

## **Understanding consumer patterns on meat and dairy products derived from animals fed with locally produced feed**

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**Abstract:** The scope of this study is to clarify the main factors affecting the consumption of foodstuff derived from animal products. For this, we applied a modified version of the health belief model (HBM); trying to quantify the differences on the impact of two food groups on human health. Principal component analysis was applied to highlight essential components influencing participants to consume locally produced animal products. Based on the 'consumers' perceptions, there is a general positive attitude towards agricultural products of animals fed with locally produced feed (LPF). Most respondents trust more LPF, considering them as healthier than imported ones, enhancing their identity. Age and educational level of respondents are characteristics that significantly influence their answers, as younger and higher educated consumers are more interested in adopting good eating habits, while seeking information about the origin of foodstuff. This is promising parameter for enhancing competitiveness of LPF on both local and international context.

**Keywords:** consumer behaviour; supply chain management; principal component analysis; PCS; agriculture.

**JEL codes:** C38, D12, D91, I12.

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Leonidas-Sotirios Kyrgiakos is a PhD student and works in the Laboratory of Agricultural Economics and Consumer Behavior of the University of Thessaly. He holds an MSc degree on Climate Change Management and Circular Economy while he has an agricultural background. His doctoral research assesses different methodological approaches for estimating input use efficiency of a given system in the agricultural sector mainly with the use of data envelopment analysis. Visualisation and results' dissemination using up to date tools like R Studio, and Tableau are of particular interest to him.

Spyros Niavis is an economist and Assistant Professor of Regional Economics at the Department of Planning and Regional Development, University of Thessaly. He has published more than 60 scientific papers in journals, edited volumes and conference proceedings, and participated in 30 research projects. His research interests include efficiency and productivity analysis, regional development, and sustainability assessment. He has worked extensively in the sectors of transport, tourism, energy, and agriculture, conducting empirical analysis and on-field work with various stakeholders. His research mainly focuses on the Mediterranean Sea.

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## 1 Introduction

Undoubtedly, meat and milk and dairy products are of great economic importance globally, mainly due to their proven high nutritional value, as they are the primary source of protein and other nutrients. At the same time, modern cultivation methods and rapid technological developments in the field of agriculture and food production are of high interest both for scientific community and individuals. According to a recent European Commission report (European Commission, 2019b), there is a noticeable increase in niche products due to the evolution of dietary habits tailored to modern lifestyle. In particular, there is an ever-increasing level of meat and dairy products consumption worldwide, while there is a shift in the types of meat preferred by consumers in developed economies, with the primary trend to be the partial replacement of part of beef and pork by poultry meat (Baltussen et al., 2016).

In recent years, consumers seem to be more interested in the origin of the food they purchase, and there has been a tendency for them to focus more on consuming local agricultural products (Skallerud and Wien, 2019). Animal feed should also be adequately locally produced, proving this diversification on pragmatic terms, using this element as a promotion key for increasing market shares (European Union, 2012). The ever-changing consumer needs lead to creating a supply chain system that respects consumers’ concerns about food quality and safety while transforming real needs into acceptable practices through practical food management. There is often a tendency of excessive stress and mistrust for specific consumer groups about certain foods, jeopardising loyalty and frequent repetition of purchasing.

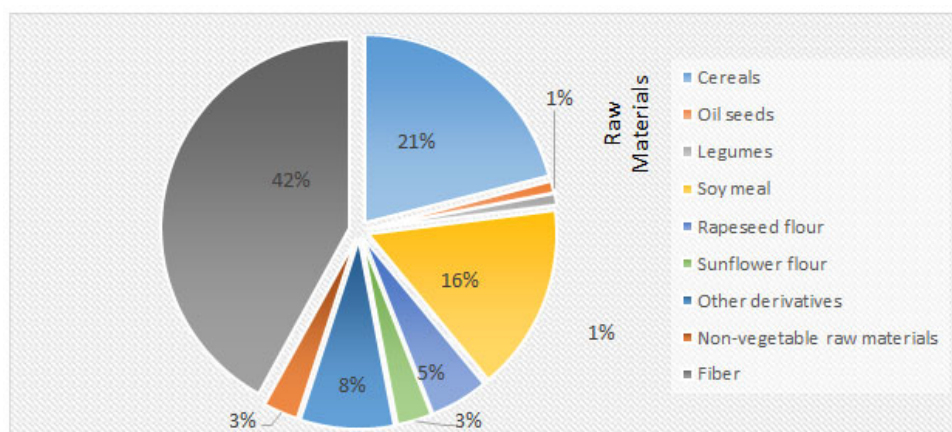
This consumers’ concern about the origin and quality of the animal products they consume combined with the entry of more and more GM foods into the European market, has led to the creation of this research, aimed at outlining consumer views on the origin of the animal feed. For this reason, in the first part of the work, reference is made to the origin of the feed used in the EU, in order to formulate a picture of the existing dependence on imports of feed, a large part of which is GM. Already published consumer behaviour surveys highlighting both the concern towards the consumption of GM foods, as well as the interest shown by modern consumers in purchasing local products, as they characterise them of superior quality. According to the main findings of those, and based on the most appropriate methodological approaches, a questionnaire was created and distributed to a stratified sample of Greek consumers. PCA was applied for the statistical analysis, in order to highlight the main factors affecting consumers. Furthermore, the intention of consumers to provide a premium price to buy specific categories of food was examined. Finally, a regression analysis was also applied to associate the factors resulted from the PCA analysis with the consumers demographic characteristics, in order to highlight preferences. The last part of the paper comments on the results and compares

them with previous researches, mentioning the limitations of this survey, proposing at the same time suggestions for future study.

### 1.1 Origin of feed ingredients in EU

Figure 1 shows the main components of animal feed used on a European level as a source of protein for animals for the year 2018, as shown by a report of the European Commission (European Commission, 2019a). The principal feed protein source seems to be fibre, which accounts for 42% of total feed use in the EU. This category includes raw materials such as grass and corn silage. The next category, 23% of the total feed use, includes cereals (wheat, barley, maize, sorghum, etc.) primarily at a rate of 21%, while 1% refer to legumes (lupine, bean, peas) and oilseeds (soybeans, rapeseed, sunflower).

**Figure 1** Main feed ingredients (see online version for colours)



Source: (European Commission, 2019a)

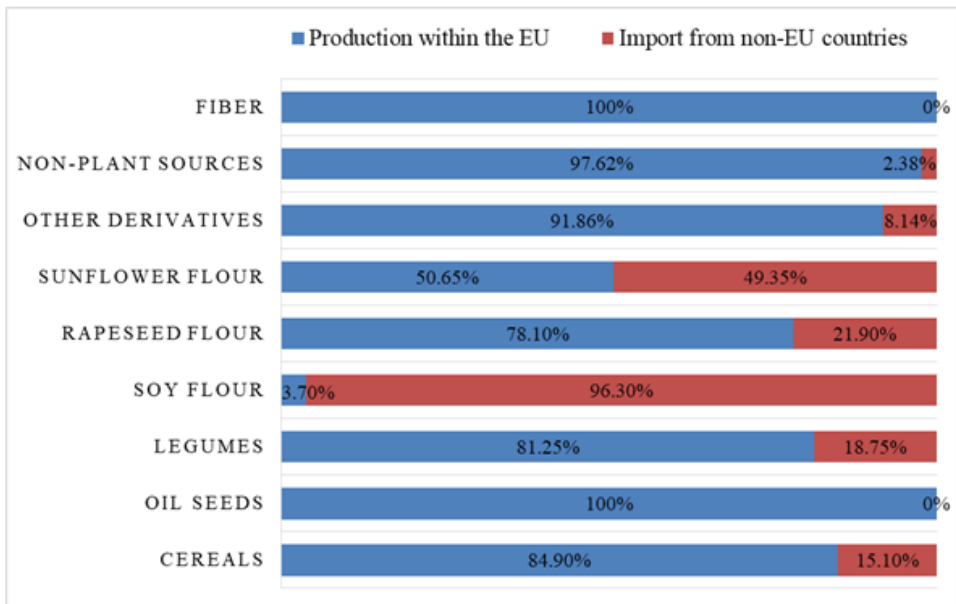
Despite the relative increase in feed production within the European Union, and given the aforementioned increase in feed demand, there is no self-sufficiency in meeting the nutritional needs of animals, which leads to an increase in imports. EU self-sufficiency in vegetable proteins for animal feed varies substantially from crop to crop. A comparative European Commission survey presented that for 2017, EU self-sufficiency in oilseed rape was close to 80%, while the corresponding rate for self-sufficiency in soybeans was only 5% (Commission, 2018).

The following diagram (Fig 2) shows the origin of the main components of animal feed for the year 2018 (European Commission, 2019). The self-sufficiency rate varies considerably for different types of plant protein sources. It is documented an EU self-sufficiency in fibres and oilseeds. EU self-sufficiency in cereals and legumes is also exceptionally high, with self-sufficiency rates exceeding 80%. In contrast, in the case of soybean meal, EU self-sufficiency does not exceed 4%. Considering that soybean meal covers a large share of 'animals' diet, it is proved that there is a remarkable dependence on soybean imports to fulfil animal nutritional needs.

Even though multiple European consumer segments are on an effort to limit consumption of imported food (Perrin, 2020), the ever-increasing demand for ensuring food security from EU countries makes it a harsh target to be met. A similar picture

describes the case of feed, since the coverage of the ever-increasing animals' needs is ever-growing, and so is the demand for feed in the EU, which is achieved mainly by imports (European Union, 2019b). More specifically, the data shows that the EU needs more than 36 million tons of equivalent soybeans a year to meet its livestock production needs. However, the EU produces only 1.4 million tons of soy per year, clarifying the high dependence for vegetable protein. Imported soybeans, mainly from American countries and China, are economically feasible for the European market, mainly due to the much lower price being marketed, compared with LP soybeans (IDH and IUCN NL, 2017).

**Figure 2** Origin of main feed ingredients (see online version for colours)



Approximately 14 million tons of soybeans and 19 million tons of soy meal were imported into the EU in 2013 according to the European Parliamentary Research Service (2015), quantities covered more than 60% of European plant-based protein needs. The main importer was Brazil, which accounted for 43.8% of total imports, followed by Argentina with 23% and the USA with 15.6%. Feed is the major input for livestock production systems, as part of total production cost. Nevertheless it is also a crucial parameter of animal nutrition regarding the qualitative characteristics of final products. (ISAAA, 2018). Soybeans and soymeal, which cover most of the imported plants used as a source of protein for poultry, pigs and cattle, are mainly genetically modified (GM). More specifically, about 14 million tons of soybeans and soy meal were exported from Brazil in 2013 to meet the needs of the European market, combined with the fact that almost 90% of soybeans grown in Brazil are GM, leads to the conclusion that high percentages of GM soybeans are imported and marketed in Europe. It is also noteworthy, that adequate percentage of soybeans imported into the EU from Argentina, for the same year, was GM.

## *1.2 Concerns about the consumption of GM food*

In recent years, there has been a great deal of concern about safety issues regarding the consumption of GM foods (Jiyoun and Fang, 2020). Genetic Modification is one of the techniques of improving organisms to create sophisticated species with new enhanced properties. GM plants' cultivation and the consumption of GM foods and feedstuff have caused a series of social reactions (De Aenlle, 2015). GM foods are increasingly entering into the human and animal nutrition chain globally, and as expected, there are intense safety concerns. GM organisms, and in particular their use in edible crops, have been at the centre of a lively public debate across the EU in recent decades. The industry claims that GM crops pose a minor risk and offer enormous potential benefits. On the other hand, perceived lack of knowledge and understanding of the risks associated with GM foodstuff consumption are the cornerstones for opposing their use. Furthermore, many consumers complain that despite the fact that GM products have been imposed in everyday life, the labelling system is not transparent, thus hindering the choice (Bawa and Anilakumar, 2013).

However, GM food and feed production technologies can help solve malnutrition in the ever-growing world population, though, as with all new technologies, their use is likely to pose risks (Maghari and Ardekani, 2011). The potential risk of disturbance of the environment and biodiversity is significant, while their cultivation has been observed to cause damage to flora and fauna. A typical example is the cultivation of a species of GM maize, for which there are indications for being responsible for the reduction of the population of a particular species of butterfly. Still, many scientists are concerned about reducing a large percentage of traditional varieties that may even disappear (Waltz, 2011).

A recent study of the attitudes of 1,000 Lithuanian consumers towards GM Foods showed that the majority of respondents were negative and opposed to this consumption trend. In fact, 63% of survey respondents said that if they saw a product label containing GMOs, they would refuse to buy it, turning their interest to search and consume locally produced food. As stated in a published study by the Department of Biotechnology of the Polish Academy of Sciences (Moses, 2012), consumers "are not interested in or do not know or are not interested in knowing if they are feeding on products derived from animals consumed GM feed". This information was derived from two large UK retail chain stores announcement that they would start selling poultry fed with GM feed as the price of imported GM feed is more favourable than non-GM, LP feed. However, consumers showed no interest in this promotion strategy and continued to consume poultry meat and eggs at the same frequency, without caring about the origin of the feed they had been fed.

A relatively high GM refusal of plant and animal foods emerged from the Puduri et al. (2005) survey of 1,200 American consumers. The statistically significant difference in the answers of people with different socio-economic characteristics is remarkable. Thus, women were more reluctant to consume these foods, while the youngest participants in the research were more reluctant on incorporating GM in their diet. The fact that GM soybeans and GM maize (which are mainly imported) have an increasing share on productive animals' feed, raise consumer concerns about the possible consequences on human and animal health. In Monier-Dilhan and Bergès (2016) research on organic and LP foodstuff derived from animals (eggs and milk were studied in this survey), the factor that influences the consumers' choices is the type of feed (non-GM

feed is more preferable), and also they care about animal welfare combined with their origin.

### *1.3 Positive attitude from the consumption of locally produced food*

As mentioned above, there are constant concerns about GM food and feed consumption, mainly related to social and economic issues. However, there are issues related to the protection of the environment and biodiversity, as well as of food safety and bioethics. At the same time, according to consumers' beliefs, GM food not only has a negative meaning, but is also a co-name with imported food, and this is the main reason why it should not be purchased (Cui and Shoemaker, 2018). Consumers are progressively interested in consuming LP food, mainly due to their interest in the origin of the food they purchase and the reduction of the ecological footprint being achieved as an outcome of this attitude (Coelho et al., 2018). A recent survey conducted by the TNS Political and Social Network under a request from the European Commission (2017), verified that a large percentage of European consumers (94%) consider environmental protection as an essential issue and confirmed that citizens need green policies to be applied in a more holistic approach. Nowadays, it is no coincidence that European consumers' tendency to choose locally produced food is becoming more and more intense, as they are the outcome of a more environmentally friendly production process, in contrast to substitutes imported ones.

A rather large EU survey of 27,881 consumers found that 43% of them were interested in consuming LP food, considering this practice as a means of protecting the environment and reducing gaseous pollutants from food transport. The same research showed that 81%, on average, of the participants associate negatively environmental impact of imported agricultural products on their health and daily life, a percentage that is much higher when studying individual European countries (in the case of Greece, it reaches 97%) (EFSA, 2010). Research on organic and local foods has revealed that consumers consider them as beneficial to health, safe and fresh, while describing them as "environmentally friendly" (Zepeda and Deal, 2009).

Following the same trend, one more European Commission report on consumers' perception of the development of EU vegetable protein for animal feed, revealed the European consumers are increasingly interested in producing animal products and improving the quality characteristics of the feed used (Grunert et al., 2018). Finally, consumers in an earlier study, stated that they link the quality of meat they consume with its origin, but also with the recommendation of the feed they are fed with and their welfare (Roininen et al., 2006). Olynk and Ortega (2013) research results highlight the factors affecting yoghurt consumption from cattle, similar to the previous study. It is quite interesting that consumers with different demographics have different beliefs and knowledge about food choices. The majority of respondents claimed they are interested in local production of dairy products they consume, while it seems that they are concerned about the quality of feed and the supplements being received by animals in order to increase the quality and quantity of produced milk. Statistically significant correlations between the socio-economic characteristics of consumers and their preferences for LP food has been verified too (Vlontzos et al., 2018). In particular, it turned out that individuals with low monthly income avoid LP food as they consider it more expensive than imported ones, while there is considerable mistrust and insecurity about the origin of food consumed by people with high educational level.



### *1.4 Objectives of the study*

Taking into consideration all the aforementioned findings from empirical studies and surveys, there is a constant urge to clarify and quantify the impact of factors influencing ‘consumers’ choices when purchasing meat and dairy products. The negative trading balance for the EU in the feed sector, combining with increasing consumers’ preferences for LP food consumption, require further assessment of their decision making process towards food selection. More specifically, this study aims to highlight the components leading to LP food consumption and create clear consumption patterns depending on participants’ demographic characteristics. Following this path, this survey aims to contribute to formulate and assess the significance of relevant parameters, resulting in new ways of promoting LP food products to specific consumer groups. Moreover, the present research attempts to fill the existing gap linking LP feed with ready to use foodstuff derived from animal husbandry.

## **2 Methodology**

In order to find out the main factors influencing Greek consumers towards the purchase of meat and dairy products, appropriate models were used to formulate a questionnaire so as to outline the participants’ profiles. According to Wu and Li (2018), the stimulus – organism – response (SOR) model tries to interpret how consumers’ decision-making process develops and analyse consumers’ influence from stimuli received by a combination of cultural, social and psychological parameters. Based on this model and the results have been outlined in the literature review section, demographic, cultural, social, and psychological factors influencing consumer decision-making, were examined. HBM examines behavioural reactions of individuals trying to predict the possibility of adopting beneficial trends to their health consumer behaviours (Jones et al., 2015). The use of this model is fitted well in this study as we want to clarify whether the origin of the animal feed is linked to consumers’ health beliefs. For this reason, HBM was used in this research to reveal the extent to which consumers prioritise health issues when purchasing food of animal origin, particularly the impact on their final choice of the use of LP feed in animals’ diet.

A questionnaire was designed to examine consumers’ preferences for meat and dairy products derived from animals fed with LP foodstuff. In the first part of it, consumers were asked about their socio-economic and demographic status, such as their age, gender, monthly income and their educational level. As already discussed, European consumers’ awareness about biotechnology and GM food technology is ambiguous, leading them to be sceptical on the perspective of usage, trying at the same time to replace them with LP foodstuff. For this reason, the key questions were focused on their nutritional self-confidence so that their subjective beliefs on good and healthy eating habits could be identified. Responses were given on a Likert scale, from 1 to reveal no knowledge to 5 indicating perfect knowledge of beneficial healthy food consumption patterns.

Moreover, questions enriched the questionnaire to determine the extent to which interviewees are concerned about the possibility of getting a severe illness and the likelihood of being affected by diseases such as obesity, diabetes, cardiovascular disease and osteoporosis. Regarding the likelihood of illness, answers were again given using the same scale. These questions were added as it was evident from the literature review that a

large proportion of the population is concerned about health issues and often combines the consumption of LP food with disease prevention.

The next group of questions outlines consumers' beliefs about the benefits of consuming meat and dairy products from animals fed with LP feed and questions about the barriers and concerns related to these products. Regarding the benefits of LP foods, consumers were asked whether they believe that these foods are beneficial to their health, whether they consider them nutritious, and whether they help prevent a series of diseases. The health factor is deeper assessed, as, through the literature review, it appeared to be a matter of particular concern of consumers. Therefore, this issue was approached by different groups of questions, so as to achieve an integrated context related to this parameter.

The last set of questions examined the willingness to pay (WTP) approaches for meat products and dairy products from animals fed with LP feed. Consumers responded if they would like to pay more, less or the same as what they already pay for these types of food:

- a meat derived from animals fed with LP feed
- b dairy products derived from animals fed with LP feed.

These questions were answered on a scale of -20%, indicating a WTP lower for purchasing these foods to 20%, indicating a positive attitude even in a possible increase in their price.

For this survey, 240 questionnaires were collected from a random stratified sample of Greek consumers. Questionnaires were distributed mainly through personal interviews without affecting respondents' responses. The questionnaires were distributed to a sample of individuals aged 18 to 82 years old from August 2020 to January 2021 to draw the necessary conclusions about consumer attitudes toward meat and dairy products fed with LP feed. Initially, an extensive check was carried out to clarify the reliability of the responses, and then the data collected was processed using R Studio. This analysis aimed to highlight the main factors related to consumer attitudes, in order to clarify the profile of consumers who finally decide to purchase this kind of foodstuff.

PCA was applied, a multifactorial statistical technique to reduce the number of variables in a dataset to a small number of 'dimensions'. In mathematical terms, from an initial set of unrelated variables, PCA generates unrelated indices or elements, where each element is a linearly weighted combination of the original variables (Vyas, 2016). Kaiser-Meyer – Olkin Index (KMO), which compares the sizes of observed correlation coefficients, was checked to determine the sample's adequacy for analysis. Low index values ( $< 0.5$ ) indicate that PCA is not an appropriate technique for the data analysis (Andale, 2017). Another method of checking the appropriateness of factor analysis is the Bartlett's sphericity test, which was used so as to examine the null hypothesis ( $H_0$ ) that all variances are equal. This aims to check the suitability of the sample by using the chi-square statistic so as to examine the assumption that the correlation table is not identical and, therefore, that the factor analysis model is appropriate (Gorsuch, 2014).

### 3 Results

#### 3.1 Analysis of demographic and socioeconomic characteristics of the sample

Table 1 provides an overview of the demographic characteristics of the total sample. In order to collect data from a stratified sample of the population, 122 men (50.83% of the sample) and 118 women (49.17% of the total sample) participated in the survey. The average age of the sample is 40.89 years, almost the same as the average age of the Greek population, which according to the 2011 census is 41.9 years, concluding that the sample is quite representative (Greek Statistical Authority, 2011). The educational level of participants is considered generally high. More specifically, over 50% of the sample stated a high level of education, as 34.17% of the respondents hold a university degree, while 17.08% of the interviewees stated that they have a Master's or PhD degree. Regarding the income criteria, 70% of survey participants claimed moderate to high satisfaction with their income. At the same time, a small slight difference in income satisfaction level between men and women is observed, with women declaring less satisfied regarding their monthly income than men.

**Table 1** Demographic characteristics of the sample

	<i>Total</i>	<i>Male</i>	<i>Female</i>
<i>Average age</i>	<i>240</i>	<i>122</i>	<i>118</i>
	<i>40.89</i>	<i>41.25</i>	<i>40.53</i>
18–24	42 (17.5%)	21 (17.21%)	21 (17.8%)
25–34	51 (21.25%)	26 (21.31%)	25 (21.19%)
35–44	67 (27.92%)	34 (27.87%)	33 (27.97%)
45–59	47 (19.58%)	24 (19.67%)	23 (19.49%)
60+	33 (13.75%)	17 (13.93%)	16 (13.56%)
<i>Educational level</i>			
Primary school	15 (6.25%)	8 (6.56%)	7 (5.93%)
Secondary/High school	102 (42.5%)	42 (34.43%)	60 (50.85%)
University graduate	82 (34.17%)	46 (37.7%)	36 (30.51%)
Master/PhD	41 (17.08%)	26 (21.31%)	15 (12.71%)
<i>Number of children</i>			
0	96 (40%)	53 (43.44%)	43 (36.44%)
1	41 (17.08%)	24 (19.67%)	17 (14.41%)
2	65 (27.08%)	28 (22.95%)	37 (31.36%)
3	20 (8.33%)	9 (7.38%)	11 (9.32%)
>3	18 (7.5%)	8 (6.56%)	10 (8.47%)
<i>Monthly income</i>			
Low satisfaction	72 (30%)	35 (28.69%)	37 (31.36%)
Moderate satisfaction	82 (34.17%)	31 (25.41%)	51 (43.22%)
High satisfaction	86 (35.83%)	56 (45.9%)	30 (25.42%)

### 3.2 Principal component analysis (PCA)

PCA was used to analyse further the data, being a method that explores individuals attitudes, perceptions and beliefs on specific issues at a time. Although this method reduces the available information, in order to create distinct groups, it provides valid and understandable results. KMO index and the Bartlett's sphericity test clarify the adequacy of the sample for analysis, as already mentioned. KMO value was 0.702, which is considered satisfactory and therefore suitable for analysis. Regarding the Bartlett sphericity test, where the null hypothesis (H0) is checked, it appears with high significance (= 0.000). The above-mentioned results indicate that the collection can be further processed by using PCA as an analytical tool.

The application of this method led to grouping the data into five (5) main components, which reflect five non-directly measurable criteria for consumption of meat and dairy products derived from animals fed with LP feed. These factors can explain the maximum variability of all variables involved. To explain the PCA scoreboard, it is necessary to mention two concepts mentioned above: the participation load index (factor loading) and the percentage of variation of the main components (variance).

The first component refers to environmental protection coming from the use of LP feed, an associate at the same time that their consumption is beneficial for human's health, compared with imported ones that are mainly GM. More specifically, this first factor shows the highest variance (17.7%), compared to the next ones, while it is almost twice the value concerning the next factor, which shows the participation of 10.81%. These two elements are considered the most important since they can explain 30.8% of the research question. The second factor describes the high intention of consumer choices to use meat and dairy products derived from animals fed in LP feed. In particular, focusing on the answers given, more than 50% of the interviewees responded that if they had the opportunity to choose from all kinds of foodstuff, they would choose LP food ones. The third factor (variance 7.05%) refers to the consumers' awareness about LP feed and their benefits for human health, while there is little motivation for the responders from their social surroundings. The fourth component focus on health issues. More specifically, there are concerns about developing some types of diseases like diabetes, obesity, and cardiovascular disease (variance 5.76%) influencing consumer attitudes. The fifth factor depicts the likelihood that consumers will suffer from the illnesses mentioned above, which verifies the extent to which they are concerned about health issues and the adoption of healthy eating habits as counter measures to avoid them.

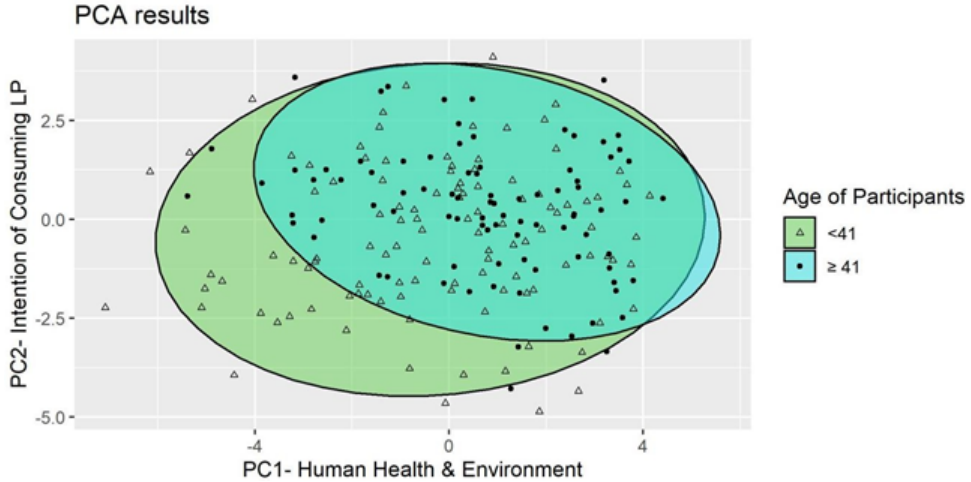
### 3.3 Correlations between the factors and variables of the sample

Figure 3 displays perception grouping having as a criterion the participants' age. Both for the first and second components, statistically significant differences have been found. More specifically, younger participants (below 41 years old) appear less determined to consume LP foodstuff and seem to care less about environmental issues and human health. Ellipses represent 95% of the represented distribution between each group. PCA provides a clear insight for market segmentation in cases where connections between multiple variables are not apparent.

Results of the comparison of socio-economic characteristics with the factors obtained are presented in Figure 4. More precisely, regarding the second component (intention of purchasing LP food), there are significant differences in the answers given, depending on

the marital status of the respondents. This intention increases when there are children in the family. As is evident from the relevant graph (a), the average scores of answers of the participants who are parents are higher, compared to the answers of childless respondents ( $p$ -value < 0.01). Comparing components 3 and 4 with the educational level of those involved in this survey, higher educated people have better knowledge about healthy consuming habits (b), while they are less stressed about developing a disease in the future, in contrast with people with a standard educational level (c) ( $p$ -value < 0.05).

**Figure 3** Components 1 and 2 in comparison with the age of participants (see online version for colours)



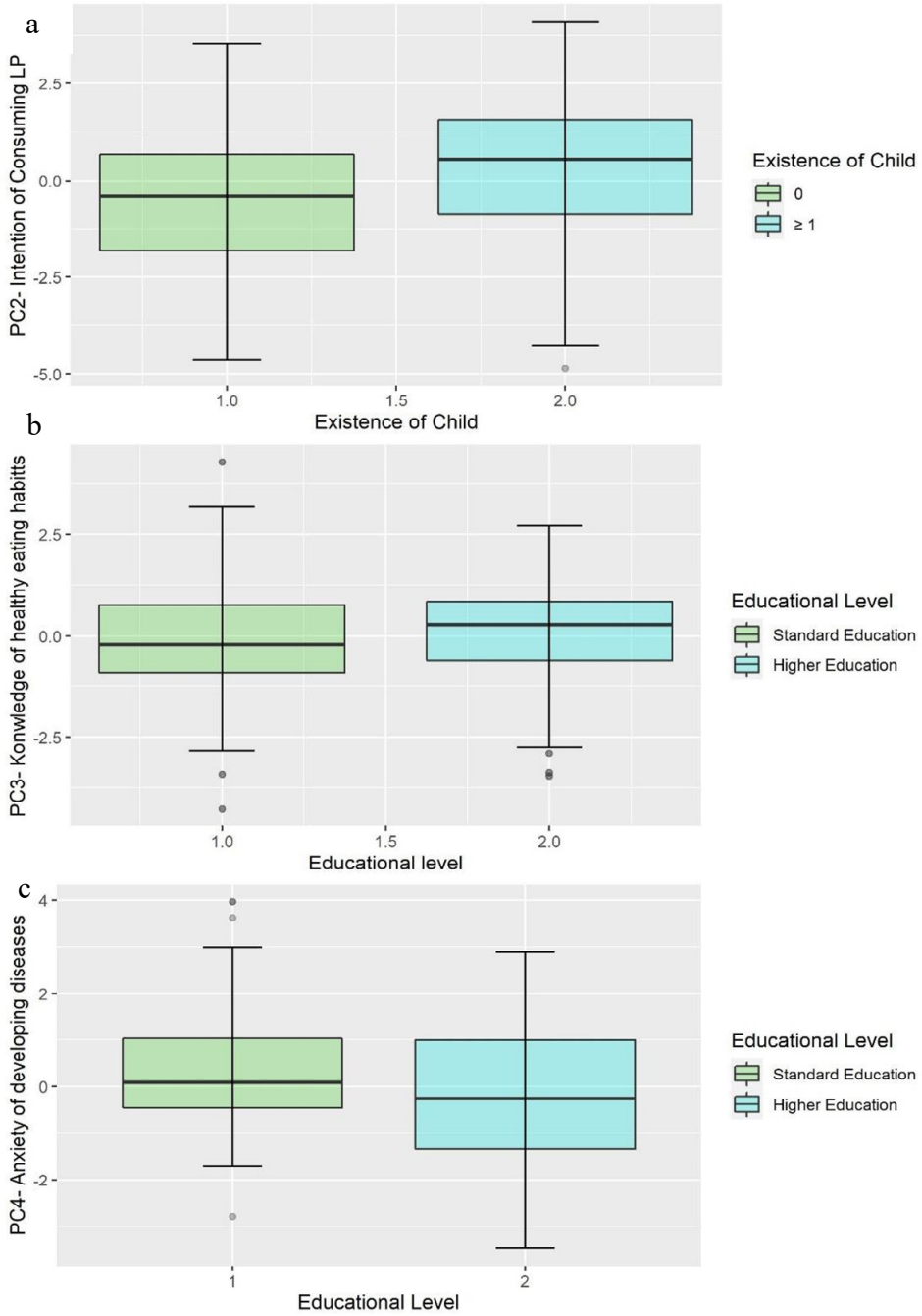
### 3.4 Intention to consume LP food

A set of questions aimed to clarify whether consumers were willing to buy meat and dairy products from animals fed with LP feedstuff. For this purpose, the following questions were incorporated in the questionnaire:

- Q 11.3 “If I had the opportunity, I would choose meat and dairy products from animals fed with LP feed”.
- Q 11.4 “If I had the opportunity, I would choose meat from animals fed with LP feed”.
- Q 11.5 “If I had the opportunity, I would choose dairy products from animals fed with LP feed”.

The answers given by consumers to these three questions showed that only a small percentage (11.3% of the total sample) stated that they would never (or rarely) choose animal products derived from animals fed from LP feed table ). Of those who expressed a willingness to consume, most are consumers up to 41 years old, with a relatively high educational level, while there is no difference in the answers between the two sexes. 32.5% of consumers maintain a neutral attitude towards consuming these animal products, while over 50% of the surveys participants are willing to find and consume LP foods, which is much higher in the case of meat (66.3% willingness to consume).

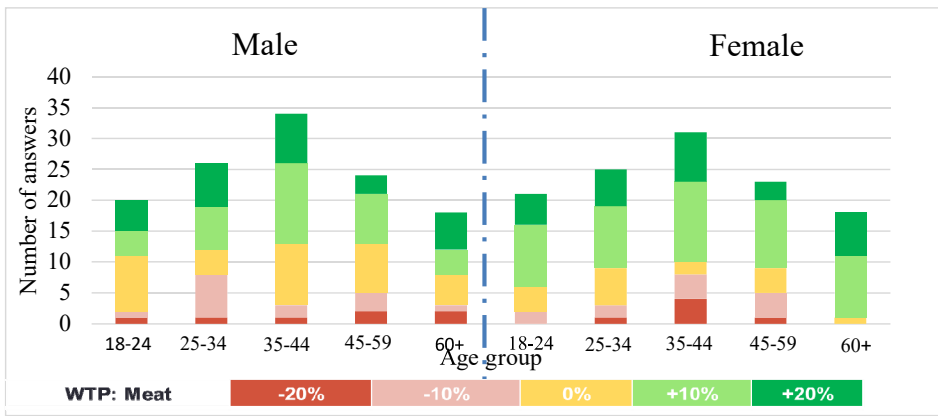
**Figure 4** Statistically significant results comparing components with socioeconomic characteristics of the sample (see online version for colours)



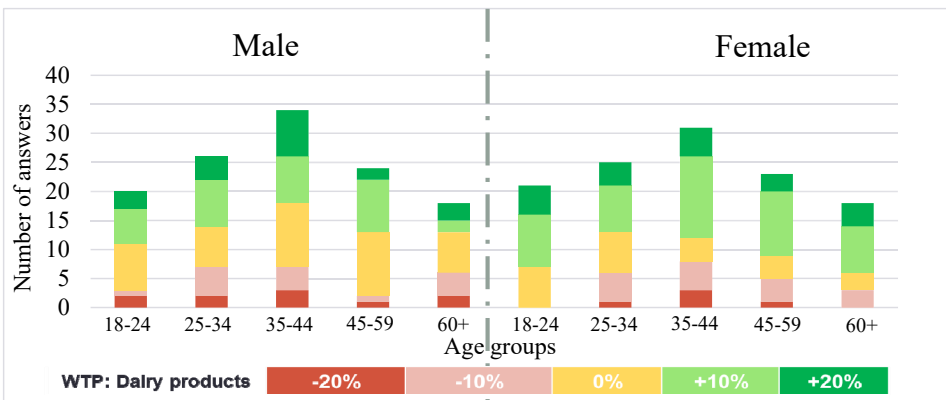
**Table 2** Intention to consume meat and dairy products derived from animals fed with LP feed

	<i>Rejection</i>	<i>Neutral attitude</i>	<i>Willingness to consume</i>
Meat and Dairy products	27	78	135
derived from animals fed with GM feed	(11.25%)	(32.5%)	(56.25%)
Meat derived from animals fed with GM feed	22	59	159
	(9.17%)	(24.58%)	(66.25%)
Dairy products derived from animals fed with GM feed	26	61	153
	(10.83%)	(25.42%)	(63.75%)

**Figure 5** Willingness to pay about meat comes from animals fed with LP feed (see online version for colours)



**Figure 6** Willingness to pay about dairy products comes from animals fed with LP feed (see online version for colours)



‘Consumers’ WTP for animal products derived from animals fed with LP feed was examined, as participants were asked on a scale of –20% to 20% for their intention to give more or less money to obtain these products. Regarding meat consumption,

descriptive statistics depict a generally positive image among all different age groups, while most of them intend to pay a premium price in order to obtain LP food Figure 5. The same attitudes appear as regards dairy products Figure 6.

#### **4 Discussion**

This research aimed to capture consumers' attitudes towards the purchase of animal products derived from animals fed with LP feed. It was implemented on a national basis in Greece, applying a modified HBM questionnaire to a randomly selected sample of 240 Greek consumers aged 18–82 years. There was, in general, a relatively positive attitude of consumers towards consuming this type of foodstuff and a considerably high intention for paying a premium to purchase them. Consumer responses are in line with the results of previous recent surveys referring to local food consumption patterns, aiming to strengthen both local economy production, adopting at the same time healthier eating habits, according to their subjective norms.

The first and most significant factor highlighted by the PCA is the correlation of animal products' consumption derived from animals that have been fed with LP feed with environmental protection. This finding is of great importance as it verifies increased environmental awareness. This finding is in line also with previous surveys (Coelho et al., 2018); (European Commission, 2017) that show that consumers in recent years are increasingly interested in protecting the environment through their food choices. The second and third important components refer to the consumers' tendency to choose locally produced foods, mainly because they characterise them healthier, while there are considerable hints that their choices in the food decision-making process are influenced by their social environment. These findings are also in accordance with findings of previous researches focussed on various locally produced foods (Skallerud and Wien, 2019; Tumuhe et al., 2020; Dukeshire, et al., 2011; Food and Agriculture Organisation of the United Nations, 2017), confirming that the same consumer beliefs apply as far as animal feed is concerned.

WTP analysis, verifies the high tendency of consumers to seek and purchase locally produced food staff. Indeed most respondents (mainly women and people of older age), declare their WTP a premium price to consume animal products derived from cows fed with LP feed. This is also an innovative finding as although WTP has been studied in the past for various locally produced agricultural products (Taylor and Signal, 2009; Hu et al., 2012; Zulug, et al., 2015), no relevant research results have been found regarding LP feed.

Therefore, it can be stated that this research has contributed to the allocation of the most important factors that affect consumption of locally produced animal products by focusing on the origin of the feed consumed by these animals. So it seems that the vast majority of Greek consumers and especially the older and more educated respondents are willing to pay a price premium to avoid imported feed combining them with GM ones. Furthermore, if this result is combined with concerns of European consumers about the negative effects of consuming GM products on their health (Bawa and Anilakumar, 2013; Kramkovska et al., 2013; Monier-Dilhan and Bergès, 2016, it is a very interesting the identification of this linkage for local producers, in order to properly organise and promote their production protocols.



## **5 Conclusions**

Consumer attitudes are being influenced, formulated and expressed according to numerous behaviours which are not stable for their lifetime. Among others, the age of the participants plays a crucial role in food choice, and more specifically adoption of LP foodstuff. Despite the fact that this particular sample is partially over-representing this market segment, as a spill-over effect of the COVID-19 pandemic and the difficulties being faced on data collection from mere aged consumers, younger consumers do not fully recognise the benefits of producing and consuming local food, with this phenomenon becoming more intense as the age of the consumer decreases. Additionally, there are several concerns about imported GM feed and its effects on 'consumer's health. People with different educational backgrounds also have different perceptions about healthy eating patterns, as those with higher education levels correlate the consumption of LP foods with healthy eating, while a part of this group is interested in purchasing them. Finally, respondents were asked to answer about their intention to consume specific types of animal products. Their responses reaffirmed their positive attitude towards the production of local feed, with many consumers stating that they would be WTP a premium for having meat and dairy products being fed with LP feeds. This trend is not affecting these value chains drastically, but it can be considered as a stepping stone for reorganising the cooperative status of stakeholders, to meet these relatively new consumer demands. Concluding, the locality index should be re-evaluated both for farms and the relative supply chains, making explicit all different aspects of originality. Final products can be placed accordingly, in order to be used as a promotional mix for local stores or supermarkets. The supply chain of LP feed remains weak, leading livestock managers to choose imported feedstuff instead of the LP ones. This is the main reason why LP feed should be promoted, as part of an integrated promotion strategy of LP foodstuff, certifying their identity and as verifying that they are being produced under an environmentally friendly protocol.

The following limitations of this research are acknowledged:

- a the number of questionnaires collected
- b the recording of consumer behaviours of individual consumer age groups
- c a more detailed approach of local products
- d a more detailed approach of the health factor, which seemed to be of particular concern to consumers.

Also of particular interest is further assessment of younger age groups, aiming to study future consumer trends for animal products from animals fed LP feed, as young people are the group of consumers who in a few years will dominate the market.

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assess soybean substitution with LP leguminous crops and examine their effects on the quality and quantity characteristics of the produced raw milk.

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