

Contents lists available at ScienceDirect

Journal of Cleaner Production



journal homepage: www.elsevier.com/locate/jclepro

# Designing and analyzing the motivational risk profile of healthy food and agricultural products purchase

# Ali Firoozzare<sup>\*</sup>, Sima Ghazanfari, Nazanin Yousefian

Agricultural Economics, Faculty of Agriculture, Ferdowsi University of Mashhad, Mashhad, Iran

#### ARTICLE INFO

#### ABSTRACT

Handling Editor: Maria Teresa Moreira

JEL classification: JEL: D81 Q18 C21 Keywords: Risk coefficient Risk matrix Generalized ordinal logit Healthy product Mashhad Several factors influence consumer preferences for food and agriculture. Knowing and evaluating these factors is necessary to promote the purchase and consumption of healthy products and correct nutritional behaviors. This study aims to identify and evaluate the risks that consumers face when buying healthy products. For this purpose, the sources of risk were displayed in a matrix, and the factors influencing the motivational risk of buying these products were investigated using the generalized ordinal logit method. The sample size in this study is 359 households that live in Mashhad- Iran, and the information on the samples is collected from an online questionnaire. The results of the risk matrix show that worrying about the low level of household income is the highest risk score, and low trust in the advice of others has the lowest score. Variables of age, education, nutritional knowledge, special diet, importance to product health, and presence of children under five years old in the household have positive effects on the risk. Variables of household expenses and government supervision have a negative effect. Suggestions like reforming the production and processing system of nutrition and agriculture in order to supply healthy, cheap, and accessible products are also made to reduce barriers to healthy nutrition.

#### 1. Introduction

In recent years, there has been a significant increase in public discussions concerning food dangers and the associated risks to human health (Rosati and Saba, 2004). This issue affects individuals of all ages, races, genders, and income levels. The development of science and technology has not only brought benefits to people but has also resulted in various adverse effects. For instance, the use of chemical fertilizers and pesticides has greatly enhanced agricultural output. However, their overuse can lead to the presence of harmful residues in food, posing health risks such as cancer and neurological issues. Additionally, these residues can contaminate water sources and cause environmental harm (Xu and Sun, 2021).

As a result of the detrimental impact of genetically modified organisms, pesticides, and other manufactured chemical products commonly used in agricultural practices, consumers have taken an interest in consuming healthier food and agricultural products (Nagib and Naka, 2020; Gupta and Sarkar, 2022). In other words, consumers are looking for a healthier diet and lifestyle due to the increase in diet-related chronic diseases and the subsequent environmental damage caused by food production and consumption (Menozzi et al., 2020; Chen et al., 2009).

Adopting healthy food affects population health, trade, the economy, and livelihoods, and to achieve it substantial changes in individuals' food choices are required, and motivation plays a central role in change (Marty et al., 2022). World Health Organization reports show that Iran is not in a good position, owing to malnutrition and a failure to follow the principles of optimal use of chemical fertilizers, poisons, and hormones for pest control in fields, as well as their effects and compounds remaining in agricultural products. The high rates of cancer, particularly digestive tract cancer, in Iran compared to other countries are linked to the presence of cadmium and nitric oxide. Different cities are experiencing this crisis at varying levels depending on their population, size, location, and economic condition.

Mashhad is Iran's second-largest and populous city after the capital of the country and one of most important agricultural centers. Mashhad has seen an increase in the incidence of incurable diseases caused by unhealthy food in recent decades, including neurological and

\* Corresponding author. *E-mail addresses:* firooz@um.ac.ir (A. Firoozzare), Sima\_ghazanfari@yahoo.com (S. Ghazanfari), nazanin.yousefian68@gmail.com (N. Yousefian).

https://doi.org/10.1016/j.jclepro.2023.139693

Received 22 April 2023; Received in revised form 25 October 2023; Accepted 7 November 2023 Available online 18 November 2023 0959-6526/© 2023 Published by Elsevier Ltd. respiratory ailments, malignancies, and cardiovascular disease (Rani et al., 2021). Despite numerous efforts to promote the choice of healthy food products, this situation is still an issue for Mashhad (Kuchaki et al., 2017). Food choices are complex and affected by various factors. Understanding the determinant factors affecting food choices could aid policy-makers in designing better strategies to promote healthy food choices for the general public (Wongprawmas et al., 2021). Also, understanding risk and perceptions of reliability could lead to more effective food policies to maintain consumer confidence in food safety (Rosati and Saba, 2004). On the other hand, checking the factors affecting the purchase gives a better insight into people's desires and fears when buying healthy products, how they make decisions, and what supports them in changing unwanted or undesirable habits.

Several researchers have investigated the issue of buying and consuming healthy food products and the risks affecting the behavior of consumers when deciding to buy food and agricultural products. For example, Gizaw (2019) examined common public health risks associated with food safety issues in the food market. The researcher identified microbial contamination of foods, chemical contamination of foods, food adulteration, improper use of food additives, incorrect labeling, genetically modified foods (GM foods), and old or expired foods as the main threats to consumers. Also, Tonkin et al. (2016) in a study introduced labeling as a symbol and risk management tool for consumers. Lockie et al. (2002) stated that the natural quality of food, food free from artificial substances and chemicals, is the most critical concern of consumers regarding the safety of food and consumer products. In another study, Liñán et al. (2019) introduced product and process values as valuable criteria for evaluating the healthiness of food. Wongprawmas et al. (2021); Basha and Lal (2018); Sirieix et al. (2011), and Mondelaers et al. (2009) considered health as the primary motivation of consumers in choosing healthy food and products. La Foucade et al. (2022) and Munt et al. (2016) mentioned lower cost, easy accessibility of unhealthy foods and products, and lack of knowledge about the value of healthy foods and products listed as barriers to healthy eating.

The mentioned studies demonstrate the necessity of focusing on purchasing and promoting healthy food. However, this matter is still not given sufficient attention in developing nations such as Iran. Furthermore, in Mashhad, which is an important hub for both agriculture and tourism, a more extensive examination of the sources of risk and factors influencing the motivational risk of buying these products is required. Therefore, this study designed and evaluated the risks that consumers face when purchasing healthy food products. In addition, the factors influencing the motivational risk of buying these products were also investigated.

#### 2. 2- Materials & methods

#### 2.1. Data collection: online survey

As Fig. 1 shows, Mashhad, the capital of Khorasan, is located in nourth eastern of Iran, and it had a population of 3,619,800 people in the 2021 (The predicted report of Iran Statistics Center, 2021). Data were collected from 359 households in Mashhad city in 2022, and questionnaires were used to collect data addressing online questionnaires. Before completing the questionnaire, their validity was checked, and the reliability of the questionnaire was confirmed by using Cronbach's alpha. The 118-item questionnaire took about 25–35 min to complete. The respondents completed the questionnaire voluntarily. Also, their anonymity was ensured, and contradictory answers were excluded from the study. Considered variables in the questionnaire and intended risks based on the review of conducted research, which will be mentioned in the next sections and interviews with academic and executive specialists and experts in the fields of nutrition and marketing have been collected. Table (1) shows the structure of the questionnaire.

# 2.2. Risk profile design template of healthy food and agricultural products consumption

The risk profile seeks to identify, evaluate, and prioritize various risks or hazards consumers face when buying food and agricultural products. The risk profile is designed in five steps. The risks are identified in the first step by using relevant literature and conducting expert interviews. The dimensions of each danger are determined in the second stage. The indicators of risk dimensions are identified in the third step, and the damages of each risk are evaluated in the fourth step utilizing field studies. The last step consists of two parts: risk frequency and impact and the risk matrix (Stoneberner et al., 2002; Hewett et al., 2004; Keegan, 2004; Girdziute, 2012; Murray et al., 2011).

Risk frequency shows the percentage of consumers who face identified risks when buying healthy food and agricultural products. The risk impact shows the impact of the identified risks on their buying behavior. The risk matrix includes the frequency of risk occurrence on one axis and the effect of risk on another axis. The risk matrix is  $3 \times 3$  to  $5 \times 5$ matrices, but based on the purpose of the study, they can have wider dimensions (Yan, 2010; Ghazanfari et al., 2021).

#### 2.2.1. Risk matrix design method in this study

After identifying the risks and worries of consumers when buying healthy products, as mentioned in Fig. 2, we will quantitatively form a risk matrix. In this study, the  $5 \times 5$  risk matrix was used to classify risks. The frequency of risk and the risk effect was divided into five classes which frequency includes 0–50%, 50–60%, 60–70%, 70–80%, and the last class is 80–100%. Then, according to the scoring method mentioned in Formula 1, the score of each house in the matrix was determined.



Fig. 1. The geographical location of the study area in Razavi Khorasan province, Iran.



Fig. 2. Risk matrix.

(1)

# $R = \sum c_i f_i \times 100$

R shows the score of each house,  $c_i$  the risk effect, and  $f_i$  the risk frequency. Finally, the risks are classified into five major areas, each with a color spectrum. These areas are scored according to the risk score of each matrix house. The first area includes a risk score of 2000–4000, the second area includes a range of 4000–5000, the third area includes a range of 5000–6000, the fourth area includes a range of 6000–7000, and

$$P(Y_i > j) = g(X\beta_j) = \frac{\exp(\alpha_j + X_i\beta_j)}{1 + \{\exp(\alpha_j + X_i\beta_j)\}}, j = 1, 2, ..., M-1$$
(2)

Where M is the number of categories of the ordinal dependent variable.

$$P(Y_i = 1) = 1 - g(X_i\beta_1)$$
  

$$P(Y_i = j) = 1 - g(X_i\beta_{j-1}) - g(X_i\beta_j)j = 2, ..., M - 1$$
  

$$P(Y_i = M) = g(X_i\beta_{M-1})$$

the fifth area includes the range of 7000-10,000 (Fig. 2).

After prioritizing, the factors affecting the risk of consumers when buying healthy food and agricultural products were investigated. Since the dependent variable is ordinal and classified into three groups (low, medium, and high), the generalized ordinal logit model was used (Williams, 2016).

### 2.3. Generalized ordered logit model (GOLM)

In econometrics, ordered logit models are used to analyze behaviors based on a ranked dependent variable. In ordinal logistic regression models, there is an important assumption that belongs to ordinal odds. According to this assumption, parameters should not change for different categories. In other words, this assumption states that the dependent variable's categories are parallel (Min, 2013; Ari, 2014; Abrudan et al., 2020).

The parallel test evaluates the hypothesis of equality of the coefficient of independent variables for all groups. Also, this test is a criterion for choosing between the ordinal logit model and the generalized ordinal logit model. The statistic  $x^2 = -2 \text{loglikelihood}_{\text{Cm}} - (-2 \text{loglikelihood}_{\text{Gm}})$  is estimated according to the following equation. Gm and Cm represent the current and general models, respectively. If the null hypothesis is rejected, the ordinal logit model will not be suitable. Then, we must use alternative models. The generalized ordered logit model (gologit) is often a superior alternative. In this study, according to the results of the parallel regression test, the null hypothesis was not accepted, and the generalized ordinal logit model was used. The gologit model is as follows (Williams, 2006; Eluru and Yasmin, 2015):

In the above relation, Yi is the ordinal dependent variable, Xi is the vector of independent variables, and  $\beta$  is the estimable parameters.

The present study investigated the factors that have the most effect on the risk of buying healthy products. The dependent variable in the model is the amount of risk factor (the product of the frequency of risk due to its effect), which is divided into 3 groups: low incentive risk (group 1), moderate incentive risk (group 2), and high incentive risk (group 3). Independent variables include age (years), education

(3)

| Section                             |                          | Subjects   | Type of<br>questions                |
|-------------------------------------|--------------------------|--|-------------------------------------|
| Introduction                        |                          | Introduction of the<br>questionnaire. Presentation of<br>the main objective. Invited to<br>cooperate | -                                   |
| Risk information                    |                          | The type of risk when buying<br>and the severity of the effect<br>of each risk                       | Likert scale<br>Multiple-<br>choice |
| Consumer-<br>related<br>information | Personal and<br>Economic | Age, education, Gender,<br>Household size, Household<br>income, Household expenses                   | Multiple-<br>choice Open-<br>ended  |
|                                     | Knowledge<br>and Values  | Awareness of the benefits of<br>healthy products<br>Special diet, Environmental<br>concerns          | Likert scale<br>Closed-ended        |
| Product- related information        |                          | Product health product price<br>Product brand<br>Product certificate                                 | Likert scale                        |

(number of years of education), gender, household expenses (dollar in month), dummy variables include presence of children under five years old at home and having a special diet. Other independent variables used in this research are divided into four groups (never, low, middle, and high): nutritional knowledge, importance of product health, importance of product price, government supervision and misbranding probability (see Table 1).

#### 3. Results and discussion

# 3.1. The risk matrix of the consumption of healthy food and agricultural products

Table 2 shows the most critical risks consumers face when buying healthy food and agricultural products that influence the motivation to buy these products.

The risks are classified from the most important to the least important. The arrangement of areas in the risk matrix shows that the most significant risk area is assigned to the second area with ten types of risk. The risk of low trust in brands, low trust in advertising contents, low trust in product quality, low trust in the seller's honesty, worrying about environmental impacts, worrying about inconsistencies with the diet, low trust in the production method and the inputs used, low trust in the seller's knowledge, low trust in labels and low trust in the provision of health certificates. The third region includes risks such as low trust in the price of products, low trust in government policies, low trust in

#### Table 2

Risks and worries of consumers when buying healthy products with their references.

| Types of risk  | Reference  |
|--|--|
| Low trust in the production method<br>and the inputs used                      | Zheng et al. (2021); Zhang et al. (2018);<br>Singh and Verma (2017); Misra and Singh<br>(2016): Lockie et al. (2002)                               |
| Low trust in the seller's knowledge<br>Low trust in labels                     | (2010), Joenne et al. (2010).<br>Buchler et al. (2010).<br>Liu (2021); Lazaroiu et al. (2019); Gizaw<br>(2019); Zhang et al. (2018); Tonkin et al. |
| Low trust in price product   | (2016); Bryła (2016).<br>La Foucade et al. (2022); Zheng et al.<br>(2021); Hansmann et al. (2020); Zhang et al.<br>(2018): Viridea et al. (2005).  |
| low trust in brands  | Bonisoli and Guañuna (2003);<br>Pandurangaro et al. (2017); Rahbar and<br>Wahid, 2011.   |
| low trust in advertising contents  | Murray et al., 2011; Naughtonet et al., 2015;<br>Rahbar and Wahid (2011).  |
| Low trust in product quality   | Nunes et al. (2020); Wang et al. (2020);<br>Bryła (2016); Misra and Singh (2016).  |
| Low trust in government policy   | Zhang et al. (2015); Barbosa et al. (2014).  |
| Low trust in monitoring devices  | Liu (2021); Barbosa et al. (2014); Voon et al. (2011).   |
| Low trust in the seller's honesty  | Zheng et al. (2021); Buchler et al. (2010).  |
| Low trust in other people's advice   | Baydas et al., 2021; Wongprawmas et al.<br>(2021); Munt et al. (2016).   |
| Low trust in the provision of health certificates                              | Liu (2021); Vega-Zamora et al. (2019);<br>Zhang et al. (2015); Kai et al. (2013);<br>Yiridoe et al. (2005).  |
| Worrying about presence a sick<br>person in the family (yourself or<br>others) | Bacârea et al. (2021); Zhang et al. (2018);<br>Misra and Singh (2016); Kai et al. (2013);<br>Yiridoe et al. (2005).                                |
| Worrying about the child's health  | Vapa-Tankosić et al. (2018); Mie et al.<br>(2017); Tonkin et al. (2016).   |
| Worrying about the healthy elderly   | Carbonneau et al. (2021); Vapa-Tankosić et al. (2018).   |
| Worrying about environmental<br>impacts  | Bonisoli and Guañuna (2023); Marty et al.<br>(2022); Cambeses-Franco et al. (2021);<br>Pandurangaro et al. (2017).                                 |
| Worrying about inconsistencies with the diet                                   | Marty et al. (2022); Melesse and Van Den<br>Berg (2021); Vapa-Tankosić et al. (2018);<br>Munt et al. (2016).                                       |
| Worrying about the low level of<br>family income                               | La Foucade et al. (2022); Singh and Verma (2017); Voon et al. (2011).  |

regulatory agencies, worry about presence a sick person in the family (yourself or others), worry about the health of the elderly, and worry about the child's health. The first and fifth regions each have a risk. The fourth area is not risky (Fig. 3).

Table 3 shows the frequency of occurrence and their score obtained from the product of frequency and risk effect. Risks are ranked from 1 to 18. The 18th level represents a negligible risk and the first level is the most important.

The results of Table 3 show that the risk of worrying about the lowincome level of the consumer household has the highest frequency, and the risk effect has been assigned the first rank among the risks. Low trust in the advice of others ranks 18th and has a minor effect and frequency. The study by Pandurangaro et al. (2017) and Zheng et al. (2021) considered the factors of the food label, hygiene, environmental worrying, price, and advertising contents as the most important factors affecting consumer decisions about organic or healthy agricultural products. Lazaroiu et al. (2019) stated product labeling has a central role in consumer decision-making. Basha and Lal (2018) and Kai et al. (2013) found the importance of environmental worries, health, product quality and price, and food safety to influence consumer behavior. Social media and advertising and the influence of friends and recommendations of others are effective in organic knowledge and creating more interest in buying these products Fannani et al. (2020). The ranking of risks is reported in Table 3 based on the risk score.

# 3.2. Investigating factors affecting the risk factor of the consumer of healthy food and agricultural products by using a generalized ordered logit model

The results of Table 4 show that the highest frequency of the dependent variable belongs to the first group (Low incentive risk) with 53.20%, followed by the second group with 36.77% and the third group with 10.03%. In this study, we considered the perceived level of risk as a factor influencing motivation for consumers to move towards purchasing and consuming healthy products. In other words, perceived risk has been contemplated as a motivator for caution, change and improvement.

#### 3.2.1. Statistical characteristics of healthy product consumers

As shown in Table 5, the average age of consumers is 30.63 years, with a maximum of 63 years and a minimum of 18 years. Roughly half of the sample population had a high level of nutritional knowledge (awareness of having healthy food, such as how to store it, how much to buy and correct nutritional behaviors (. Also, 2.51% of the respondents did not pay attention to the price, 5.57% paid little attention, 48.75% paid middle attention, and 43.18% paid much attention. Importance of product health was vital for 82.73% of people. Most people in the sample (53.20%) rated government supervision as low. 47.35% chose the middle option for misbranding probability.

Before estimating the generalized ordinal logit, the parallel regression test was performed. The results of the Brant, Wolf-Gould, likelihood ratio, and Wald tests in Table 6 indicate that the hypothesis of equality of parameters for all groups in the model estimated based on all the tests is not reasonable. According to the results of Brent's test, it is not possible to use an ordinal logit, so a generalized ordinal logit is used.

In this study, the dependent variable is in 3 groups: group 1 (low incentive risk), group 2 (moderate incentive risk), and group 3 (high incentive risk). Therefore, the number of estimated models is two groups. Also, the collinearity of the independent variables used in the model was checked, and with attention VIF = 1.21, there was no linear relationship between the variables.

In Table 7, the results of the generalized ordered logit model are reported. Group 1 was compared with groups 2 and group 3, and the results of the second group were compared to groups 1 and 2 with group 3. However, Table 7 does not report group 3. Positive coefficients indicate that the probability of consumers being at higher levels than the current levels increases with higher values of the independent variable.



Frequency of risk (percentage)

Fig. 3. Risk matrix of buying healthy products.

#### Table 3

Ranking of risks based on the frequency of occurrence and effect of risk.

| Risk name   | Frequency of occurrence (%) | Risk<br>effect<br>(%) | Risk<br>score | Rank |
|---|-----------------------------|-----------------------|---------------|------|
| low level of household income                             | 80.47                       | 74.82                 | 6020.76       | 1    |
| inconsistency with the diet                               | 61.83                       | 62.46                 | 3861.90       | 12   |
| Environmental effects                                     | 62.78                       | 60.65                 | 3807.60       | 15   |
| Elderly health  | 66.65                       | 73.78                 | 4917.43       | 5    |
| Child health  | 66.04                       | 72.33                 | 4776.67       | 6    |
| Presence a sick person in the family (yourself or others) | 75.84                       | 68.18                 | 5170.77       | 3    |
| Low trust in the Presentation<br>of a health certificate  | 62.56                       | 58.42                 | 3654.75       | 17   |
| Low trust in the advice of others                         | 54.28                       | 54.09                 | 2936          | 18   |
| Low trust in the honesty of the seller                    | 63.98                       | 62.36                 | 3989.79       | 11   |
| Low trust in monitoring<br>devices                        | 74.03                       | 68.93                 | 5102.88       | 4    |
| Low trust in government<br>policy                         | 76.23                       | 68.58                 | 5227.85       | 2    |
| Low trust in product quality                              | 69.80                       | 64.22                 | 4482.55       | 8    |
| Low trust in advertising<br>contents                      | 69.83                       | 61.34                 | 4283.37       | 9    |
| Low trust in the product brand                            | 63.70                       | 60.36                 | 3844.93       | 14   |
| Low trust in the price<br>product                         | 70.66                       | 65.25                 | 4610.56       | 7    |
| Low trust in the product label                            | 64.40                       | 59.90                 | 3857.56       | 13   |
| Low trust in the knowledge of the seller                  | 62.47                       | 59.71                 | 3730.08       | 16   |
| Low trust in the method of production and the inputs used | 68.05                       | 58.92                 | 4009.50       | 10   |

Source: research findings

In the generalized ordinal logit model, the coefficients are not

# Table 4

Description of the dependent variable.

| Group | Description             | Frequency | Percent (%) |
|-------|-------------------------|-----------|-------------|
| 1     | Low incentive risk      | 191       | 53.20       |
| 2     | Moderate incentive risk | 132       | 36.77       |
| 3     | High incentive risk     | 36        | 10.03       |
| Total |                         | 359       | 100         |

Source: research findings

interpreted directly, and the sign of the variables can be interpreted. For example, the positive coefficient of the age variable in the group 1 shows that by increasing a unit of age, the probability of consumers being placed in group 2 (moderate incentive risk) and group 3 (high incentive risk) increases compared to the level 1. Moreover, the negative coefficient of household expenses in group 1 shows that by increasing one unit of this variable, the probability of consumers being placed in groups 2 and 3 decreases compared to group 1. The base group in model estimation is the third group (high incentive risk).

According to the results of Table 7, the variables of age, nutritional knowledge, importance of product health, and misbranding probability in the first group are significant at the level of 1%, the variable of the presence of children under five years old in the household and government supervision have become significant at the level of 10%. In the second group of the dependent variable, the gender variable and the variable of having a special diet are significant at 10% and 1%, respectively, and the variables of education and household expenses are also significant at 5%.

 $x^2$  is significant at the level of 1%. It indicates the significance of the effect of the independent variables on the probability of the dependent variable. LR chi2 (22) indicates the likelihood ratio in the chi-square test, and the number in bracket indicate the degree of freedom.

There are 22 predictors in this model, so the degree of freedom of the model will be 22. Marginal effects have been used to interpret the coefficients in the logit model. The marginal effects were calculated for

#### A. Firoozzare et al.

#### Table 5

Independent variables in generalized ordered logit.

| Variables                                      | Variable Type | Frequency (%) | Mean   | Std. Dev | Max     | Min   |
|--|---------------|---------------|--------|----------|---------|-------|
| Age (Year)                                     | Continuous    |               | 30.63  | 9.07     | 63      | 18    |
| Education (Year)                               | Continuous    |               | 14.88  | 3.07     | 22      | 2     |
| Children under five years old in the household | Dummy         |               |        |          |         |       |
| Yes (1)  |               | 101 (28.13)   |        |          |         |       |
| No (0)   |               | 258 (71.87)   |        |          |         |       |
| Gender   | Dummy         |               |        |          |         |       |
| Male (1)                                       |               | 140 (39)      |        |          |         |       |
| Female (0)                                     |               | 219 (61)      |        |          |         |       |
| Observance of special diet                     |               |               |        |          |         |       |
| Yes (1)  | Dummy         | 119 (33.15)   |        |          |         |       |
| No (0)   |               | 240 (66.85)   |        |          |         |       |
| Nutritional knowledge                          | Ordered       |               |        |          |         |       |
| Never  |               | 0             |        |          |         |       |
| Middle   |               | 42 (11.7)     |        |          |         |       |
| Low  |               | 136 (37.88)   |        |          |         |       |
| High   |               | 181 (50.42)   |        |          |         |       |
| Household expenses (dollar in month)           | Continuous    |               | 282.39 | 173.45   | 1132.07 | 18.86 |
| Importance of product price                    | Ordered       |               |        |          |         |       |
| Never  |               | 9 (2.51)      |        |          |         |       |
| Low  |               | 20 (5.57)     |        |          |         |       |
| Middle   |               | 175 (48.75)   |        |          |         |       |
| High   |               | 155 (43.18)   |        |          |         |       |
| Importance of product health                   | Ordered       |               |        |          |         |       |
| Never  |               | 0             |        |          |         |       |
| Low  |               | 6 (1.67)      |        |          |         |       |
| Middle   |               | 56 (15.60)    |        |          |         |       |
| High   |               | 297 (82.73)   |        |          |         |       |
| Misbranding probability <sup>a</sup>           | Ordered       |               |        |          |         |       |
| Never  |               | 3 (0.84)      |        |          |         |       |
| Low  |               | 53 (14.76)    |        |          |         |       |
| Middle   |               | 170 (47.35)   |        |          |         |       |
| High   |               | 133 (37.05)   |        |          |         |       |
| Government supervision <sup>b</sup>            | Ordered       |               |        |          |         |       |
| Never  |               | 72 (20.06)    |        |          |         |       |
| Low  |               | 191 (53.20)   |        |          |         |       |
| Middle   |               | 89 (24.79)    |        |          |         |       |
| High   |               | 7 (1.95)      |        |          |         |       |
|  |               |               |        |          |         |       |

<sup>a</sup> Inserting the product brand without going through the process of obtaining health approval.

<sup>b</sup> The amount of government supervision on the health of agricultural products in the market. Source: research findings

## Table 6

The results of parallel regression tests.

| $\mathbf{p} > \mathbf{chi2}$ |
|------------------------------|
| 0.000                        |
| 0.000                        |
| 0.000                        |
| 0.000                        |
| 0.000                        |
|                              |

Source: research findings

each dependent variable group, and the results were presented in Table 8.

The marginal effects show the amount of change in the predicted probability for consumers to be placed in different incentive risk groups (the product of the probability of occurrence and the effect of risk) per one unit of change in the independent variable. The marginal effect of consumers' age is significant and negative only in the first group. Increasing this variable, the probability of being in a group with a low incentive risk group decrease by 0.00962. In studies by Zheng et al. (2021), Polimeni et al. (2018), and Petrovici and Ritson (2006) the negative relationship between increasing age and purchasing sustainable and healthy products is stated. The marginal effect of education level in the third group is positive and significant. In the first group, it is negative and significant. It means that by increasing the level of education by one unit and other conditions being constant, the probability of people being in the low incentive risk group decreases by 0.01509, and the probability of being in the group of high incentive risk group should be increased by 0.01599. The increase in the level of education increases people's awareness, knowledge, and understanding of food and agricultural risks, and they understand the possibility of risk, the effect of risk, or both. These results in the studies of Cardoso et al. (2020), Hansmann et al. (2020), Bacârea et al. (2021), Gil and Soler (2006), and Petrovici and Ritson (2006) can also be inferred. The marginal effect of the presence of children under five years in the household in the first group is negative and significant. It indicates that with an increase of one unit of this variable, the probability of consumers being in the group of low incentive risk group decreases by 0.10218. The presence of children under five years old brings high risk to the family and makes them pay more attention to risks and their impact and increases risk aversion. Also, Tonkin et al. (2016) showed that families with young children are risk-averse. The marginal effect of gender is positive and significant in the second group and negative and significant in the third group. It shows that with an increase of one unit of this variable and the stability of other variables, the probability of men being in the group of moderate incentive risk group increases by 0.14722, and the negative coefficient in the third group reduces the probability of men being in the high incentive risk group by 0.15788. It means that women understand the probability and effect of risk more than men and are more risk averse. The results of studies by Lima et al. (2021); Nagy Penzes et al. (2020); Munt et al. (2016); Buchler et al. (2010); Kirk et al. (2002) stated that women are more risk-averse than men and they are more careful in choosing healthy food.

The positive and significant coefficient of the marginal effect of the

#### Table 7

Results of the generalized ordered logit model.

| Variables                                   | Group 1. Low incentive risk |                       |       | Group 2. Moderate incentive risk |                    |       |  |
|---|-----------------------------|-----------------------|-------|----------------------------------|--------------------|-------|--|
|   | Coeff                       | Std.Err               | Z     | Coeff                            | Std.Err            | Z     |  |
| Age   | 0.0940***                   | 0.0369                | 2.55  | 0.0282                           | 0.0312             | 0.90  |  |
| Education                                   | 0.1473**                    | 0.0634                | 2.32  | 0.1336**                         | 0.0670             | 1.99  |  |
| Children under 5 years old in the household | 0.9983*                     | 0.5707                | 1.75  | 0.7100                           | 0.4530             | 1.57  |  |
| Gender                                      | -0.1041                     | 0.5253                | -0.20 | -1.3190*                         | 0.6757             | -1.95 |  |
| Observance of special diet                  | 0.4084                      | 0.5105                | 0.80  | 1.2288***                        | 0.4667             | 2.63  |  |
| Nutritional knowledge                       | 0.9626***                   | 0.3005                | 3.20  | -0.0114                          | 0.3102             | -0.04 |  |
| Household expenses                          | -0.0350**                   | 0.0202                | -1.73 | -0.0359**                        | 0.0175             | -2.05 |  |
| Importance of product price                 | 0.3187                      | 0.3056                | 1.04  | 0.3764                           | 0.3423             | 1.10  |  |
| Importance of product health                | 2.3415***                   | 0.6827                | 3.43  | -0.7243                          | 0.7566             | -0.96 |  |
| Misbranding probability                     | 1.2917***                   | 0.3456                | 3.74  | -0.1206                          | 0.2753             | -0.44 |  |
| Government supervision                      | -0.6158*                    | 0.3240                | -1.90 | -0.3146                          | 0.2662             | -1.18 |  |
| Constant                                    | -14.2802                    | 3.1208                | -4.58 | -2.4218                          | 2.8143             | -0.86 |  |
| Number of $obs = 213$                       | LR chi2 $(22) = 10$         | LR chi2 (22) = 104.26 |       |                                  | Pseudo $R2 = 0.26$ |       |  |
| Log Likelihood = -144.98                    | Prob > chi2 = 0.0           | 0000***               |       |                                  |                    |       |  |

\* Denotes statistical significance at the 10 percent significance level.

\*\* Denotes statistical significance at the 5 percent significance level.

\*\*\* Denotes statistical significance at the 1 percent significance level.

Source: Research findings

#### Table 8

Marginal effects of the generalized ordered logit model for three dependent variable groups.

| Variables  | The marginal<br>effect of the first<br>group (Low)<br>(Z stat) | The marginal<br>effect of the<br>second group<br>(Moderate)<br>(Z stat) | The final effect of<br>the third group<br>(High)<br>(Z stat) |
|--|--|---|--|
| Age  | -0.00962***<br>(-2.68)   | 0.00624 (1.30)  | 0.00338 (0.90)   |
| Education  | -0.01509**<br>(-2.44)  | -0.0009 (-0.10)   | 0.01599** (2.03)   |
| Children under<br>five years old in<br>the household | -0.10218*<br>(-1.80)   | 0.01720 (0.24)  | 0.08498 (1.59)   |
| Gender   | 0.01066 (0.20)   | 0.14722* (1.64)   | -0.15788**<br>(-1.99)  |
| Observance of<br>special diet                        | -0.04180 (-0.80)   | -0.10529 (-1.58)  | 0.14709***<br>(2.77)   |
| Nutritional<br>knowledge                             | -0.09852***<br>(-3.49)   | 0.09988** (2.41)  | -0.00136<br>(-0.04)  |
| Household<br>expenses                                | 0.00359* (1.80)  | 0.00071 (0.29)  | -0.00430**<br>(-2.10)  |
| Importance of<br>product price                       | -0.03262 (-1.05)   | -0.01243 (-0.27)  | 0.04505 (1.11)   |
| Importance of<br>product health                      | -0.23965***<br>(-3.87)   | 0.32635*** (3.45)   | -0.08670<br>(-0.96)  |
| Misbranding  | $-0.13220^{***}$   | 0.14664*** (3.68)   | -0.01444   |
| Government<br>supervision                            | 0.06302** (1.96)   | -0.02536 (-0.63)  | -0.03766<br>(-1.19)  |

\* Denotes statistical significance at the 10 percent significance level.

\*\* Denotes statistical significance at the 5 percent significance level.

\*\*\* Denotes statistical significance at the 1 percent significance level. Source: Research findings

special diet variable in the third group shows that people who follow a special diet have a higher probability of being in the group with a high incentive risk group by 0.14709 compared to people who do not have a diet. The result of this study is consistent with research by Liu (2021) and Padel and Foster (2005). They found a healthy diet to be effective when buying organic fruits and vegetables. The marginal effect of nutritional knowledge is negative and significant in the first group and positive and significant in the second group. It means that people who have high nutritional knowledge have a lower probability of being in the low incentive risk group by 0.09852 compared to people who low nutritional knowledge, and the probability of these people being in the

moderate incentive risk group increases by 0.09988. People with nutritional knowledge understand the possibility and effect of risk more than other people. The results of the studies by Meles and Van Den Berg (2021), Liñán et al. (2019), Thang et al. (2019), Humaria and Hudrasyah (2016), Lee et al. (2013), Petrovici and Ritson (2006), Yiridoe et al. (2005) and Demeritt (2002) also show the existence of a positive relationship between nutritional knowledge and a healthy diet. The marginal effect of household expenses is positive and significant in the first group and negative and significant in the third group. It means that, with an increase of one unit in the household expenses, with other variables being constant, the probability of consumers being in the low incentive risk group increases by 0.00359, and the probability of being placed in the high incentive risk group decreases by 0.00430. The increase in costs makes people pay less attention to risk and the impact of risk. This result in the study of Polimeni et alal., (2018) was also found. The marginal effect of importance of product health shows that the probability of people who care about product health being in the low incentive risk group decreases by 0.23965, and the probability of being in the moderate incentive risk group should be increased to 0.32635. It means that people who care about product health are more risk-averse and buy products with fewer risks. Bryła (2016) identified the product's health as the main motivation for choosing organic food in Poland. The probability of being in the low incentive risk group decreases by 0.13220 with an increase of one unit in inserting the misbranding probability. It also increases the probability of being in the moderate incentive risk group by 0.14664. Due to the low trust, these people understand the possibility and impact of more risk when buying products. This relationship in the study of Yiridoe et al. (2005) is shown. The marginal effect of government supervision is positive and significant in the first group. It means that by increasing this variable by one unit and the other variables being constant, the probability of being in the low incentive risk group increases by 0.06302 compared with other groups. This factor is mentioned in the study of Barbosa et al. (2014). Generally, the results indicate that risk aversion increases people's motivation and intention to buy healthy food and agricultural products with fewer risks and adverse effects than other products. Also, these people are more willing to buy these products than risk-takers. In other words, people who are aware of the risks of buying agricultural and food products use more healthy products.

## 4. Conclusion

In this study, we investigated the consumer risks when buying healthy food and agricultural products, identified the sources of risk, and estimated the frequency of occurrence and impact of risk. Then the sources of risk were displayed in a matrix to provide a correct and comprehensible understanding of the risk situation. The results showed that the second area with ten risks is a high-risk area. The risk of worrying about the low level of household income, the risk of low trust in government policies, and the risk of presence a sick person in the family (yourself or others) had the highest risk score based on the frequency of occurrence and the risk effect.

The results of the generalized ordinal logit model showed that in the group of low-risk, variables of age, education, the presence of children under five years in the household, nutritional knowledge, importance of product health, misbranding probability are positive and significant. Variables of government supervision and household expenses have become negative and significant. Also, in the group of moderate incentive risk, variables of education and having a special diet have positive and significant. Furthermore, marginal effects were used to interpret the coefficients of the generalized ordinal logit model. Based on the results obtained from this research and in order to use these results in the field of policy making and implementation, the following suggestions are presented.

- Determining the risk profile of consumers in buying agricultural and healthy food products provides a complete picture of existing risks and consumers' views on buying healthy products for the government and organizations related to food and agricultural products, such as the Ministry of Jihad Agriculture, Food and Drug Organization and Iran National Standards Organization (INSO)
- Determining the factors affecting the risk of consumers and the barriers to healthy food can help to plan and make appropriate policies, and review the food and agriculture system. Generally, it can be helpful for leading people to a better, healthier, and less risky life.
- The food label is one of the ways to make consumers aware of nutrients, ingredients, and production information. Consumers can use the information on food labels to decide what foods and products to buy and consume and to ensure the nutritional value and safety of food. Also, labels can increase consumer confidence and encourage them to buy healthy products. The label as an effective strategy in the market of healthy food and agriculture can have significant effects on the trust and attitudes of consumers. Also, the use of block chain technology to monitor the path of production, processing and marketing of the product can be an effective step in improving the buyer's trust in the purchased product.
- In order to have a healthier society and considering that the price of healthy products is higher than normal products and people reflect their low-income level as the most important concern, it is suggested that the government supports the production of healthy products and allocates effective subsidies for the production and supply of these products. So that these products are available in the market at a lower price. In addition, implementing supportive policies to encourage producers to produce healthy foods such as guaranteed purchasing of their products and offering low-interest loans, and also providing the necessary conditions for expanding healthy food markets in various locations of the city is proportional to individuals' purchasing power can be effective.
- By holding educational workshops, advertising in public media, and using nutritionists, people's awareness of the benefits of consuming healthy products and the harm of chemicals on human health and the environment can be increased, and chronic diseases can be prevented.
- Transparency in the programs and actions of the government and related organizations in the field of food health to increase consumer trust in government policies and the performance of supervision institutions is another suggestion that can be effective.

- To improve transparency, we can implement certain measures. Firstly, farmers and food companies should be mandated to provide comprehensive information about their products, including kind and amounts of fertilizers and poisons used, the ingredients used and the production methods employed. Additionally, the government can contribute to promoting transparency by enforcing specific standards for farmers and food companies and ensuring that consumers have access to relevant information pertaining to food safety.
- According to the research findings, the age of the buyer is a significant factor in reducing the perception of risk associated with not consuming healthy products. Thus, it is suggested to enhance the visual appeal of healthy foods, provide guidance on selecting healthy options to young individuals, educate them about the importance of healthy food, and increase their awareness of the benefits. Additionally, cafeterias in schools and universities should offer healthy food options, and the supported agriculture model should be expanded to make healthy foods more affordable.
- Benefiting from the experiences of advanced countries in the field of technical standards and certification of healthy products can be useful in promoting the purchase of these products.
- In future studies, it is suggested to use simulation techniques such as agent-based models to examine how different policies affect various beneficiary groups. This approach can enhance the efficiency and effectiveness of implemented policies and reduce implementation costs. Additionally, future studies could prioritize identifying obstacles to policy implementation for expanding the production and consumption of healthy products. They can also explore the impact of consuming unhealthy foods on different age and gender groups. By valuing the negative health consequences, the value of producing and consuming healthy food products can be further supported.

#### Declaration of competing interest

The authors declare that they have no known competing financial interests or relationships that could have appeared to influence the work reported in this manuscript.

## Data availability

The data that has been used is confidential.

# Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jclepro.2023.139693.

#### References

- Abrudan, I.N., Pop, C.M., Lazăr, P.S., 2020. Using a general ordered logit model to explain the influence of hotel facilities, general and sustainability-related, on customer ratings. Sustainability 12 (21), 9302. https://doi.org/10.3390/ su12219302.
- Ari, E., 2014. Paralel lines assumption in ordinal logistic regression and analysis approach. Int. Interdiscipl. J. Scient. Res. 1, 3.
- Bacârea, A., Bacârea, V.C., Cînpeanu, C., Teodorescu, C., Seni, A.G., Guiné, R.P., Tarcea, M., 2021. Demographic, anthropometric and food behavior data towards healthy eating in Romania. Foods 10 (3), 487. https://doi.org/10.3390/ foods10030487.
- Barbosa, L., Portilho, F., Wilkinson, J., Dubeux, V., 2014. Trust, participation and political consumerism among Brazilian youth. J. Clean. Prod. 63, 93–101. https:// doi.org/10.1016/i.iclepro.2013.08.044.
- Basha, M.B., Lal, D., 2018. Indian consumers' attitudes towards purchasing organically produced foods: an empirical study. J. Clean. Prod. 215, 99–111. https://doi.org/ 10.1016/j.jclepro.2018.12.098.
- Baydas, A., Yalman, F., Bayat, M., 2021. Consumer attitude towards organic food: determinants of healthy behaviour. Marketing i menedžment innovacij (1), 96–111. https://doi.org/10.21272/mmi.2021.1-08.
- Bonisoli, L., Guañuna, R.A.B., 2023. Going green in Ecuador: unpacking the motivations behind brand loyalty for organic products. J. Clean. Prod. 418, 138116 https://doi. org/10.1016/j.jclepro.2023.138116.

- Bryła, P., 2016. Organic food consumption in Poland: motives and barriers. Appetite 105, 737–746. https://doi.org/10.1016/j.appet.2016.07.012.
- Buchler, S., Smith, K., Lawrence, G., 2010. Food risks, old and new: demographic characteristics and perceptions of food additives, regulation and contamination in Australia. J. Sociol. 46 (4), 353–374. https://doi.org/10.1177/1440783310384.
- Cambeses-Franco, C., González-García, S., Feijoo, G., Moreira, M.T., 2021. Encompassing health and nutrition with the adherence to the environmentally sustainable new nordic diet in southern europe. J. Clean. Prod. 327, 129470 https://doi.org/ 10.1016/j.jclepro.2021.129470.
- Carbonneau, E., Pelletier, L., Begin, C., Lamarche, B., Bélanger, M., Provencher, V., Desroches, S., Robitaille, J., Vohl, M.C., Couillard, C., Bouchard, L., Houle, J., Langlois, M.F., Rabasa-Lhoret, R., Corneau, L., Lemieux, S., 2021. Individuals with self-determined motivation for eating have better overall diet quality: results from the PREDISE study. Appetite 165, 105426. https://doi.org/10.1016/j. appet.2021.105426.
- Cardoso, A.P., Ferreira, V., Leal, M., Ferreira, M., Campos, S., Guiné, R.P., 2020. Perceptions about healthy eating and emotional factors conditioning eating behaviour: a study involving Portugal, Brazil and Argentina. Foods 9 (9), 1236, 10.3390/foods9091236.
- Chen, J.S., Legrand, W., Sloan, P., 2009. Determining the motivations of German restaurant goers to eat healthy meals. J. Culin. Sci. Technol. 7 (2–3), 93–104. https://doi.org/10.1080/15428050903313358.
- Eluru, N., Yasmin, S., 2015. A note on generalized ordered outcome models. Analytic methods in accident research 8, 1–6. https://doi.org/10.1016/j.amar.2015.04.002.
- Fannani, S.I., Najib, M., Sarma, M., 2020. The effect of social media toward organic food literacy and purchase intention with AISAS model. J. Manag. Agribus. 17 (3), 285. https://doi.org/10.17358/jma.17.3.285, 285.
- Ghazanfari, S., Ghorbani, M., Dourandish, A., 2021. Designing risk profile of melon product of Mashhad city. J. Agric. Econ. Res. 4, 78–93. https://doi.org/10.30495/ jae.2021.22549.2066, 13.
- Gil, J.M., Soler, F., 2006. Knowledge and willingness to pay for organic food in Spain: evidence from experimental auctions. Acta Agricultu. Scand Sect. C 3 (3–4), 109–124. https://doi.org/10.1080/16507540601127656.
- Girdziute, L., 2012. Risks in agriculture and opportunities of their integrated evaluation. Procedia Soc. Behav. Sci. 62, 783–790. https://doi.org/10.1016/j. sbspro.2012.09.132.
- Gizaw, Z., 2019. Public health risks related to food safety issues in the food market: a systematic literature review. Environ. Health Prev. Med. 24 (1), 1–21. https://doi. org/10.1186/s12199-019-0825-5.
- Gupta, T., Sarkar, A.K., 2022. Impact of health consciousness and food safety concern on consumer buying behaviour–A review on organic food products. Asian J. Organ. Med. Chem. 7 (2), 676–686.
- Hansmann, R., Baur, I., Binder, C.R., 2020. Increasing organic food consumption: an integrating model of drivers and barriers. J. Clean. Prod. 275, 123058 https://doi. org/10.1016/j.jclepro.2020.123058.
- Hewett, C.J.M., Quinn, P.F., Whitehead, P.G., Heathwaite, A.L., Flynn, N.J., 2004. Towards a nutrient export risk matrix approach to managing agricultural pollution at source. Hydrol. Earth Syst. Sci. 8 (4), 834–845. https://doi.org/10.5194/hess-8-834-2004, 2004.
- Humaria, A., Hudrasyah, H., 2016. Factors influencing the intention to purchase and actual purchase behavior of organic food. J. Bus. Manag. 5 (4), 581–596.
- Kai, S.B., Chen, O.B., Chuan, C.S., Seong, L.C., Kevin, L.L.T., 2013. Determinants of willingness to pay of organic products. Middle East J. Sci. Res. 14 (9), 1171–1179. https://doi.org/10.5829/idosi.mejsr.2013.14.9.1959.
- Keegan, M., 2004. The orange book management of risk. HM Treasury 15–23.
- Kirk, S.F., Greenwood, D., Cade, J.E., Pearman, A.D., 2002. Public perception of a range of potential food risks in the United Kingdom. Appetite 38 (3), 189–197. https://doi. org/10.1006/appe.2001.0478.
- Kuchaki, A., Mansouri, H., Ghorbani, M., Rajabzadeh, M., 2017. Investigating factors affecting the tendency to consume organic products in Mashhad city. J. Agric. Econ. Dev. 27 (3), 188–194.
- La Foucade, A., Gabriel, S., Beharry, V., Laptiste, C., Metivier, C., Samuels, T., Edwards-Wescott, P., 2022. Assessing the determinants of unhealthy dietary habits among a sample of survey participants in Jamaica. R., Pan Am. J. Public Health 46. https:// doi.org/10.26633/RPSP.2022.72.
- Lazaroiu, G., Andronie, M., Uţă, C., Hurloiu, I., 2019. Trust management in organic agriculture: sustainable consumption behavior, environmentally conscious purchase intention, and healthy food choices. Front. Public Health 7, 340. https://doi.org/ 10.3389/fpubh.2019.00340.
- Lee, S.M., Jin, N., Kim, H.S., 2013. Relationships among knowledge of healthy food, health concern, and behavioral intention: evidence from the United States and South Korea. J. Qual. Assur. Hospit. Tourism 14 (4), 344–363.
- Lima, J.P., Costa, S.A., Brandão, T.R., Rocha, A., 2021. Food consumption determinants and barriers for healthy eating at the workplace—a university setting. Foods 10 (4), 695. https://doi.org/10.3390/foods10040695.
- Liñán, J., Arroyo, P., Carrete, L., 2019. Conceptualizing healthy food: how Consumer's values influence the perceived healthiness of a food product. J. Food Nutr. Res. 7, 679–687. https://doi.org/10.12691/jfnr-7-9-10.
- Liu, M., 2021. The effects of organic certification on shoppers' purchase intention formation in taiwan: a multi-group analysis of structural invariance. Sustainability 14 (1), 55. https://doi.org/10.3390/su14010055.
- Lockie, S., Lyons, K., Lawrence, G., Mummery, K., 2002. Eating "green": motivations behind organic food consumption in Australia. Sociol. Rural. 42 (1), 23–40. https:// doi.org/10.1111/1467-9523.00200.
- Marty, L., Chambaron, S., de Lauzon-Guillain, B., Nicklaus, S., 2022. The motivational roots of sustainable diets: analysis of food choice motives associated to health,

environmental and socio-cultural aspects of diet sustainability in a sample of French adults. Cleaner and Respons. Consump. 5, 100059 https://doi.org/10.1016/j. clrc.2022.100059.

- Melesse, M.B., Van Den Berg, M., 2021. Consumer nutrition knowledge and dietary behavior in urban Ethiopia: a comprehensive study. Ecol. Food Nutr. 60 (2), 244–256. https://doi.org/10.1080/03670244.2020.1835655.
- Menozzi, D., Nguyen, T.T., Sogari, G., Taskov, D., Lucas, S., Castro-Rial, J.L.S., Mora, C., 2020. Consumers' preferences and willingness to pay for fish products with health and environmental labels: evidence from five European countries. Nutrients 12 (9), 2650. https://doi.org/10.3390/nu12092650.
- Mie, A., Andersen, H.R., Gunnarsson, S., Kahl, J., Kesse-Guyot, E., Rembiałkowska, E., Quaglio, G., Grandjean, P., 2017. Human health implications of organic food and organic agriculture: a comprehensive review. Environ. Health 16 (1), 1–22. https:// doi.org/10.1186/s12940-017-0315-4.
- Min, H., 2013. Ordered logit regression modeling of the self-rated health in Hawai'i, with comparisons to the OLS model. J. Mod. Appl. Stat. Methods 2, 371–380. https://doi. org/10.22237/jmasm/1383279720, 12.
- Misra, R., Singh, D., 2016. An analysis of factors affecting growth of organic food: perception of consumers in Delhi-NCR (India). Br. Food J. 118 (9), 2308–2325. https://doi.org/10.1108/BFJ-02-2016-0080.
- Mondelaers, K., Verbeke, W., Van Huylenbroeck, G., 2009. Importance of health and environment as quality traits in the buying decision of organic products. Br. Food J. https://doi.org/10.1108/00070700910992952.
- Munt, A.E., Partridge, S.R., Allman-Farinelli, M., 2016. The barriers and enablers of healthy eating among young adults: a missing piece of the obesity puzzle: a scoping review. Obes. Rev. 18 (1), 1–17. https://doi.org/10.1111/obr.12472.
- Murray, S.L., Grantham, K., Damle, S.B., 2011. Development of a generic risk matrix to manage project risks. J. Industr. Systems Engin. 5 (1), 35–51, 20.1001.1.17358272.2011.5.1.3.7.
- Nagib, G., Nakamura, A.C., 2020. Urban agriculture in the city of São Paulo: new spatial transformations and ongoing challenges to guarantee the production and consumption of healthy food. Global Food Secur. 26, 100378 https://doi.org/ 10.1016/j.gfs.2020.100378.
- Nagy-Pénzes, G., Vincze, F., Sándor, J., Bíró, É., 2020. Does better health-related knowledge predict favorable health behavior in adolescents? Int. J. Environ. Res. Publ. Health 17 (5), 1680. https://doi.org/10.3390/ijerph17051680.
- Nunes, R., Silva, V.L., Consiglio-Kasemodel, M.G., Polizer, Y.J., Saes, M.S.M., Favaro-Trindade, C.S., 2020. Assessing global changing food patterns: a country-level analysis on the consumption of food products with health and wellness claims. J. Clean. Prod. 264, 121613 https://doi.org/10.1016/j.jclepro.2020.121613.
- Padel, S., Foster, C., 2005. Exploring the gap between attitudes and behaviour: understanding why consumers buy or do not buy organic food. Br. Food J. 107 (8), 606–625. https://doi.org/10.1108/00070700510611002.
- Pandurangaro, D., Chiranjeevi, K., Rao, D.S., 2017. Factors affecting consumers to buy organic food products in hyderabad and secuderabad. Int. J. Busin. Manag. Inven. 6 (3), 24–30.
- Petrovici, D.A., Ritson, C., 2006. Factors influencing consumer dietary health preventative behaviours. BMC Publ. Health 6 (1), 1–12.
- Polimeni, J.M., Iorgulescu, R.I., Mihnea, A., 2018. Understanding consumer motivations for buying sustainable agricultural products at Romanian farmers markets. J. Clean. Prod. 184, 586–597. https://doi.org/10.1016/j.jclepro.2018.02.241.
- Rahbar, E., Wahid, N.A., 2011. Investigation of green marketing tools' effect on consumers' purchase behavior. Bus. Strat. 12 (2), 73–83. https://doi.org/10.1108/ 17515631111114877.
- Rani, L., Thapa, K., Kanojia, N., Sharma, N., Singh, S., Grewal, A.S., Srivastav, L.A., Kaushal, J., 2021. An extensive review on the consequences of chemical pesticides on human health and environment. J. Clean. Prod. 283, 124657 https://doi.org/ 10.1016/j.jclepro.2020.124657.
- Rosati, S., Saba, A., 2004. The perception of risks associated with food-related hazards and the perceived reliability of sources of information. Int. J. Food Sci. Technol. 39 (5), 491–500. https://doi.org/10.1111/j.1365-2621.2004.00808.x.
- Singh, A., Verma, P., 2017. Factors influencing Indian consumers' actual buying behaviour towards organic food products. J. Clean. Prod. 167, 473–483. https://doi. org/10.1016/j.jclepro.2017.08.106.
- Sirieix, L., Kledal, P.R., Sulitang, T., 2011. Organic food consumers' trade-offs between local or imported, conventional or organic products: a qualitative study in Shanghai. Int. J. Consum. Stud. 35 (6), 670–678. https://doi.org/10.1111/j.1470-6431.2010.00960.x.
- Stoneberner, G., Goguen, A., Feringa, A., 2002. Risk management guide for information technology systems. NIST - Spec. Publ. 800 (30), 10.6028/nist.sp.
- Thang, D.Q., Dung, D.V., Dung, N.T.T., 2019. Factors affecting the consumers' ' purchase decision safe food: case study in vietnam. J. Manag. Econ. Stud. 1 (2), 43–52. https://doi.org/10.26677/TR1010.2019.72.
- Tonkin, E., Coveney, J., Meyer, S.B., Wilson, A.M., Webb, T., 2016. Managing uncertainty about food risks–Consumer use of food labelling. Appetite 107, 242–252. https://doi.org/10.1016/j.appet.2016.08.015.
- Vapa-Tankosić, J., Ignjatijević, S., Kranjac, M., Lekić, S., Prodanović, R., 2018. Willingness to pay for organic products on the Serbian market. Int. Food Agribus. Manag. Rev. 21 (6), 791–801. https://doi.org/10.22434/IFAMR2017.0068.
- Vega-Zamora, M., Torres-Ruiz, F.J., Parras-Rosa, M., 2019. Towards sustainable consumption: keys to communication for improving trust in organic foods. J. Clean. Prod. 216, 511–519. https://doi.org/10.1016/j.jclepro.2018.12.129.
- Voon, J.P., Ngui, K.S., Agrawal, A., 2011. Determinants of willingness to purchase organic food: an exploratory study using structural equation modeling. Int. Food Agribus. Manag. Rev. 14 (2), 103–120.

#### A. Firoozzare et al.

- Wang, J., Pham, T.L., Dang, V.T., 2020. Environmental consciousness and organic food purchase intention: a moderated mediation model of perceived food quality and price sensitivity. Int. J. Environ. Res. Publ. Health 17 (3), 850. https://doi.org/ 10.3390/ijerph17030850.
- Williams, R., 2006. Generalized ordered logit/partial proportional odds models for ordinal dependent variables. STATA J. 6 (1), 58–82. https://doi.org/10.1177/ 1536867X0600600104.
- Williams, R., 2016. Understanding and interpreting generalized ordered logit models. J. Math. Sociol. 40 (1), 7–20. https://doi.org/10.1080/0022250X.2015.1112384.
- Wongprawmas, R., Mora, C., Pellegrini, N., Guiné, R.P., Carini, E., Sogari, G., Vittadini, E., 2021. Food choice determinants and perceptions of a healthy diet among Italian consumers. Foods 10 (2), 318. https://doi.org/10.3390/ foods10020318.
- Xu, W., Sun, T., 2021. Risk assessment and analysis of harmful residues in edible agricultural products in China—take Anhui Province as an example. Environ. Sci. Pollut. Control Ser. 28 (39), 54317–54338. https://doi.org/10.1007/s11356-021-15866-3.

- Yan, j., 2010. Disaster Risk Assessment. Training Workshop on Trought Risk Assessment for the Agriculture Sector, pp. 20–24.
- Yiridoe, E.K., Bonti-Ankomah, S., Martin, R.C., 2005. Comparison of consumer perceptions and preference toward organic versus conventionally produced foods: a review and update of the literature. Renew. Agric. Food Syst. 20 (4), 193–205. https://doi.org/10.1079/RAF2005113.
- Zhang, B., Fu, Z., Huang, J., Wang, J., Xu, S., Zhang, L., 2018. Consumers' perceptions, purchase intention, and willingness to pay a premium price for safe vegetables: a case study of Beijing, China. J. Clean. Prod. 197, 1498–1507. https://doi.org/ 10.1016/j.jclepro.2018.06.273.
- Zhang, L., Xu, Y., Oosterveer, P., Mol, A.P., 2015. Consumer trust in different food provisioning schemes: evidence from Beijing, China. J. Clean. Prod. 134, 269–279. https://doi.org/10.1016/j.jclepro.2015.09.078.
- Zheng, G.W., Akter, N., Siddik, A.B., Masukujjaman, M., 2021. Organic foods purchase behavior among generation Y of Bangladesh: the moderation effect of trust and price consciousness. Foods 10 (10), 2278. https://doi.org/10.3390/foods10102278.