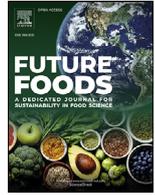


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An experimental analysis of consumers' attitudes towards honey: The case of the Sicilian market

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ABSTRACT

The *Apis Mellifera* is relevant for the structure, composition, and functioning of natural habitats, including agricultural habitats and urban and peri-urban contexts. Indeed, *Apis Mellifera* has a massive impact in terms of the positive externalities it brings to the environment in general and especially in fruit trees. In addition to these aspects that determine positive effects on the environment, the production of honey, the consumption of which is of fundamental importance for human health, should not be overlooked. This research aims to investigate the factors that drive consumers to purchase and consume honey. For the purpose of the research, we did a stage sampling by dividing the municipalities in Sicily into three stages. The research results show that 327 out of 527 participants who consume honey because they consider it remarkable for its health and therapeutic properties. This aspect, combined with the positive externalities created by bees, results in the combination of multifunctional agricultural production where production for food purposes (honey) is combined with agricultural production. This aspect has a major value in a perspective of agricultural production that increasingly respects the environment and human health.

1. Introduction

Honey is a natural product resulting from a production and processing process carried out by bees and human extraction. Its food use is now recognized all over the world. The activity of bees is of considerable importance for agricultural production. We can say that bee activity produces a positive externality on agricultural production by increasing its productivity and at the same time is a source of products such as honey and honey derivatives that are very important for human nutrition. From an economic point of view, having bee hives helps create the conditions for increasing company revenues and be a source of competitive advantage over competing businesses that do not have bees. Its use in the preparation of sweets is also very important (Wu et al., 2014). Honey is an important source of macro- and micronutrients. In fact, it is composed of carbohydrates, mono- and disaccharides such as glucose and fructose, and some micronutrients potassium, calcium, copper, iron, magnesium, manganese, phosphorus, sodium, zinc, and selenium can be found and small amounts of vitamins, such as ascorbic acid (C), thiamine (B1), riboflavin (B2), niacin (B3), pantothenic acid (B5), and pyridoxine (B6) (Alvarez-Suarez et al., 2013). In developed economies, honey consumption is very important in relation to the consumer's lifestyle, which is increasingly focused on healthy eating and the prevention of disease. In Italy, unlike the rest of the world, according to Directive 2001/110/EC honey can be classified based on the origin or to the method of produc-

tion or extraction (Europea, 2014; Costato, 2011). Again, in high per capita income economies, the distinction is very important and follows the tastes and fashions of the moment. This aspect is very important, as it allows the evolution of consumer needs to be emphasized (Sgroi and Salamone, 2022). Studies have shown that consumers make their consumption choices considering intrinsic and extrinsic quality indications. Therefore, there are several factors that may influence honey consumption; an extrinsic for example price also influence consumer choice but also organic certification (Gyau et al., 2014). Other important intrinsic factors are: appearance, whether liquid or crystallized and among these the most purchased is liquid honey (Kabbani et al., 2011); origin, i.e. whether it is produced locally or imported from abroad (Kehagia et al., 2007). Several factors influence consumers when purchasing honey. However, the decision is often habitual and dictated by knowledge of the value of honey. For example, Ali et al. (2021) stated that medical conditions product quality, brand reputation, and price have a positive and significant relationship with the purchasing behavior of Asian consumers. Similarly, Alnafissa and Alderiny (2020) highlighted that the main reasons for honey consumption are its medicinal and nutritional values. Purnomo et al. (2021) identified four main dimensions in the motivation to purchase honey: medical benefits of its consumption, dietary quality, ethical character of honey, and lifestyle suitability for food consumption. Jones Ritten et al. (2019) indicated, for the US market, that consumers were willing to pay substantial premiums

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for honey based on shape, container, brand, and, in particular, single-flower sources. Many studies have also stated that the origin of honey is the most important factor considered before purchase. The study by Khaoula et al. (2019) found that when buying honey from a retail store, there were three main constructs that were most influential in the purchase decision: brand reputation, origin, and value for money. The production of honey is combined with the pollination of fruit trees and other flowering plants apart from the olive tree, which has anemophilous pollination. In fact, we can say that bees produce a positive externality in the environment where the hives are placed or where they normally reside. In fact, the productivity of the land increases from foraging in orchards. So we can say that the activity of bees produces a positive externality towards, for example, the fruit trees that are located in the place and that there is also the production of honey (Pilati et al., 2018a). The activity carried out by bees is extremely important for agriculture and also for the well-being of man (Hristov et al., 2020; Neov et al., 2019; Shumkova et al., 2021). In this paper, after discussing the activities of bees, experimental research on consumer attitudes toward honey was conducted. Specifically, with this research, we wanted to investigate why consumers buy and consume honey. The research was conducted by interviewing a sample of consumers from Sicily.

2. Beekeeping, honey, and positive externalities on the environment

In the vision of multifunctional agricultural activity, eco-system services or the benefits that derive directly or indirectly from ecosystems take on particular importance. The eco-systemic pollination service, generated by the wind and by animals, especially pollinating insects, represents an important production factor in the context of agricultural companies. As is known among pollinating insects, the honey bee is the pollinator par excellence. Bees determine positive externalities to agricultural activity as they favor the pollination of flowers of fruit trees and vegetable species. The pollination service of bees and insects is aimed at both cultivated and wild vegetation. In the first case, by pollinating the crops, wild bees provide the agricultural enterprise with an ecosystemic service that has positive effects on productivity, while in the second case, an internal relationship is formed in the environment, between wild bees and spontaneous vegetation, which has positive effects on the entire agro-ecosystem (Belay et al., 2015). Bees are important for plant species (fruit trees, vegetables, etc.) as it promotes pollination. In addition, honey is obtained from bee activity and is a very important food in consumers' diets. In recent years, following the action of a series of stressors, especially the spread of varroa, the intensification of crops, and the use of agro-pharmaceuticals in agriculture, wild bees have reduced their consistency so much that they require the help of managed bees in pollination activities. But also managed bees, as well as wild bees, provide pollination services to both agricultural crops and spontaneous vegetation. In the case of agricultural crops, a transaction is made between the farmer who needs the pollination service and the beekeeper who rents the bee colonies upon payment of a fee; in this case, we speak of commercial pollination service. The managed bees, however, also provide pollination services to the wild vegetation that is harvested to produce honey and its by-products; in this case, the beekeeper's activity generates a positive externality for the benefit of the environment. In general, therefore, beekeeping activity produces food products such as honey (and by-products) and positive externalities that affect the productivity of the land.

From the data of the National Apiculture database, in 2021, it emerges that there are 70,257 beekeepers in Italy of which 48,991 produce for self-consumption (69.7%) and 21,266 are beekeepers who produce for the market (30.3%) (Table 1). The presence of such a considerable number of "non-professional" beekeepers is both a resource and a problematic aspect. The positive aspect concerns above all the pollination function for agriculture and for the agricultural ecosystem. In fact, the presence of bees determines positive externalities for agricultural

Table 1
Distribution of beekeepers in Italy (self-consumption and trade) year 2021.

Regions	Self-consumption		Trade		Total	
	n.	%	n.	%	n.	%
Abruzzo	1518	3.1	661	3.1	2179	3.1
Basilicata	229	0.5	344	1.6	573	0.8
Calabria	1004	2.0	758	3.6	1762	2.5
Campania	1406	2.9	481	2.3	1887	2.7
Emilia Romagna	3860	7.9	1761	8.3	5621	8.0
Friuli Venezia Giulia	1464	3.0	414	1.9	1878	2.7
Lazio	2652	5.4	1317	6.2	3969	5.6
Liguria	1874	3.8	927	4.4	2801	4.0
Lombardy	4883	10.0	3065	14.4	7948	11.3
Marche	2274	4.6	980	4.6	3254	4.6
Molise	520	1.1	272	1.3	792	1.1
Piedmont	4577	9.3	2408	11.3	6985	9.9
Apulia	824	1.7	399	1.9	1223	1.7
Sardinia	1304	2.7	894	4.2	2198	3.1
Sicily	1109	2.3	1071	5.0	2180	3.1
Tuscany	4695	9.6	2330	11.0	7025	10.0
Trentino-South Tiroi	5765	11.8	500	2.4	6265	8.9
Umbria	2528	5.2	353	1.7	2881	4.1
Aosta Valley	417	0.9	204	1.0	621	0.9
Veneto	6088	12.4	2127	10.0	8215	11.7
Total	48,991	100.0	21,266	100.0	70,257	100.0

Source: our elaborations on data from the National Beekeeping Database.

entrepreneurs in general as it favors the pollination of the flowers of agricultural species (fruit trees, vegetables); the critical aspects concern above all the negative influence on the health status of bees when these activities are carried out outside any association context. Certainly, beekeeping is experiencing a moment of strong media attention due to the important role of the bee in the ecosystem and the threats to its survival.

Every year more and more people approach amateur beekeeping attracted by the charm of bees and by activity in contact with nature that for many remains only a hobby, for others it can become a profession. Italian beekeepers have a total of 1727,735 hives and 278,776 swarms (Table 2). The number of swarms is important as it gives us a structural understanding of how beekeepers are organized. Swarming is how bee families reproduce. Swarming occurs only when the family is thriving and can pass the tough tests of rebuilding, as it can remove up to three-quarters of the total population. The 73.2% of the total hives (1264.190) are hives managed by commercial beekeepers who raise bees by profession. The region with the highest number of hives held by professional beekeepers is Piedmont with 185,756 hives per trade out of 219,918 or 84.5%. The great prevalence of hives held by beekeepers for trade underlines the high professionalism of the sector and the importance of the sector in the agro-economic context.

3. Materials and methods

To achieve the objectives of the work, a questionnaire was submitted to a sample of consumers. Stratified Sampling is a Probabilistic Sampling procedure that involves dividing the Reference Population into subpopulations called "strata" in our case are common states, as homogeneous as possible concerning the variable whose value is to be estimated, using another variable related to the one that constitutes the object of the study. A simple random sample of households was then drawn for each stratum. This type of sampling proves particularly useful when the strata, within the population, are of widely varying numbers. Indeed, in such a situation of the high variability of the phenomenon, a very large sample would be required. By stratifying the population, on the other hand, it is possible to obtain adequate coverage of the less numerous strata (e.g., those over the age of 70 who surf the Internet) even with small sample size, with appreciable savings in survey time and cost. Indeed, it is not essential that the number of sample subjects within each stratum is proportional to the size of the stratum in the population, nor that the strata all be of the same numerosity. The main limitation of stratified sampling is that the stratum of all sampling units, concern-

Table 2
Distribution of hives and swarms in Italy (self-consumption and trade) year 2021.

Regions	Self-consumption		Trade		Total	
	hives	swarms	hives	swarms	hives	swarms
Abruzzo	12,625	2779	36,145	5468	48,770	8247
Basilicata	3401	1014	22,586	5210	25,987	6224
Calabria	14,477	2146	121,889	13,410	136,366	15,556
Campania	24,666	3680	69,690	10,776	94,356	14,456
Emilia Romagna	29,454	4752	125,422	17,848	154,876	22,600
Friuli Venezia Giulia	12,512	1822	24,731	4916	37,243	6738
Lazio	17,988	4349	53,969	10,172	71,957	14,521
Liguria	13,911	3269	19,614	4953	33,525	8222
Lombardy	77,490	7191	101,789	8283	179,279	15,474
Marche	16,143	1981	61,513	6909	77,656	8890
Molise	6386	855	13,172	2352	19,558	3207
Piedmont	34,162	8192	185,756	46,057	219,918	54,249
Apulia	7846	2539	24,157	9251	32,003	11,790
Sardinia	11,675	2199	60,556	5692	72,231	7891
Sicily	15,712	4936	130,064	23,296	145,776	28,232
Tuscany	29,439	5208	111,512	18,455	140,951	23,663
Trentino-South Tirol	55,676	4950	17,819	2652	73,495	7602
Umbria	27,779	1878	19,450	1390	47,229	3268
Aosta Valley	2310	397	4370	880	6680	1277
Veneto	49,893	6308	59,986	10,361	109,879	16,669
Total	463,545	70,445	1264,190	208,331	1727,735	278,776

Source: our elaborations on data from the National Beekeeping Database.

ing the factors on which stratification is based, must be known before the sample is chosen (since the sample extraction procedure is probabilistic anyway). For the research, a questionnaire consisting of several questions was created, in particular, the questionnaire is divided into two parts. In the first part of it, questions are asked about the person to whom the questionnaire was administered, i.e. gender, age, province of residence, municipality and its number of inhabitants, income bracket, type of family and number of members, educational qualification, status and professional position of the reference person. The second part asks whether honey is consumed, what factors drive consumers to buy it, how often they buy it, and where and at what price they buy it. If, on the other hand, the answer to the question is negative, it is referred to the last question in which it is asked why they do not buy it (Vianelli and Ingrassia, 2011). The questionnaire was administered by telephone and the data were analyzed using the STATA software. The survey was conducted on a sample between November 2019 and February 2020 and involved 527 survey units located in Sicily. For the choice of the sample units, the Sicilian municipalities were divided among those with a population of up to 5000 inhabitants, municipalities that have a population between 5001 and 60,000 inhabitants, and with a population greater than 60,001 inhabitants. Stratification was essential in order not to focus the responses on particular consumer environments. Since this is a pilot survey and given homogeneous data, it has become necessary to reorganize them to reduce variability. After performing a descriptive analysis of the variables, we proceeded to analyze them by applying the probabilistic model and the multivariate probabilistic model. From the comparison of the variables with honey consumption, it was found that women and those over the age of 41 consume the most; among the different income brackets, those with an income of up to € 15,000 buy the most annually. The greatest consumption is concentrated in urban centers with the number of inhabitants ranging from 5001 to 60,000. If we consider the educational qualification, conditions, and professional position, it emerged that high school graduates consume more, than those who are not employed, and among the employed, it is the most employed (Table 3).

4. Results and discussions

The use of the STATA software made it possible to analyze all the variables related to the person who answered the questionnaire and all

Table 3
General characteristics of the sample examined.

		N°	%
Gender	Male	208	39,5
	Female	319	60,5
Age	18–29 years	167	31,7
	30–40 years	168	31,9
	> 41 years	192	36,4
Income (€)	up to 15.000	182	34,5
	from 15.001 to 28.000	174	33,0
	> 28.001	171	32,4
Residence	0 - 5.000	178	33,8
	5.001 - 60.000	184	34,9
	> 60.001	165	31,3
Family members	couple with 1 son	97	18,4
	couple with 2 sons	128	24,3
	couple with 3 or more children	106	20,1
	couples without children	68	12,9
	Single	128	24,3
Educational level	lower secondary school	146	27,7
	upper secondary school	197	37,4
	graduate or postgraduate	184	34,9
Occupation	Engaged	244	46,3
	not engaged	283	53,7

the factors that justify the consumption and non-consumption of honey (Table 4). Subsequently, the factors that affect the purchase of honey were analyzed and it was found that most people consume it for the benefits it confers and therefore for the fact that it is healthy. Research has shown that more people consume honey than those who do not. From the statistical analysis carried out on the sample, it emerged that after the variety, the factor that most influences the purchase of honey is its biological nature, also followed by its origin. Honey with organic certification and of local origin, as well as other foods, requires a higher purchase cost which should translate into a higher market price. On this aspect, we must point out that this situation does not always occur as the higher cost cannot be passed on to the price and above all because very often the consumer does not have a marginal propensity to spend more if he does not have perfect information. The higher cost may be due to a particular variety of honey in the function of the migratory practiced by beekeepers who have to transfer the hives very often a long distance away and therefore the transport cost raises the cost of honey

Table 4
Multivariate probit results.

Variables	1 therapeutic	2 Taste	3 health	4 natural
gender	0.0990 (0.253)	−0.123 (0.270)	0.501* (0.264)	0.392 (0.246)
age	0.00851 (0.178)	−1142 (0.222)	0.587*** (0.193)	−0.413** (0.177)
City of residence	0.294* (0.166)	0.271 (0.177)	0.0619 (0.171)	0.222 (0.162)
family members	−0.0146 (0.127)	−0.0901 (0.129)	0.136 (0.125)	0.178 (0.124)
constant	−0.146 (0.583)	2.413*** (0.650)	−1.331** (0.627)	0.378 (0.553)
observations	327	327	327	327

Standard errors in parentheses.

*** $p < 0.01$.

** $p < 0.05$.

* $p < 0.1$.

production; in general, organic wildflower honey is sold at a price that is around € 5.50 per jar (1/2 kg), the price paid by most of the consumers who answered the questionnaire administered under the analysis. After analyzing all the variables and factors that affect the consumption and non-consumption of honey, we proceeded with the application of the multivariate probabilistic model which aims to simultaneously estimate all the reasons to evaluate which ones are driving the consumer to buy honey. The variables considered are sex, age, origin, and family members, and since we are analyzing the factors that can affect the consumption of honey, the number of observations is 327, ie those who replied that they are honey consumers. From the regression, it is observed that the "sex" variable is significant for the "healthy" motivation (as a prevention against the flu) and not significant for all the others. The "age" variable, on the other hand, is not significant for the "therapeutic properties" motivation and significant for the rest. It follows that with age the likelihood of consuming honey increases due to the "healthy" factor. To the attribute therapeutic, consumers surveyed associate the meaning of "curative." Specifically, honey in the survey conducted is used to treat colds, flu coughs, and sore throats, and is taken as both a single food and as a food mixed in tea of different mixtures. To the attribute "health" the surveyed consumers associate the meaning of "prevention" with some diseases such as cold, flu, cough, and sore throat. Preventive consumption again is done as a single food or associated with some hot drink. In addition, some consumers have revealed to us that honey is used in the preparation of many sweets typical of Sicilian gastronomy. Its use instead of sugar allows for more crumbly desserts in keeping with the Mediterranean gastronomic tradition. Concerning the variable "place of residence", it is noted that the significance occurs for the first reason and the non-significance for the other three. The "family members" variable is not significant for all four reasons.

5. Conclusions

The activity of bees is very important for the agricultural ecosystem and for human health. In this scenario, the documents of the European Union (Biodiversity Strategy for 2030 and From to Fork Strategy) (Hermoso et al., 2022) are aimed at promoting the restoration of the habitats of the species and the integration of ecosystem services in agri-food systems. As shown in other studies (Pilati et al., 2018b; Pilati and Prestamburgo, 2016), bee activity is very important for ecosystems and the honey produced is food that protects human health. Over the years, the policies of the European Union have been aimed at promoting intensive agriculture strategies that are not very suitable for the prevention of natural ecosystems. Today we have a new concept of agricultural activity, where the entrepreneur must also be a sentinel for the ecosystem. This aspect aimed at promoting environmentally friendly agricultural

practices has shown that an important role is played by the activity of bees.

In addition to producing positive externalities, beekeepers produce food products such as honey (and other products such as royal jelly and propolis), which is a food product known since ancient times, also used in confectionery and as a product with natural health properties.

Honey is a food product with healthy and therapeutic properties. Based on these aspects, product promotion actions should be promoted. An aspect is its use both in the kitchen and in the confectionery sector. Another thing to highlight could be the direct sale to the beekeeper. However, although this aspect appears relevant, we must not forget the aspects related to the purchase opportunity cost in a short supply chain (directly from the beekeeper). Undoubtedly, in the future, the promotion of sustainable agri-food systems passes through the enhancement of the activity of bees that produce positive externalities on the environment and a food product with undisputed health properties on the human body. The absence of bee activity leads to an impoverishment of the ecosystem and the productivity of the earth. As demonstrated in the present study, honey is very important to consumers and is a food with unique characteristics for human health. Finally, as we have seen, the activity of bees contributes to the ecosystemic balance of territory and therefore of the environment.

Declaration of Competing Interest

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

Ethical

The research "An experimental analysis of consumers' attitudes towards honey: the case of the Sicilian market" was conducted with respect for human and animal ethics

Data availability

Data will be made available on request.

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