agrochemicals

MDPI

Article

Pesticide Safety in Greek Plant Foods from the Consumer Perspective: The Importance of Reliable Information

Konstantinos B. Simoglou [1], Paraskevi El. Skarpa [2] and Emmanouil Roditakis [3,4,*]

[1] Department of Quality and Phytosanitary Inspections, Rural Economy and Veterinary Directorate, Region of Eastern Macedonia and Thrace, 66133 Drama, Greece; simoglouk@pamth.gov.gr
[2] e-EFKA, e-National Social Security Fund, 66132 Drama, Greece; peskarpa@outlook.com
[3] Department of Agriculture, School of Agricultural Sciences, Hellenic Mediterranean University, Estavromenos, 71004 Heraklion, Greece
[4] Institute of Agri-Food and Life Sciences, Hellenic Mediterranean University Research Centre, 71410 Heraklion, Greece
* Correspondence: eroditakis@hmu.gr

Abstract: Greek consumers perceive an increased risk of pesticide residues in food. This study examined Greek consumers' perceptions of the safety of Greek plant-based food compared to those from other EU countries. One-half of Greek consumers believe Greek food is as safe as other European foods, while the other half disagree. According to a principal component analysis and a bivariate logistic regression, several factors, such as the perceived safety of plant foods, education, age, gender, traceability, perceived benefits and risks of pesticides, actual pesticide use, and authoritative information sources, influence this attitude. Authoritative knowledge in this field can reduce risk perception and improve Greek consumers' attitudes towards food safety. The latent class analysis identified two categories of consumers. The first class receives limited information about pesticides, leading to lower perceived pesticide benefits, higher mistrust of traceability, and concerns about pesticide residues. In contrast, the second class actively searches for information from credible sources, endorses the Greek plant foods safety, acknowledges the pesticide benefits, and trusts traceability. Official information is associated with reduced risk perception. Regulators should consider the impact of sociodemographic and other intrinsic characteristics on individuals' risk perceptions and prioritise transparency in risk communication strategies.

Keywords: food safety; risk perception; information sources; principal components analysis; logistic regression; latent class analysis; risk communication

Citation: Simoglou, K.B.; Skarpa, P.E.; Roditakis, E. Pesticide Safety in Greek Plant Foods from the Consumer Perspective: The Importance of Reliable Information. *Agrochemicals* **2023**, *2*, 484–502. https://doi.org/10.3390/agrochemicals2040027

Academic Editor: Hu Wan

Received: 4 September 2023
Revised: 26 September 2023
Accepted: 28 September 2023
Published: 30 September 2023

1. Introduction

The agricultural sector plays a crucial role in achieving food security, particularly in underdeveloped nations with high malnutrition and poverty rates. However, global agriculture's capacity to meet this demand remains uncertain [1]. Food safety is essential for ensuring safe, nutritious food, promoting economic growth, and ensuring the preservation of health and overall well-being. Ensuring food safety is crucial for achieving food security [2].

Pesticides are widely used in agriculture to improve productivity and product quality [3], enhancing crop yields and food production. Efficient use of pesticides ensures food security and sustainability, protecting crops from pests, diseases, and weeds [4–6]. Pre- and postharvest losses have a negative impact on agricultural production [4,7,8], making agrochemical use a significant contribution [9–11].

Pesticides have raised concerns about their environmental and human health impacts [12]. The long-term effects of pesticide residues on human health are not fully understood, and further research is needed to identify potential hazards [3,13,14]. Currently, research focuses on occupational exposure [12,15], but concerns have also been raised about the potential adverse effects of pesticides on the general population through food consumption [15–17]. Studies have shown that pesticide residues in food pose a threat to public health, with neurotoxic [18,19] and cytotoxic [20,21] properties influencing gene mutation, chromosomal impairment, and DNA damage [16,22]. There is evidence of a link between pesticide use and increased susceptibility to colorectal cancer [23] and Parkinson's disease [18,24]. Young children in urban and suburban regions are particularly vulnerable to pesticide exposure due to their susceptibility to neurological and neurodevelopmental effects [25–29]. However, Tago et al. (2014) [15] have contended that only a minimal number of health outcomes linked to pesticides can be classified as causal.

Recent studies suggest that existing risk thresholds for pesticide exposure may not account for potential synergistic effects from combined exposure [14,30–34]. There is a lack of agreement on the consequences of interactions, with concerns about potential increased toxicity [35,36]. Predictability is a challenge due to factors like relative doses, routes, timing, and duration of exposure [37]. According to Hernández and Lacasaña (2017) [38], synergistic effects in dietary exposure are rare and cannot be accurately predicted in terms of the toxicity of the individual components of the mixture.

EU legislation allows food samples with multiple residues to be compliant as long as each residue does not exceed the individual maximum residue limit (MRL) set for each substance [39]. The European Food Safety Authority (EFSA) conducted two cumulative risk assessments on dietary exposure to pesticides with acute neurotoxic effects [40] and chronic thyroid effects [41]. They concluded that combined dietary exposure did not exceed regulatory thresholds in all European countries in 2014, 2015, and 2016 [40,41]. There was no significant change in exposure to pesticides with long-term thyroid effects or acute neurological effects between 2016 and 2018 [42].

The European Food Safety Authority reports that Greeks and Spaniards are most likely to consider high fruit and vegetable intake as a part of a healthy diet [43]. Studies show that increased intake of these foods outweighs the potential negative effects of pesticide residues [44–46]. Public health messages should promote regular, abundant consumption of a variety of fruits and vegetables [45].

The research on the impact of pesticides on dietary health is inconclusive, making it difficult for the public to access reliable information [47,48]. There is also inadequate discourse on pesticides' function in sustainable food production [49]. The evaluation of pesticide risks and benefits remains a public concern. Public perception of hazards may differ from regulators', relying on empirical evidence [5,48,50–52] and risk assessment techniques [53]. The presence of pesticide residues in food may increase risk perception [52,54–56].

Pesticide residue monitoring and control systems can mitigate food safety concerns, as suggested by Han et al. (2020) [57]. Risk communication efforts should address reliability concerns and establish information dissemination systems to bridge the gap between regulators and the public [57,58]. Consumers should understand food safety processes and build trust through systems and mechanisms [48]. Trust can influence risk perception, especially when individuals lack knowledge about an important issue. Siegrist (2021) suggests that consumers' perception of technology is more positive and acceptable when they trust the official risk management organisation [59].

The study examines the impact of information dissemination on consumer perceptions of Greek food safety. The rise of the Internet and portable devices has significantly increased the amount of information available, leading to significant changes in how individuals obtain and disseminate information and accelerating the global dissemination of news, knowledge, and ideas [60,61].

Consumers' perceptions of pesticide residue risks are influenced by emotional factors, leading to overemphasis or exaggeration [62]. The 'post-truth era' has seen subjective emotions and personal beliefs become more influential in public opinion and decision making. Social media platforms facilitate the dissemination of inaccurate and misleading information, creating echo chambers and declining trust in established institutions [63–65]. Cognitive processing and self-reflection are crucial when considering dietary hazards [66].

The digital age has changed the information landscape, making data veracity questionable [67–69]. Public trust, perceived expertise, and demographic variables influence the reception of food safety messages [70].

The media plays a crucial role in risk communication [71], providing comprehensive information about risks and their benefits, acknowledging uncertainties in risk management, and presenting alternatives for risk reduction [72]. The media's influence on consumers' attitudes and perceptions of food safety risks has been extensively studied [73,74]. Extensive media coverage tends to amplify risk perceptions and create a desire for measures to minimise them [55,71]. Journalists may prioritise dietary hazards based on newsworthiness over the rankings provided by experts [63,75–77]. Trust in public authorities plays a moderating role in the relationship between fear and purchase likelihood [63], particularly among consumers with higher education levels [67]. The Greek media is susceptible to providing comprehensive information on food hazards, and exaggerated concerns are prevalent, particularly regarding pesticide residues [78].

In contrast, Koch et al. (2017) [79] found that media exposure increases understanding of pesticide regulatory elements, reducing perceived risk. Access to reliable sources is crucial, as nonadherents are less likely to receive information [56]. Media coverage can also be a cognitive shortcut for understanding complex issues, especially without direct expertise in risk management [63,80].

In a recent Eurobarometer survey conducted on behalf of EFSA, Greeks ranked first in terms of personal interest in food safety [43]. Previous Eurobarometer surveys [81,82] show this trend has been stable in recent years. This is supported by the study of Simoglou and Roditakis (2022) [56], who found that Greek consumers were especially concerned about the impact of pesticide residues on their own health and that of their families. The present study aimed to improve our understanding of how Greek consumers perceive the safety of plant foods, their sources of information about plant protection products and food safety, and the predictive variables related to their attitudinal beliefs. In this respect, the purpose of this study is to answer the following research questions:

RQ1: How do Greek consumers perceive the safety of Greek plant foods regarding pesticide residues compared to other EU Member States?

RQ2: Which sociodemographic and attitudinal variables predict Greek consumers' personal perspectives on Greek plant food safety?

RQ3: What is the role of information sources in forming consumer perceptions of the safety of Greek plant foods?

2. Materials and Methods

Data collection was facilitated by a questionnaire hosted on Google Forms and distributed via email, Viber, and Facebook Messenger, as well as online news forums and magazines. The survey was conducted between 6 and 31 March 2021. The questionnaire was divided into two sections: sociodemographic information and attitudes. It included closed 5-point Likert scale questions about their perceptions or attitudes. The Likert scale response levels were as follows: 1 = strongly disagree, 2 = somewhat disagree, 3 = neither disagree nor agree, 4 = somewhat agree, and 5 = strongly agree, or 1 = never, 2 = rarely, 3 = occasionally, 4 = frequently, and 5 = routinely, depending on the context.

The data collected through the questionnaire were first subjected to descriptive statistical analysis. Following Simoglou and Roditakis (2022) [56], the median was used as an appropriate measure of central tendency to present and interpret the results. The nonparametric Mann–Whitney U test was used to compare ordinal variables.

Principal components analysis (PCA) was used to determine the basic information structure contained in the original interrelated variables and to summarise it using a smaller set of composite variables. An eigenvalue threshold greater than 1 was used as a criterion for the number of principal components (PCs) retained. The oblique (promax) rotation resulted in more simplified PC loads, with each variable load on an individual PC. In the final analysis, only variables with loadings greater than or equal to 0.60 were retained. The adequacy of the PCA was assessed using the Kaiser–Meyer–Olkin (KMO) test, which uses values between 0 and 1 as a measure of sampling adequacy, and Bartlett's test of sphericity, where a significant result indicates that at least some pairwise correlations among variables are nonzero [83].

McDonald's ω reliability coefficient of internal consistency was calculated and reported for scale variables loading on a single PC. To obtain a single measure for each PC, the variables loading on a single PC were combined using composite scores for further analysis [83].

Participants' perceptions of the safety of Greek food products in comparison with products from other EU member states were used as the dependent variable in a binary logistic regression to identify potential predictors. Sociodemographic variables and factors retained from the PCA were included in the model as potential predictors. The calculated odds ratios (OR) and 95% confidence intervals (CI) are presented. Each independent variable in the model was subjected to the Wald test for statistical significance. Finally, performance metrics such as specificity and sensitivity, representing the proportion of true negative and true positive observations predicted by the model, and area under the ROC curve (AUC), which represents the trade-off between true positive and false positive rates), and is an overall test of predictive accuracy and indicates the degree of discrimination between true positive and false positive values of the estimated model, were considered. Large AUC values (greater than 0.5-1) indicated an excellent model fit [83].

For logistic regression analysis, participants' opinion variables were split into two levels with a binary outcome: "favour" = 1, after grouping the Likert response levels somewhat agree and strongly agree, and "disfavour" = 0, after grouping the Likert response levels strongly disagree, somewhat disagree", and neither disagree nor agree, following Simoglou and Roditakis (2022) [56].

Latent class analysis was used to identify potential underlying consumer categories that could explain the observed patterns across cases [84] in an effort to further clarify the significance of information sources on participants' perceptions of the safety of Greek plant foods. As class-defining variables, the original variables pertaining to the information sources used by participants for pesticide information were chosen. To characterise the differences between classes in greater detail, a chi-squared correlation test and a Mann–Whitney U test were conducted on the nominal background variables and the ordinal focus variables, respectively.

The statistical analyses were carried out using Jamovi 2.4.2 [85] and Jasp 0.17.3 [86], both of which use the R programming language.

3. Results

3.1. Characteristics of Survey Participants

All Greek regions were represented by a total of 1,846 respondents to the survey. The population under study comprised plant-based food consumers between the ages of 18 and 65 who reside in both urban and rural areas of Greece (the mainland and the islands). The survey respondents' sociodemographic details are shown in Appendix A, Table A1. Both genders (females 48.5%) and all age groups were adequately represented. The majority of respondents (45.1%) resided in the south of Greece (including Athens), while 26.6% resided in the centre, and 29.1% in the north. In accordance with Simoglou and Roditakis (2022) [56], the age groups were reduced to three for the purposes of the analyses. Of the participants, 22.5% were between the ages of 18 and 34, 58.1% were between the ages of 35 and 54, and 19.4% were older than 55. The vast majority of participants possessed at least a high school diploma and were primarily civil servants (44.1%), private employees (18.6%), self-employed individuals (12.1%), university students (11.7%), and farmers (5.3%). In addition, a number of personal habits relating to free time, smoking, sports participation, and vegetarianism were recorded (Appendix A, Table A1).

3.2. Participants' Perspectives on the Safety of Greek-Produced Plant Foods in Terms of Pesticide Residues in Comparison to those of other EU Member States

The frequency distribution of participants' responses to the research question on whether or not they perceive Greek plant foods as safe as those from other EU member states (RQ1) was determined as follows: Strongly disagree (median = 1): n = 125 (6.77%); somewhat disagree (median = 2): n = 290 (15.71%); neither disagree nor agree (median = 3): n = 499 (27.03%); somewhat agree (median = 4): n = 600 (32.50%); Strongly agree (median = 5): n = 332 (17.99%). Following Simoglou and Roditakis (2022) [56], a binomial proportion test was applied after dividing the response rates into two levels with a binary outcome, i.e., 'agree' and 'disagree'. In accordance with the null hypothesis that the two levels are equally likely (p = 0.50), a nonsignificantly higher proportion of positive responses was found. The proportion of unfavourable responses was 0.495% (95% CI: 0.472–0.518%), n = 914, while the proportion of favourable ones was 0.505% (95% CI: 0.482–0.528%), n = 932 (p = 0.692).

3.3. The Variables Predicting the Participants' Attitudes towards the Safety of Greek-Produced Plant Foods Research Question

Principal components and logistic regression analyses identified sociodemographic and attitude variables as significant predictors of Greek consumers' perceptions of the safety of Greek-produced plant foods relative to those from other EU Member States with respect to pesticide residues (RQ2).

3.3.1. Principal Components Underlying the Participants' Attitudes

The analysis of 22 original variables included six principal components (PCs) that explained 64.6% of the variance. The adequacy measures of the PCA, such as McDonald's ω reliability coefficient and Bartlett's test of sphericity, were appropriate.

Four variables accounted for 13.502% of the variance in the first principal component, representing 'Official information sources' used by participants to learn about pesticides. Variables load on the second PC included participants' opinions on 'Perceived pesticide benefits' and accounted for 12.706% of the variance. The third principal component related to "General information sources on pesticides" and accounted for 10.863% of the variance. Variables loaded on the fourth PC concerned "Confidence in traceability", accounting for 10.205% of the variance. The fifth PC consisted of variables representing "Perceived pesticide risk", which accounted for 9.008% of the variance. The sixth PC was correlated with participants' perceptions of the safety of plant food consumption, labelled "Perceived plant food safety", and accounted for 8.288% of the variance.

The relationship of the six PCs is summarised in Figure 1. On the horizontal axis, perceived pesticide risk loads in the opposite direction to perceived plant food safety, pesticide benefits, and consumer confidence in certification and is negatively correlated with these variables. It is also basically orthogonal to official sources of information, implying a rather negative relationship.

3.3.2. Predictive Variables of Participants' Perceptions–Logistic Regression Model

A binary logistic regression analysis was conducted to identify any variables that might predict participants' attitudes towards the safety of plant foods. Specifically, the dependent variable concerned participants' responses to the statement that plant-based foods produced in Greece are as safe as those produced in other EU Member States in terms of pesticide residues. Using a stepwise procedure, background sociodemographic variables and the six PCs previously retained from the PCA were included in the model as potential predictors.

The performance parameters (specificity, sensitivity) and the overall predictive accuracy of the model (AUC value) (Appendix A, Table A3) were adequate, indicating a very good model fit.

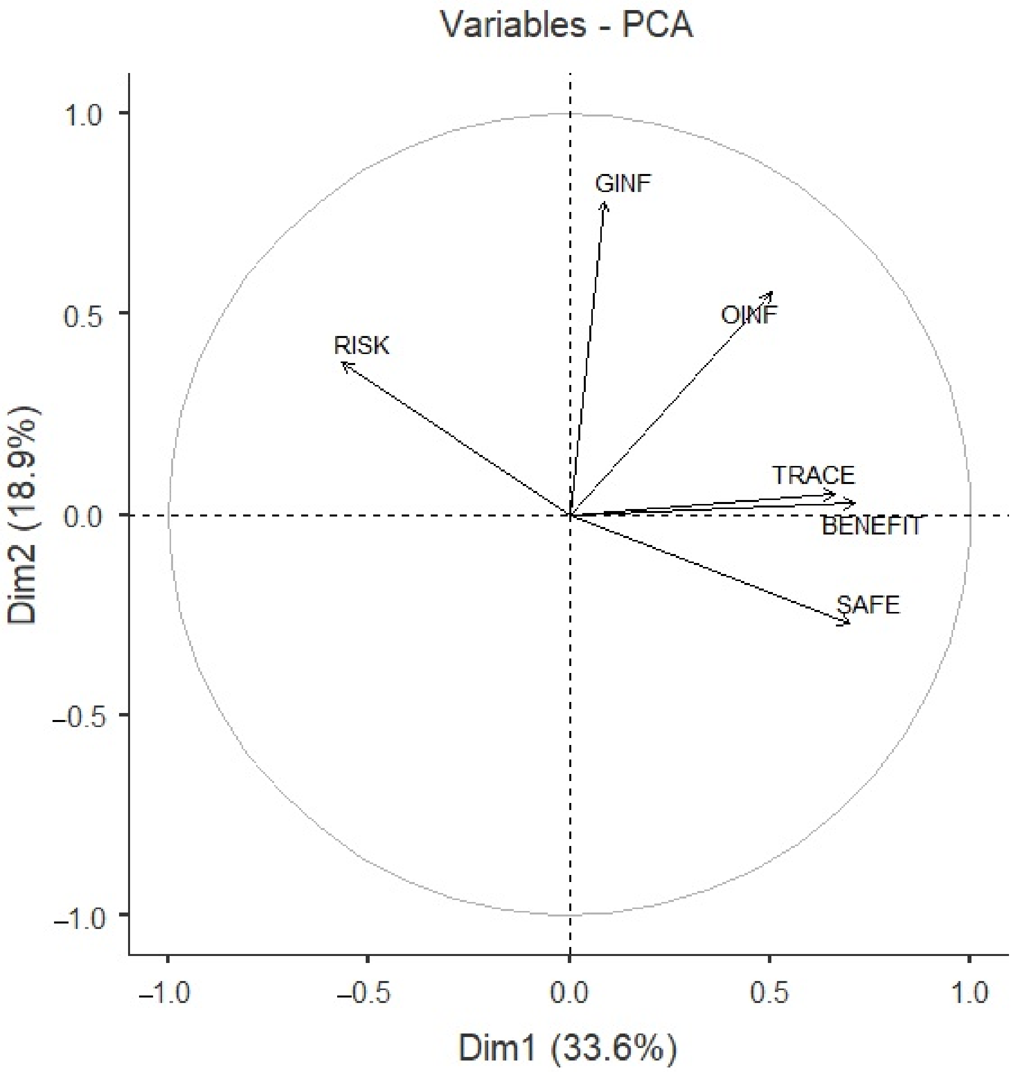

Figure 1. Graph showing the relationship between PCs using principal components analysis: OINF—official information sources; BENEFIT—perceived pesticides' benefits; GINF—general information sources; TRACE—confidence in traceability; RISK—perceived pesticides' risk; SAFE—perceived plant-food safety.

On the basis of the significant and positive regression coefficients b and the odds ratios above 1, the results indicate that respondents who report higher levels of plant food safety are better educated, over 45 years of age, more likely to obtain official information on plant protection products, male, have higher levels of trust in the traceability procedures of plant food production, perceive greater benefits from plant protection products, and have a higher likelihood of accepting the safety of Greek plant food (Appendix A, Table A3).

In contrast, individuals with a strong pesticide residue risk perception and active use of plant protection products are less likely to consider plant foods from Greece safe than those from other EU countries (Appendix A, Table A3). To enhance the assessment of how pesticide user status affects participants' opinions, several variables were examined. It was found that people who use pesticides reported a greater sense of safety regarding Greek plant foods compared with those who do not use pesticides (Mann–Whitney U test, W = 371,479.0; $p < 0.001$), although this effect size is modest. However, pesticide users (n = 788) had a 45.05% probability of supporting the position of less frequent monitoring of Greek food than in the EU. By comparison, non users (n = 1058) had a 32.99% probability of expressing identical attitudes ($\chi^2 = 27.860$; df = 1; $p < 0.001$). Also, pesticide users were significantly more likely to agree that they consume food that they have produced themselves (66.87%) compared with nonusers, where only 33.13% showed this level of agreement (χ^2 = 146.420; df = 1; $p < 0.001$).

No other background variables or principal components were found to be significant predictors and are therefore not supported in the model.

3.4. Latent Class Analysis of the Respondents

The Latent Class Analysis (LCA) was based on eight original ordinal variables related to official websites, public authorities bulletins, scientific journals, agronomists (official sources of information), TV/radio, electronic and print press, and social media (general sources of information). The primary objective was to establish the public's sources of information on food safety and pesticide issues and to assess their impact on the perception of Greek food safety (RQ3).

Following the previous findings by Simoglou and Roditakis (2022) [56], further analysis was carried out on a two-class solution. The first class (n = 871), with a prevalence probability of 0.468, consisted of respondents who were less likely to agree with the research question (RQ1). On the other hand, the second class (n = 975), with a prevalence probability of 0.532, expressed a level of partial agreement with the research question. The difference between the two classes is statistically significant (Mann–Whitney U, W = 350,100.5; $p < 0.001$).

In order to provide an insight into the two participant groups, additional analyses were conducted, which considered the focus variables (principal components or several original opinion variables) shown in Table 1 and the demographic background variables illustrated in Table 2. From these findings, Class 1 comprised participants with higher perceived pesticide residue risks, a higher proportion of females, residents of areas of northern Greece, pesticide nonusers, civil servants, university students, and secondary school graduates. Class 2 showed a tendency to use official and general sources of information on pesticides more frequently, perceive higher benefits from their use, exhibit more confidence in the role of traceability in ensuring food safety, and perceive a higher level of safety in plant foods. They were more likely to be male, reside in southern Greece, work in the private sector, be self-employed, retired, or unemployed, and finally, possess university degrees. Additionally, they were likely to be farmers. It should be noted that there was no statistically significant difference between the two groups in terms of the participants' high level of concern about their safety from pesticide residues in food. Likewise, there was no statistically significant difference in the degree of their neutrality towards the statement that Greek food is tested less frequently for residues compared with other Member States of the European Union. The age of the participants in both groups did not display a statistically significant difference.

Table 1. Characterisation of perceptions between two classes of respondents as identified by the LCA on the basis of variables related to information sources (class 1, n = 871, "Non-Supporters"; class 2, n = 975, "Supporters").

Variables of Focus	Mann–Whitney U Test	Rank-Biserial Correlation (*)
OINF—official information sources	W = 8249.0; $p < 0.001$	−0.981
BENEFIT—perceived benefits	W = 283,684.0; $p < 0.001$	−0.332
GINF—general information sources	W = 344,139.0; $p < 0.001$	−0.190
TRACE—confidence in traceability	W = 340,339.0; $p < 0.001$	−0.198
RISK—perceived pesticide risk	W = 378,416.0; $p < 0.001$	0.109
SAFE—perceived plant food safety	W = 387,926.0; $p = 0.001$	−0.086
Pesticide residues in food make me concerned about my safety	W = 428,532.0; $p = 0.588$	0.009
In Greece, plant food is not tested for pesticide residues as often as in other EU Member States	W = 428,008.0; $p = 0.760$	0.008

(*): The rank-biserial correlation indicates the effect size. Negative coefficients indicate a greater intensity of attitude towards the test variables in class 2.

Table 2. Sociodemographic characterisation of the two obtained classes of respondents.

Background Variables		Class 1 (N = 871) "Non-Supporters"	Class 2 (N = 975) "Supporters"	Chi-Squared Test
Gender	Female	54.6 %	45.4 %	$X^2 = 38.183$; df = 1;
	Male	40.2 %	59.8 %	$p < 0.001$
Age	18–44	47.6 %	52.4 %	$X^2 = 0.112$; df = 2;
	≥45	46.8 %	53.2 %	$p = 0.738$
Place of residence	Rural	40.6 %	59.4 %	$X^2 = 10.908$; df = 1;
	Urban	49.4 %	50.6 %	$p < 0.001$
Region	Northern Greece	52.8 %	47.2 %	$X^2 = 14.271$; df = 2;
	Central Greece	48.8 %	51.2 %	$p < 0.001$
	Southern Greece	42.6 %	57.4 %	
I use pesticides	No	61.6 %	38.4 %	$X^2 = 207.455$; df = 1;
	Yes	27.8 %	72.2 %	$p < 0.001$
Profession	Civil servants	53.1 %	46.9 %	$X^2 = 36.611$; df = 6;
	Farmers	30.6 %	69.4 %	$p < 0.001$
	Private employees	42.2 %	57.8 %	
	Retired	42.5 %	57.5 %	
	Self-employed	37.9 %	62.1 %	
	Unemployed	45.1 %	54.9 %	
	University students	52.6 %	47.4 %	
Education	Secondary education	52.6 %	47.4 %	$X^2 = 6.488$; df = 1;
	Higher education	45.6 %	54.4 %	$p = 0.011$

4. Discussion

Food safety and security are crucial in the global context because of the growing population and climate change. The Food and Agriculture Organization (FAO) has identified key priorities for food security in its Strategic Framework for 2022–2031, including strengthening agricultural practices, promoting nutritious diets, protecting the environment, and improving livelihoods. These strategies aim to ensure universal access to safe, quality food and sustainable agricultural practices [2].

This study aimed to understand Greek consumers' attitudes and perspectives on the safety of plant-based foods, including urban and rural areas, different age groups, education, and professional backgrounds. It also examined the impact of information sources on customers' perceptions of pesticide residues.

The analysis of the participants' responses concerning the safety of plant-based food produced in Greece compared with other EU Member States, with respect to pesticide residues, revealed no significant difference between positive and negative responses. Approximately half of the participants (49.5%) responded negatively to the research question. This suggests that they questioned the safety of Greek plant-based foods, unlike those in the EU. Greek consumers exhibit considerable uncertainty regarding the presence of pesticide residues in food. According to a Eurobarometer survey by the EFSA, up to 99% of respondents from the 27 EU Member States were personally interested in food safety [43]. A series of Eurobarometer surveys conducted by the EFSA in 2010 [81], 2019 [82], and 2022 [43] have consistently shown that Greek consumers are more concerned about pesticide residues in food than their European counterparts. The aforementioned finding indicating that half of the participants have an unfavourable perception of the safety of Greek food concerning pesticide residues can be seen as an attitude in this particular context.

Factors that positively influence individuals' perceptions of the safety of Greek plant foods include higher levels of education, older age, access to pesticide information from official sources, male gender, confidence in plant food safety and control measures, traceability and certification procedures, and perceived benefits of pesticide use. However, participants with higher risk perceptions tend to have unfavourable opinions about the safety of Greek plant foods.

The perceived safety of plant-based foods has a significant impact on consumer perceptions about Greek food safety. Participants were generally in favour of the safety of plant-based foods but remained neutral on the potential risks associated with the consumption of fruit and vegetables and the testing for pesticide residues. This underlines the importance of control measures and effective enforcement of pesticide and food safety regulations. According to Eurobarometer, 28% of Greek consumers trust national and EU food safety authorities [82]. This suggests the need for greater involvement of food safety authorities in disseminating information on potential pesticide risks to the general public. Regulatory authorities are challenged by the different risk perceptions of experts and laypersons, highlighting the need for effective communication strategies to link experts and the general public [5,47,48,50–52,66,87].

Higher education significantly influences Greek consumers' perceptions of the safety of plant-based foods. An inverse relationship between level of education and perceived risk has been found in several studies. Educated consumers have more trust in public authorities and are less susceptible to subjective norms [58,67]. This highlights the importance of education in shaping consumer attitudes towards food safety.

The perceived safety of Greek plant foods is strongly influenced by age, especially for those aged 45 and over. As confirmed by the results of the chi-squared test ($\chi^2 = 8.062$; df = 1; $p = 0.005$), this finding can be attributed to the increased likelihood of older participants having a higher level of education than those in the younger age group.

The impact of the male gender on consumer perceptions is significant and has a positive effect on the perception and acceptance of food safety. Previous studies [56,79,88–91] have shown that female consumers tend to perceive greater risks in various areas, such as chemical residues. This study shows that gender substantially influences consumer perceptions and attitudes towards Greek food safety, emphasising the need for targeted communication strategies to effectively address gender-specific risk perceptions in food safety issues.

The assurance and validation processes for traceability and certification of plant-based foods in Greece significantly influence consumer perceptions of food safety. Transparency and reliability are crucial in these processes. Improving and disseminating these techniques is essential to increasing consumer confidence in food safety. Trustworthy entities may provide consumer control in the absence of direct control [66]. Consumers rely on certification, information provision, and labelling to guarantee food quality, which aligns with previous research [88,92–98].

This study demonstrates that perceived pesticide benefits alter people's views on Greek food safety. This suggests that understanding individuals' perspectives and risk attitudes can provide valuable insights into their views on controversial issues [56,99]. The results highlight the importance of considering both perceived benefits and risks when formulating evaluations or decisions on controversial issues.

Slovic et al. (1980) [100] found that risk perception is a key factor influencing risk assessment. Pesticide residue perceived risk affected participants' views on Greek food safety, consistent with Huang's (1993) [101] findings. Participants' concerns for their health and that of their loved ones were significantly influenced by their perception of pesticide risks, which is consistent with the results of the Eurobarometer survey [43]. Additionally, other studies indicated that individuals feel more in control of biological food risks than chemical/technical risks [74]. Consumer dosage insensitivity may increase chemical risk perception [90].

Limited comprehension of food residue regulations and legal restrictions may increase perceived risk [79]. The differentiation between qualified and unqualified evaluations of chemical risks also adds complexity [5,47,48,50–52]. Policy makers and stakeholders can take advantage of these features to address public concerns and improve risk communication.

Although previous research has suggested that being a pesticide user can enhance risk–benefit perception [56], this study shows that pesticide user status actually decreases perceptions of Greek food safety. One possible explanation for this finding could be that pesticide users believe that Greek food is tested less often in the national monitoring program than in other EU Member States. This perception may contribute to the belief that it is relatively less safe than food from other EU Member States. In fact, the 2021 EU report on pesticide residues in food shows that Greece collected 36.26 samples per 100,000 inhabitants, above the EU average of 30.29. Moreover, the proportion of noncompliant food samples in Greece was found to be 3.14%, lower than the EU average of 3.65% [39]. In addition, participants who use pesticides, whether professional or amateur, are more likely to consume products from their own crops. This implies that individuals who use pesticides may possess a greater sense of control and confidence in the safety of their agricultural products [66]. Previous research suggested that people tend to take personal responsibility for risks within their control but not for risks beyond their control [102]. The reasons for the differences in attitudes and practices towards food safety in Greece and home-grown food consumption attitudes need to be further investigated.

Information on pesticide use in Greek food is crucial for consumer perceptions. The routine use of authoritative sources of information contributes to a favourable perception of food safety. The analysis (PCA) shows a strong association between official sources of information, such as official websites, newsletters, scientific publications, and agronomists. Participants prefer agronomists as their main source of knowledge about pesticides, with occasional use of official websites, newsletters, and scientific periodicals. General information sources such as electronic press, TV/radio, press, and social media have insignificant predictive power.

The influence of information on consumers' opinions about the safety of Greek plant foods was further examined in this study. Two consumer categories were identified through latent class analysis. The first-class participants received limited information on pesticides and did not believe that Greek plant foods are equally safe as those from other EU Member States. They were predominantly female, tended not to use pesticides, and were mostly civil servants and students. They had lower perceived benefits from pesticide use, less trust in traceability initiatives, greater concern about pesticide residue risks, and less confidence in the safety of plant-based foods. The participants of the second class obtained information about pesticides from authoritative or general sources of information, with a particular emphasis on the official sources. This group recognised the benefits of pesticide use, had confidence in traceability, perceived less pesticide risk, and had greater confidence in the safety of plant-based foods. This class consisted mainly of males, people living in rural areas, pesticide users, farmers, private sector employees, retired, self-employed, and currently unemployed.

This study categorised consumers into two groups: engaged (class 2) and not engaged (class 1) in seeking information about pesticides and food safety concerns. Both groups agreed on the potential adverse effects of pesticide residues on individual well-being and expressed a neutral attitude towards Greek food testing frequency compared with other EU Member States. However, as the PCA and LCA analyses of the data showed, consumers in Class 1 had a higher level of perceived risk and a greater level of concern. This approach helps to explore similarities and latent differences between individual groups.

This study is consistent with previous research by Mazzocchi et al. (2008) [103], who found that trust in information from different sources significantly affects individuals' risk perceptions. Authoritative sources reduce risk perception, while alternative sources increase it. Consumption of food safety news significantly influences individuals' and the public's perspective on the entities responsible for food safety crises [12]. Subjective factors such as emotions and intuition also influence perceptions of food risks and benefits [104]. Risk communication techniques that only fill gaps in scientific knowledge may be ineffective if they do not recognise and respect the human dimension. Koch et al. (2017) [79] found that understanding the pesticide regulatory framework reduced perceived risk. Trust in official regulatory bodies modifies the association between fear and action [59,67]. Effective mitigation of food safety concerns can be achieved through pesticide residue monitoring and control systems [57] and risk communication strategies that address fears about the reliability of regulatory processes and information sources [48]. Overall, understanding the human dimension and incorporating risk communication strategies can help mitigate food safety concerns.

Informed decisions require accurate, complete, reliable, relevant, and timely information [105]. Gathering and evaluating information from reliable sources is therefore crucial. Promoting media literacy can enhance citizens' ability to navigate information and distinguish trustworthy sources, leading to informed, knowledge-based decisions [106].

There are several inherent limitations to our research. Firstly, it is important to recognise that people who are not familiar with communication technology were inevitably excluded, as the data were only derived from a web-based survey. Individuals with these characteristics may be less educated or older. In addition, the data were collected through self-reporting, with no mechanisms in place to verify their accuracy. It should also be noted that although the sample used in this study was from a nationwide pool, it may not accurately reflect the Greek population as a whole in various respects, such as education, occupation, and individuals over the age of 65.

5. Conclusions

The aim of this study was to provide an in-depth understanding of the factors that influence Greek consumers' views on the safety of Greek plant-based foods compared to those produced in other EU Member States, with a particular reference to concerns about pesticide residues. Concurrently, the main focus of this study was to examine the influence of pesticide-related information on the perceptions and attitudes of Greek consumers towards food safety. The results are summarised in Table 3. The study found Greek consumers balancing between two conflicting perspectives on the safety of Greek food. Half of the respondents believed that Greek food has a level of safety comparable to other European foods, while the other half held the opposite view. Several predictive factors have been identified that influence the dichotomous nature of Greek consumer behaviour. These factors include the perceived safety of plant foods, higher education level, age, gender, perceived contribution of traceability to food safety, perceived benefits of pesticide use, perceived risk of pesticide residues in food, pesticide user status, and information obtained from authoritative official sources. Obtaining information about pesticides and related food safety concerns emerges as a crucial determinant in shaping consumer perspectives. Receiving authoritative, official information was found to be associated with a reduction in risk perception, improved scores in focus-opinion variables, and a positive response to the research question on Greek food safety.

The results of our study suggest potential implications for the importance of providing accurate and timely information to the public. First, it is of utmost importance that administrative and regulatory institutions prioritise transparency in their risk communication strategies. It is vital to give careful consideration to the impact of sociodemographic and other intrinsic attributes on individuals' perceptions of risk. By doing so, regulators can effectively build trust and credibility with consumers. It is also essential to ensure the efficient dissemination of official information across multiple platforms, including websites, social media platforms, and public awareness campaigns. However, it is crucial to prioritise the maintenance of direct communication channels between public institutions and consumers. Mechanisms such as agricultural warning services or peripheral agriculture directorates should be further developed to take on an expanded role in informing the general public about food safety issues. Ensuring effective risk communication channels between public institutions and consumers and bridging the gap between experts and the general public is essential to addressing concerns and inquiries and promoting transparency and accountability. In addition, tailoring risk communication strategies to different sociodemographic subgroups can ensure the effective delivery of information in a way that is understandable and relevant to a wide range of people, thereby promoting greater uptake and engagement. In addition, collaboration with other stakeholders, such as consumer and producer organisations, can further strengthen these communication initiatives.

Table 3. Summary of the findings.

Research Question	Principal Conclusions
RQ1: How do Greek consumers perceive the safety of Greek plant foods regarding pesticide residues compared to other EU Member States?	• Greek consumers are more worried than their European counterparts about pesticide residues in food, showing significant uncertainty about plant-based foods. • Concerning the safety of Greek plant food, Greek consumers are profoundly divided.
RQ2: Which sociodemographic and attitudinal variables predict Greek consumers' personal perspectives on Greek plant food safety?	• The perceived safety of plant-based foods has a positive impact and is driven by control measures and effective enforcement of pesticide and food safety regulations. • Higher education positively affects consumer food safety perceptions. • Greek consumers over the age of 45 are more likely to consider plant foods safe because of their higher level of education. • Male gender positively influences consumer perceptions. • Plant-based food traceability and certification in Greece greatly affect consumer food safety perception. • Perceptions regarding pesticide use benefits positively affect Greek food safety. • High pesticide residue risk perception lowers the perceived food safety. • Pesticide users who are consumers of their own food may have concerns about the safety of Greek food products. • Providing authoritative information on pesticides positively affects the perceived safety of plant foods in Greece.
RQ3: What is the role of information sources in forming consumer perceptions of the safety of Greek plant foods?	• For those unfamiliar with pesticide use and food safety standards, Greek products are considered less safe than EU produce. • Inadequate knowledge is associated with increased risk perception. • Effective communication is essential to ensure that Greek consumers understand food safety regulations, particularly those related to pesticides. Clear and authoritative information should take into account sociodemographic predictors of consumer behaviour.

Limitations of this study include the exclusion of those who are not technologically literate, the use of self-reported data, and a sample that may not accurately represent Greece's population in terms of education, occupation, and those over 65 years of age due to the nature of the survey. The study's strengths are the large, nationwide, gender-representative sample with a diverse representation of educational levels and occupational categories, urban and rural residences.

Author Contributions: Conceptualization, K.B.S.; methodology, K.B.S.; software, K.B.S.; formal analysis, K.B.S.; investigation, K.B.S. and E.R.; resources, K.B.S. and E.R.; data curation, K.B.S.; writing—original draft preparation, K.B.S. and P.E.S.; writing—review and editing, K.B.S., P.E.S. and E.R.; visualization, K.B.S.; supervision, K.B.S. and E.R. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: There are no studies involving humans or animals.

Informed Consent Statement: Not applicable.

Data Availability Statement: All data are included in the paper.

Acknowledgments: The authors would like to thank the three peer reviewers for their substantial contribution to the improvement of the article. We are also grateful to all the respondents to the survey. Finally, we would like to express our gratitude to the Editorial Board of the journal Agrochemicals.

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

Appendix A

Table A1. Sociodemographic characteristics of the respondents (n = 1.846).

Demographic Variables		Frequency	Percentage
Gender	Female	896	48.50%
	Male	950	51.50%
Age	18–24	220	11.90%
	25–34	195	10.60%
	35–44	404	21.90%
	45–54	669	36.20%
	55–64	304	16.50%
	≥65	54	2.90%
Educational background	Less than high school	31	1.70%
	High school–Technical education	397	21.50%
	Bachelor's degree	727	39.40%
	Master's degree	565	30.60%
	Doctoral degree	126	6.80%
Residential geographical area	Northern Greece	540	29.30%
	Central Greece	473	26.60%
	Southern Greece	833	45.10%
Population of place of residence	Less than 10,000 inhabitants (rural)	468	25.40%
	More than 10,000 inhabitants (urban)	1378	74.60%
Underage children in the family	No	1027	55.60%
	Yes	819	44.40%
Plenty of spare time	No	735	39.80%
	Yes	1111	60.20%
Smoking habits	No	1404	76.10%
	Yes	442	23.90%
Vegetarian by choice	No	1722	93.30%
	Yes	124	6.70%
Physical activity habits	Never	243	13.20%
	Occasionally	1207	65.40%
	Systematically	396	21.40%
Professional or amateur pesticide users	No	1058	57.30%
	Yes	788	42.70%
Occupation	Civil servants	814	44.10%
	Private employees	344	18.60%
	Self-employed	224	12.10%
	Farmers	98	5.30%
	Unemployed	71	3.90%
	University students	215	11.70%
	Retired	80	4.30%

Table A2. Results of the principal component analysis.

Original Variables (5-Point Likert Scale Statements)	Median [(1)]	IQR [(2)]	Principal Components						Uniqueness [(3)]
			Oinf Official Information Sources	Benefit Perceived Pesticides' Benefits	Ginf General Information Sources	Trace Confidence in Traceability	Risk Perceived Pesticides' Risk	Safe Perceived Plant Food Safety	
Official Websites as sources for pesticide information	3	2	0.918						0.185
Newsletters from public institutions	3	2	0.866						0.259
Scientific periodicals	3	2	0.853						0.270
I receive information on pesticides from Agronomists	4	3	0.712						0.428
Pesticides contribute to national income growth	4	1		0.836					0.383
Pesticides help increase food production	4	1		0.797					0.441
The use of agrochemicals is an unavoidable fact	4	2		0.719					0.470
The correct use of pesticides safeguards the user	4	2		0.697					0.418
The proper use of pesticides protects the consumer	4	2		0.652					0.411
My information sources about pesticides are TV/Radio	2	2			0.791				0.358
Electronic Press	3	2			0.789				0.282
Press	2	2			0.743				0.373
Social Media	2	2			0.716				0.483
Labelling (traceability) reassures me	4	1				0.865			0.273
Safety of certified food products	4	1				0.843			0.303
Products from Integrated Crop Management are safe	4	1				0.819			0.310
I feel that my health has been at risk	3	1					0.820		0.288
I feel uncertain about the health of my own people	4	2					0.793		0.424
Pesticide residues in food make me concerned about my safety	5	1					0.787		0.347
Food of plant origin is generally safe to consume	4	2						0.893	0.295
The consumption of fruit and vegetables does not generally pose a risk to the consumer	3	2						0.733	0.345
Plant-based foods are tested for pesticide residues	3	2						0.636	0.450
The sum of the squared loadings			2.970	2.795	2.390	2.245	1.982	1.823	
Scale reliability (McDonald's ω)			0.865	0.796	0.774	0.795	0.720	0.698	
Explained variance %			13.502	12.706	10.863	10.205	9.008	8.288	
Cumulative variance %			13.502	26.208	37.071	47.275	56.283	64.571	
Bartlett's Test of Sphericity	X^2 = 14,294.113; df = 231; $p < 0.001$								
KMO Measure of Sampling Adequacy test	0.829								

(1)—Median of the distribution of participants' answers to the 5-point Likert scale questions (1 = never to 5 = usually, or 1 = strongly disagree to 5 = strongly agree, whichever applies). (2)—Interquartile range. (3)—Proportion of variance that is "unique" to the variable and not explained by the PCs. Uniqueness equals 1-communality. The lower the uniqueness, the higher the relevance of the variable in the PC model. Note: "promax" rotation was used, and variable loadings > 0.6 and uniqueness < 0.5 were selected.

Table A3. Results of binomial logistic regression analysis.

Model Coefficients–Dependent Variable: Plant Food Produced in Greece is as Safe as in other EU Member States in Terms of Pesticide Residues									
				Wald Test			**95% Confidence Interval**		
Predictor	**Estimate, b**	**Standard Error**	**z**	**Statistic**	**df**	***p***	**Odds Ratio**	**Lower**	**Upper**
Intercept	−0.637	0.145	−4.399	19.353	1	<0.001	0.529	0.398	0.702
SAFE (Perceived plant food safety)	0.863	0.066	12.991	168.755	1	<0.001	2.369	2.080	2.698
Higher education	0.553	0.134	4.129	17.045	1	<0.001	1.738	1.337	2.260
Age group ≥ 45 years old	0.423	0.112	3.773	14.233	1	<0.001	1.527	1.226	1.903
OINF (Official information sources)	0.408	0.063	6.468	41.836	1	<0.001	1.504	1.329	1.701
Male gender	0.308	0.116	2.657	7.058	1	0.010	1.361	1.084	1.708
TRACE (Confidence in traceability)	0.231	0.062	3.702	13.707	1	<0.001	1.259	1.115	1.423
BENEFIT (Perceived pesticide benefits)	0.228	0.065	3.524	12.420	1	<0.001	1.256	1.106	1.426
RISK (Perceived pesticide risk)	−0.123	0.061	−2.006	4.024	1	0.045	0.884	0.784	0.997
Pesticides user status	−0.327	0.137	−2.395	5.736	1	0.020	0.721	0.551	0.942
Predictive measures: AUC = 0.790; Sensitivity = 0.709; Specificity = 0.736									

Note: Estimates represent the log odds of "Plant food produced in Greece is as safe as in other EU member States = 1" vs. "Plant food produced in Greece is as safe as in other EU member-States = 0".

References

1. Pawlak, K.; Kołodziejczak, M. The Role of Agriculture in Ensuring Food Security in Developing Countries: Considerations in the Context of the Problem of Sustainable Food Production. *Sustainability* **2020**, *12*, 5488. [CrossRef]
2. FAO. *Strategic Priorities for Food Safety FAO within the FAO Strategic Framework 2022–2031*; FAO: Rome, Italy, 2023.
3. Damalas, C.A.; Eleftherohorinos, I.G. Pesticide Exposure, Safety Issues, and Risk Assessment Indicators. *IJERPH* **2011**, *8*, 1402–1419. [CrossRef]
4. Carvalho, F.P. Agriculture, Pesticides, Food Security and Food Safety. *Environ. Sci. Policy* **2006**, *9*, 685–692. [CrossRef]
5. Cooper, J.; Dobson, H. The Benefits of Pesticides to Mankind and the Environment. *Crop Prot.* **2007**, *26*, 1337–1348. [CrossRef]
6. Zhang, M.; Zeiss, M.R.; Geng, S. Agricultural Pesticide Use and Food Safety: California's Model. *J. Integr. Agric.* **2015**, *14*, 2340–2357. [CrossRef]
7. Gustavsson, J.; Cederberg, J.; Sonesson, U.; van Otterdijk, R.; Meybeck, A. *Global Food Losses and Food Waste: Extent, Causes and Prevention*; Food and Agriculture Organization of the United Nations: Rome, Italy, 2011.
8. De Bon, H.; Huat, J.; Parrot, L.; Sinzogan, A.; Martin, T.; Malézieux, E.; Vayssières, J.-F. Pesticide Risks from Fruit and Vegetable Pest Management by Small Farmers in Sub-Saharan Africa. A Review. *Agron. Sustain. Dev.* **2014**, *34*, 723–736. [CrossRef]
9. Savary, S.; Ficke, A.; Aubertot, J.-N.; Hollier, C. Crop Losses Due to Diseases and Their Implications for Global Food Production Losses and Food Security. *Food Sec.* **2012**, *4*, 519–537. [CrossRef]
10. Savary, S.; Willocquet, L.; Pethybridge, S.J.; Esker, P.; McRoberts, N.; Nelson, A. The Global Burden of Pathogens and Pests on Major Food Crops. *Nat. Ecol. Evol.* **2019**, *3*, 430–439. [CrossRef]
11. Sharma, S.; Kooner, R.; Arora, R. Insect Pests and Crop Losses. In *Breeding Insect Resistant Crops for Sustainable Agriculture*; Arora, R., Sandhu, S., Eds.; Springer: Singapore, 2017; pp. 45–66. ISBN 978-981-10-6055-7.
12. Kim, K.-H.; Kabir, E.; Jahan, S.A. Exposure to Pesticides and the Associated Human Health Effects. *Sci. Total Environ.* **2017**, *575*, 525–535. [CrossRef]
13. Magkos, F.; Arvaniti, F.; Zampelas, A. Organic Food: Buying More Safety or Just Peace of Mind? A Critical Review of the Literature. *Crit. Rev. Food Sci. Nutr.* **2006**, *46*, 23–56. [CrossRef]
14. Curl, C.L.; Beresford, S.A.A.; Fenske, R.A.; Fitzpatrick, A.L.; Lu, C.; Nettleton, J.A.; Kaufman, J.D. Estimating Pesticide Exposure from Dietary Intake and Organic Food Choices: The Multi-Ethnic Study of Atherosclerosis (MESA). *Environ. Health Perspect.* **2015**, *123*, 475–483. [CrossRef]
15. Tago, D.; Andersson, H.; Treich, N. Pesticides and Health: A Review of Evidence on Health Effects, Valuation of Risks, and Benefit-Cost Analysis. In *Advances in Health Economics and Health Services Research*; Blomquist, G.C., Bolin, K., Eds.; Emerald Group Publishing Limited: Bingley, UK, 2014; Volume 24, pp. 203–295. ISBN 978-1-78441-029-2.
16. Bolognesi, C.; Morasso, G. Genotoxicity of Pesticides. *Trends Food Sci. Technol.* **2000**, *11*, 182–187. [CrossRef]
17. Nicolopoulou-Stamati, P.; Maipas, S.; Kotampasi, C.; Stamatis, P.; Hens, L. Chemical Pesticides and Human Health: The Urgent Need for a New Concept in Agriculture. *Front. Public Health* **2016**, *4*, 148. [CrossRef]
18. Costa, L.G. The Neurotoxicity of Organochlorine and Pyrethroid Pesticides. In *Handbook of Clinical Neurology*; Elsevier: Amsterdam, The Netherlands, 2015; Volume 131, pp. 135–148. [CrossRef]
19. Lee, I.; Eriksson, P.; Fredriksson, A.; Buratovic, S.; Viberg, H. Developmental Neurotoxic Effects of Two Pesticides: Behavior and Neuroprotein Studies on Endosulfan and Cypermethrin. *Toxicology* **2015**, *335*, 1–10. [CrossRef]
20. Ma, M.; Chen, C.; Yang, G.; Li, Y.; Chen, Z.; Qian, Y. Combined Cytotoxic Effects of Pesticide Mixtures Present in the Chinese Diet on Human Hepatocarcinoma Cell Line. *Chemosphere* **2016**, *159*, 256–266. [CrossRef]

21. Wang, T.; Ma, M.; Chen, C.; Yang, X.; Qian, Y. Three Widely Used Pesticides and Their Mixtures Induced Cytotoxicity and Apoptosis through the ROS-Related Caspase Pathway in HepG2 Cells. *Food Chem. Toxicol.* **2021**, *152*, 112162. [CrossRef]
22. Graillot, V.; Takakura, N.; Hegarat, L.L.; Fessard, V.; Audebert, M.; Cravedi, J.-P. Genotoxicity of Pesticide Mixtures Present in the Diet of the French Population. *Environ. Mol. Mutagen.* **2012**, *53*, 173–184. [CrossRef]
23. Matich, E.K.; Laryea, J.A.; Seely, K.A.; Stahr, S.; Su, L.J.; Hsu, P.-C. Association between Pesticide Exposure and Colorectal Cancer Risk and Incidence: A Systematic Review. *Ecotoxicol. Environ. Saf.* **2021**, *219*, 112327. [CrossRef]
24. Wirdefeldt, K.; Adami, H.-O.; Cole, P.; Trichopoulos, D.; Mandel, J. Epidemiology and Etiology of Parkinson's Disease: A Review of the Evidence. *Eur. J. Epidemiol.* **2011**, *26*, 1–58. [CrossRef]
25. Curl, C.L.; Fenske, R.A.; Elgethun, K. Organophosphorus Pesticide Exposure of Urban and Suburban Preschool Children with Organic and Conventional Diets. *Environ. Health Perspect.* **2003**, *111*, 377–382. [CrossRef]
26. Lu, C.; Barr, D.B.; Pearson, M.A.; Waller, L.A. Dietary Intake and Its Contribution to Longitudinal Organophosphorus Pesticide Exposure in Urban/Suburban Children. *Environ. Health Perspect.* **2008**, *116*, 537–542. [CrossRef]
27. Ding, G.; Bao, Y. Revisiting Pesticide Exposure and Children's Health: Focus on China. *Sci. Total Environ.* **2014**, *472*, 289–295. [CrossRef]
28. Lozowicka, B. Health Risk for Children and Adults Consuming Apples with Pesticide Residue. *Sci. Total Environ.* **2015**, *502*, 184–198. [CrossRef]
29. Yue, M.; Liu, Q.; Wang, F.; Zhou, W.; Liu, L.; Wang, L.; Zou, Y.; Zhang, L.; Zheng, M.; Zeng, S.; et al. Urinary Neonicotinoid Concentrations and Pubertal Development in Chinese Adolescents: A Cross-Sectional Study. *Environ. Int.* **2022**, *163*, 107186. [CrossRef]
30. Kortenkamp, A. Ten Years of Mixing Cocktails: A Review of Combination Effects of Endocrine-Disrupting Chemicals. *Environ. Health Perspect.* **2007**, *115* (Suppl. S1), 98–105. [CrossRef]
31. Laetz, C.A.; Baldwin, D.H.; Collier, T.K.; Hebert, V.; Stark, J.D.; Scholz, N.L. The Synergistic Toxicity of Pesticide Mixtures: Implications for Risk Assessment and the Conservation of Endangered Pacific Salmon. *Environ. Health Perspect.* **2009**, *117*, 348–353. [CrossRef]
32. Laetz, C.A.; Baldwin, D.H.; Hebert, V.; Stark, J.D.; Scholz, N.L. Interactive Neurobehavioral Toxicity of Diazinon, Malathion, and Ethoprop to Juvenile Coho Salmon. *Environ. Sci. Technol.* **2013**, *47*, 2925–2931. [CrossRef]
33. Laetz, C.A.; Baldwin, D.H.; Hebert, V.R.; Stark, J.D.; Scholz, N.L. Elevated Temperatures Increase the Toxicity of Pesticide Mixtures to Juvenile Coho Salmon. *Aquat. Toxicol.* **2014**, *146*, 38–44. [CrossRef]
34. Rizzati, V.; Briand, O.; Guillou, H.; Gamet-Payrastre, L. Effects of Pesticide Mixtures in Human and Animal Models: An Update of the Recent Literature. *Chem. Biol. Interact.* **2016**, *254*, 231–246. [CrossRef]
35. Boobis, A.R.; Ossendorp, B.C.; Banasiak, U.; Hamey, P.Y.; Sebestyen, I.; Moretto, A. Cumulative Risk Assessment of Pesticide Residues in Food. *Toxicol. Lett.* **2008**, *180*, 137–150. [CrossRef]
36. Boobis, A.; Budinsky, R.; Collie, S.; Crofton, K.; Embry, M.; Felter, S.; Hertzberg, R.; Kopp, D.; Mihlan, G.; Mumtaz, M.; et al. Critical Analysis of Literature on Low-Dose Synergy for Use in Screening Chemical Mixtures for Risk Assessment. *Crit. Rev. Toxicol.* **2011**, *41*, 369–383. [CrossRef]
37. Hernández, A.F.; Gil, F.; Tsatsakis, A.M. Biomarkers of Chemical Mixture Toxicity. In *Biomarkers in Toxicology*; Elsevier: Amsterdam, The Netherlands, 2019; pp. 569–585. [CrossRef]
38. Hernández, A.F.; Gil, F.; Lacasaña, M. Toxicological Interactions of Pesticide Mixtures: An Update. *Arch. Toxicol.* **2017**, *91*, 3211–3223. [CrossRef]
39. European Food Safety Authority (EFSA); Carrasco Cabrera, L.; Di Piazza, G.; Dujardin, B.; Medina Pastor, P. The 2021 European Union Report on Pesticide Residues in Food. *EFS2* **2023**, *21*, 7939. [CrossRef]
40. European Food Safety Authority (EFSA); Craig, P.S.; Dujardin, B.; Hart, A.; Hernández-Jerez, A.F.; Hougaard Bennekou, S.; Kneuer, C.; Ossendorp, B.; Pedersen, R.; Wolterink, G.; et al. Cumulative Dietary Risk Characterisation of Pesticides That Have Acute Effects on the Nervous System. *EFS2* **2020**, *18*, e06087. [CrossRef]
41. European Food Safety Authority (EFSA); Craig, P.S.; Dujardin, B.; Hart, A.; Hernandez-Jerez, A.F.; Hougaard Bennekou, S.; Kneuer, C.; Ossendorp, B.; Pedersen, R.; Wolterink, G.; et al. Cumulative Dietary Risk Characterisation of Pesticides That Have Chronic Effects on the Thyroid. *EFS2* **2020**, *18*, e06088. [CrossRef]
42. European Food Safety Authority (EFSA); Dujardin, B. Comparison of Cumulative Dietary Exposure to Pesticide Residues for the Reference Periods 2014–2016 and 2016–2018. *EFS2* **2021**, *19*, e06394. [CrossRef]
43. European Food Safety Authority (EFSA). *Food Safety in the EU: Report*; Special Eurobarometer—March 2022; Publications Office: Luxembourg, 2022; Available online: https://www.efsa.europa.eu/sites/default/files/2022-09/EB97.2-food-safety-in-the-EU_report.pdf (accessed on 10 August 2023).
44. Reiss, R.; Johnston, J.; Tucker, K.; DeSesso, J.M.; Keen, C.L. Estimation of Cancer Risks and Benefits Associated with a Potential Increased Consumption of Fruits and Vegetables. *Food Chem. Toxicol.* **2012**, *50*, 4421–4427. [CrossRef]
45. Valcke, M.; Bourgault, M.-H.; Rochette, L.; Normandin, L.; Samuel, O.; Belleville, D.; Blanchet, C.; Phaneuf, D. Human Health Risk Assessment on the Consumption of Fruits and Vegetables Containing Residual Pesticides: A Cancer and Non-Cancer Risk/Benefit Perspective. *Environ. Int.* **2017**, *108*, 63–74. [CrossRef]

46. Sandoval-Insausti, H.; Chiu, Y.-H.; Lee, D.H.; Wang, S.; Hart, J.E.; Mínguez-Alarcón, L.; Laden, F.; Ardisson Korat, A.V.; Birmann, B.; Heather Eliassen, A.; et al. Intake of Fruits and Vegetables by Pesticide Residue Status in Relation to Cancer Risk. *Environ. Int.* **2021**, *156*, 106744. [CrossRef]
47. Slovic, P.; Malmfors, T.; Krewski, D.; Mertz, C.K.; Neil, N.; Bartlett, S. Intuitive Toxicology. II. Expert and Lay Judgments of Chemical Risks in Canada. *Risk Anal.* **1995**, *15*, 661–675. [CrossRef]
48. Abe, A.; Koyama, K.; Uehara, C.; Hirakawa, A.; Horiguchi, I. Changes in the Risk Perception of Food Safety between 2004 and 2018. *Food Saf.* **2020**, *8*, 90–96. [CrossRef]
49. Atreya, N. Pesticides in Perspective Does the Mere Precence of a Pesticide Residue in Food Indicate a Risk? *J. Environ. Monitor.* **2000**, *2*, 53N–56N. [CrossRef]
50. Yeung, R.M.W.; Morris, J. Food Safety Risk: Consumer Perception and Purchase Behaviour. *Br. Food J.* **2001**, *103*, 170–187. [CrossRef]
51. Krystallis, A.; Frewer, L.; Rowe, G.; Houghton, J.; Kehagia, O.; Perrea, T. A Perceptual Divide? Consumer and Expert Attitudes to Food Risk Management in Europe. *Health Risk Soc.* **2007**, *9*, 407–424. [CrossRef]
52. Van Der Vossen-Wijmenga, W.P.; Zwietering, M.H.; Boer, E.P.J.; Velema, E.; Den Besten, H.M.W. Perception of Food-Related Risks: Difference between Consumers and Experts and Changes over Time. *Food Control* **2022**, *141*, 109142. [CrossRef]
53. FAO. *Guide to Ranking Food Safety Risks at the National Level*; FAO: Rome, Italy, 2020; ISBN 978-92-5-133282-5.
54. Whaley, S.R.; Tucker, M. The Influence of Perceived Food Risk and Source Trust on Media System Dependency. *J. Appl. Commun.* **2004**, *88*, 9–19. [CrossRef]
55. Hohl, K.; Gaskell, G. European Public Perceptions of Food Risk: Cross-National and Methodological Comparisons: European Public Perceptions of Food Risk. *Risk Anal.* **2008**, *28*, 311–324. [CrossRef]
56. Simoglou, K.B.; Roditakis, E. Consumers' Benefit—Risk Perception on Pesticides and Food Safety—A Survey in Greece. *Agriculture* **2022**, *12*, 192. [CrossRef]
57. Han, G.; Yan, S.; Fan, B. Regional Regulations and Public Safety Perceptions of Quality-of-Life Issues: Empirical Study on Food Safety in China. *Healthcare* **2020**, *8*, 275. [CrossRef]
58. Williams, P.R.D.; Hammitt, J.K. Perceived Risks of Conventional and Organic Produce: Pesticides, Pathogens, and Natural Toxins. *Risk Anal.* **2001**, *21*, 319–330. [CrossRef]
59. Siegrist, M. Trust and Risk Perception: A Critical Review of the Literature. *Risk Anal.* **2021**, *41*, 480–490. [CrossRef]
60. Schmitt, J.B.; Debbelt, C.A.; Schneider, F.M. Too Much Information? Predictors of Information Overload in the Context of Online News Exposure. *Inf. Commun. Soc.* **2018**, *21*, 1151–1167. [CrossRef]
61. Kotelenets, E.; Barabash, V. Propaganda and Information Warfare in Contemporary World: Definition Problems, Instruments and Historical Context. In Proceedings of the International Conference on Man-Power-Law-Governance: Interdisciplinary Approaches (MPLG-IA 2019), Moscow, Russia, 24–25 September 2019; Atlantis Press: Moscow, Russia, 2019. [CrossRef]
62. Harris, C.A.; Renfrew, M.J.; Woolridge, M.W. Assessing the Risks of Pesticide Residues to Consumers: Recent and Future Developments. *Food Addit. Contam.* **2001**, *18*, 1124–1129. [CrossRef]
63. Tiozzo, B.; Pinto, A.; Neresini, F.; Sbalchiero, S.; Parise, N.; Ruzza, M.; Ravarotto, L. Food Risk Communication: Analysis of the Media Coverage of Food Risk on Italian Online Daily Newspapers. *Qual Quant* **2019**, *53*, 2843–2866. [CrossRef]
64. Laybats, C.; Tredinnick, L. Post Truth, Information, and Emotion. *Bus. Inf. Rev.* **2016**, *33*, 204–206. [CrossRef]
65. Rochlin, N. Fake News: Belief in Post-Truth. *LHT* **2017**, *35*, 386–392. [CrossRef]
66. Ueland, Ø.; Gunnlaugsdottir, H.; Holm, F.; Kalogeras, N.; Leino, O.; Luteijn, J.M.; Magnússon, S.H.; Odekerken, G.; Pohjola, M.V.; Tijhuis, M.J.; et al. State of the Art in Benefit–Risk Analysis: Consumer Perception. *Food Chem. Toxicol.* **2012**, *50*, 67–76. [CrossRef]
67. Lobb, A.E.; Mazzocchi, M.; Traill, W.B. Modelling Risk Perception and Trust in Food Safety Information within the Theory of Planned Behaviour. *Food Qual. Prefer.* **2007**, *18*, 384–395. [CrossRef]
68. Kumar, S.; West, R.; Leskovec, J. Disinformation on the Web: Impact, Characteristics, and Detection of Wikipedia Hoaxes. In Proceedings of the 25th International Conference on World Wide Web, Montréal, QC, Canada, 11–15 April 2016; International World Wide Web Conferences Steering Committee: Montréal, QC, Canada, 2016; pp. 591–602. [CrossRef]
69. Metaxa-Kakavouli, D.; Torres-Echeverry, N. Google's Role in Spreading Fake News and Misinformation. *SSRN J.* **2017**. [CrossRef]
70. Papadopoulos, A.; Sargeant, J.M.; Majowicz, S.E.; Sheldrick, B.; McKeen, C.; Wilson, J.; Dewey, C.E. Enhancing Public Trust in the Food Safety Regulatory System. *Health Policy* **2012**, *107*, 98–103. [CrossRef]
71. Lofstedt, R.E. How Can We Make Food Risk Communication Better: Where Are We and Where Are We Going? *J. Risk Res.* **2006**, *9*, 869–890. [CrossRef]
72. FAO. *The Application of Risk Communication to Food Standards and Safety Matters: Report of a Joint FAO/WHO Expert Consultation, Rome, 2–6 February 1998*; World Health Organization, Food and Agriculture Organization of the United Nations, Eds.; FAO food and nutrition paper; World Health Organization: Geneva, Switzerland; Food and Agriculture Organization of the United Nations: Rome, Italy, 1999.
73. Swinnen, J.F.M.; McCluskey, J.; Francken, N. Food Safety, the Media, and the Information Market. *Agric. Econ.* **2005**, *32*, 175–188. [CrossRef]
74. Meagher, K.D. Public Perceptions of Food-Related Risks: A Cross-National Investigation of Individual and Contextual Influences. *J. Risk Res.* **2019**, *22*, 919–935. [CrossRef]

75. Carslaw, N. Communicating Risks Linked to Food—The Media's Role. *Trends Food Sci. Technol.* **2008**, *19*, S14–S17. [CrossRef]
76. McCarthy, M.; Brennan, M.; De Boer, M.; Ritson, C. Media Risk Communication—What Was Said by Whom and How Was It Interpreted. *J. Risk Res.* **2008**, *11*, 375–394. [CrossRef]
77. Peters, H.P.; Dunwoody, S. Scientific Uncertainty in Media Content: Introduction to This Special Issue. *Public Underst. Sci.* **2016**, *25*, 893–908. [CrossRef]
78. Kehagia, O.; Chrysochou, P. The Reporting of Food Hazards by the Media: The Case of Greece. *Soc. Sci. J.* **2007**, *44*, 721–733. [CrossRef]
79. Koch, S.; Epp, A.; Lohmann, M.; Böl, G.-F. Pesticide Residues in Food: Attitudes, Beliefs, and Misconceptions among Conventional and Organic Consumers. *J. Food Prot.* **2017**, *80*, 2083–2089. [CrossRef]
80. Skarpa, P.E.; Garoufallou, E. Information Seeking Behavior and COVID-19 Pandemic: A Snapshot of Young, Middle Aged and Senior Individuals in Greece. *Int. J. Med. Inform.* **2021**, *150*, 104465. [CrossRef]
81. European Food Safety Authority (EFSA). Food-Related Risks. Report; Special Eurobarometer—June 2010. Available online: https://www.efsa.europa.eu/sites/default/files/corporate_publications/files/reporten.pdf (accessed on 10 August 2023).
82. European Food Safety Authority (EFSA). Food-Related Risks. Report; Special Eurobarometer—April 2019. Available online: https://www.efsa.europa.eu/sites/default/files/corporate_publications/files/Eurobarometer2019_Food-safety-in-the-EU_Full-report.pdf (accessed on 10 August 2023).
83. Hair, J.F.; Black, W.C.; Babin, B.J.; Anderson, R.E. *Multivariate Data Analysis*, 8th ed.; Cengage: Andover, Hampshire, 2019.
84. Weller, B.E.; Bowen, N.K.; Faubert, S.J. Latent Class Analysis: A Guide to Best Practice. *J. Black Psychol.* **2020**, *46*, 287–311. [CrossRef]
85. The Jamovi Project. Jamovi (Version 2.3)—Computer Software. Available online: https://www.jamovi.org (accessed on 30 July 2023).
86. JASP Team. JASP (Version 0.17.3)—Computer software. Available online: https://jasp-stats.org (accessed on 30 July 2023).
87. Verbeke, W.; Frewer, L.J.; Scholderer, J.; De Brabander, H.F. Why Consumers Behave as They Do with Respect to Food Safety and Risk Information. *Anal. Chim. Acta* **2007**, *586*, 2–7. [CrossRef]
88. Karagianni, P.; Tsakiridou, E.; Tsakiridou, H.; Mattas, K. Consumer Perceptions about Fruit and Vegetable Quality Attributes: Evidence from a Greek Survey. *Acta Hortic.* **2003**, *604*, 345–352. [CrossRef]
89. Wilcock, A.; Pun, M.; Khanona, J.; Aung, M. Consumer Attitudes, Knowledge and Behaviour: A Review of Food Safety Issues. *Trends Food Sci. Technol.* **2004**, *15*, 56–66. [CrossRef]
90. Dickson-Spillmann, M.; Siegrist, M.; Keller, C. Attitudes toward Chemicals Are Associated with Preference for Natural Food. *Food Qual. Prefer.* **2011**, *22*, 149–156. [CrossRef]
91. Li, Z.; Sha, Y.; Song, X.; Yang, K.; ZHao, K.; Jiang, Z.; Zhang, Q. Impact of Risk Perception on Customer Purchase Behavior: A Meta-Analysis. *JBIM* **2020**, *35*, 76–96. [CrossRef]
92. Dimara, E.; Skuras, D. Consumer Demand for Informative Labeling of Quality Food and Drink Products: A European Union Case Study. *J. Consum. Mark.* **2005**, *22*, 90–100. [CrossRef]
93. Krystallis, A.; Chryssohoidis, G. Consumers' Willingness to Pay for Organic Food: Factors that Affect It and Variation per Organic Product Type. *Br. Food J.* **2005**, *107*, 320–343. [CrossRef]
94. Krystallis, A.; Fotopoulos, C.; Zotos, Y. Organic Consumers' Profile and Their Willingness to Pay (WTP) for Selected Organic Food Products in Greece. *J. Int. Consum. Mark.* **2006**, *19*, 81–106. [CrossRef]
95. Tsakiridou, E.; Zotos, Y.; Mattas, K. Employing a Dichotomous Choice Model to Assess Willingness to Pay (WTP) for Organically Produced Products. *J. Food Prod. Mark.* **2006**, *12*, 59–69. [CrossRef]
96. Tsakiridou, E.; Boutsouki, C.; Zotos, Y.; Mattas, K. Attitudes and Behaviour towards Organic Products: An Exploratory Study. *Int. J. Retail Distrib. Manag.* **2008**, *36*, 158–175. [CrossRef]
97. Tsakiridou, E.; Mattas, K.; Mpletsa, Z. Consumers' Food Choices for Specific Quality Food Products. *J. Food Prod. Mark.* **2009**, *15*, 200–212. [CrossRef]
98. Tsakiridou, E.; Mattas, K.; Tsakiridou, H.; Tsiamparli, E. Purchasing Fresh Produce on the Basis of Food Safety, Origin, and Traceability Labels. *J. Food Prod. Mark.* **2011**, *17*, 211–226. [CrossRef]
99. Dunlap, R.E.; Beus, C.E. Understanding Public Concerns About Pesticides: An Empirical Examination. *J. Consum. Aff.* **1992**, *26*, 418–438. [CrossRef]
100. Slovic, P.; Fischhoff, B.; Lichtenstein, S. Facts and Fears: Understanding Perceived Risk. In *Societal Risk Assessment: How Safe Is Safe Enough?* Schwing, R.C., Albers, W.A., Eds.; Springer: Boston, MA, USA, 1980; pp. 181–216.
101. Huang, C.L. Simultaneous-Equation Model for Estimating Consumer Risk Perceptions, Attitudes, and Willingness-to-Pay for Residue-Free Produce. *J. Consum. Aff.* **1993**, *27*, 377–396. [CrossRef]
102. Leikas, S.; Lindeman, M.; Roininen, K.; Lähteenmäki, L. Who Is Responsible for Food Risks? The Influence of Risk Type and Risk Characteristics. *Appetite* **2009**, *53*, 123–126. [CrossRef]
103. Mazzocchi, M.; Lobb, A.; Bruce Traill, W.; Cavicchi, A. Food Scares and Trust: A European Study: Food Scares and Trust: A European Study. *J. Agric. Econ.* **2008**, *59*, 2–24. [CrossRef]
104. Rembischevski, P.; Caldas, E.D. Risk Perception Related to Food. *Food Sci. Technol.* **2020**, *40*, 779–785. [CrossRef]

105. Miller, H. The Multiple Dimensions of Information Quality. *Inf. Syst. Manag.* **1996**, *13*, 79–82. [CrossRef]
106. McGonagle, T. "Fake News": False Fears or Real Concerns? *Neth. Q. Hum. Rights* **2017**, *35*, 203–209. [CrossRef]