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Consumers' attitude towards honey consumption for its health benefits: first insights from an econometric approach

Abstract

Purpose

As is well known, there are several aspects that characterise honey consumption and the reasons for purchasing it. Despite this, little attention has been paid to the drivers that move consumers towards the use of honey for its health benefits and therapeutic properties.

The aim of this study is to define which drivers move the consumption of honey for its health benefits.

Design/methodology/approach

The study, conducted on 640 Italian honey consumers, applied inferential tests (Chi-square) and an econometric model (logit regression), and showed that about 66% of the respondents stated that they consume honey for its health properties.

Findings

The main drivers of honey consumption are both among the intrinsic (Colour) and extrinsic (Origin and Organic certification) attributes of the product. What also emerges is that the propensity to consume honey for health purposes is influenced by the consumer characteristics and habits, such as Age cohort, Gender, BMI and Large Retail buyer. Moreover, we observed that consumption is influenced by BMI but not by lifestyle characteristics such as sport and diet.

Originality

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This study could be a support tool for policy-makers who are interested in promoting good nutrition and improving public health, since there is great interest in the functional properties of foods and the need to enhance the value of products, while at the same time ensuring consumer protection.

Keywords

honey; functional food; logistic regression; consumers; health benefits.

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Introduction

In recent years, consumer attitudes and behaviours towards honey have garnered considerable interest from researchers, resulting in a large body of scientific production covering different aspects of consumption. Researchers' interest in this product can be partly explained by the increase in production and consumption (García, 2018; Pippinato et al., 2020), but also by the positive environmental implications of beekeeping, in terms of ecosystem services (Blanc et al., 2018; Tamburini et al., 2019; Sillman et al., 2021).

Regarding consumer behaviour, several publications have investigated consumption characteristics such as places of purchase (Batt & Liu, 2012; Adam Roman et al., 2013), consumption habits and type of honey consumed (Ványi et al., 2011; Kowalczuk et al., 2017) and purchase motivations (Roman, Popiela-Pleban, Kozak, et al., 2013; Ismaiel et al., 2014). In addition, considerable efforts have been made to assess the effectiveness of the valorisation tools provided by the European Union, including, in particular, organic certification (Cosmina et al., 2016). This certification already attracted research interest in the early 2000s, when the willingness to pay for organic labelled honey was assessed (Arvanitoyannis & Krystallis, 2006). Other certifications that can be used by beekeepers to enhance the value of their products include Geographical Indication certifications (GIs) (Brščić et al., 2017) and the optional quality term “Mountain product” (Brun et al., 2020), which was recently introduced in the European legislation (EU, 2012; EU, 2014). Another aspect that has been widely investigated is the consumers’ interest in locally produced honey, purchased directly from local producers. In this regard, it seems that consumers are particularly interested in honey from local producers, considering it to be of superior quality (Roman, Popiela-Pleban, Kovaz, et al., 2013; Kowalczuk et al., 2017). Equally important are the intrinsic characteristics which can guide consumers towards the choice of honey (Cosmina et al., 2016).

Although many aspects of honey consumption have been studied, little attention has been paid to the drivers that move consumers towards the use of honey for its health benefits and therapeutic properties. Currently, in the literature, honey has been described as a food that provides health benefits (Arvanitoyannis & Krystallis, 2006) further stating that interest in its therapeutic properties may increase the frequency of consumption (Testa et al., 2019). With a different and innovative approach, it is now possible to consider honey as a *functional food*, due to its positive effects on health (Viuda-Martos et al., 2008) and, consequently, to investigate consumer response related to this specific attribute. This consideration is supported by the literature, which has provided a definition of functional food, i.e. being part of a standard diet, consumed regularly in normal quantities and having a beneficial effect on health, for which scientific evidence has been provided (Doyon & Labrecque, 2008). Several secondary components are responsible for these functional properties: for example, honey possesses amino acids, proteins, carotenes, phenolic compounds and flavonoids with an antioxidant effect (Viuda-Martos et al., 2008); however, the main antioxidant capacity is due to phenolic and flavonoids components (Vasić et al., 2019). Flavonoids and polyphenols are also predominantly responsible for the anti-inflammatory capacity (Vallianou et al., 2014). In addition, flavonoids contribute significantly to the antiulcerous effect (Viuda-Martos et al., 2008; Almasaudi et al., 2016) . Antimicrobial action has also been recently observed, including antibacterial, antifungal, antimycobacterial and antiviral properties (Israili, 2014). Finally, consumption of honey rather than refined sugar can lead to benefits related to a better regulation of the hyperglycaemic condition, reducing other metabolic disorders and mitigating the negative effects on several organs that can lead to diabetic complications (Bobiş et al., 2018).

Despite the fact that it has been suggested in literature that consumers partially associate the consumption of honey with its health properties (Brščić et al., 2017), to the best of our knowledge, no study has yet assessed through an econometric approach which drivers may be associated with honey consumption for its health benefits. To understand which determinants drive consumers to prefer honey for its health benefits, it is necessary to use these characteristics as dependent variables in an econometric model.

Considering the strong interest that some consumer segments have shown in healthy and functional foods (Van Huy et al., 2019; Nguyen et al., 2020), this study is based on the hypothesis that there is a specific demand for honey due to its health benefits. Starting from this consideration, the general objective of this article is to define which drivers move consumers towards the consumption of honey for its health benefits, as well as to quantify their importance. Therefore, the analysis was developed to answer the following research questions:

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- Is there a demand for honey for its health benefits (functional honey)?
- What are the drivers of honey consumption for its health benefits?
- Is the consumption of honey for its health benefits influenced by lifestyle and health status?

Methodology

Data collection

The research was carried out by administering a questionnaire to a convenience sample (Etikan et al., 2016) of consumers in north western Italy (Piedmont region) using the face-to-face method after a random walk recruitment of respondents. Despite some limitations in inference to the general population, this method is widely used, considering that the validity of the results is not affected (Sama et al., 2019; Testa et al., 2019; Di Vita, Zanchini, et al., 2021). Before being administered to the consumers, the questionnaire was validated through a pilot survey on 40 individuals. The questionnaire was developed to identify consumer attitudes towards the consumption of honey for its health effect. In order to understand what drives consumers' attitudes towards honey consumption for health, several drivers have been designed based of the main topics found in the literature, related to product characteristics, socio-demographic aspects, lifestyle and health status, as indicated the *econometric model* sub-section. The study was conducted in accordance with the ethical standards laid out in the Declaration of Helsinki. The participation of all interviewed was voluntary and informed given consent was provided by all participants.

The questionnaire was divided into three parts: i) general characteristics of honey consumption (quantity consumed per year, types of honey and places of purchase), ii) intrinsic and extrinsic characteristics of the product and iii) characteristics of the sample. The first section was organised with open-ended questions about the quantity of honey consumed per year, expressed in kg. Regarding the places of purchase, closed questions were asked, e.g. "Do you buy honey at the supermarket? (YES/NO). Lastly, for the types of honey purchased, questions were expressed with a Likert scale where 1 means "I never buy this type of honey" and 5 means "I buy this type of honey very often".

Regarding intrinsic-extrinsic characteristics, consumers were asked to express the importance of these attributes in the purchasing process on a Likert scale, where 1 means "Not important" and 5 means "Very important". Finally, as mentioned above, the third section investigated the description of socio-demographic characteristics of the consumer as well as its lifestyle and health status. In this context it is necessary to explain how some of these indexes were grouped from continuous to categorical

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variables, specifically the Body Mass Index (BMI) and Age. With respect to BMI, we referred to the classification provided by the World Health Organization (WHO), as follows: underweight = people with BMI <18.5; normal weight = people with BMI 18.5–24.9; overweight = people with BMI 25.0–29.9; I obesity = people with BMI 30.0–34.9.

For the Age cohorts we used the classification proposed by Brosdahl and Carpenter, (2011), where individuals born between 1982 and 2000 represent the "Millennials" cohort, respondents born between 1961 and 1981 are included in the "Generation X" cohort, people born between 1943 and 1960 are the "Baby Boomers" and, finally, respondents born before 1960 are include in the "Silent Generation" cohort. The last 2 groups have been grouped in a single cohort, named "Older generations" because they are imbalanced in the respondents' sample.

The surveys were carried out both in large retailers and in Farmer markets with the same questionnaire, having an average interview time of about 10 minutes. Data collection was conducted between the end of 2018 and the first months of 2019, obtaining a total of 640 complete interviews. The characteristics of the sample are presented in Table I.

[Table I near here]

Inferential tests

The first step of the analysis aimed at answering the first research question: for this purpose, inferential statistics, and in particular the Chi-square statistics, were considered as the most suitable analysis strategy. In fact, this test is specific to frequency analysis and allows us to understand the association existing between 2 variables, testing the null hypothesis (H_0) that two variables are independent and, therefore, that the frequency distribution is random. When the test is significant, the null hypothesis is rejected in favour of the alternative hypothesis (H_1) that there is an association between the variables (; Franke et al., 2012; Blanc et al., 2020). In this first phase, the use of honey for its health effect can be associated to socio-demographic characteristics, lifestyle, health status and places of purchase was assessed.

Econometric models

To answer the second research question, an econometric approach was adopted, using logistic regression. Variables were selected from the current literature, as shown in Table II. Lifestyle and health status variables, where not yet investigated for honey, were obtained from studies on other

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functional foods. This method makes it possible to assess the effect that many drivers have on a dependent variable from a probabilistic point of view. Covariates are related to intrinsic and extrinsic honey features, socio-demographic, lifestyle and health status. Thanks to this approach, their importance in relation to actual honey consumption for its properties was assessed. We preferred to ask for a more general definition of the health benefits of honey rather than its functional properties, to avoid consumers misunderstanding the question as follow:

- Do you currently consume honey for its health benefits? (YES/NO)

This question allows the use of the logistic model, since the answer is binary, where: 1 means "I consume honey for its health effect" and 0 means "I do not consume honey for its health effect". To obtain a robust model from an initial pool of variables, the stepwise backward selection method was performed in combination with the logistic model (Di Vita et al., 2020; Merlino et al., 2020). The backward selection method allows through an iterative process, to omit covariates that do not carry significant information (Setti et al., 2016; Di Vita et al., 2020), generating the least inflation in the residual sum of squares (Derksen & Keselman, 1992). As multicollinearity is a relevant issue in logistic regression, we applied the Variance Inflation Factor (VIF) analysis to assess this aspect. According to the literature, the 1/VIF ratio must be higher than 0.2 to indicate an acceptable model (Chen et al., 2019; Pappalardo et al., 2019). Moreover, it is important to point out that when constructing interaction models, the interaction variables should not be considered in the VIF analysis, because they are naturally collinear, so the evaluation is performed on the remaining variables (Mehmetoglu & Jakobsen, 2016). Regarding the fitting of the model, we considered the log-likelihood and the Nagelkerke's R square (Nagelkerke, 1991; Walker & Smith, 2016). The last aspect of logistic regression to be considered is the marginal effects. In fact, the coefficients of logistic regression only provide an indication of the direction and intensity of the studied effect. To have a probabilistic indication, it is still necessary to consider the marginal effects. This approach make it possible to calculate the probability variation due to the unitary variation of a regressor, keeping all the other independent variables at their average value (Cembalo et al., 2012).

[Table II near here]

Results

Descriptive statistics

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The first section of results focuses on the descriptive statistics related to the main intrinsic and extrinsic features of honey selected for the econometric models. This outcome is shown in Table III and represents the average importance expressed by consumers when purchasing honey. From a descriptive point of view, we identify that some features are considered very important by consumers, such as Taste, Origin (meaning country of origin) and label information. Other attributes, specifically Price and Organic certification, scored moderately (but still positive), exceeding the neutrality threshold of 3 points on the Likert scale. Finally, Colour and Liquid state are considered less important in the purchasing process.

[Table III near here]

Inferential tests related to frequency analysis

The first objective of this work was to assess consumers' interest in buying honey in relation to its health benefits. Looking at the sample, about 66% of the respondents stated that they consume honey for these characteristics, showing a considerable interest in the health properties of honey. In order to analyse in depth whether the observations are independent or, on the contrary, there is a relationship between consumers and consumption for health purposes, a frequency analysis combined with the Chi-square inferential test was performed. Then, in the second step of the analysis, the relationship between consumption frequency and socio demographic characteristics of the sample was assessed. Table IV shows that honey consumption for health purposes appears to be independent according to age cohort, education, diet and sport activity. On the contrary, there is a significant relationship with gender, income, BMI and Large Retail customer. Our results suggest that this attitude is positively correlated with the female gender. Looking at individual monthly income, based on the relative frequency in the "healthy" subgroup; it is possible to suggest that people with low to middle income tend to consume honey for its properties. Looking at BMI, the frequency analysis shows that honey consumption for health is slightly more related to underweight people and less common among overweight people. Among normal weight and obese people, the frequencies seem very similar. Finally, the last piece of information is related to the habit of buying honey at farmers' markets. Indeed, people who habitually attend farmers' markets consume honey more often because of its properties.

[Table IV near here]

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Econometric model

Table V reports the Logistic models performed using individual consumer characteristics and intrinsic and extrinsic product characteristics as covariates. The reported variables are those selected through stepwise backward selection. The goodness of fit was evaluated trough log-likelihood and Nagelkerke's R-square, obtaining values comparable to those observed in the literature (Stranieri & Banterle, 2015; Grasso et al., 2019). The verification of multicollinearity, through VIF analysis, is reported in Table VI: the 1/VIF rate is higher than 0.2 for all of covariates, confirming that there are no multicollinearity issues in the estimates.

[Table V near here]

[Table VI near here]

The model without interactions highlights that the covariates with a positive effect on the purchase of honey for its properties are "Colour", "Organic certification" and "Gender (female)". On the other hand, the covariates showing a negative effect on the probability to buy this product for its properties are "Origin" and "Large-scale Retail customer".

The interaction model allows a deeper understanding of drivers moving buyers towards the consumption of honey for its properties. Indeed, in the interaction model, BMI has a significant influence showing that, as the BMI increases, the probability to consume honey for its properties decreases. Moreover, including "BMI" and "Age" as interaction terms, the results show a statistically significant positive interaction of the covariates, suggesting that honey consumption for health benefits increases when both BMI and Age cohort increase.

Focusing on the role of the Age cohort, which has a negative effect in the interaction model, it can be assumed that younger consumers show a greater propensity towards honey consumption for health purposes. On the other hand, interaction term obtained from "Age" and "Gender" shows a positive coefficient, highlighting that the consumption increases in higher age cohort women.

Finally, since the interpretation of the logistic regressions is limited to the regressor covariate on the dependent variable, marginal coefficients (interpretable in percentage terms) were calculated for each variable in both models (Table VII).

Concerning the model without interactions, the highest positive magnitude effect is provided by the Gender covariate: in other terms, women are more likely to buy honey for its health effects (+15.6%).

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On the contrary, the most negative coefficient belongs to the covariate "Large Retail customer", showing that these consumers show a lower probability of buying honey for health purposes (-13.1%). On the other hand, the magnitude effects obtained for the interaction model covariates (focusing on the higher ones) suggests a decrease in the probability of purchasing honey for its properties when "Age" (-2.8%) and "BMI" (-25.9%) increase.

[Table VII near here]

In summary, it was possible to identify several drivers of honey consumption, both among the intrinsic (Colour) and extrinsic (Origin and Organic certification) attributes of the product, and with regard to consumer characteristics and habits, such as Age cohort, Gender, BMI and Large Retail buyer.

Discussions

By analysing the main findings between samples of honey consumers interested in its health properties and those who are not, it appears that women are more interested than men. This finding is consistent with a previous study conducted on consumer choice (Batt & Liu, 2012), where women were also more likely to follow healthy diet recommendations (Kearney et al., 2000; Munt et al., 2017) . Indeed, a recent study indicated that female are more likely to follow a healthy diet, probably because are more concerned in body weight than male (Hilger et al., 2017). The logit models confirm that women are more likely to consume healthy honey, particularly for women belonging to older age cohorts, as shown by the Interaction term "Age*Gender". Those findings are confirmed by other studies on specific consumer preferences for honey consumption (Kearney et al., 2000; Gyau et al., 2014), but also on general food consumption habits , where females aged 50-60 years are more likely to follow healthier eating behaviours (Lallukka et al., 2007). The interest in functional food consumption among women has also been observed and confirmed in several recent studies. In fact, women were more interested in benefits related to the improvement of general health, physical beauty and personal image (Huang et al., 2020). Regarding a specific functional component represented by lycopene, Timpanaro et al., 2020 found that the group of "Aware" consumers was mainly represented by women with a higher willingness to pay for lycopene-enriched tomatoes.

Among the other socio-demographics, "Age" shows a negative score, indicating that, in general, older age consumers are less likely to buy honey for health reasons. This result is in line with similar findings obtained on the opinion of young honey consumers (Żak, 2017) who are more interested in

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health properties of this product, and also in line with findings on other functional products (Di Vita et al., 2020). However, this result should be interpreted with caution and validated with further investigations, since it has also been suggested in other studies that older people consume honey for its health properties (Pocol & Teselios, 2012; Guziy et al., 2017).

Regarding "BMI", which is a health covariate still unexplored in the honey consumer literature, it seems that high BMI values are negatively related to consumption attitude towards health honey. BMI is often positively related to health information in food products (Bryła, 2020) or towards the interest in functional foods, for instance in the case of functional yoghurt (Moro et al., 2015). Our result also indicates that people with lower BMI are more interested in functional properties of honey; the result is partly in line with Segovia and Palma (2016), who observed for functional tomato that consumers with lower BMI are more interested in health information by showing higher WTP for such products. Moving on the interaction term, it shows that older generations with higher BMI values are more willing to consume honey for its health benefits: partially this could be due to the lower likelihood of older consumers to adopt unhealthy eating patterns (Drywień et al., 2021).

Focusing on the other socio-demographic, "Monthly income" is only statistically significant in the Chi-square analysis suggesting that consumers with low income can be interested in honey consumption for its functional properties. Although the role of income is often controversial, discouraging low-income consumers from purchasing healthier products (Lallukka et al., 2007), people with lower incomes might also be interested in consuming food for healthy properties (Bihan et al., 2010, Balco and De Magistris, 2019), as well as in the case of honey, consumers with a higher wage level (Ismaiel et al., 2014).

The analysis of the purchasing habits of honey consumers (referred to as "Large Retail customer" in the analysis) highlighted that those who buy honey mainly in large-scale retail trade, rather than at local or farmers' markets, have less inclination to consume honey for its health properties. This result is in line with previous literature, whereas the higher propensity of consumers to buy honey from small or local markets has been observed (Arvanitoyannis & Krystallis, 2006). The consumption of local honey may be due to increased consumer confidence for short supply chains, stronger perceptions of food safety (Wu et al., 2015), and quality aspects of local products (Troiano et al., 2016). Finally, a recent study found a significant relation between WTP for local honey and healthiness, confirming the relation among local food consumption and health aspects (Vapa-Tankosić et al., 2020).

Among extrinsic characteristics, "Organic certifications" have a positive impact on the likelihood of purchasing. This finding is in line with other studies focused on honey consumption habits (Jensen &

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Mørkbak, 2013; Cosmina et al., 2016; Testa et al., 2019), confirming the role of the organic label in the perception of a healthier honey, despite its lower magnitude compared to local aspects (Troiano et al., 2016). The "Origin" of the product is also often linked to the higher perception of honey health among consumers (Batt & Liu, 2012; Wu et al., 2015; Guziy et al., 2017). Moreover, these aspects are linked to the environmentally friendly perception of the product, which is considered during the purchasing process (Jensen & Mørkbak, 2013). Indeed, quality labels and GIs labels (with their specific quality and traceability requirements) are increasing their importance in the eye of honey consumers (Brščić et al., 2017; Di Vita, Pippinato, et al., 2021).

Finally, the only intrinsic characteristic showing a positive influence on the probability of purchasing honey for its health benefits is "Colour". This characteristic is a relevant property of honey in the consumers' opinion, strongly linked to the idea of quality (Arvanitoyannis & Krystallis, 2006; Brščić et al., 2017), thus confirming our findings and providing further insights into the positive connection between colour, quality and health properties for purchasers. From a chemical and medical point of view, the colour type of honey is related to the content of minerals and phenolic substances with functional activity (Tapia-Campos et al., 2017), and to a radical scavenging capacity (González Lorente et al., 2008), but consumers' awareness of these properties and the influence of these functional characteristics on the purchasing process are still unexplored.

Conclusions

Main findings

We have confirmed that there is a demand for honey consumption because of its health benefits; in fact, more than 60% of the sample is interested in these aspects. Moreover, we identified several drivers of honey consumption, both among the intrinsic and extrinsic attributes of the product, and with regard to consumer characteristics and habits. Finally, we observed that consumption is influenced by BMI, but not by lifestyle characteristics as sport and diet.

Implications

The results have several implications for academicians, policy makers and beekeepers. From an academic point of view, this is the first study to focus on the consumption of honey for its functional properties, assessing what factors drive consumers in this direction. Through this attempt, the study contributes to the literature by improving the knowledge of honey consumers and the drivers that lead them to consume functional products.

Regarding policy implications, this study could be a support tool for policy-makers who are interested in promoting good nutrition and improving public health. Since there is great interest in the functional

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properties of foods and the need to enhance the value of products, while at the same time ensure consumer protection, several tools have been provided by the European Union. In particular, regulations are related to the use of health claims (CE, 2006; EU, 2012) through which consumers can be informed about the functional properties of products. Currently, there are no claims that can be used on honey, although EC Regulation 1942/2006 suggests that their use on this product is feasible. Considering these backgrounds and the large interest in the functional properties of honey, the legislator could evaluate the technological and economic feasibility of a claim for this product.

Concerning the producers, the contribution of this article in the short term increases the awareness of honey consumers' characteristics, allowing beekeepers to better market their products. In the long term, if European regulations were to provide for the use of health claims on honey, producers could improve the market positioning of their products by reaching niche consumers sensitive to the health aspects of the product.

Limitations and future research

The limitations of this study are mainly due to the origin of the consumers, who were recruited only in northern Italy, and to the sampling methodology, which limits the possibilities of inference to the general population of honey consumers. Nevertheless, this study represents a starting point in terms of understanding the drivers of honey consumers towards its beneficial properties. Further work in the future can be carried out looking for other drivers and extending the sample to other countries. Moreover, interest in specific honey properties could be evaluated, since this study analysed interest in health benefits in general terms. Finally, this study opens the possibility to evaluate the feasibility of using health claims on honey labels, both from a technological point of view and regarding consumer interest.

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Table I. Characteristics of respondents (n = 640)

Variables	Items	Frequency	Percent
Age Cohort	Millennials	175	27.3
	Generation X	305	47.7
	Older generations	160	25.0
Gender	Male	268	41.9
	Female	372	58.1
Education	Elementary and middle schools	80	12.5
	High school	313	48.9
	Bachelor and Master degree	225	35.2
	Ph.D. and Specialities	22	3.4
Monthly Income	< 1,000 €	105	16.4
	1,000-2,000 €	288	45.0
	2,000-4,000 €	116	18.1
	No answer	131	20.5
Diet	No	549	85.8
	Specific diet	91	14.2
Regular sport activity	No	263	41.1
	Yes	377	58.9
BMI	Underweight	20	3.1
	Normal weight	461	72.1
	Overweight	148	23.1
	Obese	11	1.7
Large Retail customer	No	349	54.5
	Yes	291	45.5

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Table II. Tested variables in logistic models

Type	Variables	type	Reference
Intrinsic	Colour	Cat (1-5)	(Kowalczuk et al., 2017)
	Overall taste	Cat (1-5)	(Ismaiel et al., 2014)
	Liquid state	Cat (1-5)	(Ismaiel et al., 2014)
Extrinsic	Origin	Cat (1-5)	(Gyau et al., 2014)
	Price	Cat (1-5)	(Cosmina et al., 2016)
	Organic certification	Cat (1-5)	(Cosmina et al., 2016)
	Label Information	Cat (1-5)	(Brščić et al., 2017)
Socio demographic	Age Cohort	Cat (1-3)	(Arvanitoyannis & Krystallis, 2006)
	Gender	Dummy	(Ványi et al., 2011)
	Education	Cat (1-4)	(Gyau et al., 2014)
	Monthly Income	Cat (1-4)	(Brun et al., 2020)
Lifestyle and health status	Diet	Dummy	(Küster-Boluda & Vidal-Capilla, 2017)
	Regular sport activity	Dummy	(Blanc et al., 2021)
	BMI	Cat (1-4)	(Urala & Liisa, 2003)
Place of purchase	Large Retail customer	Dummy	(Yu et al., 2017)

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Table III. Descriptive statistics (n = 640)

Type	Variables	Mean	SD
Intrinsic	Overall taste	4.01	1.19
	Colour	2.79	1.49
	Liquid state	2.45	1.48
Extrinsic	Origin	4.59	0.90
	Label Information	4.05	1.28
	Organic certification	3.31	1.39
	Price	3.15	1.25

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Table IV. Frequency analysis and Chi-square tests

Type	Variables	Healthy (n = 424)	Non healthy (n = 216)	Chi square statistics	p-value
Age Cohort	Millennials	28.30	25.46	0.869	0.648
	Generation X	47.64	47.69		
	Older Generations	24.06	26.85		
Gender	Male	36.32	52.78	15.923	0.000***
	Female	63.68	47.22		
Education	Elementary and middle schools	11.08	15.28	3.046	0.385
	High school	50.24	46.30		
	Bachelor and master degree	35.61	34.26		
	Ph.D. and Specialities	3.07	4.17		
Monthly income	< 1,000 €	24.10	13.10	19.162	0.000***
	1,000-2,000 €	58.20	53.10		
	2,000-4,000 €	17.80	33.80		
Diet	No	84.91	87.50	0.790	0.374
	Specific diet	15.09	12.50		
Regular sport activity	No sport	42.22	38.89	0.655	0.418
	Regular sport	57.78	61.11		
BMI	Underweight	4.48	0.46	8.390	0.039**
	Normal weight	71.70	72.69		
	Overweight	21.93	25.46		
	Obese	1.89	1.39		
Place of purchase	Large Retail customer	41.27	53.70	8.917	0.003***
	Farmer market customer	58.73	46.30		

p-value significance: ** < 0.05; *** < 0.01

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Table V. Logistic regression of attributes influencing honey consumption for health purposes (n = 640)

	No interactions		Interaction model	
Variables	**Coefficient**	**p-value**	**Coefficient**	**p-value**
Colour	0.096	0.099*	n.s.	n.s.
Origin	-0.209	0.044**	-0.182	0.078*
Organic certification	0.118	0.054*	0.128	0.037**
Age cohort	n.s.	n.s.	-1.684	0.009***
Gender	0.742	0.000***	n.s.	n.s.
BMI	n.s.	n.s.	-0.963	0.031**
Large Retail customer	-0.626	0.000***	-0.617	0.000***
Age*Gender	n.a.	n.a.	0.344	0.000***
BMI*Age	n.a.	n.a.	0.441	0.025**
Constant	0.878	0.039**	4.563	0.002***
Log Likelihood	-389.978		-388.044	
Nagelkerke R-square	0.081		0.086	

n.s. = not significant; n.a. = not available

p-value significance: * < 0.1; ** < 0.05; *** < 0.01

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Table VI. VIF analysis for both logistic models

	No interactions		Interaction model	
Variables	**VIF**	**1/VIF**	**VIF**	**1/VIF**
Colour	1.02	0.98	n.a.	n.a.
Origin	1.02	0.98	1.01	0.99
Organic certification	1.02	0.98	1.00	1.00
Age cohort	n.a.	n.a.	1.04	0.96
Gender	1.02	0.98	n.a.	n.a.
BMI	n.a.	n.a.	1.04	0.96
Large Retail customer	1.02	0.98	1.01	0.99
Mean VIF	1.02		1.02	

n.a. = not available

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Table VII. Average marginal effects performed on the logistic regressions significant attributes.

	No interactions		Interaction model	
Variables	**Coefficient**	**p-value**	**Coefficient**	**p-value**
Colour	0.020	0.096*	n.s.	n.s.
Origin	-0.043	0.042**	-0.037	0.078*
Organic certification	0.024	0.052*	0.027	0.029**
Age cohort	n.s.	n.s.	-0.328	0.003***
Gender	0.156	0.000***	n.s.	n.s.
BMI	n.s.	n.s.	-0.259	0.013**
Large Retail customer	-0.131	0.000***	-0.127	0.000***
Age*Gender	n.a.	n.a.	0.073	0.000***
BMI*Age	n.a.	n.a.	0.123	0.010**

n.s. = not significant; n.a. = not available

p-value significance: * < 0.1; ** < 0.05; *** < 0.01

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