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Traceability issues of honey from the consumers' perspective in Romania

RESEARCH ARTICLE

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Abstract

The Romanian honey market is facing a problem related to traceability, especially when honey is produced in more than one country and its origin is indicated as a blend of EC and non-EC honeys. The increase of honey adulteration has consequences on both consumers and honey producers with considerable negative effects. The aim of the study was to identify the factors that influence honey purchasing behaviour and to evaluate consumers' awareness related to honey adulteration in Romania among selected age segments. An online survey was conducted between 2020-2021 on a sample of 1,233 respondents. The questionnaire covered aspects related to purchasing behaviour and honey adulteration, complemented with socio-demographic questions. The data were evaluated using descriptive, non-parametric and multivariate statistics. The results showed that the most important factors considered during the purchasing process by Romanian honey consumers were health factor and country of origin followed by producer reputation and ecological aspect, while the least important were discounts, promotion and brand reputation. The older respondents are more aware of honey adulteration and know better that crystallisation is an indicator of quality. This study provides important information for policymakers and the whole beekeeping chain in Romania. Education in terms of honey authenticity and traceability will help consumers to choose local honey of high quality and to avoid adulterated products. This consumption and purchasing behaviour will discourage producers from honey counterfeiting.

Keywords: honey authenticity, consumer behaviour, traceability, adulteration

JEL code: Q13, M31, P36

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1. Introduction

Food fraud is a topic of great debate and raised concern at present, since this unfair practice jeopardises food safety due to the possible health risks (Ahmad *et al.*, 2021). A feasible solution that could make a difference in fighting and alleviating this issue, is given by securing traceability and providing more assurances to stakeholders and customers all across the supply chain (Galati *et al.*, 2020). This may well be one of the best methods that has the potential of protecting consumers from the harmful effects of unfair trade practices in the market. Nevertheless, it is yet to be defined how much are consumers aware of the possibility to counterfeit certain foods and the impact of this practice upon their health (Rekha and Paul, 2018). Little of them know that, for instance, honey occupies the third position in the top most adulterated food products in the world (European Parliament, 2018). Honey adulteration has consequences on both consumers and honey producers with considerable negative effects. To understand better the concept, a definition of the traceable honey is brought by Menozzi *et al.* (2015): a honey with unique characteristics that can be used to identify it. For instance, information related to honey's producer, honey's production process (e.g. moisture content, bee pollen content, various additions), geographic origin, and a quality certification that guarantees that all this information is authentic. According to Menozzi *et al.* (2015), traceable honey can be related and traced back to the beekeepers.

Subsequently, the honey market is not exactly stable, and the beekeeping sector has more than its fair share of problems, especially issues related to the contradiction between the price of pure honey and that of adulterated honey (Arvane *et al.*, 2010). The most recent honey market report provided by European Commission (EC, 2021) shows that the EU self-sufficiency in honey is around 60% and the quantity imported from third countries like Ukraine, China, Argentina and Mexico was 177,650 tons in 2020. In the same year, the average price for imported honey was 2,05 EUR/kg. Imported honey is frequently cheaper than honey produced in the EU member states. According to the EU Council Directive 2001/110/EC (EC, 2001) 'the country or countries of origin where the honey has been harvested shall be indicated on the label'. However, there are some exceptions, including the situation when honey is produced in more than one country (EU/non-EU member state). In this case, the country of origin can be indicated as follows ('blend of EC and non-EC honeys'). Masking the geographical origin of honey decreases the traceability of this product and may be considered as a way of adulteration (García, 2018). In this context the transparency of the market is very important. In light of this, García (2018) recommends a re-evaluation of foreign trade rules, with the purpose of improving the traceability systems and to protect consumers. These aspects have been also discussed by Ahmad and Akhtar (2018) who stated that traceability represents a protective method against unfair market practices.

Romania is one of the main honey producers in the European Union (EC, 2021). According to the data provided by the Ministry of Agriculture and Rural Development (2020), honey trade balance is largely positive in Romania, with 45,826 tons of exported honey and 8,969 tons of imported honey between 2018-2019. Per capita consumption is still low compared to other EU countries, but there is an increasing trend of honey consumption due to its multiple benefits as food and medicine (Šedík *et al.*, 2019). Honey is perceived by Romanian consumers as a safe product, but there is a need to inform them about the risks of buying counterfeiting honey and the importance of making good choices during the purchasing process (Borodin *et al.*, 2013).

Studies on determination of honey authentication and quality in Romania are generally based on the analysis of the physicochemical parameters and chemometrics (Geana and Ciucure, 2020; Isopescu *et al.*, 2017; Oroian *et al.*, 2017; Pauliuc *et al.*, 2020). What we cannot find in the scientific literature on the honey authentication and traceability of honey are those elements related to the knowledge or awareness of Romanian consumers about these aspects. A better understanding of the main reasons behind honey purchase and consumption (food, medicine or cosmetics) together with an assessment of consumers' perception of honey adulteration could significantly make a difference. Accordingly, this insight could help launch educational and informative campaigns focused on training consumers to become aware of the importance of choosing quality products

for securing a healthy lifestyle and supporting pure honey producers. In this context, the purpose of the paper was to identify the factors that influence honey purchase behaviour and the consumers' awareness related to honey adulteration in Romania among selected age segments. Therefore, our research aims to answer the following research questions:

- RQ1: Which factors influence consumers buying decisions of honey in Romania?
- RQ2: What is the consumer's knowledge and awareness about honey traceability and authenticity in Romania?

The next section addresses the literature review, and it is divided into three subsections, namely: (1) factors influencing the honey buying behaviour; (2) consumers perception on the honey quality and adulteration; and (3) the relation between the sociodemographic features and honey consumption behaviour. The third section is dedicated to describing the methodology employed, while the fourth section comprises the main obtained results, their interpretation, and discussions on them. The final section tackles the concluding observations, the limitations of the study, practical implications, as well as features related to the originality of research.

2. Literature review

2.1 Factors which influence honey purchasing behaviour

The quality of honey, the geographical characteristics and the country of origin are elements of great interest for consumers. In addition, following the literature review, there were identified a series of factors influencing the honey buying behaviour. Yeow *et al.* (2013) tested the existence of some correlations between the honey purchasing behaviour and certain variables such as product quality, health condition of consumers, brand reputation, and price. The analysis revealed that the main factors influencing the honey purchasing behaviour are the following: product quality, consumers' health condition, and price. Same authors call the attention to the importance of honey certification both as guarantee of product quality and increased credibility of the product for consumers. Roman *et al.* (2013b) also points out the importance of honey certification for consumers, and not forgetting about brand and logo in the equation of buying decision since these elements ensure that honey comes from a safe source. At the same time, the consumers' trust level regarding the benefits of honey consumption can be elevated by appropriate product labelling (Yeow *et al.*, 2013). Batt and Liu (2012) identify the following factors as most influential for honey buying decision: brand reputation, origin, and quality-price ratio. Pocol and Bolboacă (2013) pinpoint age, education, and occupation as key influencing factors of the honey buying decision.

Roman *et al.* (2013a) finds that economic factors such as level of family income and honey price are of great importance in the purchasing process. In addition, the honey buying decision is strongly swayed by the consumers' knowledge of honey value and benefits on health (Roman *et al.* (2013a). As part of a study conducted by Cosmina *et al.* (2016) it is shown that consumers are interested in honey origin, price, and liquidity state in the buying decision. When analysing the willingness to pay and purchase honey, Vapa-Tankosić *et al.* (2020) identify the consumers' concern with organic certification. Furthermore, there are a series of factors influencing the honey purchasing behaviour such as level of family income, consumption needs, the existence of one or more children in a family (Vapa-Tankosić *et al.*, 2020). Murphy *et al.* (2000) reached the conclusion that, in the case of consumers, the most important factors for honey purchasing decision are price, texture, colour, and packaging. Ćirić *et al.* (2015) highlight the relevance of honey quality in consumers' purchasing decision which leads to the consumers' preference for buying honey directly from beekeepers as a guarantee of quality and lower prices than those found in supermarkets or specialised shops. Guziy *et al.* (2017) note that the main factors lying at the basis of the honey purchasing process are represented by the country of origin, taste, price, and features related to packaging, namely its dimensions and design. The consumers preference for local honey is also underlined by Kallas *et al.* (2019). Gyau *et al.* (2014) point out the factors that influence consumers in the purchasing decision as well as the education level (minimum secondary education) and being part of a family. Brščić *et al.* (2017) assess the key factors

of honey purchasing decision and observe that taste, flavour, smell, type of honey, and medical benefits are the major concerns of the young buyers.

Žak (2017) highlights the main factors taken into consideration by young consumers when buying honey, namely its price and the sensorial features. On assessing the factors influencing the honey-purchasing process of the alleged millennial generation, Blanc *et al.* (2021) single out perceptions that are firstly concerned with sustainability, preserving resources and environment. Further, they evaluate a series of features that have the final say when buying honey such as ecological footprint which contributes significantly to the development and support of a healthy lifestyle (Blanc *et al.*, 2021). Table 1 centralises the main intrinsic and extrinsic factors influencing the honey buying behaviour.

2.2 Consumer perception of honey quality and adulteration

Through the lens of honey being the third-most-faked food in the world, this section of the literature review focuses on the analysis of consumer awareness about counterfeit honey and on their capacity to identify the authenticity of this product. Therefore, it is under examination the consumers degree of awareness about adulterated honey and also their capacity for identifying pure honey. As part of a study conducted by Fairchild *et al.* (2003) it was found that there is an increasing need among consumers to learn more about the origin and processes undergone by the food products, honey included. Ahmad *et al.* (2021) point out that consumers are aware of the existence of the adulterated honey market and, still, some of them choose to buy and consume it. This is due to the consumption needs of this segment of consumers that favour fake honey since it has a lower price and it is available in almost any store or supermarket (Ahmad *et al.*, 2021). Accordingly, even if consumers are knowledgeable of the presence of adulterated honey on the market, this does not affect their intention of buying it (Ahmad *et al.*, 2021).

Concurrently, Addam *et al.* (2017) reveal that some consumers test the purchased honey at home by applying different techniques to make sure that it is pure. According to Soares *et al.* (2017) some consumers associate crystallised honey (incorrectly informed) with low quality honey or sugar-adulterated honey. Yet, a large part of consumers is starting to become aware of the health hazards associated with certain toxic substances found in food and favour those labelled as organic (Soares *et al.*, 2017). Although honey labelling comes to the support of consumers to increase their level of trust in the process of purchasing and consuming, there are consumers who are yet wary of these quality guarantees (Addam *et al.*, 2017). A common feature emerges in

Table 1. Overview of studies on factors influencing honey purchasing behaviour.

Authors	Contribution / factors influencing honey purchasing behaviour
Murphy <i>et al.</i> (2000)	Price, texture, package, colour
Batt and Liu (2012)	Brand reputation, origin, quality-price
Yeow <i>et al.</i> (2013)	Quality, medical condition, brand reputation, price
Roman <i>et al.</i> (2013a)	Consumer needs, level of income, price
Roman <i>et al.</i> (2013b)	Brand, logo and certification
Pocol and Bolboacă (2013)	Education, occupation and age
Gyau <i>et al.</i> (2014)	Education, family
Ćirić <i>et al.</i> (2015)	Quality, trust in beekeepers,
Cosmina <i>et al.</i> (2016)	Origin, liquid state of honey, price
Guziy <i>et al.</i> (2017)	Country of origin, taste, type, price, size of packaging, design of packaging
Brščić <i>et al.</i> (2017)	Flavour, smell, honey type, colour, medical benefits
Žak (2017)	Price, sensory characteristics.
Kallas <i>et al.</i> (2019)	Origin
Vapa-Tankosić <i>et al.</i> (2020)	Certification (organic), family income, presence of a child in the family
Blanc <i>et al.</i> (2021)	Environmental sustainability aspects, ecological footprint

the honey assessing behaviour adopted by consumers, namely they prefer buying directly from beekeepers and thus be certain of the purchase quality (Addam *et al.* 2017; Ćirić *et al.*, 2015).

The young consumers lack the trained capacity for distinguishing between local honey produced by a local beekeeper and imported honey, capacity based on sensorial assessment (Šedík *et al.*, 2018a). The same authors raise the question of information need and education of consumers about the features of pure honey (Šedík *et al.*, 2018a). It is shown that the consumers informed about the negative effects of fake honey have a higher demand for locally produced honey (Wu *et al.*, 2015). This aspect is also underlined by Jones Ritten *et al.* (2019) who pointed out that consumers in possession of honey laundering information are more willing to pay a higher price for local pure honey. Jones Ritten *et al.* (2019) emphasise the importance of educating consumers by beekeepers on matters such as honey adulteration and effectiveness of labelling which guarantee the product quality. Accordingly, beekeepers can increase their income and bring a significant contribution to reducing food fraud (Jones Ritten *et al.*, 2019). For this purpose, Runzel *et al.* (2021) suggest implementing a smart agricultural system focused on honey traceability as a solution for honey adulteration. This system could be based on the following key elements subjected to constant checks and tests such as production (volume and type of honey), validation of distribution chain, and honey testing at the sale stage to the end consumer (pollen signature) (Runzel *et al.*, 2021).

2.3 Relation between socio-demographic characteristics and honey consumption behaviour

In what concerns the socio demographic features, the literature shows that despite the lack of a standard profile of the honey consumer, the factors positively influencing the consumption are as follows: age, gender, level of education and income (Pocol, 2012; Pocol and Ványi, 2012). Moreover, it is shown that consumers with higher studies who are part of 2-4 member families register a high consumption of honey (Ćirić *et al.*, 2020). Arvanitoyannis and Krystallis (2006) also confirm the fact that the consumers who have a family register a higher honey consumption behaviour. Testa *et al.* (2019) note that income is a key factor for high honey consumption. From the perspective of multiple sociodemographic factors analysed and their influence on the honey consumption behaviour, it was noticed that age is one of the best predictors of honey consumption.

According to a study conducted by Ćirić *et al.* (2020), consumers over 50 years old are regular consumers of honey. This is also corroborated by Pocol and Boloacă (2013) that showed that consumers over 50 with average and higher studies and consumers over 50 with maximum 10-year education are prone to daily honey consumption. At the same time, there is a daily honey consumption at the level of consumers under 50 years old with higher studies and living in small towns (Pocol and Boloacă, 2013).

The class of young consumers (25-34) is either not interested in honey consumption or registers very low levels of consumption (Krystallis *et al.*, 2007). This is also corroborated by Šedík *et al.* (2019) who underline the fact that younger consumers (18-30) rarely eat honey (up to 1 kilo per year) especially when their health condition is not at their best, in certain alcoholic drinks, or during wintertime, in the evening. The socio-demographic factors also influence the location where consumers buy the honey. Therefore, consumers over 45 years old prefer buying honey directly from beekeepers or from open markets/fairs (Kowalcuk *et al.*, 2017). Persons whose age ranges between 16 and 30 years old generally have little or no knowledge of the nutritional value of honey. The same happens in the case of those with lower education who prefer buying honey from the supermarket (Kowalcuk *et al.*, 2017). The female persons with higher education and knowledge about the health benefits choose to buy honey from specialised shops, generally health food stores (Kowalcuk *et al.*, 2017).

3. Materials and methods

An online survey was conducted between August 2020 and May 2021 on a sample of 1,233 respondents. The questionnaire contains aspects related to purchasing behaviour and honey adulteration, complemented with socio-demographic questions. For a certain number of questions the Likert scale was used, with grades from 1

to 5 where 1 means 'completely unimportant' and 5 stands for 'very important'. The first section, addressing the purchasing behaviour, includes the following courses of directions: buying frequency, factors influencing purchase (such as health concern, organic certification, origin, brand, price, place of purchase, family budget, presence of children in a family, discounts, promotions), place of purchase (including honey purchase during vacations), quantity of purchased honey, influence of sanitary crisis triggered by COVID-19 on the quantity of honey purchased. The second section is dedicated to honey adulteration and focuses on the perception and information of consumers about counterfeit honey. The final section comprises the sociodemographic features of the respondents which are shown in Table 2. The age segments were established according to previous findings on honey consumption behaviour in Romania (Šedik *et al.* 2019). The authors of these studies defined the similar age groups.

30.3% of the respondents are male, while 69.7% are female. The main age categories, where a significant number of respondents (25%) are found, are above 34 and under 44 years old. Most respondents have higher education both in terms of licence and master's degree or PhD (34.7%). The majority of participants are either students (19.9%) or employees (56.7%). The income is under 820 Euros in the case of 26.6% of the total respondents and above 820 Euros for most participants in the questionnaire (40.4%). Some of them

Table 2. Socio-demographic characteristics of the sample.¹

Variable	Definition	Percentage (%)
Gender	Male	30.3
	Female	69.7
Age	18-24 years	24.7
	25-34 years	18.3
	35-44 years	25
	>44 years	32
Education	Maximum 8 years of schooling	0.6
	Professional school	2.4
	High school	17.8
	Post high-school	3.1
	Higher education (license)	41.4
	Higher education (master, doctorate)	34.7
Socio-professional category	Housewife	4.1
	Student	19.9
	Retired	5.9
	Unemployed	1.5
	Employee	56.7
	Freelancer	6
	Business owner	5.6
	Other	0.3
Family income (Euros) ²	≤820	26.6
	821-1,640	40.4
	1,641-3,074	13.6
	>3,074	4.5
	I don't know / I don't answer	14.9
Residence	Rural	32.2
	Urban area, small town	15.5
	Urban area, residence/municipality	52.3

¹ In August 2020-May 2021, 1,233 respondents provided this information.

² Exchange rate (the average value for August 2020-May 2021): 1 Euro = 4.8791 RON (Romanian Leu).

(14.9%) did not provide information about their monthly income. Most respondents (52.3%) live in the urban area, in big cities that are either municipalities or county capitals.

Obtained data were processed and evaluated by using descriptive, nonparametric and multivariate statistics. The analysis was carried out in XLSTAT, version 2021.1. (Addinsoft Inc, New York, NY, USA) and in IBM SPSS 25 software (IBM Corp., Armonk, NY, USA). Nonparametric test such as Friedman test was applied in order to identify differences in evaluation among factors which are statistically significant. In addition, Nemenyi's procedure was used to determine among which factors exist these statistically significant differences. The 5-points scale (1-not at all important, 7-very important) was used for evaluating the importance of the following factors during honey purchase: health factor (F1), ecological aspect (F2), country of origin (F3), brand (F4), producer reputation (F5), place of purchase (F6), family budget (F7), price (F8), discounts (F9) and promotion (F10). Categorical principal components analysis with varimax and Kaiser normalisation was further applied in order to reveal the existence of latent factors. Differences among age segments towards selected questions regarding honey adulteration were examined by using chi-square test of independence.

4. Results and discussion

The survey showed that respondents purchase honey if necessary (55.7%) or once a month (26.5%). When comparing this result to those of older studies, it must be pointed out that Menozzi *et al.* (2015) is highlighting that those consumers who frequently purchase honey presented an increased preference for traceable honey. The majority of respondents stated that they buy honey directly from beekeepers and from friends. A similar conclusion was reached by other researchers who highlighted that consumers prefer to purchase honey directly from beekeepers, whose products are of high quality, a better taste and flavour (Ćirić *et al.*, 2015; Popescu and Guresoaie, 2019). Short supply chain offers consumers more confidence in the honey authenticity and quality. This is consistent with what has been found by Roman *et al.* (2013b), Šedík *et al.* (2018b), and Thoma *et al.* (2019). On the one hand, honey is mostly purchased from beekeepers situated at markets, fairs or direct delivery. On the other hand, purchase via Facebook, website or along roadside is executed rarely or never. Rare frequency of purchase was indicated also in case of supermarkets, specialty shops, neighbours and relatives. Popescu and Guresoaie (2019) have also shown that supermarkets are not preferred by Romanian consumers in the case of honey purchase.

Honey is rarely purchased during holidays at touristic places by Romanian consumers. Contrary to these findings, Li and Ryan (2018) have revealed that in other parts of the world, honey is one of the most popular souvenirs for tourists, being considered a natural and clean product. Most respondents confirmed that the presence of children in the family often influences the willingness to purchase honey. The findings are directly in line with previous findings obtained by Menozzi *et al.* (2015) and Vapa-Tankosić *et al.* (2020). Arvanitoyannis and Krystallis (2006) have also demonstrated that one of the main dimensions of honey purchasing motivation is related to the ethical character of this product, which includes its suitability with children's diet. In the last 3 years, the quantity of honey bought for family has mostly stagnated (49%) or increased (39.9%). During the sanitary crisis caused by COVID-19, the quantity of honey consumed by the whole family has mostly remained constant (56.6%) or increased (34%). A different conclusion was reached by Eftimov *et al.* (2020) who analysed the consumption patterns during the pandemic crisis, in 24 countries. Their findings show a decrease of honey consumption during the quarantine.

Furthermore, the present study examined the importance of selected factors which are considered during purchase of honey (Table 3). Friedman test supported with post hoc test – Nemenyi's procedure – confirmed that respondents evaluated selected factors in different way. The most important factors considered during purchase were health factor and country of origin followed by producer reputation and ecological aspect. The least important were discounts, promotion and brand followed by price and family budget (Table 4).

A similar pattern of results was obtained in other studies which suggest that health benefits and country of origin represent important incentives for honey consumption (Blanc *et al.*, 2021; Kowalczuk *et al.*, 2017;

Table 3. Consumer attitudes towards factors considering during honey purchase.¹

Factors	Mean	Standard deviation
F1 Health factor	4.29	1.06
F2 Ecological aspect	3.72	1.24
F3 Country of origin	4.18	1.08
F4 Brand	2.78	1.34
F5 Producer reputation	3.75	1.23
F6 Place of purchase	3.56	1.29
F7 Family budget	2.97	1.32
F8 Price	3.09	1.25
F9 Discounts	2.62	1.33
F10 Promotion	2.64	1.35

Mean=3.35, standard deviation=0.62, Friedman's test ≤ 0.0001

¹ The honey consumers evaluated the importance of selected factors on a 5-point scale from 1 (not at all important) to 5 (very important).

Table 4. Nemenyi's procedure.¹

Factors	Mean of ranks	Groups ²
Discounts	3.83	A
Promotion	3.92	A
Brand	4.10	A
Family budget	4.62	B
Price	4.88	B
Place of purchase	5.89	C
Ecological aspect	6.29	D
Producer reputation	6.35	D
Country of origin	7.43	E
Health factor	7.69	E

¹ Nemenyi's procedure = a post-hoc test of Friedman's test.

² Factors with different letters were evaluated differently from statistical point of view.

Roman *et al.*, 2013a; Yeow *et al.*, 2013). The importance of ecological aspects in the honey purchasing process was also highlighted in previous studies (Blanc *et al.*, 2021; Sîrbu *et al.*, 2016; Vapa-Tankosić *et al.*, 2020).

In addition, categorical principal components analysis revealed two latent components (Table 5). First components were titled as 'monetary factor' includes promotion, discounts, price, family budget while factors such as health factor, country of origin, producer reputation, ecological aspects and place of purchase comprise the second component entitled as 'factor of authenticity'. Approximately 69% of respondents consider Romanian honey as a honey of higher quality in comparison to imported honey from other countries. Crystallisation of honey is perceived as a sign of authenticity by 72.6% while only 7.8% thinks that it represents a sign of adulteration.

Honey belongs to the most adulterated food world-wide due to the strong economic motivation (Jaafar *et al.*, 2020). Only 51.4% of respondents are aware of adulteration and they suppose that honey is mostly counterfeit by table sugar and glucose syrup. Moreover, around 48% have been in a situation where they realised that honey was counterfeit.

Table 5. Rotated components loadings.

Factors	Dimension 1	Dimension 2
F1 Health factor	0.815	0.124
F2 Ecological aspect	0.725	0.214
F3 Country of origin	0.879	0.095
F4 Brand	0.514	0.437
F5 Producer reputation	0.785	0.170
F6 Place of purchase	0.727	0.207
F7 Family budget	0.269	0.807
F8 Price	0.249	0.834
F9 Discounts	0.123	0.920
F10 Promotion	0.106	0.908

Next questions were oriented on how consumers are protecting themselves from honey adulteration. On the one hand, the majority of them do not perceive the country of origin as a clue regarding the counterfeiting and higher price as a guarantee regarding honey's authenticity. On the other hand, the most respondents (56%) consider a very low price for a clue regarding the counterfeiting of honey. In general, respondents indicated that in order to distinguish authentic honey from counterfeit honey they have never used the following methods: napkin test, water cup test or fire test. A different conclusion was reached by Addam *et al.* (2017) who show that some consumers test the purchased honey at home by applying different techniques to make sure that it is pure.

Nevertheless, the majority of them consider the selected criteria (consistency, taste and degree of crystallisation) as an appropriate method for distinguishing authentic honey from counterfeit honey. The degree of crystallisation (or the liquidity state) was also mentioned by Cosmina *et al.* (2016) as an important element in honey purchasing decision. The chi-square test of independence confirmed statistically significant differences in answers towards questions with honey adulteration among age segments. Results showed that respondents belonging to age segments between 35-44 years and more than 44 years are more aware of the fact that honey is among the easiest and most often counterfeited food items (Table 6). The same results were obtained regarding the statement which claims that honey and other bee products from Romania are of higher quality than those from other countries. However, these segments do not know whether country of origin represents a clue regarding the counterfeiting of honey. The youngest segment (18-24 years) has the lowest percentage for assuming the honey crystallisation is a sign of its quality and the highest percentage for a sign of honey inauthenticity. The majority of all age segments think that very low price represents a clue regarding the counterfeiting of honey.

5. Conclusions and implications

The importance of authenticity in the food market is currently increasing due to many food scandals and adulteration of various food products. Similar situations have occurred in the honey market where raw honey is assumed to be the third most adulterated food in the world (Garcia and Phipps, 2017). Recent scandals with adulterated honey have created some doubts about declared quality, origin and authenticity (Zhou *et al.*, 2018). Our study brings original consumer research oriented on consumer attitudes toward honey adulteration as well as it examined the importance of several factors which are being considered during purchase of honey in the Romanian market.

The research showed that Romanian people purchase honey mostly from beekeepers or from their friends. In general, health aspect and country of origin are considered as the most important factors followed by producer reputation, ecological aspect and place of purchase. All aforementioned factors belong to latent

Table 6. Consumer attitudes towards honey adulteration among age segments.

Questions	Answers	18-24 years	25-34 years	35-44 years	>44 years	P-value ¹
Do you feel that honey and other bee products from Romania are of higher quality than those from other countries?	yes no I do not know	63.61% 10.16% 26.23%	58.85% 10.62% 30.53%	72.08% 5.84% 22.08%	76.90% 5.33% 17.77%	0.000**
Did you know that honey is among the easiest and most often counterfeited food items?	yes no I do not know	38.36% 51.48% 10.16%	40.71% 43.81% 15.49%	56.49% 30.19% 13.31%	63.71% 20.56% 15.74%	0.000**
In your opinion, the crystallisation of honey is:	A sign of its quality A sign of its inauthenticity I do not know	57.05% 14.75% 28.20%	72.12% 9.73% 18.14%	79.87% 3.90% 16.23%	79.19% 4.31% 16.50%	0.000**
Do you think that the country of origin represents a clue regarding the counterfeiting of honey?	yes no I do not know	32.79% 34.10% 33.11%	26.99% 34.96% 38.05%	21.75% 32.14% 46.10%	25.63% 31.47% 42.89%	0.018**
Do you think that a very low price represents a clue regarding the counterfeiting of honey?	yes no I do not know	58.03% 26.23% 15.74%	55.75% 28.32% 15.93%	57.79% 21.10% 21.10%	55.84% 21.57% 22.59%	0.096

¹ **indicates statistical significance at the 5% by applying chi-square test of independence.

factor entitled as 'factor of authenticity'. Less important factors were price, family budget, promotion and discounts. All of them belong to the second latent factor entitled as 'monetary factor'. In addition, research provided interesting insight into issues related to honey adulteration and its awareness among consumers. The majority of respondents are aware of honey adulteration and nearly a half have personal experience with fake honey. Honey produced in Romania is perceived as honey of higher quality in comparison to honey imported from other countries. The most respondents have never applied authenticity tests for honey (napkin test, water cup test and fire test) however, they consider very low price of honey as a clue regarding the counterfeiting of honey. The overall awareness of honey adulteration is higher in case of respondents who were 35 years and older. The more interesting is the fact that honey crystallisation is considered 'a sign of quality', however the youngest segment (18-24 years) had the lowest percentage for this answer and the highest percentage for 'I don't know' and 'it's a sign of honey inauthenticity'.

Honey market of European Union including Romania is flooded with cheap imported honey with unknown country of origin ('blend of EU and non-EU honeys'). This cheap honey exerts pressure on market prices in Romania and many beekeepers suffer from this situation. This study provides important information for beekeepers but mainly insight into purchasing behaviour of Romanian consumers and their attitudes towards honey adulteration. Beekeepers should focus more on components included in 'factor of authenticity'. Highlighting health factor, country of origin, reputation and ecological aspect of their product can increase the value of domestic honey in consumers' minds. All these components should be seen as added value.

Furthermore, policy makers should inform people about possible honey adulteration and its consequences on consumers in order to avoid inexperienced consumers from purchasing counterfeit honey which is only sweetener without any added value (healing effect, nutritional value). Beekeepers should educate their consumers about honey crystallisation as a sign of its quality especially to target younger segments because their awareness is the lowest.

The country of origin represents an important factor for Romanian consumers during the purchasing process of honey. Their trust in the high quality of Romanian honey should represent an important element for producers and distributors in order to increase their competitive advantage on the honey market. Traceability of honey should be in the attention of policy makers in order to protect consumers against low quality and cheap honey with unknown country of origin.

The main limitation of this study is related to the research sample, especially its structure which is not representative on a national level. This limitation exists due to COVID-19 pandemic which allowed only to distribute the questionnaire in online environment by using the snowball method. Further research should be addressed in order to investigate the consumer attitudes towards honey adulteration and authenticity in other countries of the European Union.

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