Journal of Ethnic Foods

ORIGINAL ARTICLE

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The traditional Greek cheese Tsalafouti: history, technology, nutrition and gastronomy

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Abstract

Tsalafouti is an "unknown" Greek traditional cheese with great potential for getting Protected Designation of Origin accreditation and leading entrepreneurship in the area of origin. This study aimed to collect and comprehensively analyse valuable data on the history, technology, nutrition and gastronomy of Tsalafouti. A study survey was designed and 8 out of 13 Tsalafouti producers in Greece participated, providing data on Tsalafouti's technology, quality, nutrition and history. It was revealed that there currently are some variations in Tsalafouti's production, while the end product is of special nutritional (low in fat) and gastronomic attributes. In any case, it is apparent that food heritage and specifically dairy products heritage can possibly act as a tool for entrepreneurship, given that the special attributes that Tsalafouti may hold will be highlighted and further evidenced.

Keywords Cheese, Greece, PDO, Tsalafouti, Food heritage

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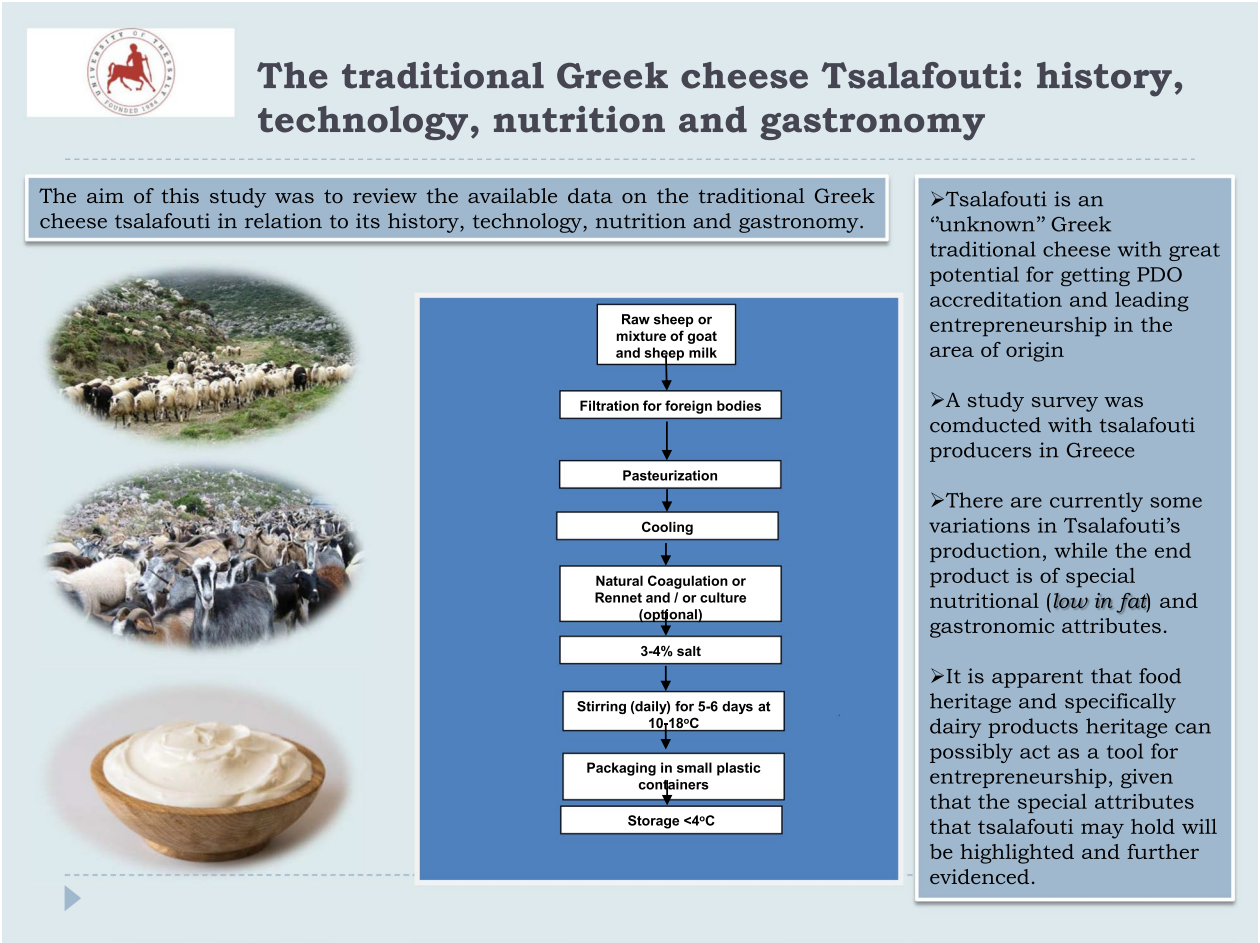
Graphical Abstract



Introduction

Following the European Green Deal for sustainable development of mountainous and marginal areas, the Mediterranean dairy sector holds currently an opportunity in characterising, standardising and certifying the quality attributes of several distinguished products [1]. Cheeses hold a great proportion of the products related to the identity of an area, as they are related to factors such as the geographical origin, but also the social and cultural traditions of specific areas [2, 3]. Greece, as a Mediterranean country, has a lengthy tradition in cheese making, and already produces 23 cheeses certified as protected designation of origin (PDO) and more than 50 other well known traditional cheeses, dated back the Homeric epics [4–6]. Nowadays every region and almost every island has its own distinct cheese-making tradition and produces special, unique, cheeses, mainly produced from sheep and goat milk, either at home based level or in dairy plants. [7, 8]. It is considered though important, to enhance the typicality of all these cheeses, safeguarding biodiversity, culture and economy, as these can act as tools for sustainability and prosperity in these areas, as performed in other countries [9]. One of the ways to achieve the EU's rural development goals is quality agri-food products and in particular geographical indications (GIs). Certified geographical indications in the EU include Protected Designations of Origin (PDO) and Protected Geographical Indications (PGI). These products are characterized by a great symbolic value and in some cases, they can be considered as cultural indicators. They also help to preserve traditional know-how and cultural heritage, but also may have a societal impact [10–12]. Registration of GIs seems to be a continuous process rather than a step and it seems to

require constant management and re-definition of production quality or geographical boundaries to adapt to market, climate or technological changes, as reported globally [13]. Across the world, there is an apparent complexity both ex-ante and ex-post, GI registration processes, that requires to reorganize current members of GI applicants and to fill the gaps and enhance the effects of GI registration at a later stage. In this sense, several GI cases have been reported as a protection tool for local farmers' collective action and old varieties [14, 15].

Several Greek traditional cheeses hold special quality and nutritional attributes, alongside distinguished organoleptic characteristics that may be related to their breed and their geographic origin [16–21], and therefore it is crucial to become both known and protected. Such information is embedded in PDO and PGI products and therefore this should be the target for ''unknown" cheese, in order to possibly receive a higher price in the market [22, 23]. A promising representative of these ''unknown" cheeses in Greece is ''Tsalafouti", that is currently in the process of evaluation for the PDO standards approval [24]. The so far available historical records on Tsalafouti date back to 1930, when the first written record was made, describing the special attributes of the specific cheese while laographic documents exist up to 2000 [24], proving that there is a constant interest on the specific product. Apart from the PDO standards proposed for evaluation, there are only 3 peer reviewed articles dealing with the primary production and the semi-industrial production of Tsalafouti, from Koutsoukis et al. [25] and Pappa et al. [26, 27], respectively. There is no research though so far on the special characteristics that Tsalafouti brings in terms of its possible bio functionality, that is nowadays, in the post COVID pandemic era, a main consumer's concern [28]. The aim of this study was to review the available data on the traditional Greek cheese Tsalafouti in relation to its history, technology, nutrition and gastronomy.

Materials and methods

A quantitative survey was performed based on primary data collected through a standardized questionnaire which was completed on March 2021. The questionnaires were completed by Tsalafouti producers identified, using the personal interview method.

Questionnaire

A standardized questionnaire was developed, including twenty-one (21) questions in total, divided into 4 sections: personal data, technological production, quality, nutrition and safety aspects and distribution/use/history. The questionnaire consisted mainly of open questions and was pilot tested by 4 persons, prior completion, in order to identify any weaknesses and shortcomings, to determine the time needed for completion and also to conclude whether the questions were well-perceived by the respondents. The questions in detail are presented in the Additional file 1 section.

Study sample

Initially, the dairy plants where Tsalafouti is produced were searched through internet. Out of 13 dairy plants that were identified to produce Tsalafouti, 8 participated in this study, which were located in different regions of Greece, namely; in prefectures of Aitoloakarnania (4/8), Evrytania (1/8), Karditsa (1/8), Arta (1/8) and Fthiotida (1/8). As this is not a PDO cheese yet, there is no official record identifying the producers. Apparently, there are more traditional producers of Tsalafouti with farm or home based production, but the focus of this study was to assess the industrialised production of Tsalafouti that could possibly be certified to produce this cheese as PDO in the near future. Tsalafouti producers' participation in this survey was voluntary.

Results and discussion

Based on the interviews conducted and the analysis of the data collected, this study presents valuable information in terms of history, technology, nutrition and gastronomy of the Greek traditional cheese Tsalafouti:

Description

The Greek traditional cheese Tsalafouti is a delicious white spreadable cheese, with a soft-creamy texture. It has a slightly sour taste, as a consequence of its acidic nature, and a pleasant aroma. It is made of sheep milk or a mixture of goat and sheep milk, from livestock reared in the Central-Southern end of the Pindos mountain range.

History

Tsalafouti was a product that contributed to the diet and tradition of the mountainous regions in Central—West Greece for decades, as reported by others [25, 26]. Based on the data collected, it is concluded that traditionally, the product was produced at the end of the dairy season when the animals' milk started to run out, with a special way of cheese making that requires a very short ripening time. Tsalafouti is a fresh Greek spreadable cheese with a soft-creamy texture (Fig. 1), a mild aroma and a slightly acidic and salty taste that is usually produced from sheep's milk, however in some regions goat's milk is also added to the sheep's milk. The breeding of dairy animals is mainly extensive and this gives a special taste and quality to Tsalafouti. It is traditionally produced in the summer, especially from July to August, from fresh sheep's milk that is in the last stage of the milking period

Fig. 1 Tsalafouti (https://vasileioudairy.gr/Tsalafouti-vasileiou, accessed 30/11/2022). Tsalafouti is a white spreadable cheese, with a soft-creamy texture

and where the animals are milked once a day. Towards the end of the lactation period, the milk's fat, protein, solids and mineral contents increase while the lactose content decreases. Additionally, based on the data collected from the cheese makers, its name most likely comes from the process of dipping the bread into the cheese. This cheese is traditionally produced, but with small variations, in the highlands and semi-mountains of Agrafa and Tzoumerka as reported by other [25]. In our study most producers were identified in areas of south Pindos mountain range (Aitoloakarnania, Arta, Evritania) (Fig. 2). Similarly, the proposed areas in the relevant PDO standard that is under evaluation mentions that Tsalafouti may be produced at the mountain masses of Agrafa, Orinos Valtos, Argithea, Aspropotamos and Tzoumerka and the areas adjacent to them. Their common feature is the mountainous relief that corresponds to the Central-Southern end of the Pindos mountain range. With reference to the replies recorded from the questionnaires in relation to the certification of the cheese as a PDO product, most cheese makers believe that it will be difficult to certify it as a PDO, because the production process differs in regions and in dairy plants. It was also stated that the possible certification of the cheese with a Geographical Indication label will increase the recognition of the product and the demand, and consequently its price in the market.

Based on the information collected it is evident that the specific cheese comes under the wide variety of Greek traditional dairy products, some of which are not

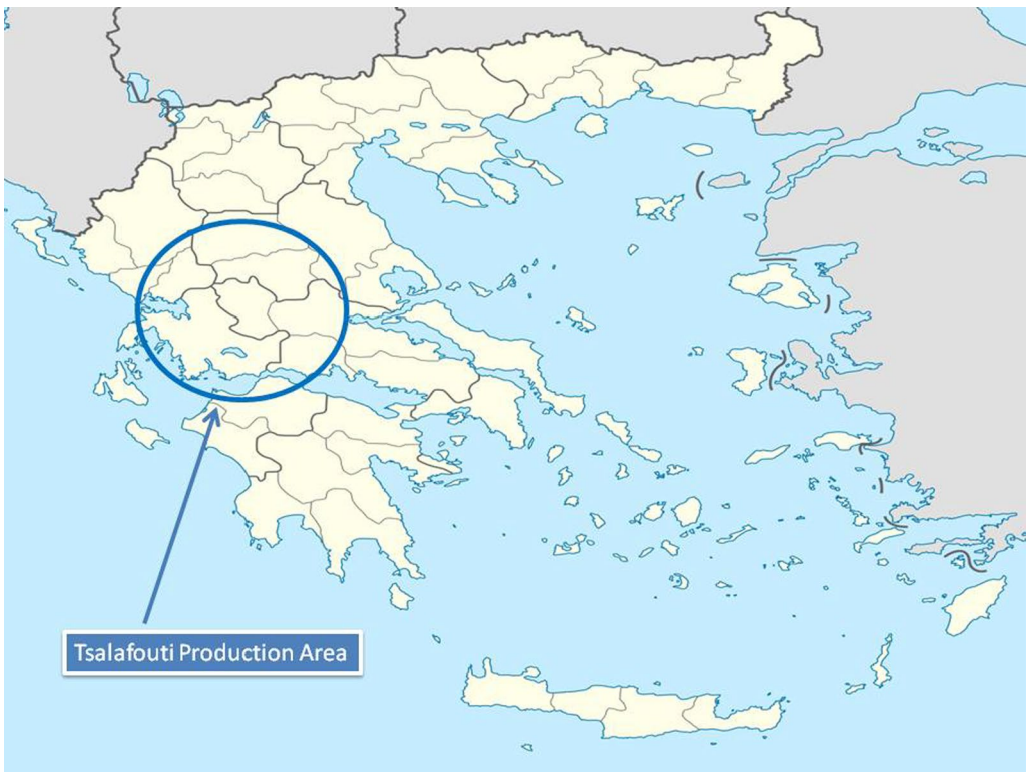


Fig. 2 Geographical area of Tsalafouti's production. Tsalafouti is produced in a specific area of Greece, the south Pindos mountain range, namely in the prefectures of Aitoloakarnania, Arta and Evritania

known to the general public but have a long tradition [4, 5]. Traditional dairy and cheese products are not only an important cultural heritage for the regions where they are produced, but also a driver of economic development [10, 12, 15].

Technology

The cheese makers participated in this study has given valuable data on Tsalafouti's processing technology in an industrial environment. Even though there were some differences noted among them, the following process steps for the industrial production of Tsalafouti are identified: Raw sheep or mixture of goat and sheep milk is received by the dairy industry and its filtration for foreign bodies is following. Milk is then pasteurized and cooled and then a natural coagulation takes place or in some cases rennet and/or culture may be optionally added. At a next stage salt (3–4%) is added and a daily stirring commences, lasting for 5–6 days at 10–18 °C. Following the completion of the stirring stage, packaging in small plastic containers and storage < 4 °C is considered as the end production step (Fig. 3). Based on the proposed PDO specifications that are currently under evaluation, the acceptable processing refers to the following: After the milk is pasteurized, a quantity of rennet is added, which may be industrialized, in powder or liquid form. During the summer months it is possible not to add rennet. In addition, salt (NaCl) is added, while it is also possible to use harmless lactic acid bacteria. This is followed by cooling the milk to 12–18 °C. The mixture is then placed in a sterile container (plastic, wooden, stainless steel or any material suitable for food), sealed airtight and left at a temperature of 12–18 °C, so that natural fermentation by the milk microflora takes place in synergy with the microflora of its environment. The overall process takes a maximum of 12 days and is completed when its pH reaches the desired value. According to the special methods of the cheesemakers of the region, regular stirring of the cheese during its acidification-ripening is important. Finally, it is drained in a cloth so that it is possible to reach the desired moisture of the product (66–73%). After ripening it should be kept at 2–4 °C [24].

Fig. 3 Tsalafouti cheese basic production steps. Following sheep and goat milk reception, milk undergoes pasteurization, coagulation and stirring, before the end product is completed)

Variations though are noted in the technology process proposed as a standard, as reported by our study and also by others [25, 26]. Koutsioukis et al. [25] state that after milking, the milk is strained to retain foreign bodies resulting from the milking process, e.g. stones, animal hair, etc., then is heated on a fire, stirred at the same time and when it starts to foam (about 85–90 °C), it is removed from the fire. Afterwards a small amount of salt is added during or at the end of heating and then milk is cooled, transferred to plastic containers or wooden barrels, which are placed in cool and shady places at a low temperature, such as caves, near streams or running water or even in the ground, in such a way that the rim of container protruding. The product is then stirred daily. The ripening of "Tsalafouti" cheese takes about five to six days. After the production process is completed, the product is placed in smaller containers and is available for consumption.

A similar procedure is described by Pappa et al. [26], with slight modifications: The milk is concentrated by heating to 'boiling' at 90 °C under continuous stirring in order to increase the total solid content, for approximately 40 min. The milk is then cooled at 30 °C, recrystallized coarse-grained salt is added, followed by inoculation with the selected starter culture (FD-DVC MO-10, Hansen) consisting of *Lactococcus lactis* subsp. *lactis* and *Lactococcus lactis* subsp. *cremoris*. The inoculated milk is then poured into sterilized glass containers and incubated for 1 h at 30 °C and then containers are transferred to a ripening room (10 °C) for 30 days and finally places in a cold room (2–4 °C) for storage up to 90 days.

Based on the details in relation to Tsalafouti's cheese production process, it is evident that this cheese comes under the spreadable cheeses technology [5] and resembles other Greek traditional cheeses such as Katiki Domokou kai Galotyri [4, 5, 19] with slight modifications.

Nutrition and gastronomy

Tsalafouti is a soft, creamy cheese and has a short shelf life, approximately 40 days (from 20 to 60 days depending on the producer). The proposed PDO standard mentions 60 days shelf life. Special characteristics of the product are the very short ripening time that does not exceed 12 days, its low acidity (pH less than 4.5) and its significantly reduced fat content (10–17%), based on the proposed PDO standards [24]. According to the information recorded in the questionnaires the average nutritional profile is presented in Table 1.

Additionally, Tsalafouti producers reported that Tsalafouti is eaten either as an appetizer or as a side dish to the main meal, or it is used in various recipes in salads, pies, etc. Traditionally Tsalafouti was made in the summer months by the breeders themselves, but also by the local inhabitants of the mountain villages and settlements and was consumed as an appetizer spread on bread. Tsalafouti is known for its special taste and texture and currently its consumption is limited mainly to some regions of Greece, as stated by others [25]. Even though there is some evidence on the gastronomic aspect of Tsalafouti cheese, as mentioned above, there is lack of awareness among producers but there is also lacking research data on the nutritional traits, with some slight exceptions related to very specific authenticity mainly characteristics [19, 21, 27].

Table 1 Nutritional Value of Tsalafouti cheese per 100 g of product

Energy	203 kcal
Fat	16.3 g
Sugars	6.2 g
Proteins	7.9 g
NaCl	1.9 g

As possible limitation in this study it can be considered that Tsalafouti is produced with slight technological differences per producer, as there is no PDO standard yet. Additionally, as there is no official record for the Tsalafouti producers, there might be a lapse in the actual total number of producers in Greece. Future research should focus in standardising the production of the traditional cheese Tsalafouti, but also investigating its special attributes that may highlight its nutritional value such a functional peptide and the lipid profile.

Overall, Tsalafouti is similar in texture with other spreadable cream Greek PDO cheeses, such as Xigalo Sitias, Pichtogalo of Chania, and Katiki Domokou. Nevertheless, it differs in some points at the processing technique as well as in its physicochemical, microbiological, and sensory characteristics [27, 29, 30]. In that sense, Tsalafouti can be further exploited as a PDO cheese, alongside it can be further investigated in terms of distinctive differences related to its nutritional value alongside its possible biofunctionality, as mentioned for other similar cheeses across the globe [31, 32]. The cheese functionality is considered as a current consumer's trend [33], that Greece can satisfy both with PDO and non PDO cheeses, given that these traits will be evidenced and highlighted.

Conclusions

Tsalafouti is a traditional Greek spreadable cheese in a process of standardization under the EU geographical indication labels scheme. As several other Greek PDO cheeses are already well-established, Tsalafouti may

act as new entry for niche markets, focused on healthy (low fat) cheeses. On the other hand, food heritage and specifically dairy products heritage can possibly act as a tool for boosting entrepreneurship in marginal mountainous areas in Greece, given that the special attributes that Tsalafouti may hold will be highlighted and further evidenced.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s42779-023-00187-2.

Additional file 1. Survey questionnaire.

Acknowledgements
We extend thanks to the dairy plants participated in this study, that provided us with data on process, history, nutrition and gastronomy.

Author contributions
EMa: conceptualization, methodology, formal analysis, writing original draft; EMe, AS, MA: data collection and analysis, review and editing of final draft; AM conceptualization, review, editing, and writing the manuscript. All authors have read and approved the final manuscript.

Funding
There was no external funding received for this study.

Availability of data and materials
All data generated or analyzed during this study are included in this published article.

Declarations

Ethical approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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Received: 21 September 2022 Accepted: 6 June 2023
Published online: 12 June 2023

References

1. European Green Deal (2019) https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en
2. Di Trana A, Di Rosa AR, Addis M, Fiori M, Di Grigoli A, Morittu VM, Spina AA, Claps S, Chiofalo V, Licitra G, et al. The quality of five natural, historical Italian cheeses produced in different months: gross composition, fat-soluble vitamins, fatty acids, total phenols, antioxidant capacity, and health index. Animals. 2022;12:199.
3. Scintu MF, Piredda G. Typicity and biodiversity of goat and sheep milk products. Small Rum Res. 2007;68:221–31.
4. Minagric (2022a). http://www.minagric.gr/index.php/el/for-farmer-2/2012-02-02-07-52-07/ellinikaproionta/1270-tiria
5. Papademas P, Bintsis T. Global cheesemaking technology: cheese quality and characteristics. 1st ed. West Sussex: Wiley; 2017.
6. Litopoulou-Tzanetaki E, Tzanetakis N. Microbiological characteristics of Greek traditional cheeses. Small Rum Res. 2011;101:17–32.
7. Michailidou S, Pavlou E, Pasentsis K, Rhoades J, Likotrafiti E, Argiriou A. Microbial profiles of Greek PDO cheeses assessed with amplicon metabarcoding. Food Microbiol. 2021;99:103836.
8. Bozoudi D, Torriani S, Zdragas A, Litopoulou-Tzanetaki E. Assessment of microbial diversity of the dominant microbiota in fresh and mature PDO Feta cheese made at three mountainous areas of Greece. LWT-Food Sci Technol. 2016;72:525–33.
9. Uzun P, Serrapica F, Masucci F, Assunta BCM, Yildiz H, Grasso F, Di Francia A. Diversity of traditional Caciocavallo cheeses produced in Italy. Int J Dairy Technol. 2020;73:234–43.
10. Vakoufaris H. The impact of Ladotyri Mytilinis PDO cheese on the rural development of Lesvos island. Greece Local Environ. 2010;15(1):27–41.
11. Tregear A, Kuznetsof S, Moxey A. Policy initiatives for regional foods: some insights from consumer research. Food Policy. 1998;23(5):383–94.
12. Nizam D, Tatari MF. Rural revitalization through territorial distinctiveness: the use of geographical indications in Turkey. J Rural Stud. 2020;93:144–54.
13. Kizos T, Kohsaka R, Penker M, Piatti C, Vogl CR, Uchiyama Y. The governance of geographical indications: experiences of practical implementation of selected case studies in Austria, Italy. Greece Jpn Br Food J. 2017;119(1):12.
14. Tashiro A, And UY, Kohsaka R. Internal processes of Geographical Indication and their effects: an evaluation framework for geographical indication applicants in Japan. J Eth Foods. 2018;5(3):202–10.
15. Gugerell K, Uchiyama Y, Kieninger PR, Penker M, Kajima S, Kohsaka R. Do historical production practices and culinary heritages really matter? Food with protected geographical indications in Japan and Austria. J Eth Foods. 2017;4(2):118–25.
16. Andrikopoulos NK, Kalogeropoulos N, Zerva A, Zerva U, Hassapidou M, Kapoulas VM. Evaluation of cholesterol and other nutrient parameters of Greek cheese varieties. J Food Compos Anal. 2003;16:155–67.
17. Samelis J, Kakouri A, Pappa EC, Matijasic BB, Georgalaki MD, Tsakalidou E, et al. Microbial stability and safety of traditional Greek Graviera, cheese: characterization of the lactic acid bacterial flora and culture-independent detection of bacteriocin genes in the ripened cheeses and their microbial consortia. J Food Prot. 2010;73:1294–303.
18. Zlatanos S, Laskaridis K, Feist C, Sagredos A. CLA content and fatty acid composition of Greek feta and hard cheeses. Food Chem. 2002;78:471–7.
19. Danezis GP, Tsagkaris AS, Camin F, Brusic V, Georgiou CA. Food authentication: techniques, trends and emerging approaches. Trends Anal Chem. 2016;85:123–32.
20. Karoui R. Methodologies for the characterization of the quality of dairy products. Adv Food Nutr Res. 2017;82:237–75.
21. Litopoulou-Tzanetaki E, Tzanetakis N. The microfloras of traditional Greek cheeses. Microbiol Spectr. 2014;2(1):177–218.
22. Marsden T, Banks J, Bristow G. Food supply chain approaches: exploring their role in rural development. Sociol Rural. 2000;40(4):424–38.
23. Renting H, Marsden TK, Banks J. Understanding alternative food networks: exploring the role of short food supply chains in rural development. Environ Plan A. 2003;35(3):393–411.
24. Minagric (2022b). http://minagric.gr/images/tsa%CE%99afouti_prodiagrafes_200622.pdf
25. Koutsoukis C, Voidarou C, Demertzis PG, Akrida-Demertzi K. Effect of the composition of grazing matter on the quality characteristics of the traditional Greek dairy product "tsalafouti." J Environ Sci Toxicol Food Technol. 2017;11:79–84.
26. Pappa E, Kondyli E, Vlachou A-M, Kakouri A, Malamou E, Samelis J. Semi industrial production of tsalafouti dairy product. AIMS Agric Food. 2022;7(2):444–60.
27. Pappa EC, Kondyli E, Malamou E, Kakouri A, Vlachou AM, Samelis J. Chemical, microbiological and sensory characteristics of 'tsalafouti'traditional Greek dairy product. Food Res. 2022;6:170–9.
28. Galanakis CM, Aldawoud TM, Rizou M, Rowan NJ, Ibrahim SA. Food ingredients and active compounds against the coronavirus disease (COVID-19) pandemic: a comprehensive review. Foods. 2020;9(11):1701.

29. Lapidakis N, Fragkiadakis GA. Dairy processing: the soft spreadable cheese Xygalo Siteias. Processes. 2022;10(1):80.
30. Samelis J, Kakouri A. Microbiological characterization of Greek Galotyri cheese PDO Products relative to whether they are marketed fresh or ripened. Fermentation. 2022;8(10):492.
31. Banihashemi SA, Nikoo M, Ghasempour Z, Ehsani A. Bioactive peptides fractions from traditional Iranian Koopeh cheese; lactic fermentation products. Biocatal Agric Biotechnol. 2020;29:101798.
32. Öztürk Hİ, Göktepe ÇK, Akın N. Proteolysis pattern and functional peptides in artisanal Tulum cheeses produced from Mut province in Turkey. LWT. 2021;149:111642.
33. Curutchet A, Tárrega A, Arcia P. Changes in consumers interest on cheeses with health benefits and different manufacture types over the last decade. CyTA-J Food. 2023;21(1):L72–81.

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