Agriculture and Food

AIMS Agriculture and Food, 7(2): 403–425.
DOI: 10.3934/agrfood.2022026
Received: 17 January 2022
Revised: 09 May 2022
Accepted: 02 June 2022
Published: 10 June 2022

http://www.aimspress.com/journal/agriculture

Research article

Recent scenarios in Italy on fresh-cut products in the Covid-19 context

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Abstract: In recent years, the fresh-cut products segment has shown a growing trend in Italy even in the current complex socio-economic phase determined largely by the Covid 19 pandemic. The paper proposes an evolutionary path with the analysis of data produced by statistical sources, effective for cognitive purposes. Data mainly refer to the large product group of "salads" that represent the prevailing market share of the fresh-cut products segment. The vitality emerged has suggested to focus on some of the quality aspects orientated both on the part of firms, in order to promote competitive capacity, and on the part of consumers because of the need to respond to requests for food safety. In relation to this aspect, the paper proposes theoretical consideration, relevant for practical and factual purposes, on whether food safety is really one of the factors closely linked to determining quality. This is to identify the role and the importance attributed respectively to quality, as regards the ability to satisfy expressed or implicit needs, and to food safety, as an absence of risks that could endanger human health. The resulting difference in role and function raised the question of whether food quality and safety should be considered universally combined in the reference food. Finally, the paper, in the general regulatory framework, inherent to the agro-food sector of the European Union and of the Italian legislative authorities, has sought to identify the provisions that directly and/or indirectly influence the improvement and innovation of fresh-cut products.

Keywords: fresh-cut products; quality; market; agro-food; legislation

1. Introduction

In Italy, the fresh-cut products segment is expanding [1] and shows many new elements, pertaining to the general market, regulatory context and to initiatives for the valorization of local products.

The fresh-cut products are highly innovative [2] and involve intense variability and/or expansion of supply with changes in market equilibrium, even in a short period of time. In this logic, for the benefit of the fresh-cut products segment, strategies that involve the improvement of products already on the market, or that enable the transformation of traditional products into innovative ones, to introduce new functionalities into the markets, are included.

Such dynamism [3] gives rise to some problems in the measurement of the phenomenon/context and, in Italy, it places the fresh-cut products among the sectors of the unobserved economy, determining comparability difficulties, in time and space, and replicability hardships of the data. However, the economic relevance of the market in Italy arouses great attention and interest on the part of institutional organizations and/or market categories, which, for their own purposes, collect and process the results of direct surveys with the character of continuity. The knowledge and acquisition of these results provide useful information about trends and the evolutionary potential of fresh-cut products, as well as socio-economic and market analysis of this segment in Italy.

This series of cognitive elements allow providing, for the purposes of this work, a general overview of recent developments, relative probabilities of growth and the trend of the main variables, in the context of *fresh-cut products* in Italy.

A decisive role in the evolution of fresh-cut products derives from food quality, which is becoming increasingly important due to the solicitations concentrated on it, deriving from the economic and political context. Therefore, emerges the strategic significance that quality seems destined to assume as a development factor of the segment under examination. This article takes into consideration the most significant aspects characterizing the food quality theme, also to verify the possible connection between food quality and food safety of fresh-cut products [4].

In addition, without claiming completeness, the paper dwells with some of the most important regulatory measures, concerning the main aspects of activities related to fresh-cut products as a whole in Italy, remanding that the legislation of this segment currently includes ad hoc provisions for food/s (also specific for fresh-cut products) and general nature legislative measures with reference to agro-food products. The aim of the acquisition of notions about the relationship between the two dimensions (vertical and horizontal) is reducing the effects of information asymmetry so that the information is known to the consumers before they make a purchase and regardless of their consumption experience.

Ultimately, the arguments contained in the present paper aim to trace the importance of the fresh-cut products segment in Italy in its mutable aspects and in its potential for growth and development. Therefore, this research intends to provide new inklings to keep alive the debate on prevention and protection of the environment and food safety, especially in this Covid 19 pandemic era.

2. Materials and methods

In order to verify the economic relevance of the market of fresh-cut products in Italy, data and information generated by surveys conducted by private entities and organizations and by specialized journals and widespread on internet, have been selected and applied.

The insufficient statistics on fresh cut products from administrative sources of Italian origin led to this path of research and elaboration.

Thus, among the websites available and used for the arguments of this paper, the main ones are the "Cso Italy-Centro Servizi Ortofrutticoli" (based in Ferrara and operating since 1998), the "Istituto di servizi per il mercato agricolo-alimentare (ISMEA)", the "Confcooperative nazionale che utilizza dati Euromonitor International—Market Research Reports" and the information network Italiafruit News.

The "statistical documentation" of reference resulted in line with the operational purposes of the study, in relation to the accuracy of the data disclosed and the precision in the methods adopted, even in the survey at the level of the main economic operators in the chain of fresh-cut products in Italy.

A preliminary indication in the analysis conducted concerns the statistical unit of reference, which converges in the generic and common term "salads".

The mentioned statistical services made this strategic choice in view of the complex presence of numerous varieties of vegetables. These different product units are packaged for consumption in bags and/or Polyethylene Terephthalate (PET) trays and the varietal combinations of "salads" differ in time, space and form.

Developing the analysis on "salads" does not obscure the validity of the results achieved, given that salads represent the largest amount, i.e. 90%, of fresh-cut products in Italy, among other things, little affected by the adverse effects of the recent Covid 19 pandemic.

Regarding the identification of the time frame underlying the analysis, it is subordinated to the source of information to be consulted.

Thus, as regards the evolution of fresh-cut products over time, the investigated period is the 15-year period 2006–2021; while for the socio-economic characteristics of the consumer of fresh-cut products it is the four-year period 2016–2019. The research period does not include the years to follow to prevent that the effects of adverse events caused by the Covid-19 pandemic, that affected the usual trend of food consumption, would alter the analysis.

However, data from the years of the 2020–2021 pandemic resulted relevant to bring out the intensity of the link between fresh-cut products and organic fresh vegetables considered by the consumer, in the pandemic era, to some extent as alternatives to the former.

The determination of Pearson's correlation coefficient r allowed for verification of any correlation that existed between both types of vegetables.

$$r_{xy} = \sum_{i=1}^{n}(x_i - \bar{x})\,(y_i - \bar{y}) \Bigg/ \sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2 \sum_{i=1}^{n}(y_i - \bar{y})^2} \tag{1}$$

The extreme values of the index vary between −1 and +1. A positive/negative relationship indicates that the direction of the values of one variable lean towards the same direction of the other variable, i.e. towards high/low values; $r = 0$ represents the absence of a linear relationship, while $r = 1.00$ is the case of perfect positive correlation and each variable will obtain the same value.

3. Results (market trend)

In Italy, the introduction of fresh-cut products dates back to just twenty years, so after the relative consumption had already spread in other parts of the world.

Ready-to-eat (accommodated fruit and vegetables) products appeared for the first time in the 1960s in the United States of America (under the name "ready to eat") [5] with the evolution of large-scale retail trade (GDO). After twenty years, they appeared in Europe. First in France (with the name "IV gamme"), then in the United Kingdom (fresh cut) and later in Italy (fresh ready to eat—other processed mixed vegetables), contextually to the change in lifestyles and diet that gradually, during the 90s, the local population [6] manifested as a result of technological progress and the communication system that is becoming increasingly fast and practical [7].

At the time of introduction in Italy these products, not yet categorized as fresh-cut products, fell in a specific category of perishable products indicated in article 1 letter c and point 6 of DM(SAN) of 16/12/1993 on official bio-toxicological control of perishable food products.

Since their introduction on the market, in relation to their high content of innovation, practicality and speed of consumption, the fresh-cut products, have gone through a process of growth hampered by the restrictions of the pandemic from Covid 19. The prevailing causes may be referred to the longer time spent at home and the lesser need for a ready-made meal to consume at the workplace. No less relevant has been the touristic crisis that also occurred in terms of incoming flows to Italy. Another relevant intrinsic reason has been the limited life span [8] of fresh-cut products (shelf life valid for a few days) and the differential price for this category of product, packaged in bags or plastic trays, which is higher than for other fresh fruit and vegetable categories, although the average figure has decreased during the last years of the pre-pandemic period.

Cso Italy data [9] indicate that the average prices of "salads" fresh-cut products in the four-year period 2016-2019 have gradually decreased, i.e. from 7.06 euros they fell first to 6.94 euros, then to 6.71 euros and finally to 6.49 euros kilogram.

In Italy, the turnover of fresh-cut products at the beginning of the century stood at around 600 million euros [10] and has gradually increased up to recent years (877 million), albeit with some decline over the years (Figure 1).

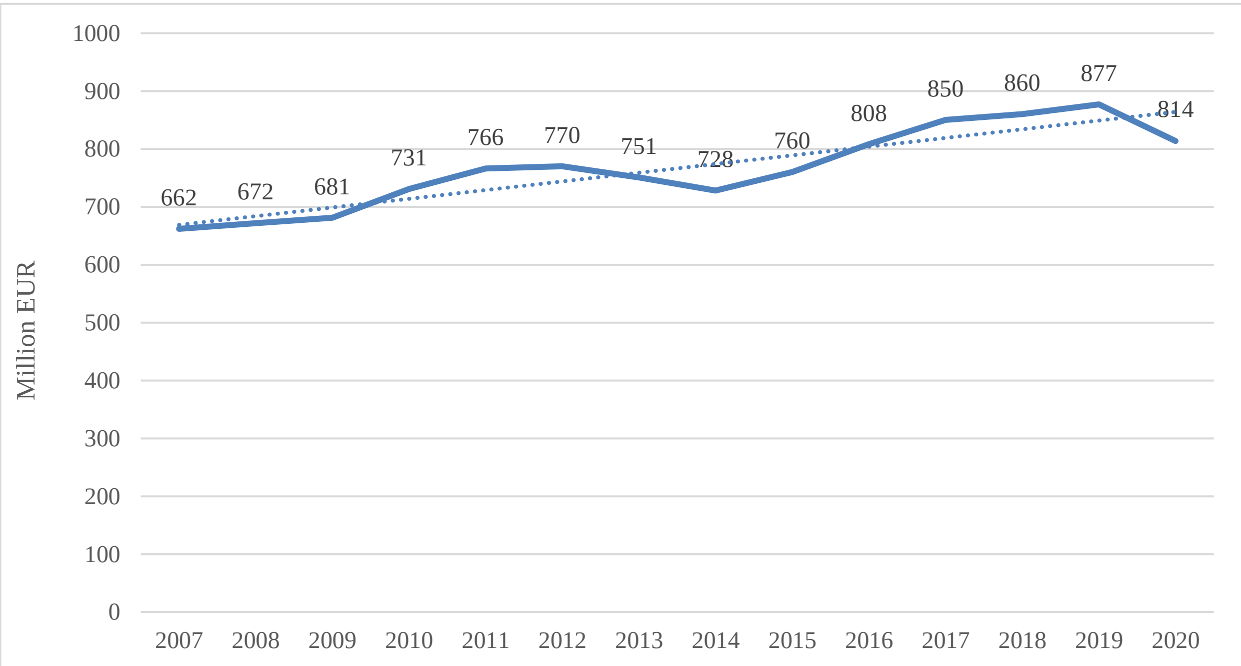

Figure 1. Evolution in the last fifteen years of the total market value of fresh-cut products in Italy. Our elaboration. (Source: http://www.italiafruit.net/DettaglioNews/29861/la-categoria-del-mese/iv-e-v-gamma-il-mercato-italiano-dai-dati-di-vendita-al-percepito-del-consumatore).

A clear decline refers to the year 2014, due to the lack of balance between supply and demand [11,12] also related to the enactment of the law May 13, 2011, n.77 which has led to great uncertainty among operators of the segment because of the new rules about the production, packaging and distribution of fresh-cut products. Such market disruption gradually rebalanced starting from Ministerial Decree no. 3746 of June 20, 2014 (implementation of art. 4 of the above-mentioned Law 77/2011) to August 12, 2015 (period for implementation of the provision).

Another slowdown in the growth rate of the fresh-cut products' economic value, highlighted in Figure 1, occurs between the years 2017 and 2018, due to the temporary effects of adapting to the law 3 August 2017, n. 123, regarding the reduction of the use of plastic bags in light material (art. 9-bis). Then, the last evident decrease in the observed period occurs with the increase of the pandemic from Covid 19-probably with the year 2020, i.e. from 877 million euros in 2019 [13] to 814 million euros in the following year, due to changes in consumer purchasing behaviors [14], etc. No less relevant were the consequent effects of the pandemic on the unit prices of supplies as a result of the increase in fixed costs, largely related to all the health security provisions to be implemented [15].

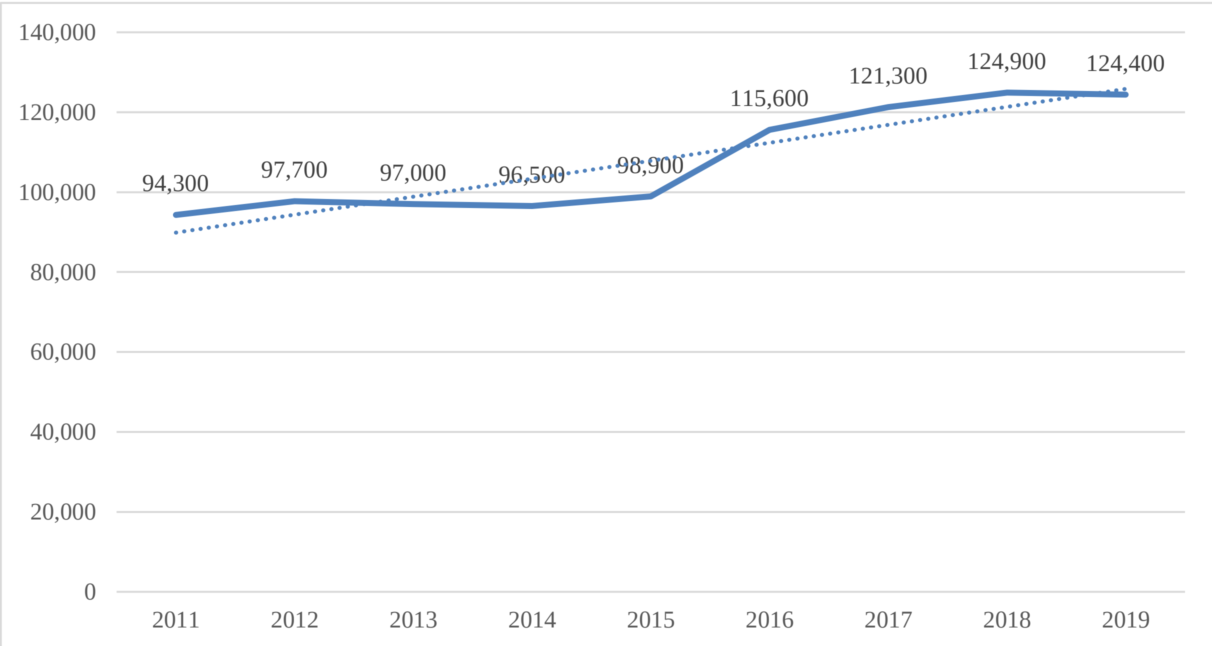

Figure 2. Evolution of fresh-cut products salads in Italy. Our elaboration. (Source: Confcooperative-Euromonitor data).

However, the aforementioned downturns in economic values do not significantly affect the angle of inclination of the trend line and so the market demand seems to tend to further increase the economic weight in the future. Moreover, some scholars estimate that in 2021 the segment would reach "the turnover of one billion euros" [16].

With regard to volumes, from 90 thousand tonnes in 2007 [17,18] fresh-cut products progressively increase to about 125 thousand tonnes in 2019 (Figure 2), with a trend line reflecting the economic trends already highlighted.

Regarding the commodity types (Figure 3), in 2019 mixed salads with 36%, monovarietal salads and vegetables both with 29%, "ready-to-eat" (mostly represented by baby carrots and julienne carrots) and fruits (monovarietal fruits and fruit salads) with the remaining 6% [16,19], represent the fresh-cut products.

For the agricultural phase, the availability of the most recent data refers to the solar year 2015 and they are to be considered extremely useful for a quantification of the territorial surface of Italy potentially used for the cultivation of horticultural products for the realization of fresh-cut products. In particular, in the Nomisma/Unaproa Report on the competitiveness of the national fruit and vegetable segment [15,17], the territorial base of Italy used for this production destination amounted to 6500 hectares, for more than half in a protected environment where, depending on the species and on market and/or environmental conditions, when possible, five to six annual growing cycles were carried out (and are still obtained). The number of farms distributed in this area was estimated at 500.Certainly, on the basis of the increases just mentioned, but also for the development of various forms of integration (consortia, producers' organizations, simple associative forms), in Italy, in recent years, the number of farms and the corresponding surface destined to the production of fresh-cut products is believed to have increased at a sustained pace, so as to involve an increasing number of agricultural producers, even if new in horticultural and/or fruit and vegetable production suitable for fresh-cut products.

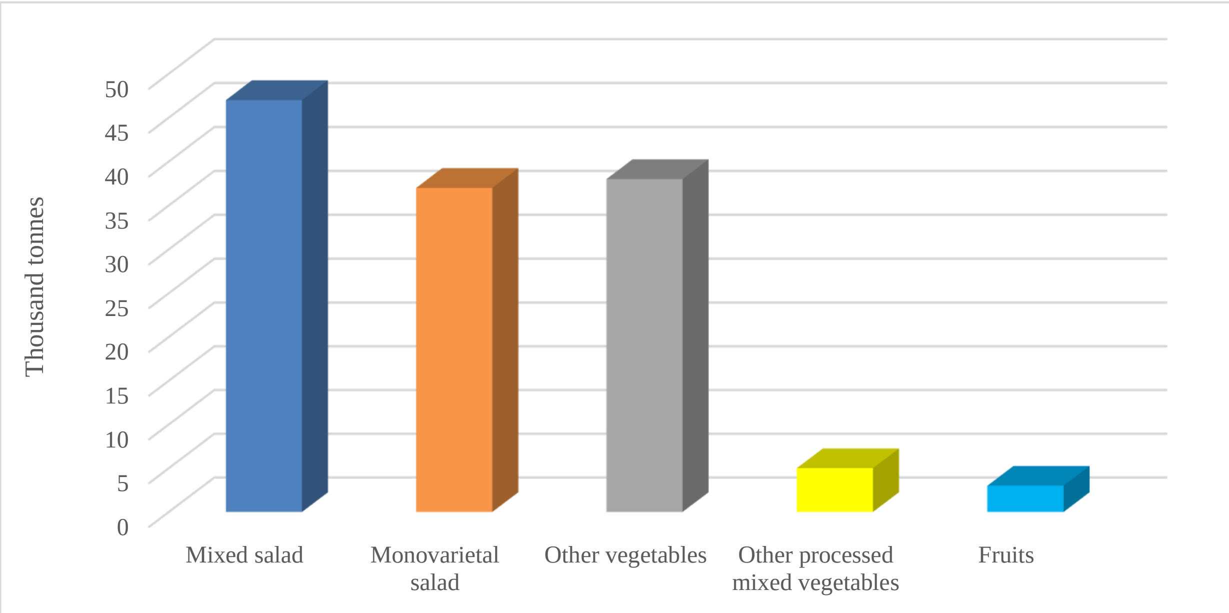

Figure 3. Fresh-cut products distribution by macro categories in Italy (2019). Purchases of fresh-cut products by types. Our elaboration. (Source: https://www.freshcutnews.it/2020/02/28).

In any case, in Italy the production of fresh-cut products is mainly concentrated in two main "poles": in a typical local production system in which, together with the farms, corresponding processing plants are established. In detail, the poles are one in the North of the Peninsula and the other in the Central-South. The first is located between the regions of Lombardy and Veneto, stretching along the line of the municipalities of Bergamo and Padua, while the second is spread over the Sele Plain involving the municipalities of Eboli, Battipaglia, Pontecagnano Faiano, Bellizzi, Montecorvino Pugliano, Capaccio and Serre [20]. Other smaller territorial production areas are found in Tuscany, Sardinia and other regions mostly in the south [15].

Between the North-Central and Southern poles of Italy [18], between agricultural and processing firms, differently localized, there is a functional collaboration based on complementarity, aimed at overcoming the seasonality's problems and qualitative-quantitative supply constancy. The latter are two fundamental factors for a product that makes standardization and market presence key elements of the service offered to the consumer [21]. Basically, these are the adaptive and evolutionary capacities of productive activities animated by strong entrepreneurial characteristics in the sense indicated by Schumpeter, namely, a marked propensity for innovation [18].

The processing and/or transformation phase of vegetables and/or fruit into fresh-cut products, in Italy, are activities carried out in plants with mainly mixed production lines, which allow the production of both fresh fruit and vegetables with a low level of manipulation [22,23] and fresh-cut products, with different placement of the offer realized. In the first case the commercial destination concerns the local and/or proximity market [24], whereas in the case of fresh-cut products the relative placement takes place on foreign and/or national markets located at a certain distance from the industrial phase. It is, therefore, a dynamic sector and the quantification in Italy of the specialized firms in the fresh-cut products is rather difficult also in consideration of the fact that the activity of processing firms is often discontinuous. This activity is partly imitative and partly driven by a local entrepreneurial environment, which has quickly proved receptiveness to innovation both in terms of production and commercial organization [18]. Turning to the demand side [25], the relative distribution of the location of purchases of fresh-cut products on the consumer markets in Italy is of some interest. Figure 4, with reference to 2019, shows that the national demand is concentrated more in the North of the country, in particular 34% falls in the North-West and 23% in the North-East areas; while in the areas of Central Italy and Sardinia there is 27% and finally in the South and Sicily there is the remaining lower rate (16%).

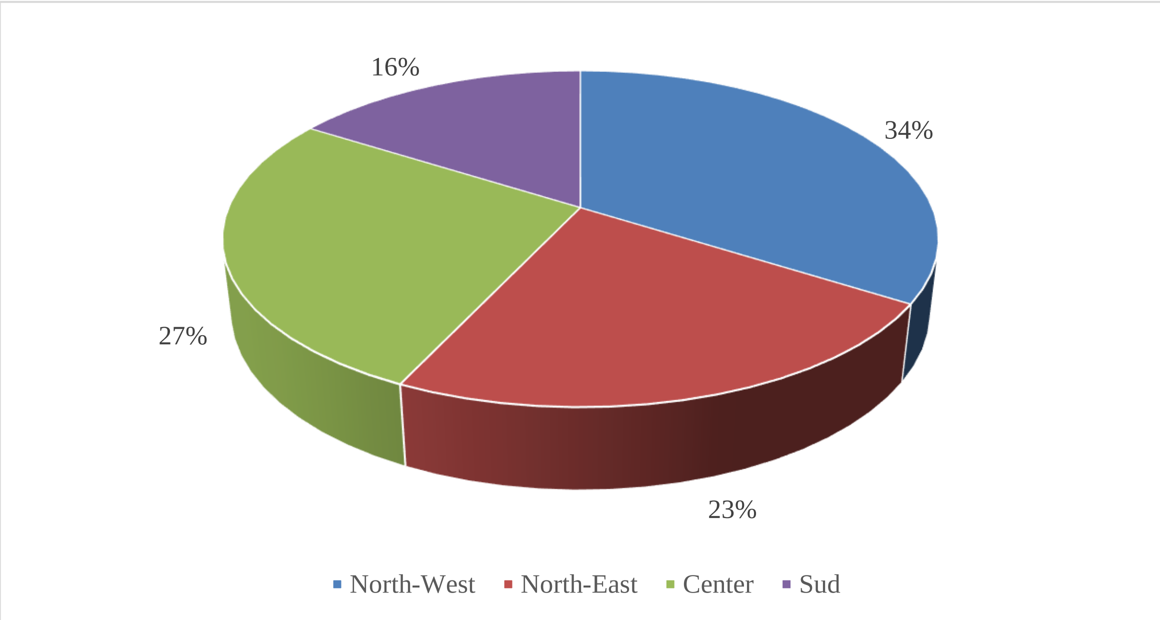

Figure 4. Relative distribution of "salad" purchases by major territorial areas in Italy-2019 volume shares. Our elaboration. (Source: Cso Italy-Centro Servizi ortofrutticoli. https://www.csoservizi.com/).

Another significant fact/datum is the place of purchase. Among the main points of sale for "salads", Supermarkets accounted for the highest volume share of purchases, in fact, Figure 5 shows how in this channel the demand turned out to be 53%. Then, in descending order, Discounts with 31%, Hypermarkets with 12% and finally Superettes with the remaining 4%, follow.

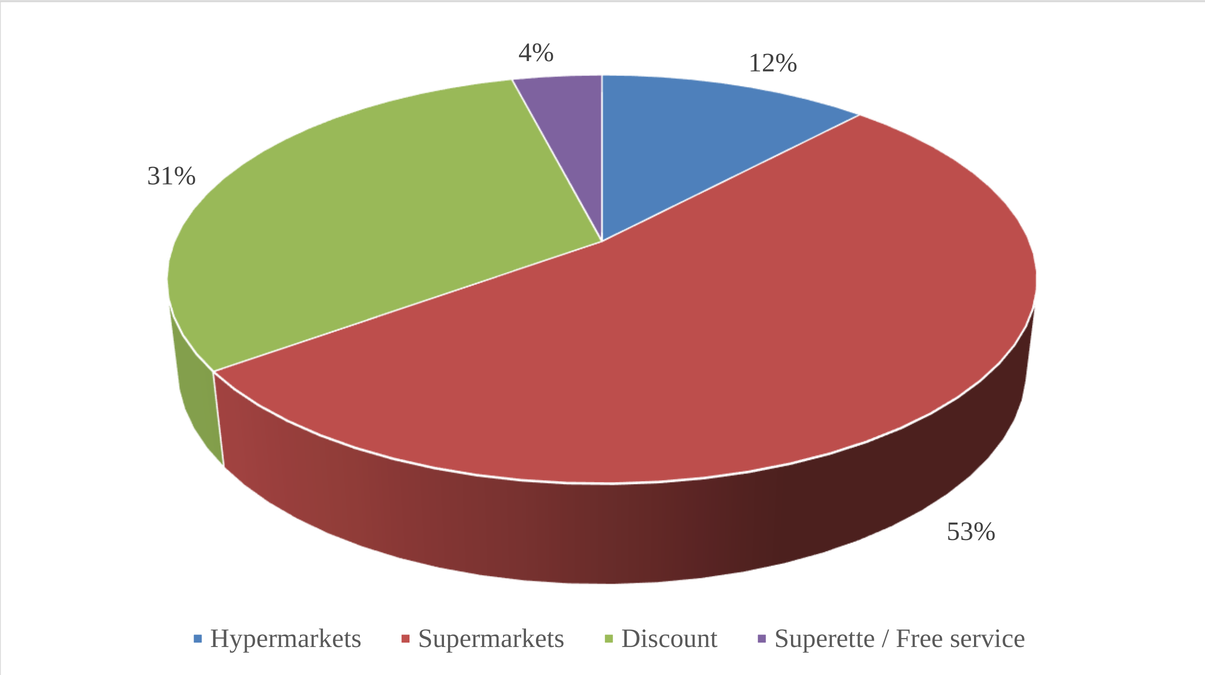

Figure 5. Relative distribution of "salad" purchases by self-service purchasing channels in Italy-2019 volume shares. Our elaboration. (Source: Cso Italy-Centro Servizi ortofrutticoli. https://www.csoservizi.com/).

As regards the size of the sales unit (Figure 6) of the "salads", the preferences of consumers, expressed in the GDO stores, mainly concerned packages between 101–150 grams and 151–200 grams, while less on those up to 100 grams and even more negligible on those from 201–250 grams to 301–400 grams.

Also, the time of realization of purchases assumes a certain relevance for the organization and management of activities related to the production of "salads" both for farms and for processing plants. Among the relevant issues to be considered, in the case of farms, the planning and management of the crop cycles of the different varieties of horticultural cultivation in rotation is important. In the case of industries, a decisive role is played by the productive dimensioning, the ability to adapt to the requests, the programming of the handling cycles, the potential expulsion of phases and/or activities from the processing line (de-integration), etc.

Whatever the role played by the firms involved in the production of fresh-cut products, the knowledge of the distribution of the amount of consumption during the calendar year is of great importance in the planning phase of the firms involved.

Specifically, Figure 7 highlights the primary importance of the consumption of fresh-cut products in the spring, which follow winter and precede summer, when the demand drops until the autumn; the trend that applies to all the years observed (four-year period 2016–2019).

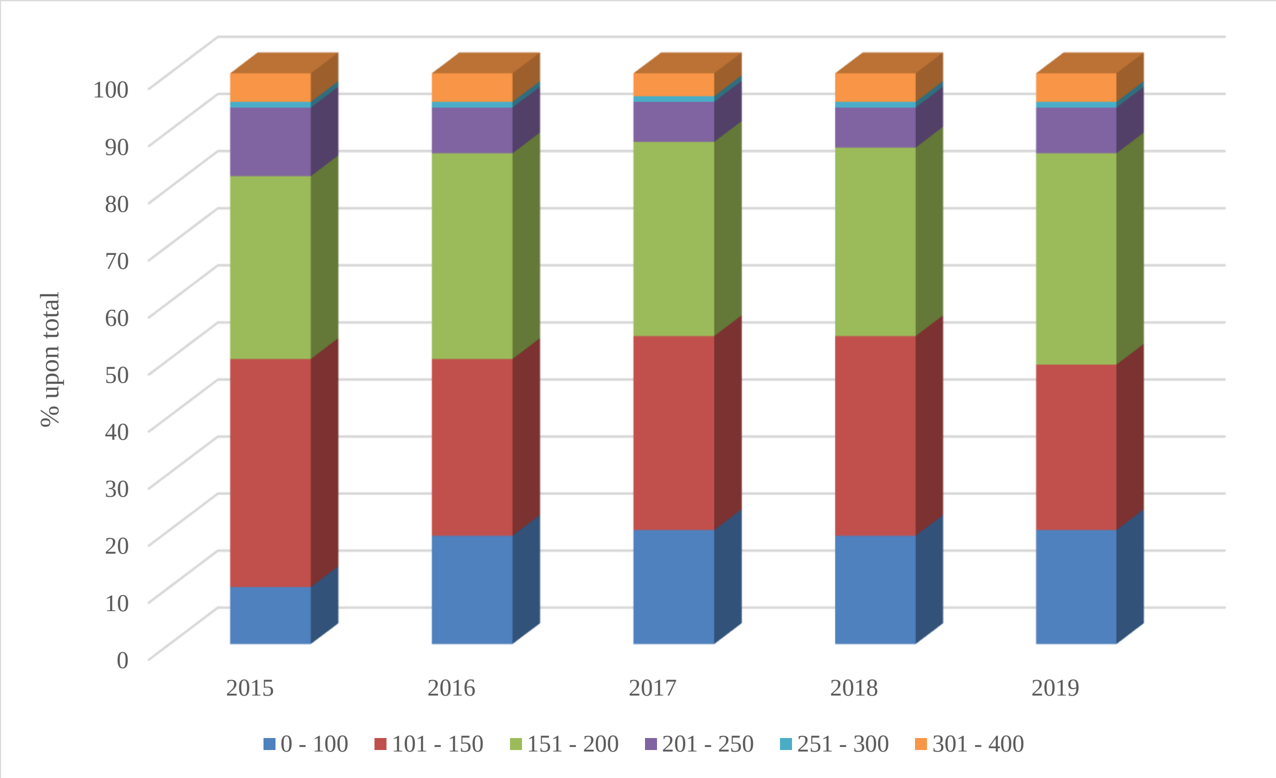

Figure 6. Relative importance of fresh-cut "salads" for sale at large-scale retail outlets in Italy-percentages by volume 2019. (Source: Cso Italy-Centro Servizi ortofrutticoli. https://www.csoservizi.com/).

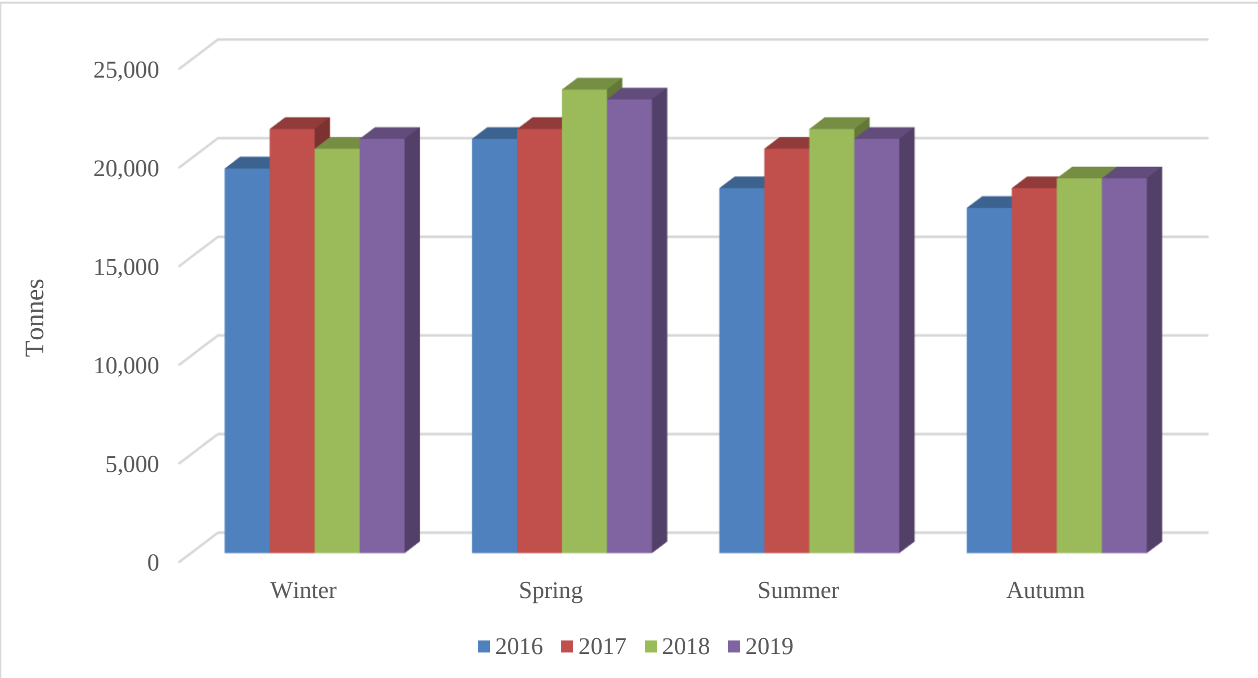

Figure 7. Evolution of consumption of fresh-cut "salads" by seasonal period in Italy. Our elaboration. (Source: Cso Italy-Centro Servizi ortofrutticoli. https://www.csoservizi.com/).

A further element of knowledge is the evolution of the distribution of the various types of fresh-cut products in Italy. Mixed "salads" show higher volumes than all the other categories, which, in order of importance, are "other vegetables", "simple salads" and "processed vegetables", as Figure 8 displays. In this regard, the decline that "mixed salads" showed in 2019, compared with increases in the other categories including packaged fruit, would lead to consider it as a temporary change, or a different new trend, in the consumer evaluation system with respect to categories of fresh-cut products with a low degree of handling, as evidenced by the trend in correspondence of "processed vegetables".

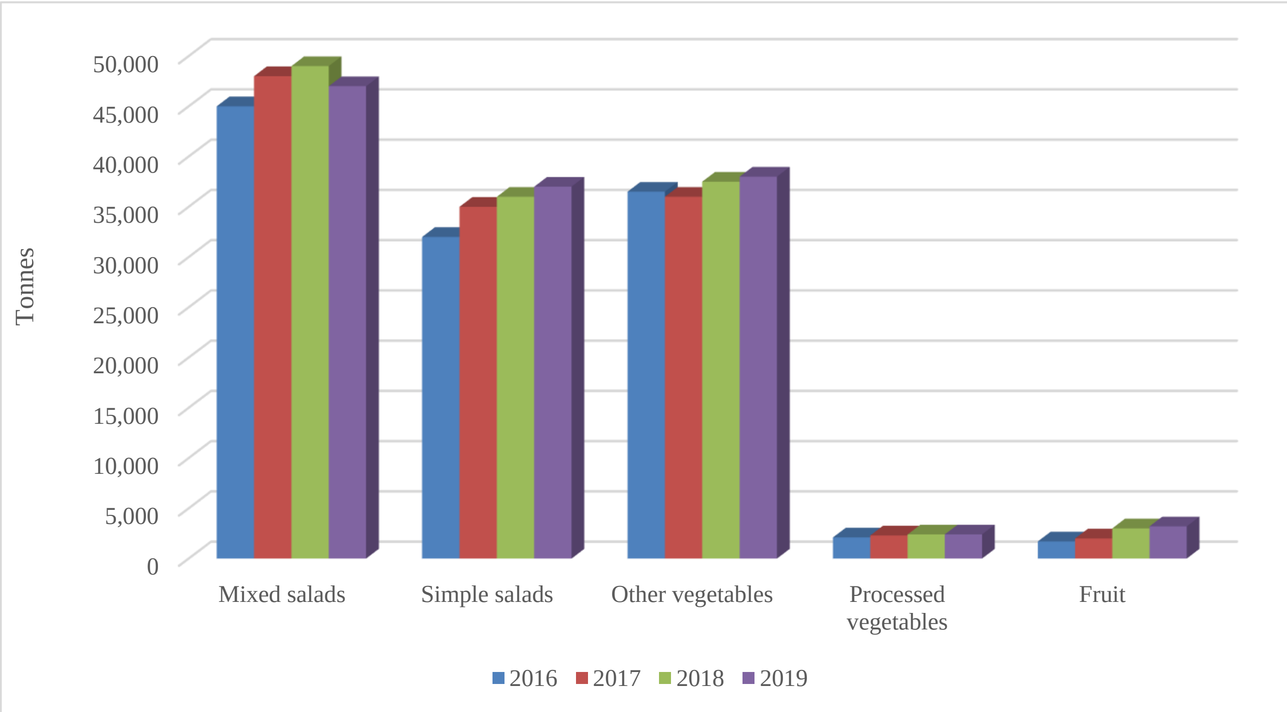

Figure 8. Evolution of consumption by major types of fresh-cut products in Italy. Our elaboration. (Source: Cso Italy-Centro Servizi ortofrutticoli. https://www.csoservizi.com/).

In relation to the composition of consumer households, ISMEA data [26] show that Italian households interested in fresh-cut products are becoming more numerous than those targeting fresh whole vegetables: 19,500 households compared to a universe of 24,500. The impact of buyers of fresh-cut products on those of fresh vegetables (relative penetration index) in the decade 2011–2020 increased from 70% to 81.3%. As for the composition by number of components (Figure 9), the family of 2 units intercepts the prevalent share (28%) of the volume of fresh-cut products consumed in Italy.

Moreover, regarding household income bracket, Figure 10 shows that high or medium-high income households intercept 55% of the volume, medium-low-income households 31% and low-income households the remaining 14%.

It is also important to note that the Covid 19 pandemic has influenced new trends in consumer behavior with changes in the types of fresh-cut products chosen. In fact, recently [27] fresh "salads" accounted for 73% of fresh-cut products, processed vegetables for 19% and "ready-to-cook" vegetables for the remaining 8%, which previously ranked below this position.

Furthermore, recently the demand for fresh-cut products has decreased while the demand for organic vegetables has increased resulting in a higher market position in the relative financial values for both the "ready" type (i.e. placed in bags or in Polyethylene Terephthalate-PET-trays) and the fresh bulk type. Comparing the purchases of organic and fresh-cut vegetables reveals some important aspects.

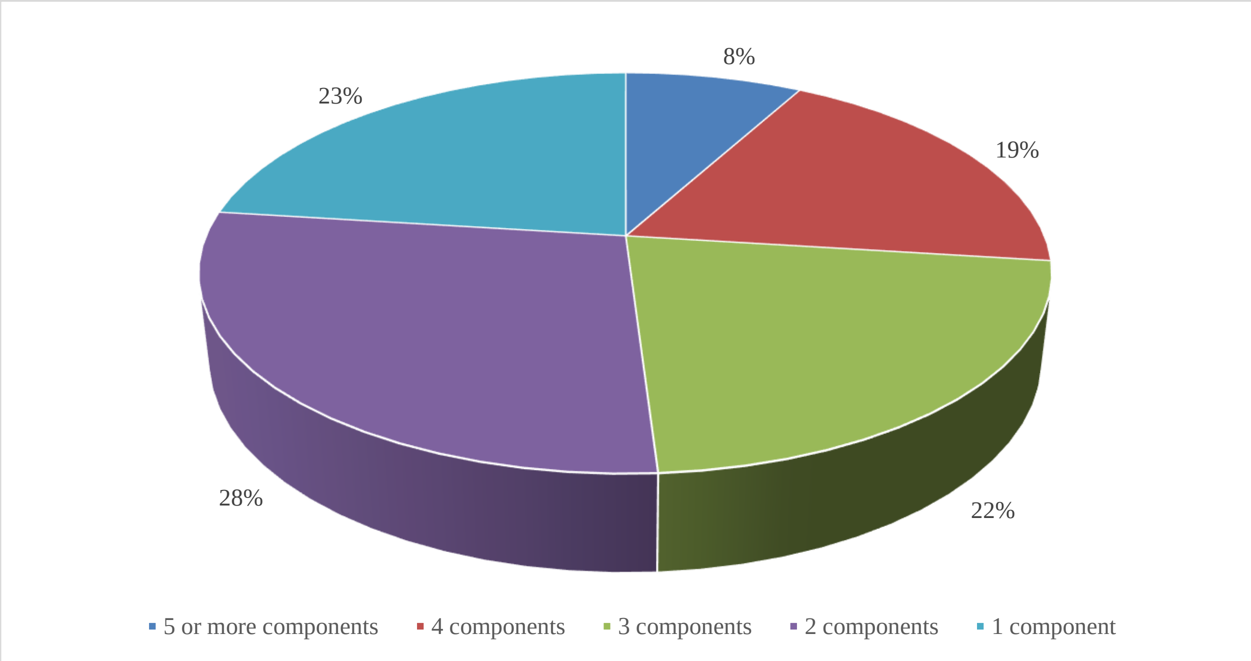

Figure 9. Distribution of household fresh-cut consumption by number of members in Italy (2019). Our elaboration. (Source: ISMEA-Nielsen Consumer Panel data).

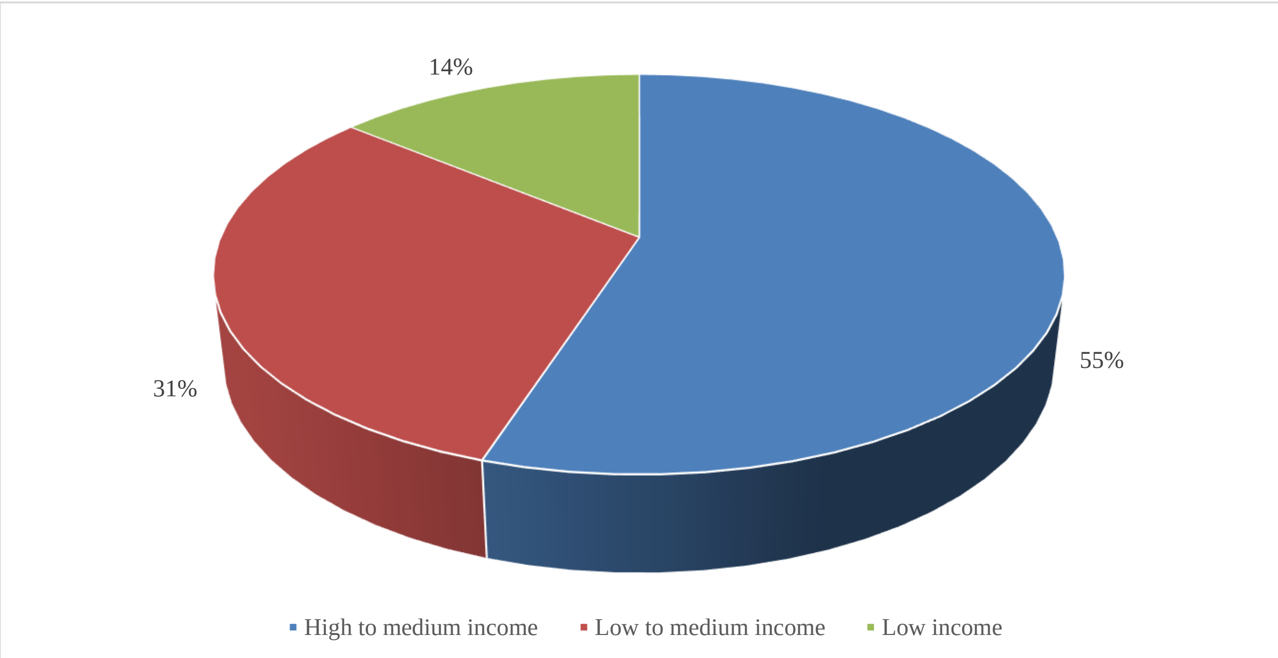

Figure 10. Distribution of fresh-cut consumption by household income classes in Italy (2019). Our elaboration. (Source: ISMEA-Nielsen Consumer Panel data).

With reference to the period 2017–2021 (Figure 11), the comparison of the evolution trends in millions of euros, between fresh-cut products and "ready" organic vegetables, shows that the growth trend concerns both types. This happens likely for almost the entire period with parallel trends, with the exception of the last year, in which the values would confirm the effects of the pandemic on the consumption of fresh-cut products, i.e. a decline of the fresh-cut products and a continuation of the increase of organic vegetables "ready". In contrast, the comparison between fresh-cut products and fresh bulk organic vegetables describes divergent manifestations in the corresponding trends throughout the observed period.

The analysis of the correlations between the different categories of products considered reveals that there is a positive correlation, with a significance of around 1%, between organic vegetables and organic fresh vegetables, as shown in Table 1. There is no significant correlation between the other categories although the values found are acceptable.

Therefore, the presence of correlation in the first case contrasts with the almost absence of correlation in the other case.

Ultimately, Pearson's coefficient would suggest consumer preferences for "packaged" products, regardless of the type of product observed, and, at the same time, would show prospects of greater impulses for fresh-cut products growth, if the origin of the vegetables (and/or other plant species) comes from organic farming.

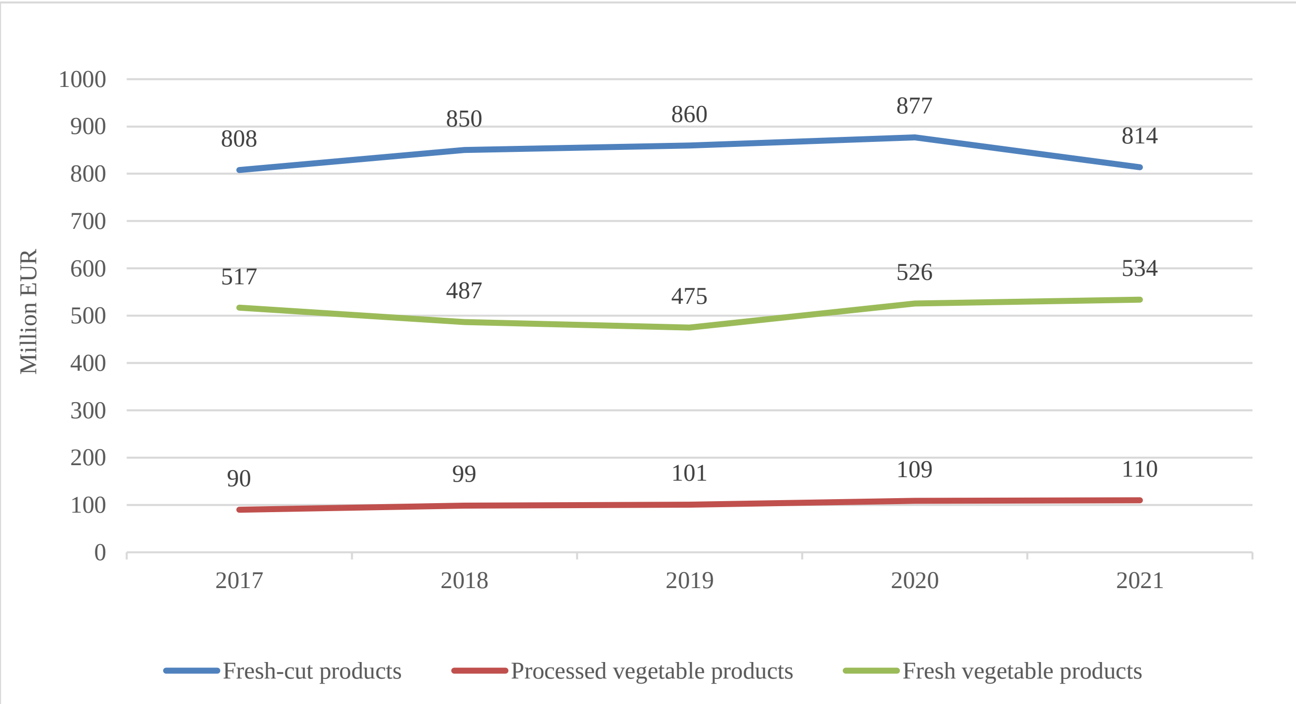

Figure 11. Comparisons between fresh-cut products and types of organic vegetables along the evolutionary dynamics of the last five years. Our elaboration. (Source: http://italiafruit.net/DettaglioNews/62397/in-diretta-da/ortofrutta-biologica-la-corsa-continua).

Table 1. Correlation of Pearson.

		Fresh-cut products	Organic vegetables	Organic fresh vegetables	Organic processed vegetables
Fresh-cut	Pearson correlation				
	Sign. (two-tailed)				
Organic vegetables [a]	Pearson correlation	−0.220			
	Sign. (two-tailed)	0.722			
Organic fresh vegetables [b]	Pearson correlation	−0.383	0.967**		
	Sign. (two-tailed)	0.525	0.007		
Organic processed vegetables	Pearson correlation	0.397	0.607	0.386	
	Sign. (two-tailed)	0.508	0.277	0.522	

** A correlation is significant at the 0.01 level (two-tailed). [a] Organic vegetables: broad beans, peas, zucchinis, eggplant, peppers, cauliflower, etc. [b] Organic fresh vegetable: red radicchio, pan sugar chicory, curly endive and escarole, fennel, etc.

4. Discussion

4.1. Quality profiles

In Italy, users of fresh-cut products seem to orient their consumption choice on the extrinsic attributes more than on the intrinsic attributes of the product, and they seem to trust mostly their own judgment [28]. So, in the presence of packaged product [29], the demand is influenced by the presence of certifications, brand, price, etc. [30,31]. These indications, however, allow making a comparison [32] through the main informative tool of veracity, although not the only one: the label. The label permits the consumer to make informed and consistent choices [33] through knowledge of, among others, the procedures that lead from the raw material to the final product, the date of packaging, the shelf life and place of origin of the product itself, i.e. the traceability [34,35]. In some cases, in fact, the value of a food product lies in the link between quality and territory giving rise to the specificity of the local quality of the product itself. It emerges the association with a given geographic and cultural context as perceived in the imagination of the people of the places of references. "Quality-local" represents products having market intrinsic and extrinsic characteristics that differentiate them from other similar products of the same species and make them suitable for consumption and therefore to fall into the fresh cut food category. The consumption of local fresh-cut products, thus produced as close as possible to the place of consumption, are reassuring in terms of quality, genuineness and freshness, thanks to the rapidity of the logistic activities and for to the possibility of being directly informed about the production methods and the intrinsic quality of the product.

In Italy, fresh-cut products connect with the UNI 11350:2010 standard which establishes traceable indications on definition, requirements, general principles, food safety and labelling.

The general food provisions established by the European Union by Regulation 178/2002 (art.10, "principle of transparency"), Regulation (EC) 2073/2005 (microbiological criteria in the application of general and specific hygiene measures), Regulation (EU) No 1169/2011 (provision of food information) and Regulation No. 1151/2012 (quality schemes) provide important food protection functions for fresh-cut products.

In any case, whatever the characteristics and requirements of the quality, it is important that the product meets the functions of use to which it is intended and so the "particularities" expected, fixed or desired by both mandatory standards and the consumers. According to the terminology adopted by the UNI EN ISO 9000:2005, "quality" definition is "*the degree to which a set of intrinsic characteristics meets the requirements*".

Whatever the organoleptic features and/or market characteristics, a key determinant of the consumer choice trends is certainly the consumer's purchasing power and any changes in it based on various factors of an economic-social nature. Income level determines market demand to a very large extent, with repercussions in terms of household habits and behavior (just as in the case of an economic crisis we would see greater attention, sobriety and prudence, with trends toward savings and low-cost consumption).

There are several aspects that contribute to attract the consumer inducing him to purchase; the wrapping constitutes a fundamental market role, especially when it plays an additional function to the traditional ones of containment and of generic protection of products from the most frequent contamination of environmental origin [36,37]. In this respect, as some authors argue [38], fresh-cut products packaged in envelopes fall within the definition of "potentially dangerous products" [39]. For example, certain enteric pathogenic micro-organisms in humans may be carried by irrigation water, just as inadequate storage temperature may be the cause of primary microbial contamination [40–45]. These aspects are closely related to the hygienic-sanitary profile of these products. According with Legislative Decree 26 May 1997, no. 155 of May 26, 1997 (in implementation of Directives 93/43/EEC and 96/3/EC on the hygiene of foodstuffs), an obligation to withdraw the products from the market may arise if the contamination resulted in an immediate risk to the health of the consumer. Moreover, the person responsible for one of the handling phases, following primary production (food industry in its various activities) (art. 2), in which the contamination occurred, may be liable to administrative and criminal sanctions (art. 8). As a result, it emerges a relevant priority in terms of health and hygiene, that is, food safety.

International Organizations have expressed their views on food safety [46]. Among those commonly accepted internationally, the World Food Summit of 1996 described a situation in which "all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to ensure their food needs and preferences to lead an active and healthy life" [47]. More recently, the European Commissioner for Health and Consumer Protection declared, in presenting the "White Paper on Food Safety 2000 (COM 99/719)" [48], "food safety is an intrinsic part of its quality".

The question arises as to whether the attribution of the health and hygiene profile, or of food safety, as an inherent component of the complex concept of food quality, may be regarded as such, or as a different and autonomous requirement, in the light of the safety requirements for food at risk provided by art. Art. 14 of Regulation (EC) No 178/2002 laying down the general principles and requirements of food law. Indeed, it is not allowed to place on the market foods at risk to human health or unsafe, or *unacceptable for human consumption according to its intended use, for reasons of contamination, whether by extraneous matter or otherwise, or through putrefaction, deterioration or decay*. This although in case of non-compliance the same Article 14 does not provide for an appropriate sanction.

In particular, as already pointed out [32], the issue is questionable when dwelling on the "delimitation of the concept of food quality and the identification of its possible declinations". If a contaminated (fresh-cut) product cannot be placed on the market, it follows that food safety is the prerequisite to sale a product. Therefore, food safety cannot "constitute an integral element of the concept of quality", since quality concerns a product when, suitable for sale, it is placed on the market.

The issue is particularly relevant because, apart from the variety-based product standards, which, especially for the consumer of packaged fresh-cut products represent the basic preferential attributes for consumer preference [49], the product must be safe to access the market. Hence, it is preferable to keep the two profiles very distinct, arguing that "safety and quality do not coincide, even at a level of extreme genericity" [32]. Moreover, the autonomy of the two requirements is confirmed by the fact that "food quality" is not mentioned in Regulation 178/2002 in outlining the general principles and requirements of food law.

For the market acceptability of fresch-cut products in containers, Regulation (EC) No. 2073/2005 and Law No. 77 of May 13, 2011 regulate the two profiles safety and quality about the hygienic-sanitary aspect. Regulation (EC) No. 2073/2005 regulates the profiles attached to microbiological risks (the prevalent cause of harmful contamination) and establishes criteria and control measures (as amended by Regulation (EC) No. 1441/2007); Law No. 77 of May 13, 2011, which regulates the preparation, packaging and distribution of fresch-cut products in Italy, aims to ensure hygienic safety and establishes that these products can be packaged individually or mixed, in containers of different weights and sizes.

4.2. Regulatory profiles

The legislation regulating the fresh-cut products' segment in Italy comprises both general rules, with reference to food products ("horizontal", or generic, legislation) and specific ones for specified food products and specified intended use ("vertical", or specific, legislation).

The linchpin "horizontal" regulations for food products mainly derive from European Union provisions. The aim is to guarantee the wholesomeness, safety and pathway of foodstuffs. To ensure the hygienic and environmental quality of the handling processes up to consumption, the protection from health risks due to pathogenicity from microorganisms or toxins/metabolites [50], as well as the guarantee of a high level of consumer protection also through communication systems useful also to favor the functioning of the market. This set of provisions also encompasses activities related to fresh-cut products as a whole and which find legal force within the framework of the following European Union regulations. Among these there are:

-Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 lays down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. It establishes the European Food Safety Authority and lays down procedures in the field of food safety (e.g. traceability is to be regarded as a fundamental prerequisite for safety, understood as the ability to identify and track food from the production, processing and distribution stages);

-Regulation (EC) No 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs as emended by Commission Regulation (EU) 2021/382 of 3 March 2021.

-Commission Regulation (EC) No 2073/2005 of 15 November 2005 on microbiological criteria for foodstuffs, as emended by Commission Regulation (EU) 2019/229 of 7 February 2019 with regards to certain methods, the food safety criterion for Listeria monocytogenes in sprouted seeds, and the process hygiene criterion and food safety criterion for unpasteurized fruit and vegetable juices (ready-to-eat);

-Regulation (EC) No 1924/2006 of the European Parliament and of the Council of 20 December 2006 on nutrition and health claims made on foods concerns non-mandatory commercial communications used by companies to attribute to their products particular qualities or to magnify the properties of the nutrients contained in the food ("claims" or nutritional and health indications);

-Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers. It covers the ingredients and instructions on how to use the product, right down to reporting substances that may cause allergies or intolerances or listing the nutritional components of the product.

As for the "vertical" legislative discipline related to fresh-cut product, in Italy it currently lays mainly on Law n.77 of May 13, 2011, article 4 (implementing decree of June 20, 2014 n. 3746/2014, of the Minister of Agricultural Food and Forestry Policies in agreement with the Minister of Health and the Minister of Economic Development). It strengthens the aspects concerning preparation, packaging and distribution aspects. This to guarantee, together with specific generic measures of the European Union on the subject, the consumption of a safe and controlled product along the entire single food chain.

As a result of the combined effects of the aforementioned European Union provisions (cited among the "Visto" of the implementing Decree No. 3746 of June 20, 2014) and Law n. 77 of May 13, 2011, it descends that the fresh-cut products to circulate on the Italian markets shall comply with mandatory hygiene, health and quality requirements, such as microbiological quality (absence of Escherichia coli) [51], the absence of contamination by microorganisms (Salmonella, Listeria monocytogenes, etc.) and defects related to quality, preservation and safety of the product. Other requirements are related to the maintenance of the so-called cold chain, the type of packaging that ensures the direct shelf life and that induced by the storage environments, of great importance are the "specific information to be reported on the packaging" (Article 8 of Ministerial Decree No. 3746 of 2014).

It seems relevant to point out that Article 8 provides that the label must be clearly legible the indications:

-"washed and ready-to-eat product" or "washed and ready-to-cook product", along with instructions for use in the case of products to be cooked;

-"keep in the refrigerator at a temperature below 8 °C". For raw products ready to be consumed, the tagline "consume within two days from the opening of the package and in any case no later than the expiry date".

Also important are the prescriptions (Article 3 and Annex 1) for establishments/factory set for the production of fresh-cut products; the temperature of internal processing environments must not exceed 14 °C, while that of the premises for the storage of raw materials, semi-finished and finished products must be below 8 °C.

Regarding the national regulatory measures that go beyond the normal organization and management of the market of fresh-cut products, in the context of the adverse effects caused by the lockdown for the Covid-19 virus pandemic, the Decree Law of November 9, 2020, n.149 entered in to force (management mode: Decree of the Minister of Agriculture, Food and Forestry Policies n.9361598 December 2, 2020) which provides for the granting of a contribution in favor of fruit and vegetable producer organizations (recognized under Regulation (EU) no. 1308/2013 of the Council and the European Parliament), for producer members who have suffered the reduction/loss of marketed production of agricultural products intended for the production of fresh-cut product.

Moreover, the contribution of the fresh-cut products to overcome the Covid-19 crisis could also be realized as a result of European Union initiatives. Thus, to "address the economic, social and health consequences for Member States and to mitigate the social and economic fallout" caused by the pandemic crisis, the European Union has established both a technical support facility (Regulation (EU) 2021/240 of February 10, 2021) and the "Recovery and Resilience Facility" (Regulation (EU) 2021/241 of February 12, 2021).

Alongside the regulatory profiles, other European economic policies emerge which, although not specifically addressed to fresh-cut products, may also concern them also in view of the economic dimensions of the market achieved [52,53]. In such a perspective, the European Green Deal for a Climate Neutral Europe in 2050 [54] addresses climate and environmental issues through the *green economy* and the *circular economy* for a sustainable growth toward "*green transition*" or "*ecological transition*" without leading to the dissipation of natural capital, implementation of the Green Deal [54].

In this respect, the 10-year plan of the EU Biodiversity Strategy 2030 tends to protect and restore nature and reverse the degradation of ecosystems [55] and for the relevant profiles, the Farm to Fork strategy aims at ensuring food security, reducing food waste, combating food fraud, encouraging and promoting healthy eating habits.

Furthermore, in line with the European Green Deal and the Biodiversity Plan and the Farm to Fork Strategy is the EU Commission's Action Plan for the Development of Organic Production [56] to boost consumption, increase production and further improve the sustainability of the organic segment.

In the intention to expand the fresh-cut products market, alongside the aspects of quality and safety, the sustainability is a key element not to neglect [57].

For a large number of consumers to be "conquered" it is necessary to continue towards a better quality and safety of products, as well as the content in services, without neglecting the aspects of sustainability [57].

5. Conclusions

The analysis carried out confirmed that in Italy the fresh-cut products segment grew at a sustained pace before the Covid-19 pandemic. ISMEA's information services revealed a recent downturn in the segment or of -5.3%, even -8.7% in the case of ready-to-eat "salads". More recently, fresh-cut products have revived their growth trend, so much so that the volumes consumed have almost reached pre-pandemic levels and have placed Italy at the top for consumption of fresh-cut products in Europe (ISMEA-Nielsen). This situation has also been facilitated by the active participation of a wide base of socio-economic operators with high agro-commercial qualification of certain territorial areas of high production concentration.

In this context, there are still territorial differences motivated largely by the different structure of the organization of work and the territory, but also by agro-social models linked to different production systems.

From the information acquired, it has emerged the will to strengthen development in new areas, especially in southern Italy, where the offer of fresh-cut products is already on going following the enhancement of local resources and the strengthening of the link with the consumer.

The enlargement of the offer of fresh-cut products, in destinations possibly different from the large-scale retail trade and/or organized distribution, that is, in the traditional proximity markets, very present in the southern urban areas, could bring advantages for producers and consumers.

In regard to the expansion of supply, a certain relevance seems to have, for its operational importance, the development of cultivation systems that contribute to soil protection, water or energy saving, improvement or maintenance of water quality, protection of habitats or biodiversity, mitigation of climate change and reduction or improved waste management. In this context, an example derives from soilless agronomic techniques (vertical farming) that, together with the reduction of the use of production factors, allow for more annual cycles, even out of season, which vary depending on the type of vegetable (especially for "salads"), and less waste in the subsequent processing phase [58].

The use of this hydroponic cultivation system is being developed in different parts of the world, but in Italy the implementation has been very slow due to organizational and management adaptations to new cultural experiences and also to the consolidated preference of farmers to conventional cultivation systems able to confer the characteristics of "typicality" to the products. The resistance may also come from the economic efforts to sustain for the initial investment costs of the structures to realize and for the operating costs, which, depending on the typology adopted, could variously increase especially in cases of cultivation techniques related to the energy needs of artificial lighting of the seedlings [59,60].

Considering the environmental benefits that would arise with crops soilless and the guarantees of health and genuineness that hydroponic technology may interest the fresh-cut products, in Italy, in the epidemiological emergency period, have emerged amendment proposals in support of types of crops soilless. The Decree-Law March 22, 2021, n. 41 (Urgent measures in support of businesses and economic operators, labor, health and territorial services, related to the COVID-19 emergency; converted with amendments by Law. May 21, 2021, no. 69) has established provisions for contributions to economic operators affected by the epidemic by COVID-19

For the subsequent phases (transport and delivery of the product to industry [61]; the industrial phase, distribution to the distribution centers and transport to distribution), the excessive fragmentation of the product units (resulting in heterogeneity of the batches of products involved) obviously poses problems of concentration and qualitative homogeneity, with repercussions both on costs and on specific controls on the quality of the product, which do not allow different price differentials than the standard ones.

Another important aspect, given the commodity characteristics of fresh-cut products, is the confusion that emerges from the polysemy, which characterizes the term quality, especially when food safety is considered included, as an immanent component. The examination of the regulation 178/2002 has contributed [62] to clarify and to provide elements to consider, on the contrary, the areas of quality and food safety as separate areas. Quality refers to the organoleptic characteristics of the product entered into the market, while food safety concerns the hygienic-sanitary profiles connected to the risks for human health and to the unsuitability for human consumption.

Therefore, whatever the level of the supply chain of fresh-cut products and of the related agro-food species/variety involved, it shall be a priority to identify strategies to guarantee, on the one hand, the typical quality profiles for each product and the food safety, thus strengthening the production system involved, and, on the other hand, consumer's trust.

Acknowledgments

This research was supported by: -Project MODESTI by Starting Grant "PIAno di inCEntivi per la RIcerca di Ateneo 2020/2022 (Pia.ce.ri.)" UNICT (5A722192168) and Project "Sostenibilità economica, ambientale e sociale del sistema agroalimentare del mediterraneo", by PIAno di inCEntivi per la Ricerca di Ateneo (PIACERI) UNICT 2020/22 line 2, the University of Catania (5A722192154).

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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