as we observe a high variable specificity of the associations. The variables that seem to be more robust in capturing an association are fruit, fried food consumption and eco-labelled food products.

With regards to the direction of the associations, we find five positive and two negative relations, meaning that, in most cases, environmentally-sustainable food choices are associated with healthy habits, but in a few cases, we find a contrasting direction of the relationship. Therefore, the results are not all consistent. The non-consistencies arise in correspondence with the variable about seasonal F&V. Moreover, the positive sign of an association highlights a link between what we define as healthy and environmentally-sustainable behavior, but also between unhealthy and non-environmentally-sustainable ones.

What is more apparent is the fact that the high/low consumption of fruit is in many cases associated with a high/low consumption of seasonal F&V for environmental reasons, while for vegetables, we have, in many cases (except for the case of the subset with a university degree), the opposite. This could be related to the fact that it can be more difficult to follow seasonality with vegetable consumption, and thus, the environmental motivation can be overcome by other ones. Indeed, there are many vegetables that are commonly eaten all year round and are thus "unseasonal" [58,59]. Moreover, it may be more difficult also because vegetables tend to be, especially in the Mediterranean diet, more inherently connected to the meal than fruit, which instead tends to be eaten separately and at the end of the meal.

The analysis of the socio-demographic variables suggests that differences by gender, age and education exist, even if in our analysis, such results could be related also to the size of the sub-samples. In particular, it seems that:

(1) males and females show different associations of the two concerns;
(2) the age category 41–65 seems to be the one where the association is the strongest;
(3) the most highly-educated people of the sample (university degree) are those that most strongly associate health and environmental concerns (or unconcern).

Our work is only a first exploratory analysis in the context of a large Italian city. Indeed, it is based on stated preference data and on a limited and geographically-defined sample. Moreover, the variables used to identify consumer health and environmental concerns regarding food choices are broad proxies and cover only a limited set of health and environmentally-sustainable behavior related to food choices. We are well aware of the difficulties in defining "healthy" and "environmentally sustainable" food consumption. For example, what is usually defined as "junk food" is not necessarily unhealthy if eaten in moderation; similarly, environmental certifications targeting specific attributes may not cover the whole range of environmental impacts of the product. Moreover, the variable concerning the consumption of seasonal F&V for environmental reasons is only one of the possible proxies that can be used to evaluate consumer concerns for the environmental impact of food choices. Other variables that could be used are, for example, those capturing the change in meat consumption, the use of bottled water and plastic supermarket-bags or the choices connected to packaging. Future work should include a broader set of variables.

Another limitation of the methodology used to test the association between health and environmental concerns is that while it facilitates the study of the joint distribution between two variables, it does not reveal whether the observed relationships are a reflection of causality. Despite the limitations of this study, it provides a first overview of the relationship between health and environmental sustainability concerns related to food products. The study also serves to indicate research needs.

6. Conclusions

Issues linked to health and the environment in the food market are becoming more and more crucial, both for policy makers and for consumers. Societal and consumer perspectives are both relevant in the framework of sustainable development. The objective of our study was to observe if an association exists between healthy and environmentally-sustainable food choices.

Our results do not allow the identification of a general finding on the association between the two concerns. Nevertheless, for some of the variables chosen in the analysis, a relation was revealed. This means that the results reflect a strong case specificity. In particular, among our five health variables, the one that seems to show a more robust association with environmental concerns is the variable related to fried food consumption. Furthermore, the variable linked to fruit consumption seems to perform well in evaluating the joint concern for health and environmental issues. Among the environmental variables, the one related to eco-labelled products shows more robust results. The one connected to the choice of seasonal fruit and vegetables for environmental reasons seems to be weaker, as it presents some contradictory results. Thus, this variable does not seem to be particularly appropriate to capture consumer concerns linked to health and the environment.

Moreover, our results suggest that socio-demographic conditions play a role in determining the association between health and environmental concerns, with middle-aged and/or highly-educated respondents showing a stronger association.

Thus, a crucial point that emerged from our analysis is the choice of the appropriate variables. In the literature, the empirical analysis on this topic is not extensive, and there is no consensus on which are the best variables able to capture the two concerns and their association, but the results strongly depend on the typology of the variables selected. Therefore, we believe that additional research is needed to identify unambiguous variables that can be used in the assessment of the two attitudes. This will allow the further investigation of the association between the medium/long-term private utility (health) and the long-term public utility (environmental sustainability) of food choices [60].

The weak association between the two concerns for certain kinds of variables could be related to a low consciousness about the health and environmental impacts of such food choices. An indication of this could be the fact that highly-educated respondents show a stronger joint attitude (positive or negative) towards health and environmental issues. This could be overcome by information campaigns aimed at increasing consumer knowledge about the impacts of every day food choices.

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Author Contributions

This paper is the result of teamwork. The four authors contributed equally to this work. All authors read and approved the final manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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