Table grapes as functional food: Consumer preferences for health and environmental attributes

A. Seccia[1], R. Viscecchia[2], and G. Nardone[2]

[1] University of Foggia, Department of Humanities, via Arpi 176, 71121 Foggia, Italy

[2] University of Foggia, Department of Sciences of Agriculture, Food and Environment, via Napoli 25, 71122 Foggia, Italy

Abstract. Consumers' interest towards food with healthy and sustainable characteristics is growing and companies try to address such trend through the supply of products with characteristics for which consumers show willingness to pay a premium price. Table grapes could be considered a product with functional characteristics since offer a wealth of health benefits due to their high nutrient and antioxidant contents. Moreover, its production and distribution are increasingly affected by sustainability concerns. On the basis of these considerations, the objective of this paper is to evaluate the consumer preferences for health and environmental attributes of table grapes. For this purpose, a nationwide survey was conducted in Italy using the Computer Assisted Web Interviewing (CAWI) method and the Best- Worst Scaling Method (BWS) for data analysis. The survey is divided into sections which consider, besides the socio-demographic characteristics of respondents, questions about their preferences related to specific attributes of table grapes (variety, color, seedless, organic or conventional production, origin) and to nutritional and sustainable characteristics reported on the label. Results could be of interest for companies which can focus their marketing strategies on specific characteristics of the product, and for policy makers who are asked to take decisions for public health.

1. Introduction

In recent years, particularly in advanced economy countries, there has been a change in consumption trends for food products considered as a source of well-being, leading consumers to approach their diet in a more selective way, with a growth interest towards health products. The health phenomenon is not limited to diets and needs linked to certain pathologies but covers many aspects of lifestyles [1]. At the same time, consumers' healthy lifestyles are affected not only by health consciousness but also by environmental attitudes. To confirm the new consumption interest there is a growing trend of functional foods, organic products, food made with low environmental impact technology or the use of biodegradable packaging. The agro-food companies, with the aim of differentiating quality products, have invested on health and environmental attributes towards which consumers are willing to pay a premium price [2]. There are several food products that meet these characteristics and for which certificates have been issued attesting the higher quality level. In the fruit and vegetable sector, table grapes are a valid example of food product with a great market potential in the functional food segment. It is a product rich in vitamins, minerals and antioxidants and is suitable for consumption by healthy people, given the large quantities of simple carbohydrates and calories. The positive effects related to the intake of table grapes are well known. The presence of polyphenols such as anthocyanins, flavonoids and resveratrol has effect on many biological activities: antioxidant power, cardioprotective effect, anticancer, anti-inflammatory, anti-aging and antimicrobial properties. Starting from these

preliminary remarks, the objective of the present work is to evaluate the consumer preferences for health and environmental attributes of table grapes. This kind of analysis has important practical implications because the results may be useful in understanding the consumers preferences for health and sustainable attributes of table grapes with the aim of addressing marketing strategies. Moreover, results could be useful to policymakers for decisions regarding the effectiveness of claims targeted to improve healthy and sustainable lifestyles.

The remainder of this paper is organized as follows: Sect. 2 briefly presents an overview of the functional characteristics of table grapes; Sect. 3 gives a description of the applied methodology; Sect. 4 discusses the results; Sect. 5 summarizes the main findings and highlights some implications.

2. Table grapes functional characteristics

A diet rich in fruits and vegetables has been associated with lower risk of chronic diseases because, in addition to vitamins and minerals, they contains various compounds with health-protective effects, in particular antioxidants and anti-inflammatory compounds. Its consumption reduces the risk factors for cancer, cardiovascular diseases and a number of other chronic diet-related diseases. These foods contain relatively high levels of beneficial phytochemicals (plant-derived and biologically active compounds) among which the preventive activity of antioxidants is better known and well documented. Reports on medical studies related to food intake and national educational initiatives such as the USDA Food Guide Pyramid and the Better

Health program have successfully raised public awareness of the health benefits of increasing fruit and vegetable consumption [3–5].

The factors that influence the choice of food are complex and related. They include: sensory preferences, physiological factors (pre and post ingestion), age, sex, lifestyle, behavior, personality, education, income, social attitudes about diet and health, ethnicity and tradition, religion, beliefs, social pressures, influence of marketing, information on available products and knowledge (labeling, media coverage, etc.) or self-identity beliefs. According to EU Regulation 1924/2006, a food can be considered functional if it proves to have a beneficial effect on one or more specific functions of the organism, beyond the nutritional effects, which improves the state of health and well-being and/or reduces the risk of disease. Functional foods must be foods and must demonstrate their effects at the doses consumed in the normal diet: they are not pills or capsules, but part of the normal diet. They can be: natural foods; foods to which a component has been added; foods from which a component has been removed; foods in which the characteristics of one or more components have been modified; foods in which the bioavailability of one or more components has been modified; finally, it could be any combination of these possibilities [6].

A fundamental concept, closely linked to functional foods and referred to the regulations and discussions relating to functional foods, is that of a "claim" divided into nutrition and health claim. As defined by the Codex Alimentarius, the term "claim" means "any message or representation, including graphic and symbolic ones, which establish, suggest or imply that a product has particular characteristics that are related to its nature, origin, property nutritional, production, processing, composition and any other quality". Regulation (EC) n.1924/2006 establishes the rules for the use of nutrition and health claims that can be inserted on food labels and/or advertising. The purpose of the regulation is to protect the health of consumers and make them more aware of choices through correct information. The claim of a food product can be used only if truthfully and based on scientific data and does not attribute to the food properties that prevent, cure and/or cure diseases. The kinds of claims are: Nutrition Claims; Health claims; EU Register on nutrition and health claims (nutrition and health claims with data protection) [7]. For Nutrition claim is meant any claim that states, suggests or implies that a food has particular beneficial nutritional properties, due to: the energy (calorific value) it brings, or brings at a reduced or increased rate or does not contribute; the nutrients or other substances it contains, contains in reduced or increased proportions or does not contain. By Health claim instead, it is meant: any indication that states, suggests or implies the existence of a relationship between a food category, a food or one of its components and health; any claim about health that states, suggests or implies that the consumption of a food category, food or one of its components significantly reduces a risk factor for the development of a human pathology [8].

The reasons for the growth of the functional food market are many and depend on various factors (socio-economic, cultural, demographic, etc.). However, it can be asserted that the growth of the functional food market at global level has been determined by the increased awareness of the role of the diet in maintaining an optimal level of health and in the prevention of specific diseases linked to dietary imbalances. The worrying increase in pathologies related to a sedentary lifestyle and an unbalanced diet has encouraged the development of this food awareness. Furthermore, given the increase in health expenditure for the treatment of these diseases, the authorities have also developed initiatives to promote the consumption of functional food, especially those aimed at the health of the cardio-circulatory system and the prevention of cardiovascular diseases. The functional food market, although relatively new and niche, has developed considerably over a short period of time, so that the trade in functional foods is becoming a real business even for the so-called developing countries. The few studies carried out to identify the factors determining the demand for functional foods are based on investigations developed within very limited territorial areas. Furthermore, most of the researches conducted so far is aimed at analyzing the factors that determine the demand and, therefore, the purchase of a specific type of functional food, instead, only in rare cases scholars have examined the socio-economic factors involved in the purchase of functional food compared to conventional food [9, 10].

For these reasons, it is really complicated to find a scientific and rational explanation for the very rapid spread of functional foods on a global scale. Awareness of the high level of well-being achieved by modern society makes people more aware of the importance of lifestyle and proper nutrition in maintaining well-being. On the other hand, the increase in well-being has also led to an increase in the incidence of pathologies linked to the greater availability of resources (food, technology, etc.). In any case, this has also led consumers to look for "solutions" in the nutritional field to prevent or contain the negative effects of diseases linked to a sedentary lifestyle and a diet rich in fat, carbohydrates and high energy value. The evaluation of the functional food market is subject to variations that depend on the lack of a univocal definition; unlike a narrower meaning of the term, according to which functional foods are foods and beverages that have clear health claims, the more extensive definition also considers those health products that, although without claim, are perceived as functional foods. Following a narrow definition, in the last decade there has been a notable growth of this market (with an annual growth rate 4% higher than that of food and drink) which, from almost 8 billion dollars in 1991, exceeded 24 billion dollars in 2010 [11].

The table grape is a food rich in vitamins, mineral salts and antioxidants which, however, brings significant amounts of simple carbohydrates and calories by raising the glycemic index (a food's ability to raise blood glucose). Therefore, table grapes are a product suitable for consumption by healthy subjects, thanks to the presence of some non-energetic molecules, it seems to possess several noteworthy metabolic characteristics. Among these, the potential to optimize cholesterolemia (reduction of bad LDL cholesterol), the ability to reduce platelet aggregation and the advantage of moderating oxidative stress. Most of these positive effects resulting from the intake of table grapes can be attributed to the presence of phenolic molecules, or polyphenols such as anthocyanins,

flavanols, flavonols and resveratrol, which have many biological activities: antioxidant power, cardioprotective effect, anticancer properties, anti-inflammatory, anti-aging and antimicrobial. It is thought that the health benefits derive mainly from the bioactivity of polyphenols and from flavonoids which are powerful antioxidants capable of inducing endothelium-dependent vasodilation of vascular rings arising from human coronary arteries. From the tests performed and the analysis of the collected data it emerged that the health effects deriving from the intake of fresh table grapes could help protect the body from the onset of cardiovascular diseases [12–19].

The consumption of table grapes worldwide is increasing considering that in 2000 it was over 15 million tons while in 2014 it was over 26 million tons. In Italy, consumption recorded a reduction of consumption from 0.8 million tons in 2000 to 0.48 million tons in 2014, while in 2017 there was an increase compared to the previous year of 3.6% [20]. Research results on low-calorie grapes takes into account the real needs of western countries where diabetes, hyperglycemia, obesity and cardiovascular diseases are the main metabolic disorders deriving from a diet that is too rich in calories. These grapes therefore represent a new frontier and an opportunity for table grape producers, who want to take a market share on the "grape diet" and represent a genetic basis for breeding aimed at obtaining new cultivars of low-calorie grapes [21].

3. Material and methods

For the present analysis the Best-Worst (BW) approach, developed by Louviere and Woodworth and first published in 1992 [9], has been chosen. The Best-Worst approach, also known as Maximum Difference Scaling, assumes that there is a subjective dimension, such as "degree of importance" or "level of interest" and the researcher wishes to measure the location of some set of objects along this dimension and analyze those by comparison [22]. The respondents are asked to choose from a number of choice sets the best/most important and the worst/least important attribute in each set. This approach models the cognitive process which underlies the identification of two attributes as, respectively the worst and the best from a designed sub-sets of three or more attributes. An example of application of this methodology in the last years is the field of wine marketing [23–26]. In the present work the Best-Worst method has been applied preparing a survey with 21 choice sets, considering 21 attributes, or choice influencers, using a balanced incomplete block design (BIBD) to assure that each attribute appeared the same times across the experiment and equally within the attributes set. Each choice set includes 3 attributes to be indicated as the best or the worst according the interviewed person.

The survey has been conceived in five sections: the first is about the purchase and consumption behavior of table grapes, including questions on the frequency of consumption; the second section presents 7 choice sets about the following attributes of the table grapes: brand of the company, use of biodegradable packaging, price, presence of seeds (with seeds or seedless), Italian origin, nutritional claim, sustainable production; the third section presents 7 choice sets about the following nutritional and health indications: fat free, natural source of resveratrol, high in potassium, source of vitamins and minerals, rich

Table 1. Results of Best-Worst Score and Average Best–Worst Score for table grapes attributes.

Attributes of table grapes	BWS	ABWS
Italian origin	262	0.38
Nutritional claim	161	0.23
Sustainable production	72	0.10
Price	24	0.03
Presence of seeds (with seeds or seedless)	−146	−0.21
Use of biodegradable packaging	−167	−0.24
Company brand	−206	−0.30

in polyphenols, low in sugar, polyphenols content helps to prevent chronic-degenerative diseases; the fourth section presents 7 choice sets about the following characteristics of sustainability: organic production, sustainable packaging, reduction in the use of pesticides and chemical inputs, environmental certification, Kilometer-zero origin, waste reduction, fair remuneration of workers; finally, the fifth section concerns socio-demographic characteristics of the interviewed, including information on the lifestyle, education and job.

The survey has been submitted in the period May–June 2018 to a sample of 230 people living in Italy, using the CAWI-Computer Assisted Web Interviewing method. Respondents were asked to answer to the survey thinking to the last time she/he has purchased table grapes and, with reference to the three attributes presented in each choice set, to indicate the best and the worst.

The collected data, 102 valid questionnaires, has been analyzed by counting the total number of times each attribute is mentioned as "worst" and subtracting that from the number of times it is mentioned as "best". The result is the "Level of importance", referred to each attribute, which is then standardized to enable samples with different numbers of respondents to be comparable.

$$\text{Level of importance} = \text{Count best} - \text{Count worst}$$

$$\text{Standard Score} = \frac{\text{Level of importance}}{4n}$$

where:

n is the number of questionnaires

3 is the frequency of the appearance of each attribute in the design.

For each attribute the result is a coefficient which is a ratio-level representation of its value to the consumer.

4. Results and discussion

The sample consists of 230 subjects of which 73% women and 27% men. As regards the age, the classes between 0–24 and 25–34 years obtained the highest percentages, respectively 23.83% and 37.83% followed by the class 35–54 with 23.48%; lower are the age group 55–64 with 8.26% and the age group above 65 years with 2.61%. With regard to employment, the majority of consumers are students (37.8%), followed by employees in the public and private sector (17.8%), unemployed in search of employment (12.2%), freelancers and entrepreneurs (11.7%), employees in other unspecified occupations (7.8%), workers (4.3%), public and private managers

Table 2. Results of Best-Worst Score and Average Best-Worst Score for nutrition and health claims.

Nutritional and health indications	BWS	ABWS
Thanks to the polyphenols it helps to prevent chronic-degenerative diseases	191	0.28
Rich in polyphenols	182	0.26
Source of vitamins and minerals	81	0.12
Natural source of resveratrol	11	0.02
High content in potassium	−66	−0.10
Low in sugar	−101	−0.15
Fat free	−298	−0.43

Table 3. Results of Best-Worst Score and Average Best-Worst Score for sustainability characteristics.

Characteristics of sustainability	BWS	ABWS
Reduction in the use of pesticides and chemical inputs	163	0.24
Organic production	94	0.14
Kilometer-zero origin	85	0.12
Fair remuneration of workers	13	0.02
Environmental certification	−44	−0.06
Waste reduction	−110	−0.16
Use of biodegradable packaging	−201	−0.29

(3.81%) housewives (2.6%) and artisans (1.3%) and retired people (1.3%). As regards the number of members of the family, the highest percentages were for 4 components (37.4%), followed by 3 (27%), 2 (20%), 5 (9.6%) 1 (4.3%) and for 6 (1.7%). The lowest percentage is for singles and for families formed by more than 5 people. Considering the city of origin, the highest percentage of the respondents was from cities with more than 100,000 inhabitants (45.2%), followed by less populous cities with less than 20,000 inhabitants (29.1%) and finally from cities in the range between 20,000 and 100,000 inhabitants (25.7%). Considering the lifestyle, half of the respondents play sport and almost 80% do not smoke. The section of the questionnaire dedicated to the purchase and consumption of table grapes shows that 50.4% of the subjects only partially take care of shopping, perhaps relying on other figures, while it is autonomous in 23% of cases and delegated to other people in 26.5% of cases. In choosing the variety, the most appreciated and consumed is the white table grape with 201 consumers followed by black grapes with 163 consumers and red grapes with 139. The frequency of consumption is mainly several times in a year considering also the months in which the interview took place (May–June). The seedless table grapes is never purchased by the 46% of the sample and organic grapes is never purchased by 56%. The most of the respondents declare to always choose an Italian product. Respondents show a higher level of The preference in buying late grapes (October–December) with 150 replies than the early typology (May–June) with 106 responses. From an environmental and sustainable point of view, consumers pay more attention to biodegradable packaging with 89 responses compared to 72 responses regarding the purchase of table grapes with reduced environmental impact. The greater frequency of purchase of all the proposed items remains at several times in a year. Grapes is consumed more frequently at lunch with 89% of subjects, followed by dinner with 83%, while 80% declare to have it as a snack and 21% for breakfast. In the Italian culture it is still little used as an ingredient for coking with only 27% of responses, preferring other foods or fruits.

The results of the Best-Worst method come from the elaboration of data of Sects. 2, 3 and 4 of the questionnaire. Results of the Sect. 2 "attributes of the table grapes"

show that respondents prefer Italian origin with 22.86% of responses. Also interesting is the type of sample that made this choice, that is to say most women aged between 25 and 34 years with an high level of education. The least voted attribute, on the other hand, is the brand with 22.11%, by a predominantly female sample aged between 25–34 years. The Sect. 3 "Nutrition and health claims: indications on the label" shows how the consumer's attention is focused on the prevention of the onset of chronic degenerative diseases with 20.81% of votes given by a predominantly female sample, with age between 25–34 years, with an high level of education. The least voted indication is "seedless" with a 25.65% majority vote for women with an age between 25–34 years. The Sect. 4 on "sustainability characteristics: sustainability of table grapes" describes as the most voted choice the reduction in the use of crop protection products with 19.44% of votes and a predominantly female sample aged between 25–34 years of age. The least voted feature was, strangely, the sustainable packaging with 21% of votes given by a female majority sample, aged between 25–34 years of age, with high education level. In conclusion, the study shows a high rate of purchase of table grapes, above all for white varieties, and shows how grapes are a seasonal consumption product. This confirms that the consumer is inclined to consume functional products by placing them in a healthy diet given by the antioxidant properties of resveratrol. Finally, both the consumption of new types of grapes, such as the low-calories typology, and the choice of a packaging that respects the environment, despite the problems connected to it, are still underdeveloped.

5. Conclusion

The aim of the present paper has been the evaluation of the consumer preferences for health and environmental attributes of table grapes For achieving such aim a nationwide survey was conducted in Italy using the Computer Assisted Web Interviewing-CAWI method and using the Best- Worst Scaling Method (BWS). The main finding was that the consumers were more willing to choose table grapes with health properties compared to a product with reduced environmental impact. The BWS has identified as "most important" attributes the Italian origin of the product, the prevention of chronic-degenerative diseases thanks to the polyphenols, the reduction of the use of agro-chemicals and as "less important" attributes the brand, the reduced content of fat and the biodegradable packaging. The study suggests that

nutritional, health and sustainable claims on food label, leading consumers towards healthy and ethical behavior, represent a useful tool not only for marketing strategies but also for public health decisions. In such scenario, companies could improve the information provided to consumers by encouraging an eco-sustainable lifestyle; policy makers could promote the consumption of table grapes out of meals and support the production and supply of healthy and eco-friendly foods. These results are of considerable importance for the implications they can offer in terms of marketing both by identifying a series of claims to be reported on the type label: "grapes of Italian origin" or "grapes containing resveratrol that helps to prevent chronic diseases" or "grapes produced with low use of agropharmaceuticals", both to delineate the purchasing choices of the ideal grape that must be white and seedless, thus enhancing the existing market and seeking strategies that can make consumption no longer seasonal. This study can be the starting point for further in-depth international scientific research with a wider consumer panel to evaluate the reliability of these results even in the long term.

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