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Trends in consumers' preferences towards fresh-cut vegetables during the Covid-19 pandemic

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Abstract

The fresh-cut sector has shown a positive trend in recent years, due to the "ease of use" and the increasing innovation in the quality and safety features of these products. However, in Italy, a negative trend was observed during the lockdown Covid-19. The objective of this study is to investigate consumer preferences for fresh-cut products and to identify the sensory and extrinsic attributes that influence consumer choice. It also examines whether consumer behaviour has changed during the lockdown Covid-19. An online questionnaire was administered to a convenience sample of 427 consumers. A one-way ANOVA was conducted to identify preferences for specific types of fresh-cut products; then, a factor analysis was conducted to highlight key socioeconomic variables and product attributes. Finally, a cluster analysis was conducted to identify homogeneous consumer groups.
The results indicate that some attributes, including "ease of use", "texture" and "colour" show a high level of interest and appreciation by consumers. The outcomes also reveal that there has been a change in consumer attitudes during the lockdown Covid-19, mainly for reasons related to the difficulty in food procurement, the fear of contagion during purchasing occasion, and higher prices. The findings of this research contribute to the knowledge of consumers' behaviour towards fresh-cut products in the period of lockdown Covid-19.

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Introduction

The human health benefits of consuming fresh fruits and vegetables are well known to consumers who are increasingly health conscious and committed to wellness in their lifestyles (Migliore *et al.*, 2017; Pappalardo *et al.*, 2017; Lorente-Mento *et al.*, 2022).

Scientific research has shown that a diet based on fruits and vegetables reduces the risk of cardiovascular, heart, metabolic, and degenerative diseases (Zhang *et al.*, 2005; Chen *et al.*, 2006; Dai *et al.*, 2006). Accordingly, policy makers have developed and strengthened food guidelines and directives to influence consumers' healthy dietary choices (Alzamora *et al.*, 2000; Pappalardo and Lusk, 2016). To illustrate, healthy diet guidelines recommend daily consumption of fresh fruits and vegetables, with a recommended daily intake of at least 400 g per capita, according to the World Health Organization (WHO, 2008).

In recent decades, there have been significant changes in the lifestyle and eating habits of consumers, who are increasingly looking for healthy foods (Chinnici *et al.*, 2019; Baselice *et al.*, 2017; Lorente-Mento *et al.*, 2022), but at the same time have less time to prepare meals (Girgenti *et al.*, 2016). In this context, to increase the daily per capita consumption of fruits and vegetables, the fresh-cut sector plays an important role in the convenience and freshness of the minimally processed product. Thanks to the improvement of post-harvest technologies, these products provide additional services (cleaning, peeling, washing, cutting), while preserving the freshness and genuineness of fresh product (Colelli, 2001; Galati *et al.*, 2019; Amodio *et al.*, 2011; Jang *et al.*, 2011; Lorente-Mento *et al.*, 2022). Since their development in the European market in the 1980s, consumers have increasingly purchased them. In Italy, the sales volume of fresh-cut products increased from 95.8 thousand tons in 2010 to about 126 thousand tons in 2018, representing a growth of over 30%, and the sales value increased from 731 million euros in 2010 to 816 million euros in 2018, representing an increase of about 12% (italiafruit.net, 2018).

As shown by the relative penetration index (share of fresh-cut vegetable buyers in fresh vegetable buyers), the consumption of fresh-cut fruits and vegetables in Italy increased from 70% in 2011 to 81.3% in 2020 (Ismea, 2021).

Consumption of fresh-cut fruits and vegetables, more specifically fresh-cut salads, is steadily increasing (Merlino *et al.*, 2020; Testa *et al.*, 2021), due to the increasing demand of consumers who recognize the benefits of combining convenient consumption with a product perceived as fresh, natural, and healthy (Baselice *et al.*, 2017). Health attitudes are an important motive for consumers' purchase decisions of fresh-cut products (Nassivera and Sillani,

2015). Moreover, in addition to healthy and timesaving motives, other factors such as sociodemographic and psychometric variables play an important role in shaping consumer demand for these products (Fusi *et al.*, 2016; Stranieri *et al.*, 2017; Baselice *et al.*, 2017; Ricci *et al.*, 2018; Contini *et al.*, 2018). To illustrate, the characteristics of fresh-cut products most appreciated by consumers generally refer to the convenience of saving time, quality, and nutritional value analogous to fresh products (Rico *et al.*, 2007; Jang and Moon 2011; Oner and Walker, 2011; Bigatti, 2019; Fruitbook Magazine, 2020), high added value, and reduction of household waste (Colelli and Elia, 2009).

However, despite their popularity, these products can be vectors for pathogens (Faour-Klingbeil *et al.*, 2016). In addition, fresh-cut products are negatively evaluated for their environmental impact due to the use of chemicals in the cultivation phase, high water consumption in the washing phase, the use of non-renewable energy resources, and non-biodegradable/recyclable resources for packaging materials (Fusi *et al.*, 2016; Raffo & Paoletti, 2022). These issues, combined with environmental impacts and food safety concerns, contributed to a negative trend for the fresh-cut sector during the Covid-19 pandemic (Ismea, 2021; Fruitbook Magazine, 2021).

The Covid-19 pandemic caused a global health crisis that also affected the economic system (De Maria *et al.*, 2020). The spread of the virus prompted several countries around the world to take extraordinary measures to contain it, which inevitably had consequences for economic markets (De Maria *et al.*, 2020). The Covid-19 pandemic significantly affected consumer purchasing behaviour and dietary habits (Grunert *et al.*, 2021; Pappalardo *et al.*, 2020). The lockdown Covid-19 had a strong impact on sales of ready-to-eat salads. The fresh-cut sector recorded a total value of 814 million euros in 2020, with –7% in value and –4.5% in volume compared to 2019 (Ismea, 2021). In Italy, during the first phase of lockdown in 2020, the sector of fresh-cut products showed a negative performance, despite the extraordinary efforts made by companies to ensure the supply of products to channels store (Ismea, 2021).

In 2020, the fresh-cut sector in Italy shows its first decline: –4.1% the decrease in volumes sold wholesale and even more significant the decrease in spending: –5.6% compared to 2019 with the lowest average prices (Ismea, 2021).

Underlying this trend are certainly new buying habits during the Covid-19 pandemic period (Montefrio, 2020).

Studies have shown that consumer habits and eating behaviours toward fruits and vegetables generally changed during the Covid-19 pandemic (Bracale and Vaccaro, 2020; Di Renzo *et al.*, 2020) with consequence on food markets (Lee *et al.*, 2021).

The literature on consumer purchasing behaviour towards fresh-cut products during the restriction period is scarce, and there is a gap in understanding the reasons for the change in purchasing behaviour toward these products. To the best of our knowledge, this is the first article to examine consumer behaviour during the Covid-19 restriction period with regard to fresh-cut products.

The purpose of this study is to understand consumer behaviour and preferences related to various attributes of different fresh-cut products, the change in purchasing behavior towards these products and the reasons that led to this shift in consumer purchasing behaviour during the lockdown Covid-19.

The objectives of this study are to: (1) analyse consumer preferences for different type of fresh-cut products; (2) evaluate attributes considered important to consumer purchase decisions and which sensory and extrinsic attributes that influence consumption decisions; (3) examine whether there are well-established homogeneous consumer groups; (4) test whether consumer behaviour toward fresh-cut products changes during Covid-19 lockout.

To examine the major impacts of the Covid-19 pandemic on the fresh-cut sector, a survey was conducted. An online questionnaire was sent to a convenience sample of Sicilian consumers (Italy). A one-way ANOVA was conducted to identify preferences for specific types of fresh-cut products and a factor analysis to summarise and highlight the main socioeconomic variables and product attributes influencing fresh-cut consumption. Finally, a cluster analysis was conducted to identify homogeneous consumer groups. The results of this research contribute to the knowledge of consumer behaviour toward fresh-cut products during the lockout Covid-19 period. The results of this work could be useful to industry and government.

1. Materials and methods

A questionnaire was sent online via Google Moduli to a sample of 427 Sicilian (Italy) respondents. The survey period extended from June to September 2020, and respondents were immediately informed of the privacy and anonymity of their answers. The online survey allows for easier data collection and processing. In addition, online questionnaires provide a dynamic pool of options for question design.

The questionnaire was submitted to a convenience sample. This sampling method implies that the results should be interpreted with caution due to the reduced possibility of inference to the general population. Several studies examining how consumer food-related behavior changed during the pandemic relied primarily on convenience samples (De Backer *et al.*, 2020; Murphy

et al., 2021). The first part of the questionnaire aimed to collect the main socioeconomic characteristics of the respondents, such as gender, age, family size, education level, employment, and average monthly income (Massaglia *et al.*, 2019; Lorente-Mento *et al.*, 2022). The second part focused on consumer preferences for different types of fresh-cut product considered (Lorente-Mento *et al.*, 2022). Specifically, respondents were asked questions aimed at determining the level of knowledge, familiarity, interest, and frequency of consumption of fresh-cut products. The questions aimed to code attitudes towards different types of fresh-cut products and were organized as binary questions (yes/no). The third part of the questionnaire examined consumption of different vegetable categories and preferences for sensory and extrinsic attributes. The variables selected were the main questions analyzed in the food purchase literature (Roininen *et al.*, 1999; van Trijp and van der Lans, 2007; Massaglia *et al.*, 2019; De Gennaro *et al.*, 2021). These questions aimed to code preference for different categories of fresh-cut products, as well as sensory and extrinsic attributes using a Likert scale (from 1 = "not relevant" to 7 = "very relevant"). In addition, this section of the questionnaire also explores whether consumption of fresh vegetables decreased during the Covid-19 lockdown, as well as the reason for this decrease in consumption. In addition, respondents were also asked a question about changes in the amount consumed after Phase 1 of the Covid-19 lockout. Table 1 provides an overview of the variables collected in the survey and used in the model.

Table 1 - Variables used in the model

Variables	**Type**	**Coding**	**Min**	**Max**
Gender	Dummy	(0 = Male; 1 = Female)	0	1
Age group	Categorical	1-3 (1 = 18-39; 2 = 40-59; 3 = Equal to or greater than 60)	1	3
Family members	Categorical	1-9	1	9
Education level	Categorical	1-3 (1 = Elementary school; 2 = High school; 3 = University degree and post degree)	1	3
Employment	Categorical	1-5 (1 = Employed; 2 = Unemployed; 3 = Homemaker; 4 = Retired; 5 = Student)	1	5
Monthly net income	Categorical	(1 = Below 2,000€; 2 = 2,001-4,000€; 3 = Over 4,000€)	1	3
Have you ever heard about ready for use vegetables?	Dummy	(0 = No, 1 = Yes)	0	1
Are you familiar with fresh-cut products?	Dummy	(0 = No, 1 = Yes)	0	1

Table 1 - continued

Variables	Type	Coding	Min	Max
Are you interested in consuming fresh-cut vegetables?	Dummy	(0 = No, 1 = Yes)	0	1
Do you regularly consume fresh-cut vegetables?	Dummy	(0 = No, 1 = Yes)	0	1
Lettuce consumed	Categorical	1-7 (1 = Not relevant; 7 = Very relevant)	1	7
Carrots consumed	Categorical	1-7 (1 = Not relevant; 7 = Very relevant)	1	7
Mushrooms consumed	Categorical	1-7 (1 = Not relevant; 7 = Very relevant)	1	7
Spinach consumed	Categorical	1-7 (1 = Not relevant; 7 = Very relevant)	1	7
Mixed salad consumed	Categorical	1-7 (1 = Not relevant; 7 = Very relevant)	1	7
Nutritional properties	Categorical	1-7 (1 = Not relevant; 7 = Very relevant)	1	7
Taste	Categorical	1-7 (1 = Not relevant; 7 = Very relevant)	1	7
Practicality	Categorical	1-7 (1 = Not relevant; 7 = Very relevant)	1	7
Timesaving	Categorical	1-7 (1 = Not relevant; 7 = Very relevant)	1	7
Colour	Categorical	1-7 (1 = Not relevant; 7 = Very relevant)	1	7
Consistency	Categorical	1-7 (1 = Not relevant; 7 = Very relevant)	1	7
Freshness	Categorical	1-7 (1 = Not relevant; 7 = Very relevant)	1	7
Flavour	Categorical	1-7 (1 = Not relevant; 7 = Very relevant)	1	7
Juiciness	Categorical	1-7 (1 = Not relevant; 7 = Very relevant)	1	7
Affordability	Categorical	1-7 (1 = Not relevant; 7 = Very relevant)	1	7
Safety	Categorical	1-7 (1 = Not relevant; 7 = Very relevant)	1	7
During Phase 1 of the Covid-19 emergency did you decrease your consumption of fresh-cut vegetables?	Dummy	(0 = No, 1 = Yes)	0	1
Reason for reduction of fresh cut salad during Phase 1* of lockdown Covid-19	Categorical	1-6 (1 = No answer; 2 = Difficulty in finding; 3 = Mistrust of the product due to fear of contagion; 4 = Distance to the place of purchase; 5 = No difficulty; 6 = High prices)	1	6
After Phase 1 of lockdown Covid-19, how did the amount consumed change?	Categorical	1-4 (1 =No answer; 2 = Has increased; 3 = Has decreased; 4 = Has remained unchanged)	1	4

* Phase 1 of lockdown Covid-19 in Italy (9 March - 3 May 2020).

First, a one-way analysis ANOVA was performed along with a post-hoc Tukey test to determine whether sensory and extrinsic attributes (Scarpa and Del Giudice, 2004; Caracciolo *et al.*, 2020) differed significantly

among the different types of fresh-cut products. A factor analysis was then performed to summarize preferences for sensory and extrinsic attributes. Factor orthogonalization was performed along with the Varimax method, which allows for a simpler and more correct interpretation of the results (Kaiser, 1960; Kaiser and Rice, 1974). The statistical model was tested using the KMO test and Bartlett's test based on the partial correlations between the variables to determine if the hypothesized model was a good fit to the data. In analyzing the factor matrix, we considered 0.50 as the absolute minimum value following Hair *et al.* (2009), who categorized the factor loadings as 0.30 = minimal, 0.40 = important, and 0.50 = significant.

Factorial analysis was also performed for sociodemographic variables and then a cluster analysis was performed based on the individual factor loadings to identify homogeneous groups of consumers. We use the k-means non-hierarchical classification procedure (k-means cluster analysis) to define the clusters by minimizing the Euclidean distances between centroids in an iterative process. To test the differences between clusters, the ANOVA test was performed to test the association between fresh-cut products and the reason for change in consumption during Covid-19 (García *et al.*, 2010; Franke *et al.* 2012).

The sociodemographic characteristics of the sample are summarized in Table 2. The sample consists of 57.8% female respondents. This percentage is slightly higher than in the Sicilian population, as shown by data from Istat (2021).

The majority of respondents are between 18 and 39 years old (74.0%), have at least a college degree and live in a family of four (45.0%). In terms of employment, the majority of respondents are employed (54.3%) and have an income of up to €2,000.00/month (53.1%).

Table 2 - Socio-demographic characteristics of the sample (n. = 427)

Variables	**Sample**		**Sicilian population***
	n.	**%**	**%**
Gender			
Male	180	*42.2*	*48.1*
Female	247	*57.8*	*51.9*
Age group			
18-39	316	*74.0*	*31.5*
40-59	93	*21.8*	*35.3*
Equal to or greater than 60	18	*4.2*	*33.2*

Table 2 - continued

Variables	Sample		Sicilian population*
	n.	%	%
Education level			
Elementary school	31	*7.3*	*56.6*
High school	186	*43.6*	*32.3*
University degree or post university degree	210	*49.2*	*11.1*
Family size			
Single	18	4.2	*33.3*
2 members	55	*12.9*	*27.1*
3 members	115	*26.9*	*19.3*
4 members	192	*45.0*	*15.1*
5 members	36	8.4	*4.0*
Over 5 members	11	*2.6*	*1.3*
Employment			
Employed	232	*54.3*	n.a.
Unemployed	40	*9.4*	n.a.
Housewife	20	*4.7*	n.a.
Retired	8	*1.9*	n.a.
Student	127	*29.7*	n.a.
Monthly net income			
Below 2,000€	227	*53.1*	n.a.
2,001-4,000€	128	*30.0*	n.a.
Over 4,000€	72	*16.9*	n.a.

* Source: Italian Institute of Statistics – ISTAT (2021).

2. Results

2.1. *Overall results*

Table 3 shows the results of ANOVA, which reveal different attribute values and significances for each of the products investigated.

In general, among the product categories investigated, lettuce salad obtained significantly higher values for all sensory and extrinsic attributes studied, followed by mushrooms and spinach, while mixed lettuce obtained the lowest values.

For the lettuce salad, it should be noted that of all the attributes considered, “taste” received the highest and statistically significant score, followed by the attributes “practicality”, “colour”, “juiciness” and “nutritional properties”.

Table 3 - Mean of sensory and extrinsic attributes for all products analysed

Attributes	**Fresh-cut salad**				
	Lettuce	**Carrots**	**Mushrooms**	**Spinach**	**Mixed**
Nutritional properties	2.838***	3.064**	3.018***	2.927***	3.076**
Taste	2.336***	2.596***	2.559***	2.609***	2.682
Practicality	2.058***	2.364	2.315***	2.344**	2.372
Timesaving	2.109***	2.368	2.311**	2.334*	2.342*
Colour	2.479***	2.770*	2.721***	2.744**	2.770*
Consistency	2.179***	2.446	2.346***	2.394***	2.461
Freshness	2.353***	2.592	2.514***	2.506***	2.575
Flavour	2.330***	2.551	2.477***	2.470***	2.580
Juiciness	2.876***	3.151*	3.315**	3.141**	3.184
Affordability	2.590***	2.606***	2.639**	2.634**	2.689
Safety	2.553***	2.724***	2.674***	2.672***	2.733***

Statistical differences were tested using ANOVA.
*, **, ***, indicate significance at 0.1; 0.05 and 0.01 level, respectively.

2.2. *Results of Factor analysis*

The first group of variables considered are the socioeconomic variables, which explain 63.7% of the total variance. The validation of the model was tested using the KMO test and Bartlett's test, which yielded a model adequacy test of 0.691 and 137.469 (p-value 0.000), respectively (Table 4).

The first extracted factor, explaining 24.2% of the variance, characterized respondents aged 40-59 years (+0.621), with monthly income above 4,000 euros (+0.711) and negatively correlated with employment (–0.697).

The second factor, explaining 20.7% of the total variance, characterizes consumers with a high level of education (+0.898) and a young age (–0.544).

The third factor describes respondents with a higher number of family members (+0.695) and female gender (+0.775).

*Table 4 - Rotated component matrix of socio-demographic characteristics**

Variables	Factor		
	1_SD	2_SD	3_SD
Gender			0.775
Age	0.621	–0.544	
Education level		0.898	
Family members			0.695
Employment	–0.697		
Monthly net income	0.711		
Total Variance	24.2	20.7	18.8
KMO test	0.691		
Bartlett's test of sphericity	137.469		
Sign	0.000		

* Factor loadings less than 0.50 have not been reported.

The rotated component matrix of the sensory and extrinsic attributes analysed is shown in Table 5. Factor analysis allowed the identification of two factors explaining 74.7% of the total variance and obtaining high scores on

*Table 5 - Rotated component matrix of attributes analysed**

Variables	Factor	
	1_AT	2_AT
Nutritional properties		0.901
Taste		0.895
Practicality	0.788	
Timesaving	0.764	
Colour	0.810	
Consistency	0.876	
Freshness	0.825	
Flavour	0.843	
Juiciness	0.842	
Affordability		0.615
Safety		0.820
Total Variance	45.9	28.8
KMO test	0.894	
Bartlett's test of sphericity	4289.586	
Sign	0.000	

* Factor loadings less than 0.50 have not been reported.

the KMO test (0.894) and on Bartlett's test 4289.586 (p-value 0.000) for the goodness of the model used. The first factor shows positive correlations between the attributes "colour", "consistency", "freshness", "flavour" and "juiciness") with the attributes "practicality" and "time saving". This first factor explained 45.9% of the total variance. The second factor, explaining 28.8% of the total variance, shows a positive correlation between the extrinsic attributes "food safety" and "affordability" with the attributes "nutritional properties" and "taste".

2.3. *Results of Cluster analysis*

To investigate whether there are well-established homogeneous consumer groups among the respondents, a cluster analysis was performed. The cluster analysis identified 3 homogeneous consumer groups. The main characteristics of these groups are shown in Table 6, which also shows the factor scores in the centroids with the K-mean.

Table 6 - Results of cluster analysis

Variables	**Clusters**			**p-value**
	1. Pragmatists (n. = 163)	**2. Skeptics (n. = 133)**	**3. Healthy Consumers (n. = 131)**	
Factor 1_SD	0.791	–0.302	–0.677	0.000
Factor 2_SD	0.404	–0.776	0.286	0.000
Factor 3_SD	0.071	–0.002	–0.087	0.402
Factor 1_AT	–0.034	–0.833	0.888	0.000
Factor 2_AT	0.576	–0.103	–0.612	0.000

Consumption of the different types of fresh product and the reasons for the change in consumption during and after lockdown Covid-19 are shown in Table 7.

Table 7 - Consumption of fresh product and reasons for change in consumption during and after Phase 1 lockdown Covid-19 among consumer groups

Variables	Clusters			p-value	Chi-Square
	1. Pragmatists (n. = 163)	2. Skeptics (n. = 133)	3. Healthy Consumers (n. = 131)		
Lettuce consumed - 1	0.17	0.41	0.24		
Lettuce consumed - 2	0.09	0.13	0.15		
Lettuce consumed - 3	0.28	0.23	0.09		
Lettuce consumed - 4	0.16	0.08	0.13	< 0.001	51.125
Lettuce consumed - 5	0.10	0.04	0.12		
Lettuce consumed - 6	0.06	0.05	0.13		
Lettuce consumed - 7	0.13	0.08	0.14		
Mushrooms consumed - 1	0.50	0.59	0.40		
Mushrooms consumed - 2	0.22	0.16	0.11		
Mushrooms consumed - 3	0.07	0.10	0.11		
Mushrooms consumed - 4	0.04	0.05	0.15	< 0.001	34.060
Mushrooms consumed - 5	0.06	0.05	0.08		
Mushrooms consumed - 6	0.04	0.02	0.10		
Mushrooms consumed - 7	0.07	0.03	0.05		
Spinach consumed - 1	0.20	0.44	0.41		
Spinach consumed - 2	0.24	0.28	0.18		
Spinach consumed - 3	0.27	0.19	0.11		
Spinach consumed - 4	0.11	0.02	0.12	< 0.001	48.427
Spinach consumed - 5	0.07	0.03	0.11		
Spinach consumed - 6	0.04	0.02	0.02		
Spinach consumed - 7	0.07	0.03	0.05		
Reason for reduction of fresh cut salad during Covid-19 Phase 1					
• No answer	0.21	0.30	0.49		
• Difficulty in supplying	0.66	0.24	0.10		
• Fear of contagion	0.71	0.22	0.07	< 0.001	68.497
• Distance to the place of purchase	0.53	0.32	0.15		
• No difficulty	0.36	0.36	0.28		
• High prices	0.50	0.33	0.17		
After Covid-19 Phase 1, how did the amount consumed change?					
• No answer	0.21	0.30	0.49	< 0.001	57.163
• Increased	0.57	0.17	0.27		
• Decreased	0.22	0.44	0.33		
• Unchanged	0.47	0.36	0.17		

1) Pragmatist. This is the largest group, with a sample size of 38.2%. This group is characterized by female respondents who have a high level of education and are employed. The family unit of these consumers consists of 4 people in 38% of the respondents, while the reported income level is medium-high. The reasons for purchasing fresh-cut products are the attributes of "nutritional properties" and "taste". Consumers in this cluster pay attention to the low price and safety. During Phase 1 of the lockdown, this group of consumers limited their consumption of fresh-cut salads because of fear of infection and greater difficulty in obtaining supplies of these products. After Phase 1 of lockdown Covid-19, respondents in this cluster declared to increase the consume of fresh-cut product.

2) Skeptics. This group makes up 31.1% of the sample and consists mainly of young women who are single and have an average low level of education. This group is not very concerned about the sensory characteristics of fresh-cut products and the convenience and time saving of fresh-cut products. In addition, this group indicated that the amount of fresh-cut products consumed decreased after Phase 1 of Covid-19 due to the higher prices that characterize this product category.

3) Healthy consumers. They represent 30.7% of the sample. This group includes consumers with a high level of education. These consumers attach great importance to the sensory characteristics (color, texture, juiciness, taste) of fresh-cut products and evaluate with positive interest the practicality and time-saving features of fresh-cut products. This group does not take advantage of the low price, but pays attention to the sensory characteristics of the product. Regarding the consumption habits after Phase 1 Covid-19, there are no significant changes, although with a slight decrease.

3. Discussion

This paper examines consumer behaviour and perceptions of product attributes of fresh-cut products during the Covid-19 pandemic. To achieve the objective (1) of the study, consumer preferences for various fresh-cut products were analysed. It was found that respondents mostly consume lettuce salad, followed by spinach salad. In addition, the study investigates which sensory and extrinsic attributes influence consumers' choice to achieve objective (2). In general, the results show that the sensory and extrinsic attributes of lettuce salad received the higher importance for consumers. This can probably be explained by the greater popularity of lettuce salad in the market, which is therefore more familiar and well known by consumers. Moreover, among the attributes considered, "taste" is the most important attribute for consumers, followed by "practicality", "colour", "juiciness", and

"nutritional qualities". These results are consistent with previous research, which found that consumers consider product appearance as the primary purchase criterion for consumer behaviour in fresh-cut products (Kays, 1999). Specifically, colour was found to be a key attribute in consumer preferences and also influenced taste perceptions (Clydesdale, 1993). In addition, previous studies have found that the crunchy texture is an important attribute because consumers associate it with freshness attributes (Fillion & Kilcast, 2002; Szczesniak, 1998). Our results are also consistent with Pollard *et al.* (2002) on factors influencing consumer choice of fruit and vegetable products, which indicated that sensory attributes, price, and timesaving are relevant factors influencing consumer choice of fresh-cut products.

To respond to the objective (3) of this study, the cluster analysis shows the identification of three homogeneous groups of consumers. The "pragmatist" group is mainly female, employed, and has numerous family members. These consumers look for an affordable price, probably due to a medium income, but at the same time they also pay attention to food safety, as they are responsible for the family's purchases. The second group, the "Sceptics", is mainly composed of young women who are single and are not as concerned with the price and timesaving of fresh-cut products. Finally, the "Healthy Consumers" are women with a high level of education and a large family unit. They attach great importance to the sensory characteristics and the practicality and time-saving features of fresh-cut products.

To answer the objective (4) of this study, our study confirms that Covid-19 has significantly influenced consumers' purchasing behaviour and eating habits. Our results are consistent with other studies that found that purchasing behaviour for fresh product changed during the Covid-19 lockdown (Pappalardo *et al.*, 2020). The results show that purchasing behaviour tended to change in favour of conventional fresh products during the Covid-19 lockdown. Respondents stated that the reasons for the shift of behaviour were the fear of contagion in the grocery shop, difficulty in procurement these products at grocery stores, and also the higher prices that characterise this product category.

Moreover, the change in consumer behaviour might be influenced not only by external constraints due to the lockdown, but also by perceptions of the pandemic situation (Kozlowski *et al.*, 2020; Moran *et al.*, 2020). As is also evident from our results and consistent with other previous studies (Goolsbee and Syverson, 2020), the reduction in frequency of shopping or restaurant occasions is driven mainly by fear of contagion. On the other hand, concerns about health also contribute to an overall change in consumer behaviour (Laguna *et al.*, 2020, Murphy *et al.*, 2021). However, it is important to note that some changes in food-related behaviour during the pandemic may represent a temporary change. In addition, different consumers may change

their behaviour in different ways due to external conditions, demographic variables, or psychological characteristics (Grunert *et al*., 2021). Existing literature shows that there are different types of consumers who respond in different ways to the pandemic and that the magnitude of change is related to the severity of pandemic-related actions and their impact on consumer well-being (De Backer *et al*., 2020). Our study extends these findings by identifying clusters of consumers characterised by changes in self-reported behaviours associated with fresh-cut products.

Conclusions

Nowadays, the fresh-cut sector is concerned with improving the quality and safety of products (Artés *et al*., 2009). In addition, the techniques and technologies used in the fresh product sector are constantly evolving, and knowledge of consumer preferences is not yet fully explored and discussed in the literature. Increasing consumer attention to the health aspects of foods, and fresh-cut products in particular, has prompted scientific research to highlight the lack of information that should be addressed to gain a better understanding of consumer preferences for food attributes. Currently, consumers are paying more attention to different aspects and especially to the healthiness of food than before the pandemic.

The Covid-19 pandemic has generated a global economic crisis and is impacting economies around the world (Bulgari *et al*., 2021), affecting all aspects of life, including consumer behaviour in relation to food (Eftimov, *et al*., 2020). The consumer market for fresh-cut vegetables, despite the slight decline in 2020 caused by the Covid-19 pandemic, represents a key sector contributing to the improvement of the health status of the population (Merlino *et al*., 2020; Testa *et al*., 2021).

The results indicate that some attributes, including "ease of use", "texture" and "colour" show a high level of interest and appreciation by consumers. The findings of the study show that, overall, consumer behaviour changed during the lockdown Covid-19 due to supply difficulties, fear of contagion during purchasing occasion, and higher prices. However, this might be a temporary behaviour related to the one-time moment of the lockdown.

Although this study has some limitations, such as the small size of the consumer sample and the fact that certain sensory attributes (acidity, bitterness, etc.) were not considered, the results have contributed to the knowledge of consumer acceptance during the lockdown period for fresh-cut products. Moreover, the empirical approach described in this study allowed, on the one hand, the corroboration of the most preferred attributes and, on the other hand, the classification of homogeneous groups of consumers.

Furthermore, despite the composition of the sample of Sicilian respondents, the results of the study can also be extended to a broader scale, since Sicily is a representative demographic area in the national context of Italy, but also a representative area in the fresh-cut sector in the south of Italy.

Future research could replicate the study and provide more information on the extent to which the changes in eating behaviour observed in this study are permanent or whether they are a short-term response by consumers to a new exceptional situation.

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