

Article

Consumption Preferences for Truffles and Truffle-Based Products: An Application of the PLS-SEM Model

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Abstract: The truffle is a niche, valuable and ecological product exported and consumed all over the world. However, little is known about consumers' preferences for truffles and truffle products. This study empirically explores the factors influencing their consumption in Italy. A PLS-SEM model was implemented and validated using an extended version of the theory of planned behavior, including consumers' food-specific curiosity as an additional construct to basic constructs such as attitude, subjective norms and perceived behavioral control. The analysis allowed us to examine and verify the significance of the relationships between the factors and what impact they have on intentions to consume fresh and truffle-based products. The processing concerns of consumers were reached through face-to-face consultation with a semi-structured questionnaire. The results obtained suggested that consumers' intentions in using truffles involve several factors, such as consumers' personal experiences, organoleptic characteristics (aroma and taste), food safety, trust in the seller/brand, traceability information, the aspect of green products and, more generally, the protection of the environment and forests. The findings provided novel insights for researchers to understand the aspects of truffle consumption, and also represent a guideline for marketers to develop appropriate marketing tactics to grow the truffle business.

Keywords: truffles; consumption intentions; semi-structured questionnaire; Italy; PLS-SEM



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1. Introduction

Strengthening resilience, halting the loss of biodiversity and building a healthy and sustainable food system are practices which have already been highlighted for some time, and have become essential priorities following the crisis triggered by COVID-19, which has shown the fragility of the food system [1,2]. The pandemic highlighted the value of rural areas for the well-being of the whole society and their specific contribution in tackling the climate crisis. The post-2020 Community Agricultural Policy (CAP) supports farmers and rural communities in facing the difficulties and challenges inherent to innovation in agriculture, forestry and rural development, with the aim of creating synergies between different policy programs at both EU and Member State levels [3].

Moreover, within the main aims of the 2021-27 PNR, particular importance was attributed to the multifunctional role of forests, supporting the valorization of non-timber forest products, but also giving particular care to the value of the intangible forest services through the application of nature-based solutions (NBS) [4,5]. Implementing innovations aimed to improve the conditions of agricultural and rural populations is a task entirely in line with the desired development and growth processes promoted by the CAP.

In recent years, interest in truffles (valuable mushrooms) has increased, for both spontaneously grown truffles and those cultivated in artificial truffle grounds. In the latter case, new income opportunities are promoted for the various operators in the supply chain [6], supporting the recovery and valorization of marginal territories and inner areas [7], which can also happen through the promotion of the potential links with food and wine tourism.

Huber et al. [6] argued that non-timber forest products (NWFP) play a fundamental role in the provision of forest ecosystem services, highlighting how, in the cases observed in Europe, NWFP products offer opportunities to forestry companies willing to manage a combination of woody and non-woody resources. Furthermore, sustainable co-production can support the appropriate management of agro-forest ecosystems across Europe. Truffles and truffle products therefore represent a valuable option for sustainable food supply.

Huber et al. [6] also pointed out that wild mushrooms and truffles strengthen the economic vitality of rural and inner areas, constituting the most widespread opportunity to increase additional income deriving from forest management for non-woody products.

Büntgen et al. [8] focused on the emerging Spanish black truffle industry. After having highlighted the economic crises that many European rural areas are experiencing and which overlap with the long-term negative effects of climate change, they focused on aspects linked to the potential of micro-tourism. They also suggested that micro-tourism, through the use of qualified guides and the promotion of restaurants serving mushrooms, truffles and local products, can compensate for the related economic losses deriving from unemployment and production reductions induced by summer drought, therefore promoting sustainability and the conservation of biological diversity.

In awareness of this growing importance of truffle cultivation and its use in the gastronomic sector in marginal and inner European areas, our study examines the importance of knowing consumers' preferences, attitudes and consumption motivations, and also suggesting appropriate marketing actions.

On the other hand, in 2021 Oliach [9] was already encouraging the promotion of truffle consumption, due to the increase in cultivated truffle plantations; he underlined the importance of the emergence of truffle hunters who collect on behalf of farmers and specialized wholesalers, while the number of collectors who search for truffles to sell them to small itinerant buyers significantly decreased.

Consequentially, the application of the Theory of Planned Behavior (TPB), as described in Ajzen's work [10], can provide a tool for exploring consumption behaviors. The multidimensionality of consumers' eating behaviors has led many authors in the literature to extend the constructs by including others in the applied models [11,12]. At present, however, the objective and subjective knowledge, socio-demographic profiles and lifestyle that influence the consumption of truffles and truffle products are still little explored. As a consequence, this study represents, as far as we know, the first empirical exploration of Italian consumers' preferences on truffles and truffle products. Our findings will improve the understanding of consumer preferences for these niche products, offering valuable information to the supply chain operators in order to develop tailor-made strategies to effectively meet consumer expectations.

In Italy, the truffle market is very fragmented and characterized by a multitude of small operators (pickers, artificial truffle growers, distributors, restaurateurs, etc.). No official data are available on the real amounts of truffles collected each year, especially in relation to the type of sale and negotiation. Many transactions are still carried out at a local scale in the main production regions and, in many cases, occasional sales of small quantities directed to the final consumer are considered. The demand for truffles is mainly linked to the catering, processing and tourism industries; it is highly seasonal, reaching a peak in the months of October–November, when the most truffle harvesting occurs.

Focusing on truffle prices, the economic activity of the truffle sector generates tens of millions of Euros annually. We discuss average retail prices, as reported below, referring to the last decade: *Tuber Magnatum Pico* between 1500.00 and 4000.00 EUR/Kg at retail price and between 800.00 and 2000.00 EUR/Kg wholesale; *Tuber Uncinatum Vitt* truffle between 300.00 and 500.00 EUR/kg at retail and 150.00 and 250.00 EUR/kg at wholesale level; *Tuber Aestivum Vitt* between 100.00 and 300.00 EUR/Kg at retail and 40.00 and 150.00 EUR/Kg wholesale; and finally the *Tuber Melanosporum* truffle, which ranges from 400.00 to 1000.00 EUR/Kg at retail and 200.00 to 600.00 EUR/Kg wholesale. The prices cited above are indicative, since they strongly fluctuate; however, these "random" prices

make the search and purchase of the precious underground mushroom an attractive experience [9]. Oliach et al. [9,13] affirm that, during the last few decades, the European market has undergone changes due to the cultivation of truffles. New producers have appeared in a traditional sector linked to wild production, and new business opportunities have emerged through online sales, giving more visibility to the truffle.

Recently, many authors [14,15] have focused on the “rethinking consumption” approach to interpret consumption as a complex practice and as a combination of elements of choice and consumption habits [16,17] both from the emotional point of view of rational choices, which influence the consumer towards practices of sustainable consumption [18], and in relation to know-how. Truffle farms can allow the valorization of marginal and inner areas, promoting new employment and income opportunities and also supporting gastronomic tourism, which revolves around the production of truffles and truffle-based gastronomy (fresh and/or processed). Thanks to their high cultural and gastronomic prestige, various species of truffles are appreciated all over the world for their high nutritional value, bioactive compounds and prestigious aroma.

The aim of this research work is to explore motivations and preferences for the consumption of truffles and truffle-based products. The study was conducted through a survey of consumers in Italy through face-to-face interviews.

In the context of food consumption literature, many studies have applied the predictive power of the Theory of Planned Behavior (TPB) [10,19] to investigate consumers’ intentions regarding healthy behaviors [20,21], healthy eating, environmental protection behavior and the consumption of organic foods. The approach aims to understand the processes that lead individuals to intentional behavior in their consumption choices.

Other studies have added constructs to the TPB by expanding it with additional variables to explain the greater variation in personal conduct and consumption intentions [2,22–24].

TPB provides basic constructs, which are intention (INT) to carry out that specific act of consumption, attitude (ATT), subjective norm (SN) and perceived behavioral control (PBC). All these factors are determined by behavioral, normative and control beliefs, respectively. In the literature, several studies extend these constructs, such as awareness of sustainability, moral attitudes, health consciousness, territorial identity and recently also the impact of COVID-19 on purchasing intentions [2,22,23,25]. Also, our study extended the TPB framework by adding the food-specific curiosity (SGAC) construct in addition to the TPB core theory constructs.

To identify which drivers influence consumers in the process of choosing truffles to be purchased/consumed, an exploratory factorial analysis (EFA) was carried out based on the analysis of the main components (PCA).

To identify the factors that influence the propensity to consume truffles, a structural equation model (PLS-SEM) was implemented using a self-administered questionnaire.

This model represents one of the most widespread methodologies in the analysis of behavioral data, as it allows us to study the interrelationships between variables that are not directly measurable, called latent variables or factors. PLS-SEM was used to test the following research questions:

- Which factors determine the intention to consume truffles and truffle-based products?
- Which are the main personal behaviors and attitudes that guide the choice to consume truffles and truffle-based products?
- Is gastronomic curiosity a relevant factor in the intention to consume truffles and truffle products?
- Is food safety important when planning to consume truffles and truffle-based products?
- Does the approval of family members and acquaintances count in the intention to consume these niche products?

This paper is organized as follows: the introductory section is followed by a literature review on the truffle market and the state of the art. Subsequently, the methodological approach adopted for consumer analyses is illustrated and the results obtained are outlined. The paper concludes with discussions and conclusions.

2. Literature Review

2.1. Description of the Research Object: Truffle

The truffles of the *Tuber* genus are the most interesting forest products from an ecological, hydrogeological and economic point of view. Specific growing habitats, unpredictable growth patterns and growing seasons, unique harvesting methods, limited natural resources and a limited shelf life make truffles one of the most expensive foods in the world [26]. The distribution and abundance of the various truffle species are influenced by the climate, soil and vegetation conditions [27]. Because of the great demand for truffles in the market and the shortage of wild resources, cultivation is a possible strategy for truffle production [26].

Due to their high cultural and gastronomic prestige, various truffle species are appreciated worldwide for their high nutritional value, bioactive compounds and prestigious aroma [28–30]. Truffles of the *Tuber* genus have been the focus of cultivation efforts for many years, particularly in southern and central Europe, where regional endemic species such as *Tuber melanosporum*, *T. aestivum* and *T. magnatum* have a long tradition of culinary use [31,32]. Italy is one of the most important countries in Europe for truffles gathering and trade.

The rapidly growing and wide-ranging economic sector includes the production of mycorrhized plants in nurseries, the harvest of wild and cultivated truffles, truffle dog training, the marketing of fresh and processed truffles, the transformation of truffles into secondary products, myco-tourism (i.e., truffle tourism), mycological gastronomy, interdisciplinary research and producer extension services [8].

Broadleaved forests and plantations in the Mediterranean basin in Italy, France, and Spain represent the most productive environments for the production of the Périgord black truffle, *Tuber melanosporum Vittad* [8,33–35]. Due to the organoleptic qualities of its fruitbodies, *T. melanosporum* truffles represent one of the most in-demand *Tuber* species in the world [36] and one of the most relevant in terms of global consumption and economic importance [37,38]. In the second half of the 20th century, intensive orchard farming started (Murat) due to the introduction of protocols to stimulate *T. melanosporum* ectomycorrhizal production in controlled conditions, among other things. The actual global yield is approximately 120,000 kg per year, generating a yearly revenue of approximately EUR 50 million for truffle farmers [13] with retail prices of ca. EUR 700–1500 per kilogram, depending on seasonal and meteorological variables [33,34,38]. In France, Italy and Spain, productive truffle orchards provide rural landowners with an alternative to agricultural subsidies, encouraging the regeneration of abandoned crop fields because, among other things, this requires little agricultural input [39,40].

The black truffle is cultivated in different countries, mainly in Spain (47 tons/year), France (43 tons/year) and Italy (19 tons/year) [9], as well as in the Southern hemisphere in Australia (11 tons/year) [35], Chile (1.3 tons/year) and Argentina (0.6 tons/year) [41].

Italian truffle hunting and extraction are part of a set of knowledge and practices that has been transmitted orally for centuries. Today, it still characterizes the rural life of entire communities in the Italian peninsula. Truffle hunters usually live in rural areas and small villages. There are two steps to truffle hunting: the hunting and the extraction. The hunting entails the identification of areas where the truffle plant grows, from whose roots grows the underground fungus named ‘truffle’. This step is carried out with the help of a trained dog. The hunters then use a special spade that allows them to extract the truffles without disturbing the soil conditions. Truffle hunting involves a wide range of skills and knowledge (about climate, the environment and vegetation) related to the management of natural ecosystems and to the dog–truffle–hunter relationship. This knowledge is passed on through oral traditions, including stories, fables, anecdotes and expressions that reflect the local cultural identity and create a sense of solidarity within the truffle hunting community. Truffle hunting is often associated with popular feasts that mark the beginning and end of the truffle season. Truffle hunting and extraction in Italy are considered traditional knowledge and practices and part of an Intangible Heritage by the Culture Sector of

UNESCO, confirming the great value that the whole world attributes not only to the truffle itself, but to the entire supply chain, rich in history, traditions and culture [42]. Truffle hunting is traditionally practiced with respect for the environment and plant biodiversity, guaranteeing the seasonal regeneration of the truffle. However, the natural production of white truffles in Italy is endangered by several factors including truffle hunting pressure in some Italian regions. The number of truffle hunters is constantly increasing and their official number is now over 70,000 [43].

In 2021, the export of Italian truffles was recorded at +48%, especially to countries like the United States, which have always appreciated them.

Their peculiar sweetness, appreciated by even the most delicate of palates, makes them a very versatile ingredient in the kitchen; they lend themselves not only to classic, elaborate dishes but also to quicker and simpler recipes, such as finger food and appetizers to be offered with aperitifs, or minimal, chic or vegan-friendly recipes, which thanks to the unmistakable flavor of the truffle will have a great impact.

Rich in beneficial nutritional properties, the truffle is recognized as a truly healthy food, and an extremely genuine food; the presence of mineral salts, proteins, magnesium and vitamins also make it an excellent ally for the summer, while the high antioxidant level helps prevent aging.

Thanks to its low calorie content (31 kcal per 100 g) and high water (76%) and fiber (8.4%) content, it is also considered an efficient dietary food. But it is not only the body that benefits from the consumption of truffles: a study has revealed that, thanks to anandamide [44], a neurotransmitter also present in breast milk, all truffles instill in those who taste them a widespread sense of well-being.

2.2. Methodological Approach

In order to carry out this research work, aimed at identifying the factors that determine the propensity to consume truffles and truffle-based products, the TPB was expanded and the PLS-SEM was implemented [2,22–25,45–47].

PLS-SEM has now become the methodology of choice for many researchers studying complex relationships between latent constructs, such as in marketing, consumer choice and other fields. It allows for the evaluation of complex patterns and structural pathways, with many variables considered and used. As highlighted by Lei and Wu [48], PLS-SEM represents an advanced version of general modeling procedures and it is therefore used to evaluate whether the model hypothesized in theory is consistent with the data collected [45,49].

This model represents one of the most widespread methodologies in the analysis of behavioral data, allowing us to study the interrelationships between variables that are not directly measurable (latent variables or factors).

The conceptual framework applied in this study is detailed in Figure 1, which illustrates the research hypotheses and the potential reasons that influence the intentions towards truffle consumption. We considered behavioral intention, defined as the likelihood that a person will engage in a particular behavior [10]. Intention reflects a person's willingness to engage in a goal behavior. In this study, we hypothesize that the intention is connected, on the one hand, to trust in the seller/restaurateur, and to knowledge of the product and environmental sustainability and, on the other hand, to a combination of motivational variables based on attitude, perceived behavioral control, subjective norms and specific gastronomic curiosities (see Appendix A, Table A1).

There is a positive relationship between attitude towards truffle consumption and both intention and actual consumption. In fact, many studies on consumer behavior in the field of food and drink marketing have shown how the attitude towards a product significantly influences intentions and actual consumption [2,50–52]. Attitudes are a person's positive or negative opinions about events or behaviors, and they reflect a series of preferences, and then generate intentions towards purchasing and consuming at home or away from home (restaurants, pizzerias, etc.). Personal attitude is the main decisive factor in the intention to

behave in a certain way and, furthermore, represents the individual's positive or negative evaluation of that behavior.

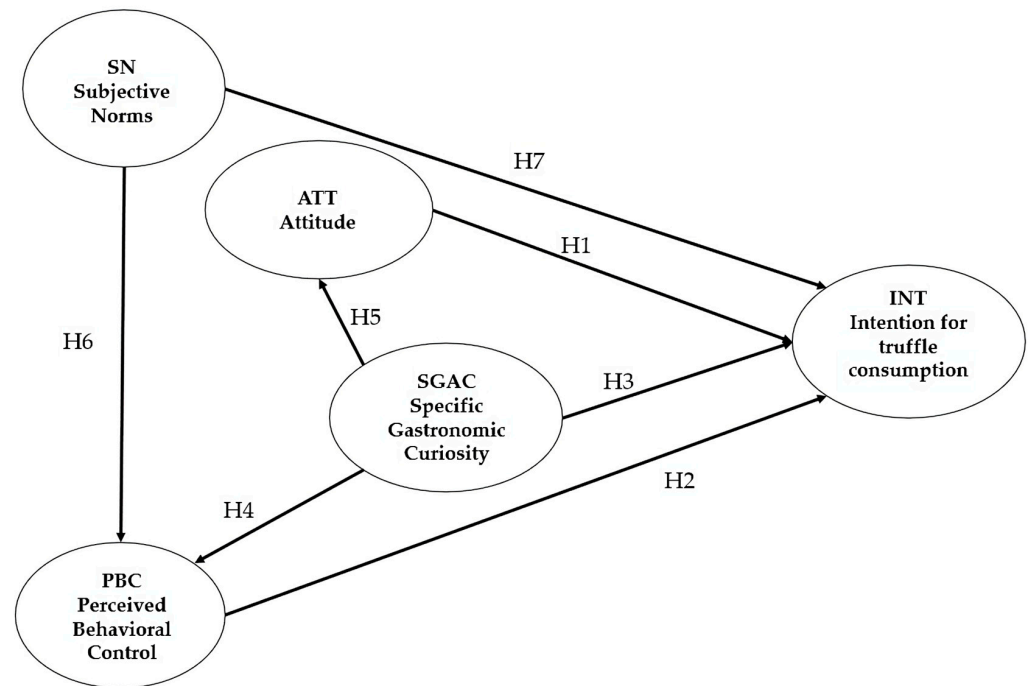


Figure 1. Conceptual model hypothesized in the analysis and the related research hypothesis.

The following hypothesis was constructed:

H.1. *Attitude has a positive and significant impact on consumption intention.*

In hypotheses H1, it is believed that attitude plays an important role in the intention to consume truffles due to the high cultural and gastronomic prestige and the particular aroma. Furthermore, the consumer, although attracted by a niche product, pays attention to the perceived behavioral control of the product he consumes.

Perceived behavioral control is explained as an individual's perception of their ability or self-judgment in terms of engaging in a certain behavior [1]. Several studies have shown that the greater the behavioral control an individual perceives, the stronger their intention to engage in the behavior in question [53–56]. Shin e Hancer [24] confirmed that, regarding food and drinks, PBC has an influence on intention and actual consumption/purchase. Therefore, the following hypotheses are proposed:

H.2. *Perceived behavioral control has a positive and significant impact on consumption intention to consume truffles and truffle-based products.*

In hypothesis H2, perceived behavioral control is believed to be an important element for intentional consumers of truffles, and therefore attention to health, diet and correct nutrition represent key elements and important predictors of purchase intentions.

There is a positive relationship between curiosity and attitude/intention to consume/purchase truffles and truffle-based products. Numerous studies on consumer behavior in the field of food and drink marketing show that specific curiosity towards a product significantly influences consumption attitudes [52,57]. In this regard, the following research hypotheses were formulated:

H.3. *Gastronomic curiosity has a positive and significant impact on the intention to consume truffles and truffle-based products.*

H.4. *Gastronomic curiosity has a positive and significant impact on perceived behavioral control.*

H.5. *Gastronomic curiosity has a positive and significant impact on attitude.*

In the hypotheses H3, H4 and H5, the specific gastronomic curiosity (SGAC) is believed to positively influence the consumption intentions towards truffles and truffle-based product. Gastronomic curiosity moves the consumer towards new cultural experiences, social relationships and an escape from routine. Furthermore, the consumer, although intrigued by a niche product, pays attention to the perceived behavioral control of the product he consumes.

There is a positive relationship between subjective norms and intention to consume/purchase truffles and truffle-based products. In a context linked to the consumption/purchase of food and drinks, many authors [24] underlined how subjective norms are significant predictors of purchase/consumption intention. Subjective norms are understood as the perceived social pressure to engage in or refrain from a particular behavior, representing an individual's perception or opinion of what others believe they should do. Subjective norms concern the perception that particular behavior is approved or disapproved of by the people who are important to him/her (loved ones or close ones, family, friends, partners, etc.) [58]. James, Rickard and Rossman [59] defined them as a powerful internal control factor that can easily shape a person's behavioral intention. Subjective norms are commonly identified as another significant predictor of consumption intention that accentuates the level of importance of another individual's thoughts [16]. Therefore, in this study on truffles, it is believed that there is a relationship between subjective norms and consumption and/or purchase intention at home and away from home. The following hypotheses were therefore proposed:

H.6. *Subjective norms have a positive and significant impact on perceived behavioral control.*

H.7. *Subjective norms have a positive and significant impact on consumption intention.*

In hypothesis H6, it is believed that consumers' attention, on the one hand regarding possible scams and on the other regarding the information present in product labels, can positively influence greater caution towards perceived behavioral control, in particular with reference to food safety. In hypothesis H7, the aspects related to the importance of information positively influence the intention to consume truffles and truffle-based products.

3. Materials and Methods

3.1. Data Collection

The questionnaire was filled out by 145 users residing in Italy and approached in northern regions (the provinces of Lombardia and Piedmont) and in the south-center (the provinces of Lazio, Calabria, Sicily and Campania). Interviews were carried out face to face in the second half of 2022. Respondents were intercepted in particularly crowded places, such as various tourist locations, including some restaurants, hotels and meeting points. Some interviews were conducted during cultural events.

The overall complexity of the structural model has little influence on the sample size requirements for PLS-SEM. Two initial studies [60,61] systematically evaluated the performance of PLS-SEM with small sample sizes, confirming that PLS-SEM performs well.

More recently, a simulation study carried out by Reinartz et al. 2009 [62] indicated PLS Sem as a good choice when the sample size is small.

Researchers can also rely on the rules of thumb provided by Cohen 1992 [63]: regarding statistical power, he analyzed multiple regression models, confirming that the measurement models had acceptable quality in terms of external saturations, i.e., the saturations should be above the known threshold of 0.70.

The sample size needed for PLS-SEM must be "at least ten times the largest number of structural pathways to a particular latent construct in the model" [45]. As is shown in Figure 1, here we reported seven paths, indicating that the sample size must be greater than 70. Consequently, the sample of 145 valid responses in our survey meets the PLS-SEM minimum size criterion.

The questionnaire required the informed consent of the survey participants, whose anonymity was ensured. Consumers were informed that, according to the Italian pri-

vacy law n. 675/96, data collected were processed in an aggregate manner for research purposes only.

Our study used convenience and snowball sampling methods. It used a qualitative research sampling strategy that involves selecting participants based on their accessibility and availability to the researcher.

The choice of this type of sampling is justified by reasons related to the duration and cost of the investigation; moreover, it aimed to limit the risk of obtaining excessive refusals or missed contacts. Before proceeding with data collection, the questionnaire was pre-tested to assess whether some statements were too difficult to understand due to the language, or for lack of clarity in the wording of the questions. These checks allowed us to improve and establish the construct validity of the questionnaire [64,65].

The survey tool is divided into a grid of choice questions: socio-demographic, occupational and family income characteristics; knowledge, habits, places of consumption (restaurant, home, friends' houses), frequency and prices; any reasons for not purchasing (do not like it, high prices, poor availability, etc.); reasons for consuming truffles (aroma, taste, trust and recommendations of the seller); attention to food safety; curiosity and attitudes; and opinions on truffle groves and sustainability in the territories.

The questions were organized to collect both binary (yes/no) and multiple choice answers (3–4 types of choices), while others were based on a five-point Likert scale (from 1 = strongly disagree to 5 = strongly agree).

The current tendency to study increasingly complex relationships makes the application of multivariate analysis methods a useful techniques. Therefore, on the basis of the responses collected, databases were created with the support of the IBM SPSS Statistic v.20 and SmartPLS 4 v. 4.1.0.3 software aimed at detecting the behavior of the consumers [66]. In total, 26 variables were coded, following the order of the questions asked in the questionnaire. The data were processed, analyzed, summarized and interpreted to describe the characteristics of the sample, with the final aim of identifying the main explanatory variables, to highlight the distinctive attributes that most influence consumers' decision-making processes [67].

3.2. Research Model's Step

In the analytical procedure, several steps were performed; firstly, an Exploratory Factor Analysis (EFA), based on principal component analysis (PCA), was applied to identify the latent factors, but also for a preliminary interpretation of the solution obtained. The principal components were extracted with the aim of maximizing the proportion of the variance explained. The reliability of the model was assessed using the Kaiser–Meyer–Olkin (KMO) test and the Bartlett's spherical test (see Supplementary Files) [68,69].

PLS-SEM is a non-parametric statistical method. However, it is recommended to check that the data are not too far from normal to avoid risking standard errors during the bootstrapping procedure. The dataset had no missing values and, considering the principles of the descriptive statistics, the model presents valid absolute values of skewness and kurtosis, as well as with regard to the "Cramer-van Mises p -value" equal to 0.000 for all 15 variables considered in the analysis. In particular, the control of the chosen variables allows absolute values of skewness and kurtosis that have to be identified in advance, in order to remove any anomaly values before carrying out the procedure provided by the software. In particular, for skewness and kurtosis, the values must not be greater than +1 or less than -1 . In fact, for asymmetry this would mean that the data distribution is unbalanced, while for kurtosis, with a value greater than +1, the distribution is too sharp; if it is less than -1 it is too flattened.

The application of the PLS-SEM procedure allowed us to build the structural model, to examine the final results and the quality criteria of the model [46]. The most important metrics of the model evaluated the reliability, but also the convergent validity and the discriminant validity. The bootstrap procedure was used to estimate the significance of the path parameters and allowed the confidence interval to be reported.

Analysis with the PLS-SEM method is strictly defined and consists of two parts, as described by Hair 2019 [45]. The first step consists of evaluating an external model (reflective and formative measurement models) in which the reliability and validity must be satisfactory. The second step consists of evaluating the internal model to generate loadings and relationships between the structural model (with reference to the latent constructs) and the observed variables [70]. Finally, bootstrapping was carried out to evaluate the statistical significance of the relationships hypothesized in the model. Model estimation provides empirical measures of the relationships between the indicators and the constructs (in the measurement models) and between the constructs themselves (in the structural model). These measures allow us to verify and evaluate the results of the PLS-Sem. In detail:

The most important metrics of the reflective measurement model are

- (1) internal consistency (Cronbach's alpha and CR composite reliability); (2) convergent validity (reliability of indicators and average variance extracted AVE); and (3) discriminant validity (HTMT Heterotrait–Monotrait ratio and Fornell–Larcker criterion);
- With regard to the formative measurement model, the indicators to be verified are the following: (1) convergent validity (reliability and validity of the construct); (2) the collinearity between indicators (VIF); and (3) the significance and relevance of external weights;
- The most important evaluation metrics are the coefficient of determination R2 (explained variance), f2 (effect size), Q2 (predictive relevance) and the size and statistical significance of the model path coefficients (obtained through the procedure PLS predict/CUPAT).

4. Results

4.1. Socio-Demographic Characteristics

Table 1 details the socio-demographic information. All interviewees were aged between 20 and 74, with an average age of 42.1 years. Males represented 46.2% of interviewees and females 53.8%. Overall, 34.5% of those interviewed belonged to the millennial generation (respondents were between 26 and 35 years old); the majority of those interviewed had a degree (46.9%) or a post-graduate degree (20.7%), were employed (38.6%) and had a medium–high average annual income (48.3%). They resided in the south–center (74.5%) and north (25.5%) of Italy.

Table 1. Socio-demographic characteristics of the sample.

		%			%
Gender	Male	46.2	Food purchasing responsibility	Interviewed	69.6
	Female	53.8		Other	30.4
Age generations	Generation Z	20.0	Education level	Middle school	8.3
	Millennials	34.5		High school	24.1
	X Generation	30.3		Degree	46.9
	Baby boomers	15.2		Post-grad degree	20.7
Annual income	Not answer	4.1	Occupation	Employed	38.6
	≤15,000	5.5		Self-employed	22.8
	15,001–30,000	40.0		Retired	4.8
	30,001–48,000	48.3		Student	20.7
	≥48,001	2.1		Other	13.1

The majority of those interviewed declared that they appreciate truffles (72%); 11% had never tasted them but were curious and interested in consuming them, while 17% of those interviewed declared that they do not like truffles and do not consume them (Table 2).

Table 2. Consumption, frequency and purchase prices declared by the consumers interviewed.

Consumption of truffles and truffle-based products	Appreciate them	65.5%
	Do not like	15.2%
	He/she has never tasted them, but is curious/interested	19.3%
Consumption frequencies	Regularly, at home or in a restaurant	15.0%
	Occasionally, at home or at a restaurant	57.0%
	He/she does not consume them because they do not like them	17.0%
	He/she has never tasted them	11.0%
Purchase prices	<EUR 50.0/100 g	5.0%
	EUR 50.0 and EUR 100.0/100 g	9.0%
	Greater than EUR 100.0/100 g	1.0%
	He/she does not know, does not remember or did not answer	85.0%
Truffles' green role: spontaneous truffles are a resource for protecting forests	Yes, it is true	68.6%
	No, it is not true	2.6%
	I do not know	28.8%

As for frequency, only 15% consume them more or less regularly, both at home and in restaurants; 57% consume them occasionally, and finally the remaining 27% do not consume them because they do not like the product (17%) or because they have never tasted it (11%). For purchase prices, the majority (85%) did not respond, did not remember or said they do not purchase. In addition, 9% of those interviewed purchased at a price between 50 EUR and 100 EUR/hectogram; only the 5% of respondents declared having paid a price lower than 50 EUR/hectogram; and finally, the remaining 1% declared having paid a price greater than 100 EUR/hectogram.

Overall, 68.6% of consumers interviewed stated that spontaneous truffles are a resource for protecting forests. Only 2.6% did not agree and 28.8% of consumers did not know or did not answer for this aspect.

4.2. Evaluation of PLS-SEM Results of the Structural Model

From a methodological point of view, the development of the EFA made it possible to reduce the complexity of our database into a smaller number of variables. The analysis, performed on fifteen variables, identified five "latent factors" that explained 74.31% of the total variance. An orthogonal rotation was applied with the Varimax method, allowing a simpler reading of the matrix of the extracted components. The adequacy of the sample was verified with the KMO test (the value obtained, equal to 0.824, was considered adequate) and Bartlett's test of 0.00 (see Supplementary Files). The five components extracted were (1 ATT) "Attitude, preferences and personal experience"; (2 INT) "consumption intentions and motivations"; (3 PBC) "perceived behavioral control"; (4 SGAC) "specific gastronomic curiosity and attitude in the approach to truffle consumption"; and (5 SN) "importance of information on fresh and processed truffles purchased and/or consumed".

The convergent validity was assessed by the factor loadings of the items and the Average Variance Extracted (AVE). The "Standardized factor loadings" of the 15 items considered should be kept in the measurement model only if their standardized loadings

are equal to or greater than 0.6 [71,72]. In fact, as highlighted in Figure 2 and in Table 3, the saturations of the items that make up the measurement model are all valid and between 0.775 and 0.907. The commonly used measure to establish convergent validity is the AVE. It is considered acceptable with values that exceed 0.50, indicating that the variance shared between a construct and its elements exceeds the variance of the measurement error [45]. The results revealed that, for all the constructs, the values of AVE were greater than 0.6 and were between 0.656 and 0.794.

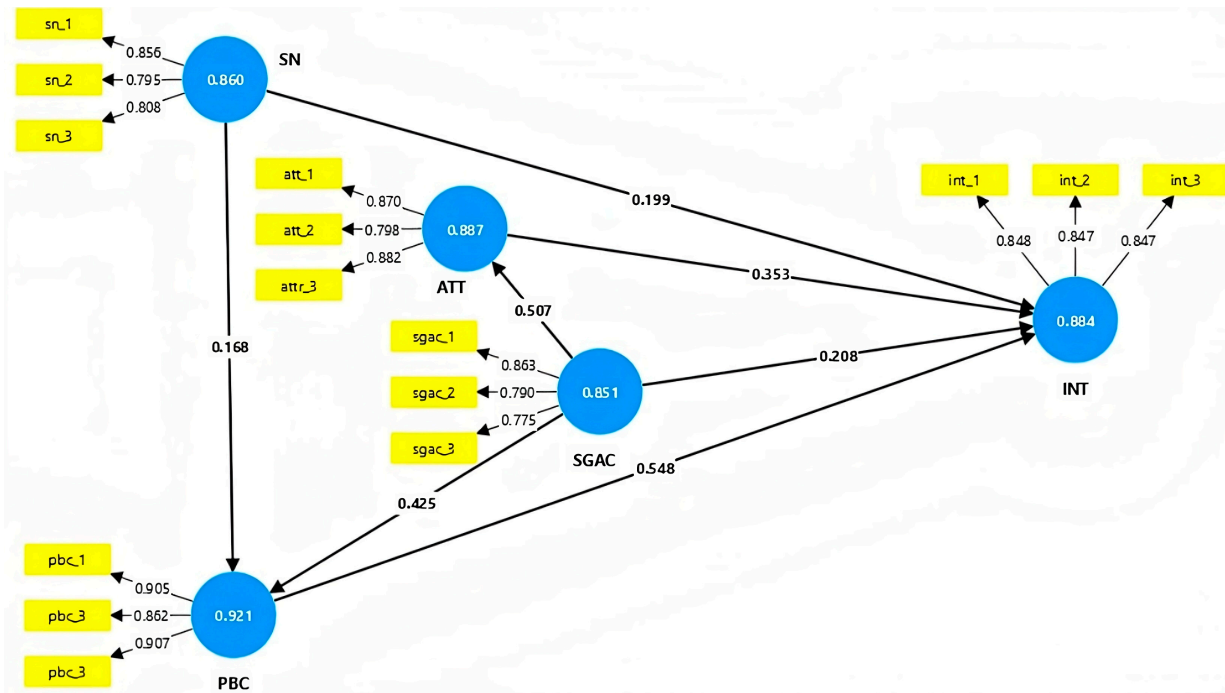


Figure 2. Results of PLS-SEM. Own development and adaptation. External model: external saturations; internal model: total effects; constructs: CR composite reliability. ATT = Attitude; INT = Intention for truffle consumption; PBC = Perceived Behavioral control; SGAC = Specific Gastronomic Curiosity; SN = Subjective.

The internal consistency reliability of the model is represented by the Composite Reliability (CR); it varies from 0 to 1, with higher values indicating higher levels of reliability. This composite reliability in the five latent factors exceeds the recommended value of 0.7 (ATT = 0.887; INT = 0.884; PBC = 0.921; SGAC = 0.851; SN = 0.860).

As for Cronbach's Alpha, it is a conservative measure of reliability, returning relatively lower values than the CR and representing its lower limit. Therefore, it seems appropriate to report on and compare both the parameters. The Cronbach's Alpha values are valid within the range 0.6 to 0.9. Our values are between 0.738 and 0.871, as can be seen from Table 3.

As regards to the discriminant validity, the Heterotrait–Monotrait (HTMT) criterion and Fornell–Larcker criterion were used [45,73].

In order to confirm the validity of the model, as highlighted by Benitez [74], the HTMT can be evaluated in two ways: (1) by comparing it with a threshold value and (2) by building a confidence interval to examine whether the HTMT is significantly lower than a certain threshold value. For the first approach, simulation studies [75,76] suggest a threshold value of 0.90 if the constructs are conceptually very similar or 0.85 if the constructs are conceptually more distinct. For the second approach, previous methodological research has suggested examining whether HTMT is significantly less than 1 or less than other, smaller values, for example 0.85 or 0.90. The HTMT is a reliable tool for assessing discriminant validity [46,77]. As shown in Table 4, following the second approach, the matrix shows that all the HTMT values are lower than 0.85, thus indicating a good discriminating validity.

Table 3. Standardized loading of individual items, CR, AVE and Cronbach’s Alpha.

	Factors and Items	Standardization of Individual Items	Cronbach’s Alpha	Composite Reliability (rho_a)	Composite Reliability (CR)	Average Variance Extracted (AVE)
	ATT		0.809	0.814	0.887	0.724
att_1	For me and my family it is pleasant to consume truffles and truffle-based products	0.798				
att_2	If I want to I can consume truffles and truffle-based products	0.870				
att_3	Truffle aroma makes me very keen to consume them	0.882				
	INT		0.805	0.814	0.884	0.718
int_1	I intend to consume truffles and truffle-based product thanks to the advice of a seller	0.848				
int_2	I intend to consume truffles because I consider them a sustainable product	0.847				
int_3	I prefer to consume truffles from my area	0.847				
	PBC		0.871	0.901	0.920	0.794
pb_1	I consider myself attentive to the quality of the truffles I consume	0.905				
pb_2	I believe I can recognize truffles and truffle products as a healthy and safe food.	0.862				
pb_3	For me, consuming healthy, low-calorie foods like truffles is a good habit	0.907				
	SGAC		0.738	0.747	0.851	0.656
sgac_1	I am curious about the gastronomic culture that revolves around truffles	0.863				
sgac_2	I like trying new foods and new gastronomic experiences	0.790				
sgac_3	For me, consuming truffles is important to escape from a routine	0.775				
	SN		0.756	0.756	0.860	0.673
sn_1	Paying attention to the information on the label when purchasing truffles is a habit acquired in the family	0.856				
sn_2	Reading the expiry date is a habit for me	0.795				
sn_3	When I buy truffles or truffle-based products I pay attention to possible “scams”	0.808				

Note: ATT = Attitude; INT = Intention for truffle consumption; PBC = Perceived Behavioral control; SGAC = Specific Gastronomic Curiosity; SN = Subjective norms. Source: own elaboration from the analysis of data from Smart PLS4.

The Fornell–Larcker criterion is valid when the square root of the AVE of each construct is greater than its maximum correlation with any other construct in the model. As shown in the results reported in Table 4, the matrix indicates that each construct shares more variance with the items assigned to it (bold values on the diagonal of the table) than with the remaining constructs in the model, thus confirming that the requirements of the Fornell-Larcker criterion are satisfied.

Table 4. HTMT and Fornell–Larcker criterion (discriminating validity).

HTMT					
	ATT	INT	PBC	SGAC	SN
ATT					
INT	0.597				
PBC	0.510	0.738			
SGAC	0.652	0.289	0.548		
SN	0.077	0.266	0.245	0.153	
Fornell–Larcker Criterion					
	ATT	INT	PBC	SGAC	SN
ATT	0.851				
INT	0.493	0.847			
PBC	0.439	0.635	0.892		
SGAC	0.507	0.224	0.439	0.810	
SN	0.031	0.212	0.203	0.082	0.820

Note: ATT = Attitude; INT = Intention for truffle consumption; PBC = Perceived Behavioral control; SGAC = Specific Gastronomic Curiosity; SN = Subjective norms.

The fit of the model is also ascertained by the Standardized Root Mean Square Residual (SRMR) index, which is defined as the difference between the observed correlation and the model-implied correlation matrix. Thus, it can assess the average magnitude of the discrepancies between observed and expected correlations as an absolute measure of model fit criterion.

According to the literature [74,78], a value lower than 0.10 or equal to 0.08 is considered a good fit. Henseler et al. (2015) [77] introduced the SRMR as a goodness of fit measure for PLS-SEM that can be used to avoid model misspecification. In the present study, SRMR has a value of 0.08 and is therefore considered acceptable. The fit is relatively good between the hypothesized model and the observed data.

Figure 2 shows the Composite Reliability (CR) of the constructs, the saturations of the external model and the total effects of the internal model.

The quality criteria R², f² and the collinearity statistics were valid (Tables 5 and 6). The first R² concerns the so-called “coefficient of determination”, which is a measure of the share of variance of an endogenous construct that is explained by its predictor constructs (all the constructs connected to it). Furthermore, the coefficient of determination (R²) indicates the degree of explained variance, which is the proportion of the variation in the dependent variable explained by a linear model. Significant, moderate or weak endogenous latent variables have R² values of 0.75, 0.50 or 0.25, respectively. Based on the R² value reported in Table 5, in this study, some predictors had weak (ATT = 0.257 and PBC = 0.221) and moderate (INT = 0.498) explanatory power.

Table 5. R² and Q².

	R ²	Q ² Predict *
ATT	0.257	0.239
INT	0.498	0.037
PBC	0.221	0.139

* Q² result of the PLS predicting CVPAT procedure (PLS_SEM ver. 4.1). ATT = Attitude; INT = Intention for truffle consumption; PBC = Perceived Behavioral control.

Table 6. f2 and VIF collinearity statistics.

	f ²	VIF
ATT → INT	0.169	1.466
PBC → INT	0.428	1.399
SGAC → ATT	0.346	1.000
SGAC → INT	0.057	1.461
SGAC → PBC	0.231	1.007
SN → INT	0.022	1.048
SN → PBC	0.036	1.007

Note: ATT = Attitude; INT = Intention for truffle consumption; PBC = Perceived Behavioral control; SGAC = Specific Gastronomic Curiosity; SN = Subjective norms.

The Q2 test is used for a more in-depth investigation of the predictive relevance of the endogenous components [11,45,74]. Q2 greater than zero indicates significant predictive relevance. In the present study, Q2 ATT values = 0.239, INT = 0.037 and PBC = 0.139 were above the threshold value.

Quality criterion f2 is referred to as the “effect size”. The guidelines for evaluating f2 are as follows: values of 0.02 represent weak effects, values of 0.15 represent medium effects and values of 0.35 represent substantial effects [79]. As can be observed in Table 6, f2 is also valid, although it varies between the three types, from weak values (SN → INT = 0.022; SN → PBC = 0.036 and SGAC → INT = 0.057) and average values (ATT → INT = 0.169 and SGAC → PBC = 0.231) up to substantial values for PBC → INT = 0.428 and SGAC → ATT = 0.346.

Furthermore, with reference to the collinearity, all the hypothesized paths are valid since the “VIF threshold values” (Variance Inflation Factor) fall within the limits of the range 0.20–5.0, recording values between 1.0 and 1.466 (Table 6).

Table 7 reports the results of the SEM path. The t-values of the seven paths are all supported by the analysis; the hypothesis H2 (PBC → INT) has the highest t-value (8.383), confirming the importance attributed by consumers to food safety, followed by hypothesis H5 SGAC → ATT (7.531), which confirms how the curiosity for a valuable product greatly attracts consumers, even if it is considered a luxury, whether fresh naturally or proposed as a gourmet product.

Table 7. Bootstrap procedure—total effects.

Path Coefficients	Hypothesis	Original Sample (O)	Confidence Interval Bootstrap 97.5%		t-Values	p-Values	Results
			Lower	Higher			
ATT → INT	H1	0.353	0.205	0.500	4.608	0.000 ***	Supported
PBC → INT	H2	0.548	0.414	0.672	8.383	0.000 ***	Supported
SGAC → ATT	H5	0.507	0.365	0.633	7.531	0.000 ***	Supported
SGAC → INT	H3	0.208	0.071	0.352	2.859	0.004 ***	Supported
SGAC → PBC	H4	0.425	0.293	0.557	6.326	0.000 ***	Supported
SN → INT	H7	0.199	0.056	0.339	2.753	0.006 **	Supported
SN → SAF	H6	0.168	0.020	0.325	2.147	0.032 *	Supported

* p-Value < 0.05; ** p-Value < 0.01; *** p-Value < 0.001 Source: Authors elaboration from data analysis in Smart-PLS4. Note: ATT = Attitude; INT = Intention for truffle consumption; PBC = Perceived Behavioral control; SGAC = Specific Gastronomic Curiosity; SN = Subjective norms.

In hypothesis H4, SGAC → PBC (6.326) confirms consumers’ interest in food and truffle quality and safety, with additional reference to the curiosity stimulated by new gastronomic experiences.

In hypothesis H1, $ATT \rightarrow INT$ (4.608) highlights the attitude of the product for its aroma, for the pleasure of tasting it and for sharing it with others (family and/or friends), pushing towards the consumption of fresh and processed truffles.

In hypothesis H3, $SGAC \rightarrow INT$ (2.859) also confirms how curiosity and gastronomic culture lead to the intention to consume truffles.

Finally, the lowest values of the t-value were recorded for hypotheses H7 and H6, respectively, $SN \rightarrow INT$ (2.753) and $SN \rightarrow PBC$ (2.147). This shows that it is necessary to give greater attention to the acquisition of information.

As can be observed in Table 8, the indirect effects represent the mediation effects [80], improving the t-value compared to the direct path (Table 7) only in the following two paths:

- In the first $SGAC \rightarrow PBC \rightarrow INT$ mediation path (i.e., from curiosity to consumption intention, mediated by specific attention to subjective norms), the t-value is improved, being equal to 4.920;
- In the second mediation path that we verified, $SGAC \rightarrow ATT \rightarrow INT$ (i.e., curiosity towards consumption intention mediated by attitude) improved the t-value to equal to 3.606.

Table 8. Specific indirect effects and mediation process.

	Original Sample (O)	Confidence Interval Bootstrap 97.5%		t-Values	p-Values	Path Hypothesis	Results
		Lower	Higher				
$SGAC \rightarrow PBC \rightarrow INT$	0.233	0.151	0.336	4.920	0.000 ***	H4 \rightarrow H2	Supported
$SGAC \rightarrow ATT \rightarrow INT$	0.179	0.096	0.283	3.747	0.000 ***	H5 \rightarrow H1	Supported
$SN \rightarrow PBC \rightarrow INT$	0.092	0.010	0.189	2.005	0.045 *	H6 \rightarrow H2	Supported

* p -Value < 0.05; *** p -Value < 0.001 Source: authors' elaboration. Note: ATT = Attitude; INT = Intention for truffle consumption; PBC = Perceived Behavioral control; SGAC = Specific Gastronomic Curiosity; SN = Subjective norms.

Even in these two cases, the importance attributed to "Perceived behavioral control" and to "Attitude" was underlined; these have the effect of mediating and improving the relationship observed between the two latent variables "Specific gastronomic curiosity" and "Consumption intention", aspects that improve the potential for truffle consumption.

5. Discussion

This study used partial least squares structural equation modeling (PLS-SEM) to investigate the factors that determine the desire to consume fresh truffles and truffle products. The work provides information on the demand side of products considered sustainable, contributing to the academic and political debates on green and sustainable production. The results obtained suggested that consumers' intentions to use fresh and processed truffles derive from a complex decision-making process involving several factors, such as consumers' personal experiences, marketing communication, food safety, organoleptic aspects, green appearance products and, more generally, environmental protection. This study represents, as far as we know, the first empirical exploration of Italian consumers' preferences on truffles and truffle products. The findings will improve our understanding of consumer preferences for these valuable niche products. Our results could also offer valuable information to the supply chain operators, in order to develop tailor-made strategies to effectively meet consumer expectations. We can here underline that consumers' intentions to use fresh and processed truffles derive from a complex decision-making process involving several factors, such as consumers' personal experiences, marketing communications, food safety, organoleptic aspects, the green reputation of products and, more generally, environmental protection.

The study examined the relationships and effects of ATT, PBC, SGAC and SN on intentions to consume truffles and foods with truffles. All the relationships were identified

as positive and significant, and all the mediators were reported to have effective mediating impacts on the pathways of the proposed model.

The results were then discussed considering the existing literature, although the works are not very numerous. Firstly, PBC mainly influenced the consumption intentions: hypothesis H2 (PBC \rightarrow INT) had, in fact, the highest t-value (8.383). This result is consistent with the studies of Qing et al. (2023) [11], Ellinda Patra et al. (2020) [81], Petrescu et al. (2017) [82] and Azlie et al. (2023) [83], who demonstrated that attention to health plays an important role in the decision-making processes. It indicates that people currently give priority to a healthy lifestyle, with increasing attention paid to health and nutrition.

Furthermore, safety focus positively associated with INT is in line with natural resource studies conducted by Qi and Ploeger (2021) [2], van Ripper and Kyle (2014; 2020) [84,85] and Goodson et al., 2024 [86]. In fact, INT highlights people's consideration towards the consumption of green products supplied by trusted sellers and deriving from their own territory. Particularly, Büntgen et al. (2017) [8] pointed to the use of qualified micotourism guides: the importance of promoting restaurants serving mushrooms, truffles and local products derived from the sustainable management of forest areas, aiming to support the production of non woody products with particular care on the support of other forest ecosystem services, such as the mitigation of climate change effects and the conservation of the biological diversity, has already emerged.

Research hypothesis H5 highlights the second most significant path (SGAC \rightarrow ATT with a t-value equal to 7.531). The attractiveness of truffles and truffle-based products is in line with the study by Chen and Wei 2017 [25], which underlines how consumers often try new foods out of curiosity and interest or to remove ambiguity [87]. As Woo Bin Kim and Ho Jung Choo (2023) [88] already indicated, the curiosity refers to behaviors that explore new stimuli which then translate into greater consumer creativity driven by the desire to acquire new knowledge and new information. Curiosity represents a unique combination of aroma, taste, shape and nutrition. The expansion of a new sensorial experience and the nutritional value of truffles and truffle-based products represents an important reason for their consumption.

Furthermore, other studies in the retail field also treat consumer curiosity as a temporary motivational state or desire evoked by novel or inconsistent stimuli [11,89,90].

Hypothesis H4, (SGAC \rightarrow PBC, t-value equal to 6.326) also confirms that consumers' interest in food safety, in particular with reference to curiosity, is stimulated by new gastronomic experiences. This means that healthy foods are preferable to less safe foods. Chen and Hua Tsai (2023) [91] used structural equation modeling to explore the behaviors that influence intentions to purchase plant-based meat. In their work, it clearly emerges that exploratory behaviors include risk-taking, a variety of seeking and curiosity, while regulatory-focused values include values focused on promotion and prevention.

Another key result of our work is that hypothesis H1 (ATT \rightarrow INT, t-value 4.608) had a positive and significant impact on the intention to consume truffles and truffle-based products, thanks to the positive attitude of the whole family and the attractiveness of the truffle aroma, which makes them appetizing. In their article, Chen and Wei 2017 [25] underline the importance of olfactory stimuli capable of activating human cognitive states that can influence individuals' behaviors and moods [92] for attractiveness or, on the contrary, disgust [93]. The aroma of truffles can represent a powerful incentive in purchasing decisions. Smell differs from other senses, triggering emotions and memories [94] that influence individuals' moods.

Finally, according to the research model, all the mediation pathways (i.e., curiosity, healthy eating beliefs, attitudes, intention to consume truffles and truffle products) have indirect and specific mediation effects that are both positive and significant with consumption intentions. In addition, through SGAC, PBC, ATT and SN One interpretations of these results it can be seen that consumers demonstrate an intention to consume truffles and truffle-based products in relation to their sustainability values, product attractiveness and status as a valuable niche product, beliefs and pro-environmental standards and linked to

the product's reputation as being rich in nutritional properties and green. All these aspects play an influential role in consumers' consumption intentions and decisions.

6. Implications

6.1. Theoretical Implications

This study provides an overview of the decision-making process of consumers of truffles and truffle-based products, presenting a theoretical framework that contributes to enriching the current literature on consumption behavior regarding truffles and truffle-based products, which has not been explored in depth so far. In fact, to the best of our knowledge, here we present the first study on the constructs that can help in the prediction of the "consumption intention" of truffles and truffle products.

Our study extended the TPB framework by adding the construct of food-specific gastronomic curiosity (SGAC), linking perceived behavioral control (PBC) to the importance attributed to health and food safety. The factors that influence the propensity to consume fresh and processed truffles were empirically examined by evaluating the PLS-SEM model in the context of the consumption of these products in Italy, one of the main European truffle-producing countries.

We can then assert that this is the first empirical exploration of Italian consumers' preferences on truffles and truffle products. The proposed approach facilitated our exploration on the factors influencing the consumption of fresh and processed truffles, also providing information on the extent to which attitudes, the recognition of the green and sustainable role of truffles, subjective and objective knowledge and lifestyles influence consumption.

The empirical investigation demonstrated that all components of the applied model had a strong effect on consumers' consumption of fresh and processed truffles.

This research brings valuable insights into both theoretical and marketing fields. From a theoretical perspective, the study improves the understanding of consumer preferences for these valuable niche products, paving the way for an exploration of the impact of the need for food safety, the emphasis on actual consumption intentions and motivations or potential, the push exerted by curiosity and the highlighting of changes in dietary patterns and the importance that consumers attribute to the sustainability of production systems and the importance of a valuable niche product in purchasing behavior.

6.2. Practical and Managerial Implications

The role that the truffles can have in the correct and sustainable management of forests and mountain ecosystems in the inner areas, in the production of food, in people's control of the territory, in the recovery of wooded areas and in their economic support has been confirmed [95]. Truffle-related activities represent a promising and continuously growing commercial driver. This is a niche segment in a market increasingly oriented towards expanding the consumption base, which is also thanks to countless truffle-based products, which make their purchase more attractive and accessible. The presence of truffles allows and strengthens the socio-economic development possibilities of the territories involved and slows down the processes of depopulation, which is widespread in mountainous and inner areas. Furthermore, the cultivated truffle represents an opportunity to move towards innovative and specialized agriculture which has been experimented on for decades in Italy and in various European countries. In recent decades, the European market has undergone changes due to the cultivation of truffles, and the appearance of new companies and new operators in a traditional sector linked to natural production and new marketing opportunities have emerged, with an expansion of the range of processed products. Furthermore, promotion and online sales have given greater visibility to the truffle.

This research contributes valuable marketing insights with actionable implications for marketing strategies. For example, the study suggests that both subjective and objective knowledge can be effectively improved through well-designed information campaigns that detail truffle characteristics.

The findings could offer valuable information to supply chain operators to develop tailor-made strategies to effectively meet consumer expectations.

Furthermore, it is becoming evident that since consumers are increasingly interested in the naturalness, nutritional aspects and origin of the product, product labels should incorporate such information to stimulate the consumption of truffles and truffle-based products with particular attention. It is important to indicate on labels the presence of the natural aroma of truffles in products that contain it rather than artificial aromas, which are dangerous and banned by the EU.

This work also has implications for policymakers. The European Commission (EC), with its new policies (EU Green Deal with F2F and biodiversity strategies, Horizon Europe, Next Generation EU), is committed to making European food the global standard of sustainability. The only way to make this product attractive is to raise consumer awareness, highlighting the sustainability attributes and dietary recommendations that they appreciate and that lead to the acceptance of greater spending.

7. Limitations and Directions for Future Research

The present study investigates consumer preferences for truffles and truffle-based products. The study is certainly not without limitations. The first limitation concerns the very nature of the complexity of consumption choices, conditioned by a variety of factors, including the economic, social and cultural conditions of consumers. This is because the consumption of these products is strongly linked to the economic availability of consumers and also to their education, knowledge of the product and the importance they attribute to truffles and truffle-based products and the ability to appreciate them, aspects linked, therefore, to their socio-cultural sphere. Also, these aspects of the socio-cultural sphere could be the object of future insights. Another limitation concerns the fact that the survey deals with a case study of Italian consumers and the results, therefore, pertain to this investigated universe. To make generalizations it is necessary to further extend the studies to other countries and other populations. Furthermore, the demographic and cultural aspects of consumers could also have a different impact on their consumption choices, with obvious repercussions on the results of the study. Future studies should therefore include the effects of additional consumption factors and their consequences. The survey is therefore a first approach aimed at understanding and investigating the consumption of truffles and truffle-based products in Italy. The study, in our opinion, fills a gap and lays the foundation for future research. As far as possible, this implies the need to consider additional geographical realities, given that the survey carried out only considers the Italian territory. In addition to this, future studies would allow further testing of the methodology developed in the study, in light of greater levels of complexity linked to what has been said.

8. Conclusions

This study aims to advance the understanding of attitudes towards the consumption of truffles and truffle products and the underlying mechanisms that influence this propensity. We want to shed light on the decision-making process through which consumers organize and formulate their consumption choices for fresh and processed truffles. The results of this study suggest that intentions to consume fresh and processed truffles derive from a complex decision-making process involving several factors, such as consumers' personal experiences, marketing communication, food safety, organoleptic aspects, products with a green reputation and, more generally, environmental protection. Trying to clarify how these aspects can influence consumption choices is also of great importance for the choices that must be made by stakeholders. The latter in fact require useful and reliable information for the purposes of formulating suitable product promotion and market development strategies. Furthermore, as emerges from the results obtained, it is a market that still has ample opportunity for expansion both in terms of the quantity of truffles marketed and the range of processed products made. This requires the study, coordination and implementation of strategies, with evident positive effects that do not exclusively concern

the food sphere. We are referring to the large scale of the nursery sector, to the marketing of products, to micotourism, to the world of research and dissemination services to producers and also to the selection and training of truffle dogs. It is necessary to improve the labeling of truffle-based products to provide a description of the nutritional content and focus on the natural origin of the aroma attested by reliable certifications to gain consumer trust. The results of this study will be useful to stakeholders to better understand the impact of our insights on consumer purchasing intentions and habits.

Some limitations of the current study point to future research directions. Firstly, the number of interviewees should be increased and the research extended to other Italian or European areas to improve our understanding of the consumption behavior of fresh and processed truffles. Secondly, the study addressed only some factors related to attitudes, behaviors, motivations and subjective norms and may have overlooked further crucial elements (such as the influence of social media, ethical aspects, perception of quality and allowing an enrichment of the results).

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/su16125002/s1>.

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Institutional Review Board Statement: Ethical review and approval were waived for this study due to the nature of this research. All participants were fully informed that anonymity is assured. All the participants agreed to answer the questions, taking into account that the data obtained would be used strictly for statistics.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study. All participants were fully informed of the anonymity of the collected data.

Data Availability Statement: <https://ich.unesco.org/en/RL/truffle-hunting-and-extraction-in-italy-traditional-knowledge-and-practice-01395> (accessed on 15 July 2022) and <https://www.politicheagricole.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/11100> (accessed on 15 July 2022) <https://www.politicheagricole.it> (accessed on 15 July 2022).

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Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. Construct, survey question and reference bibliography.

Construct	Survey Questions	Definition	References
ATT	1. For me and my family it is pleasant to consume truffles and truffle-based products 2. If I want to I can consume truffles 3. Truffle's aroma makes me very keen to consume it	Attitudes are a person's positive or negative opinions. Events and behaviors reflect a series of preferences and generate positive or negative intentions towards purchasing and consuming at home or away from home	[96–99]
INT	1. I intend to consume truffles and truffle-based product thanks to the advice of a seller 2. I have an intention to consume truffles because I consider them a sustainable product 3. I prefer to consume truffles from my area	Purchasing intent allows people to make informed decisions with the aim of consuming/purchasing both immediately and in the near future	[21,23,72,100,101]
PBC	1. I consider myself attentive to the quality of the truffles I consume 2. I believe I can recognize truffles and truffle products as healthy and safe food. 3. For me, consuming healthy, low-calorie foods like truffles is a good habit	Personal beliefs and the importance attributed to safety give rise to consumer behavioral control	[21,81–83,102,103]
SGAC	1. I am curious about the gastronomic culture that revolves around truffles 2. I like trying new foods and new gastronomic experiences 3. For me it is important to escape from routine	Curiosity and gastronomic culture regarding a new food can trigger choice mechanisms that influence the overall eating experience	[103,104]
SN	1. Paying attention to the information on the label when purchasing truffles is a habit acquired in the family 2. Reading the expiry date is a habit for me 3. When I buy truffles or truffle-based products I pay attention to possible "scams"	Subjective norms relate to beliefs about one's own and others' attitudes with respect to the actions that each person carries out	[12,57,66,105]

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