

Article

Sustainability of Palm Oil: Drivers of Consumers' Preferences

Massimiliano Borrello ¹, Azzurra Annunziata ^{2,*} and Riccardo Vecchio ¹¹ Department of Agricultural Sciences, University of Naples Federico II, 80055 Portici, Italy² Department of Economic and Legal Studies, University of Naples Parthenope, 80133 Naples, Italy

* Correspondence: azzurra.annunziata@uniparthenope.it; Tel.: +39-0815-474-336

Received: 26 July 2019; Accepted: 2 September 2019; Published: 4 September 2019



Abstract: In recent years, the public debate on the health and sustainability of palm oil and its use by food industries has strongly influenced consumer choices. Consequently, palm oil-free products have asserted their image as healthier and more sustainable food products. The current paper contributes to the extant knowledge on consumers' perception of palm oil, particularly concerning preferences for food products carrying a "palm oil-free" label on their packaging. A web survey with a sample of 291 individuals was performed. Determinants of consumers' preferences towards the "palm oil-free" label were estimated with an ordered logistic model using as the dependent variable the purchasing frequency of palm oil-free foods and a set of independent variables. Results show that respondents generally prefer palm oil-free products, perceiving these products as healthier or eco-friendly. Furthermore, individuals are strongly influenced by the available information on these foods that may guide their choices for palm oil-free foods, which may be perceived as cleaner. Findings also highlight the low degree of information on this ingredient, underlining the need for public information and communication campaigns through different media, in order to emphasize that no scientifically proven negative health effect is currently attributed to palm oil consumption.

Keywords: free-from labeling; consumer preferences; ordered logistic model

1. Introduction

In recent decades, palm oil has become the dominant vegetable oil consumed in global markets [1]. The increasing relevance of the palm oil market has generated concerns regarding the wider cultivation of palm trees, as well as the spreading adoption of this ingredient in food products. On the one hand, palm oil production is often considered unsustainable. Palm trees are produced in monocultures, causing deforestation and other types of environmental degradation in tropical regions of Asia, Africa, and Latin America [2]. Furthermore, the industry has often been accused of having a negative impact on local communities in terms of labor exploitation and a lack of respect for basic human rights [3]. On the other hand, the use of palm oil in a wide range of processed food products (e.g., potato chips, confectionary, frozen meals, salad dressings, etc.) has been associated with an increased risk of cardiovascular disease, given its high saturated fat content [4].

These aspects of palm oil production and its nutritional proprieties have over the years generated a bad reputation for the industry. Accordingly, different authors have reported consumers' negative perception of food products containing palm oil as an ingredient, e.g., [5–7]. This phenomenon has led food companies to market products by highlighting on the package the absence of palm oil by means of a "free-from" label. In particular, starting with the introduction of new EU labeling Regulation No. 1169/2011 on the provision of food information to consumers, which introduced the obligation to declare the nature of vegetable oils on the label, manufacturers and retailers have begun to indicate, on a voluntary basis, palm oil-free products.

In general, food labels serve to guide consumers during food purchasing by reducing the cognitive effort related to the choice process [8]. In the case of free-from labels, the main advantage is the simplification of complex information reported on nutrition tables, also providing a shortcut for consumers who are not familiar with the ingredient mentioned on the label [9]. Different studies have sought to identify the determinants of consumers' preferences for products commercialized with a free-from label [10–12]. Consistent with what happens for the broad category of clean labels, it is accepted in the academic literature that the tendency to “avoid something” (e.g., new technologies, artificial ingredients, chemicals) is a main driver for consumers to choose free-from labeled foods [13–15]. Additionally, free-from labeled products are selected due to the absence of the target ingredient, conveyed by means of easy-to-process information or visual cues, guiding heuristics of which consumers are often unconscious [16,17]. However, the relevance of the latter pattern is likely to be clearer for those consumers more accustomed to paying attention to food claims and labels [11].

Based on the abovementioned considerations, the current paper contributes to the extant knowledge on consumers' perception of palm oil, focusing particularly on preferences for food products having a “palm oil-free” label on their packaging. The study draws on the assumption that consumers' avoidance of food products containing palm oil may be determined by different drivers. First, as palm oil is frequently associated with issues of social and environmental sustainability, as well as concerns about its effects on human health, we might expect that consumers who ascribe great importance to these aspects are more likely to choose palm oil-free foods. Second, given the bad reputation palm oil has gained over the years, consumers might have developed specific negative attitudes and beliefs that may guide their choice of products perceived as cleaner. Third, palm oil-free products might be selected by those consumers more engaged in searching for information on food products, and thus keener to use food labels and more attentive to the information contained on food packaging. Notwithstanding the growing interest in issues related to palm oil production and consumption, only a limited number of studies have addressed consumer-related aspects so far. The main contribution of this paper is to analyze consumers' preferences for palm oil-free products, exploring the possible determinants of individuals' avoidance of this ingredient.

The remainder of this paper is structured as follows: Section 2 reviews the main issues concerning the palm oil market that have led to the emergence of palm oil-free food products; Section 3 illustrates the methodology adopted in the study and the questionnaire administrated to respondents; in Section 4 results are reported; and the paper ends with a discussion of the main findings and implications.

2. The Emergence of Palm Oil-Free Foods

In 2017, 65 million tons of palm oil were consumed globally [1]. Given its high calorie content as a source of fat, palm oil is the most widely used vegetable oil in the world and is considered a staple food in many countries [18]. In the context of expanding the adoption of oil crops at the expense of other food and non-food crops [19], the success of palm oil is explained by its cheapness and versatility, as well as its advantageous physical characteristics for food processing processes. Its main advantage in comparison to other oils is its oxidation resistance at high temperatures in deep-frying preparations. A list of food products containing palm oil that can be purchased at common retail shops includes the following: bakery products, packaged bread, margarine, biscuits, chocolate-flavored confectionary, potato chips, ice creams, cheese, coffee creamer, whipped cream, mayonnaise, salad dressings, coconut milk powder, and frozen meals [20–22].

Despite the current widespread consumption of palm oil in foodstuffs, issues concerning the environmental and social sustainability of the palm industry are relevant. Plantations of the palm oil tree (*Elais guineensis*) have expanded in tropical countries, with South-East Asian countries positioned at the top of global production; in particular, Indonesia and Malaysia are leaders of the sector, producing more than 80% of the world's palm oil [1]. This expansion has occurred via capitalized agricultural development, with agribusiness actors guiding the conversion of wide land surfaces from forest and peatland to monoculture plantations [23]. Environmental concerns then derive from the consequences

of irrational land use change, leading to deforestation and fragmentation of land. This threatens the natural environment of regions considered as biodiversity hotspots [24] and generates considerable increases in net greenhouse gas emissions [25]. Furthermore, the acquisition of extensive arable land by private companies reduces land availability for smallholder farmers and influences local livelihood options [26,27], with local communities also affected by the human rights violations and abuses caused by the labor conditions of local workers in palm plantations [28]. On the other hand, a recent report from the IUCN Oil Palm Task Force (OPTF) suggests that, if palm oil is replaced by other types of crops, such as soybean or sunflower, the result will be more planting, leading to more deforestation, and thus different natural ecosystems and species may suffer.

Besides the contested legitimacy of the palm oil industry regarding sustainability issues, the widespread adoption of palm oil in processed food products raises further reasons of concern. Over the years, different studies have focused on the potential consequences of palm oil consumption on human health. Given its high concentration of palmitic acid, the most common saturated fatty acid, palm oil is believed to increase the risk of diseases such as obesity, type 2 diabetes mellitus, cardiovascular diseases, and cancer [29–31]. Nevertheless, there is no agreement in the medical community on palm oil-related health issues, with, among others, two recent reviews highlighting the need for further investigation to define the net advantages and disadvantages of palm oil for cardiovascular diseases, as well as to clarify its potential association with increased cancer risk [32,33]. The scientific uncertainty over the health effects of palm oil consumption is also reflected by public institutions such as the EFSA (European Food Safety Authority) which, after having issued an alert in 2016 about the toxicity of 3-MCPD (3-monochloropropane diol)—a contaminant of processed palm oil—updated its evaluation in 2018 by increasing the tolerable daily intake 2.5-fold [34].

Irrespective of controversial evidence concerning palm oil consumption risks, public campaigns and negative media crusades have spawned public misperceptions about this ingredient [35]. Therefore, although no official label exists to certify the absence of palm oil from food products in the EU, manufacturers and retailers have started to indicate with their own labels that their products are palm oil-free. Based on 2017 data on the Italian market, palm oil-free foods are ranked first for sales growth, having increased 12.9% in value and reaching 27.1% of total sales in breakfast products (3% of total sales) [36].

3. Materials and Methods

3.1. Questionnaire Content

Data were collected using a structured questionnaire survey, administrated via computer-assisted web interviewing. In order to reach the research objective, the questionnaire was organized into five sections to measure the following issues: (1) individuals' motivations, (2) information search habits, (3) individuals' environmental, health, and social beliefs about palm oil, (4) preferences for palm oil-free products, and (5) socio-demographics.

Individuals' motivations were measured through two different constructs: health interest in food choices and sustainability concerns. Consumers' health interest in food choices was measured by applying the eight items from the General Health Interest subscale developed by Roininen, Lähteenmäki, and Tuorila [37]. Participants had to indicate their level of agreement on a five-point scale (ranging from totally disagree to totally agree). Sustainability concerns about food choices were measured through 10 different statements, selected from the sustainability concerns scale proposed by Grunert et al. [38]. For each item, participants were asked their level of concern on a five-point scale (ranging from 1 = not at all concerned to 5 = extremely concerned).

Information search habits were measured at two levels. First, attention to and use of general food labels were measured by asking about the frequency of reading the information on the label in general terms and then the frequency of reading specific information on the label, as collected in previous research e.g., [39,40]. Subsequently, attention was focused on palm oil as a food ingredient and the

self-reported degree of information about its nutritional properties and environmental impacts was measured on a five-point scale (ranging from 1 = poorly informed to 5 = very well informed). In addition, the frequency of searching for information about palm oil and the main sources of information were investigated, as well as the relevance of information in influencing consumers' choices.

Individuals' beliefs about palm oil were measured using eight items (three reverse-coded) related to environmental, social, and health aspects of palm oil production, previously used in the literature [41].

Respondents' preference for "palm oil-free" products was measured by asking individuals the frequency of consumption of free-from palm oil food and the perceived benefits of this kind of product. Finally, socio-demographics variables, such as gender, age, education, presence of children in the household, and family income status were collected. Participants were also asked to state if they personally or someone in their household had any diet-related health problems.

3.2. Data Collection and Analysis

The questionnaire was pre-tested on a sample of 20 individuals to detect any possible misinterpretation, error, or duplication. The survey was delivered through the web platform LimeSurvey during September–November 2018 and advertised via social networks, blogs, online forums, and word of mouth. Participants had to be at least partially responsible for food purchases in their household; this screening was performed on the first, welcome page. A total of 358 responses to the survey were received, but 67 were incomplete, so the final sample consisted of 291 individuals living in southern Italy (Campania region). Even though the sample was randomly selected, the gender distribution and average age are in line with the 2017 regional data from the Italian National Institute of Statistics.

Descriptive univariate and bivariate analyses were performed in order to describe the sample profile related to labeling information attention and use, palm oil perception, and free from palm oil food preferences.

Determinants of consumers' preferences towards the "palm oil-free" label were estimated with an ordered logistic model, using as the dependent variable the purchasing frequency of palm oil-free foods and a set of independent variables. This model fits our data well as it allows for ordered categories of a dependent variable to be modeled as a sequence of latent variables through increasing threshold levels [42]. Additionally, this type of econometric model has been applied extensively in recent food consumer preferences research (see, among others: [43–45]). All analyses were conducted using Stata/SE 15.0 software (StataCorp, College Station, TX, USA).

4. Results

4.1. Descriptive Statistics

Table 1 reports a description of the sample in terms of socio-demographics variables. The share of females is slightly higher (55.7%) than males, the mean age is 40.65 years, and 27.4% have children under 10 years old in the household. Analyzing attitudes toward healthy eating, it emerges that in most cases respondents, or some member of their household, have a diet-related health problem (51.2%), mainly related to obesity and overweight (13%), followed by food intolerance (12%), diabetes (10%), and cardiovascular disorders (7%).

Considering individuals' motivations, Table 2 reports the mean values and standard deviations of respondents' general health and concerns about sustainability in food choices.

General health interest revealed that respondents consider themselves particularly interested in the healthiness of what they eat ($M = 3.5$, $S.D. = 1.12$), but at the same time they do not give up the foods they like even if they are unhealthy ($M = 3.4$, $S.D. = 1.23$) and state that they eat only foods that they like ($M = 3.2$, $S.D. = 1.26$). The Cronbach alpha value (0.81) confirms the satisfactory scale reliability; therefore, these items were summarized in one single construct by using the mean score of these eight items as a global measure of consumers' health interest.

Table 1. Socio-demographic description of the sample.

Gender	Female	55.7%
	Male	44.3%
Mean Age	40.65	
Current Education Level	Master's/PhD	6%
	Bachelor's degree	18%
	High school diploma	61%
	Other	15%
Family Economic Status	Below average	39%
	Average	43%
	Above average	18%
Diet-Related Health Problems	No	48.8%
	Yes	51.2%
Children <10 Years in Household	No	72.6%
	Yes	27.4%

As for sustainability concerns in general food choices, the data show that the level of worry is particularly high in relation to the use of natural resources and poor labor conditions of workers. Even though they still showed significant interest, participants stated that they were less concerned about non-recyclable packaging and the amount of energy used when transporting food products. The Cronbach alpha value (0.91) reveals very high internal reliability, allowing us to summarize items in one construct by using the mean score of these 10 items' average scores.

Table 2. Consumers' general health interest and concerns about sustainability in food choices.

	Mean Value	S.D.
General Health Interest		
I always follow a healthy and balanced diet	3	1.01
I eat what I like	3.19	1.26
I am very particular about the healthiness of the food I eat	3.50	1.12
I always choose the healthiest product option	3.10	1.15
It is important for me that my diet is low in fat	2.88	1.20
It is important for me that my daily diet contains a lot of vitamins and minerals	3.30	1.17
I do not give up the foods I like even if they are unhealthy	3.38	1.23
The healthiness of snacks makes no difference to me	2.85	1.41
Sustainability Concerns in Food Choices		
Using too many natural resources (water and land)	4.26	1.11
Poor working conditions	4.23	1.17
Starvation and malnutrition in the world population	4.12	1.10
The amount of food waste	4.12	1.06
The use of child labor in food production	4.12	1.22
The use of pesticides in food production	4.03	1.13
Deforestation and biodiversity loss	3.80	1.27
Carbon emissions caused by food production and transportation	3.79	1.23
Unfair market conditions for small producers	3.63	1.20
Packaging that is not recyclable	3.57	1.26
The amount of energy used when transporting food products	3.54	1.22

With reference to individuals' beliefs about palm oil, as reported in Figure 1, respondents are worried that palm oil is harmful for their health ($M = 4.1$, $S.D. = 0.91$) and the use of palm oil in the food industry favors the increase of obesity/overweight in society ($M = 3.2$, $S.D. = 1.31$). On the contrary, participants do not believe that palm oil is not harmful to health but feel that it should be consumed in moderation, like all saturated fats ($M = 2.71$, $S.D. = 1.17$).

Considering environmental beliefs, respondents are worried that palm oil production damages tropical forests ($M = 3.3$, $S.D. = 1.17$) and contributes to the loss of biodiversity ($M = 3.1$; $S.D. = 1.23$). On the contrary, individuals do not believe that palm oil production has a lower environmental impact than other oils ($M = 2.68$, $S.D. = 1.18$). In terms of social beliefs, respondents are quite worried about the exploitation of workers in palm oil plantations ($M = 3.1$; $S.D. = 1.16$).

Analyzing the variables related to information search habits, 27.8% of respondents self-reported that they consulted labels only when buying food products for the first time, while 27.4% stated that they often use the information on the label to compare products. Considering the specific information provided on the label, the highest use scores are related to the best before date (60.5% always), pack quantity (29.2% always), and ingredients list (27.5% always).

Considering the degree of self-reported information about palm oil impacts, 25% of respondents declared that they were uninformed about the nutritional properties of palm oil and 33% stated that they were neither informed nor uninformed. Only 4% considered themselves informed. Likewise, with regard to environmental impacts, 24% considered themselves uninformed, while 35% said that they were neither informed or uninformed and 7% felt informed. The main sources through which respondents actively searched for information about palm oil were: websites of consumer associations (31%), TV (15%), sites of environmental associations (14%), and newspapers (8%). However, 26.5% of respondents state that they have never actively sought information about palm oil. Still, over 60% of respondents state that the information gained influenced their food choices (32% somehow and 29% strongly).

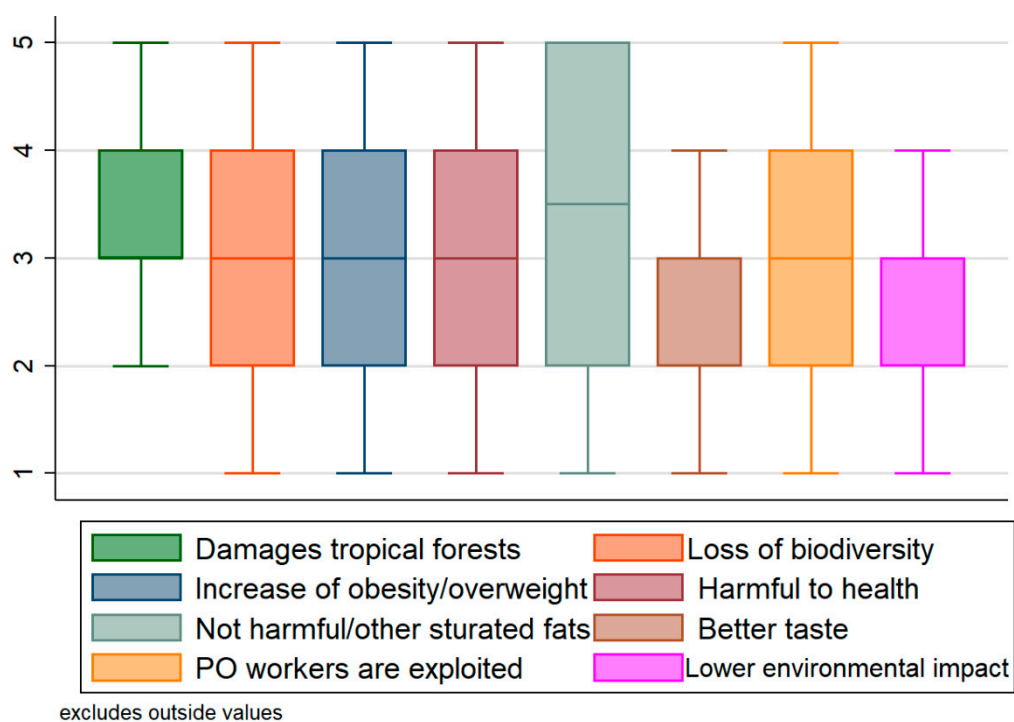


Figure 1. Individuals' beliefs about palm oil.

Considering variables related to consumers' preferences for "palm oil-free" foods, over 30% of respondents stated that they very often bought the free from palm oil option, 19% often and 20% seldom. Meanwhile, 21% and 10% stated that they rarely or never buy free from palm oil foods. Considering the perception of free from palm oil products, 38% of the sample stated that they prefer them because they are healthier, while 25% prefer them due to the lower environmental impact; 14% consider them useful in the preservation of tropical forests.

4.2. Determinants of Consumers' Preference for "Palm Oil-Free" Products

To investigate the drivers of consumers' preference for "palm oil-free" products, an ordered logistic model was performed. As reported in Table 3, the dependent variable was constructed as a sequence of different levels of stated purchasing frequency of palm oil-free foods. In particular, this included five categories in increasing size by level of consumption: POF1) never purchased palm oil-free foods, POF2) rarely purchases palm oil-free foods, POF3) seldom purchases palm oil-free foods, POF4) often purchases palm oil-free foods, and POF5) very often purchases palm oil-free foods. The theoretical framework of this procedure is standard normal random utility maximization (McFadden, 1973). In this study, a consumer's utility function associated with the consumption of palm oil-free foods is postulated in terms of relative consumption frequency rankings (such as very often, often, seldom, etc. to measure the corresponding latent utilities). The utility function is not observable, but it is assumed to underlie the observed vector of responses expressed as ordinal rankings. The dependent variable takes a value of 0, 1, 2, 3, or 4. These values reflect categories of arbitrary width. The ordered estimator is specified around a latent variable whose level is influenced by the identified explanatory variables. The likelihood ratio chi-square and its *p*-value suggest that the model with predictors as a whole was statistically significant, as compared to the null model with no predictors. The goodness of fit of the model was also evaluated by comparing the likelihood value with that obtained by fitting the model with multinomial (polytomous) logistic regression.

The econometric analysis was performed stepwise. First the effect of all available variables was tested and, subsequently, only statistically significant relations were kept in the final model. To facilitate the interpretation of findings, Table 4 reports the odds ratio only of significant independent variables. Due to the proportional odds assumption, the relationship between all variables and the categories of the response variable is the same, and therefore there is only one set of coefficients.

Table 3. Definition and measurement of variables included in the ordered logistic regression. (Dependent variable: purchasing frequency of palm oil-free food.)

Variable	Definition	Measurement	Mean	S.D.
General Health Interest * (GHI)	Degree of agreement with eight statements related to health interest in food choices (Table 2)	5-point Likert scale from 1 not at all to 5 strongly	3.01	0.72
Palm Oil Beliefs * (POB)	Degree of agreement with eight statements related to environmental, social and health aspects of palm oil production (Figure 1)	5-point Likert scale from 1 not at all to 5 strongly	3.06	0.73
Sustainability Concerns in general Food Choices * (SUS_CONC)	Degree of agreement with 10 statements related to sustainability issues in food choices (Table 2)	5-point Likert scale from 1 not at all to 5 strongly	3.92	0.86
Food label use (LAB_USE)	Frequency of use of labeling information when shopping	5-point scale from 1 = never to 5 = very often	3.47	1.22
Relevance of information (REL_INFO)	Degree of influence of information currently available on palm oil impacts on their own food choices	5-point scale from 1 not at all to 5 strongly	3.75	1.32

* Calculated as the mean value of the mean scores of the items of the scale.

Table 4. Odds ratio of ordered logistic regression.

	O.R. (S.E.)
GHI	0.726 (0.132) *
POB	2.383 (0.465) ***
SUST_CONC	0.682 (0.104) **
LAB_USE	1.478 (0.185) ***
REL_INFO	3.435 (0.427) ***
Log likelihood	−352.24037
Prob > χ^2	0.0000
Pseudo R^2	0.2196

Note: * = $p < 0.1$, ** = $p < 0.05$, *** = $p < 0.01$.

In particular, the model shows that for a one-unit increase in PALM OIL BELIEFS, the odds of being in a higher category of purchasing frequency of palm oil-free food are 2.38 times greater, given that the other variables are held constant. Similarly, for a one-unit increase in the RELEVANCE OF INFORMATION score, the probability of being in a higher category of purchasing frequency of palm oil-free food is 3.43 times greater. FOOD LABEL USE also exerts a positive effect on the purchasing frequency of palm oil-free foods (1.48). GENERAL HEALTH INTEREST (GHI) and SUSTAINABILITY CONCERNS (SUS) lower the probability of respondents being in a higher category of purchasing frequency of palm oil-free food.

Socio-demographics as well as personal health status variables do not affect the purchasing frequency of palm oil-free food.

5. Discussion

In recent years, consumers have developed a negative perception of palm oil as an ingredient, especially in terms of the potential environmental and health impacts connected to its production and consumption [5–7,41,46]. This has led the food industry to invest in the reformulation of food products and in marketing campaigns aimed at communicating the absence of this ingredient in their goods.

In brief, the findings of the current study confirm the existence of different drivers that influence consumer preferences for palm oil-free foods, providing several insights useful for marketers as well as for public institutions. The results show that respondents generally prefer palm oil-free products, perceiving these foods as healthier or eco-friendly. Moreover, individuals are strongly influenced by the information available on these foods [11,41], which may guide them to choose palm oil-free foods, which might be perceived as cleaner.

The econometric model corroborates this tendency, revealing that the relevance of information is the main predictor of consumers' preference for palm oil-free products, followed by respondents' beliefs about palm oil in terms of health, environmental, and social issues. In line with previous research, consumers are concerned about the negative consequences that palm oil could have on human health and the environment [5,41]. In addition, in line with previous research, consumers more engaged in searching for information on food products—in our study, those who frequently use food labeling information—are more likely to prefer palm oil-free products [11].

Conversely, results from the econometric model show that motivations related to general health interest as well as sustainability concerns in general food choices do not affect palm oil-free preferences. Similarly, socio-demographic characteristics and personal health status do not impact the preference for palm oil-free products. There is thus no specific market segment (in terms of gender, age, education, or economic status) that has a stronger predilection for this type of food.

This leads to the conclusion that a wide variety of consumers are attracted to palm oil-free products, suggesting that researchers should further explore other individual characteristics that may impact preferences (e.g., lifestyle and personal values).

More importantly, the current findings show that a specific attitude towards a healthy diet or strong motivations in everyday food choices (such as the presence of health problems) are not core drivers of preferences for these foods. The results reveal that consumers have developed specific negative beliefs and attitudes towards palm oil.

Like in previous studies [11,46], our results confirm that preferences for palm oil-free foods are strongly related to the negative image that consumers have of this ingredient, which has led public opinion towards an unfavorable attitude toward this ingredient [35]. Notably, our findings also show that respondents self-reported that they were poorly informed, particularly about the health aspects of palm oil. As a consequence, the presence of a free-from indication on the label might lead consumers to have unrealistic expectations and optimism bias concerning the healthiness of these products [9]. The literature has already observed this so-called “health halo effect” with reference to different free-from labeled products, e.g., [47], highlighting how often this type of message influences food choices but also generates unintended consequences.

6. Conclusions

In recent years the public debate about the health and sustainability of palm oil and its use by food industries has strongly influenced consumer choices. Consequently, palm oil-free products have gained a reputation as healthier and more sustainable food products.

Our results confirm a high level of consumer skepticism towards palm oil, which is perceived as an unhealthy and unsustainable ingredient. The findings also highlight the low degree of information about this ingredient.

The findings underline the need for public information and communication campaigns through different media, in order to emphasize that no scientifically proven negative health effect can be attributed to palm oil consumption at present. In this regard, the Italian Superior Health Institute stated, “The scientific literature does not report the existence of specific components of palm oil that can have negative effects on health,” stressing that over 80% of the saturated fat we consume comes from other foods such as meat, dairy products, eggs, oil, and other fats.

It is therefore important to improve consumer communication transparency, in order to avoid misleading information that generates unjustified worries, recognizing that consumers have the right to better evaluate the properties and safety of quality palm oil.

In particular, it would be advisable to avoid the “health halo effect” that drives consumers to consider a product healthy only because it is labeled as palm oil-free and regardless of its actual nutritional content. This consideration may be generalizable to other ‘free-from’ labels in order to improve their use and effectiveness, avoiding misleading interpretation and misperceptions, such as an overestimation of the benefits or the ascription of inappropriate health benefits.

At the same time, with reference to consumers’ concerns about the unsustainability of palm oil, according to several environmental associations (e.g., WWF, IUCN), it would be appropriate to raise consumer awareness about the existence of sustainable palm oil certification schemes, as a valid alternative to the boycotting of palm oil [48]. As recently highlighted by IUCN [48], global demand for vegetable oil makes the use of palm oil a better option than other sources such as rapeseed, soy, or sunflower. Indeed, banning or boycotting palm oil would displace production of these crops that are more demanding in terms of land surface, thus encouraging deforestation. Therefore, a significant solution to environmental sustainability concerns related to palm oil would be working towards deforestation-free palm oil.

In conclusion, it is worth highlighting that the current findings are subject to several limitations. First, self-reported measurements (such as those collected in this study) are prone to social desirability bias [49]. Furthermore, our convenience sample included self-selected respondents who probably already had a higher interest in health-related issues compared to the national population. Therefore, the conclusions are to be understood only as non-generalizable indications.

Author Contributions: M.B. contributed to the research conceptualization, preparation of the draft, writing a literature review, and research background; R.V. contributed to the research conceptualization, methodology, and formal analysis; A.A. contributed to the data collection, discussion and conclusions, review, and editing.

Funding: This research was funded by the University of Naples Parthenope within the research project “Analysis of the factors that determine the transition towards sustainable food consumption”.

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

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