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Customer knowledge about purchasing perceptions, safety and quality issues of Syrian cheese in Egypt

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ABSTRACT

Food safety is a crucial global public health issue. Food-borne diseases are mostly due to lack of knowledge about food processing, storage, and handling practices. Consumer's behavior towards food safety should be considered during implementation of control measures to eliminate potential hazards and keep the products quality. Syrian cheeses such as Akawi, Halloumi, and Mudaffara are nowadays commonly produced and sold in Egyptian markets, with high acceptability from the Egyptian consumer's side. The present cross-sectional study was designed using a structural questionnaire to estimate the consumer familiarity and consumption rates of such products. Meanwhile, evaluating the consumers Knowledge, attitude, and practices (KAP) among Syrian cheeses safety, quality, purchasing and storage parameters. The study was conducted online by 407 Egyptian citizens from different districts in Greater Cairo governorates. The questionnaire included thirty questions divided into 4 sections: sociodemographic questions; Syrian cheese general consumption data base; the consumer's Attitude and Practice; and the knowledge level toward the products. Most of the responders were females (66%), with age range 20-40 years (76%), university graduates (64%) and work in public health field (57%). 51% of the responders consume Syrian cheese, while 70% prefer the Egyptian cheese. 47.8% used to consume Syrian cheese indirectly in food recipes. About 31% of the Egyptian consumers often considered Syrian cheese as a high-quality product and 64.2% select the products on flavor basis. Only 5% of the responders suffered after Syrian cheese consumption and 3% have allergy from cheeses. Regarding safety and quality of Syrian cheeses, 47% of the responders have good knowledge about the necessity of cold storage of cheese. Although the shelf life of soft cheese is one month, however only 8% knew that, and 67.5% used to keep Syrian cheese in refrigerator till consumption regardless to the shelf life. 64.4% of responders accepted the addition of chemical preservatives to cheese but within the acceptable limits, and at the same time 92% preferred the natural ones. Most of responders have a good knowledge level about: the incidence of food poisoning from cheese (77.3%), food poisoning symptoms (87.8%), and the main causative agent of such cases (53%).

Introduction

White soft cheese is one of the most abundant dairy products marketed and consumed in Egypt and appreciated worldwide. From different white soft chesses, brined ones are produced and consumed in 15 or more countries of North Africa and Middle East. Egypt has a large variety of cheese types including soft, brined, salted, semi-soft and hard cheeses, from which Domiati cheese is the most popular type consumed by all socioeconomic classes (Hayaloglu, 2016; Manal et al., 2022; Mohamed et al., 2023).

Regarding sensory quality, each country has its own preferred, white-brined cheese. The most common brined cheese varieties used in traditional trade are Akawi (Lebanon and Syria), Brinza (Russia, Czech Republic), Halloumi (Cyprus and Syria), Domiati (Egypt), Kefalotyri (Greece), and Urfa cheese (Turkey) (Ozer et al., 2002). Hundreds of cheese varieties are present all over the world depending on type of milk, method of production, and metabolic activity of starter organisms.

Due to political issues, millions of Syrians migrates to Egypt; many of them established business that mainly based on fast food industry (IOM, 2022). Syrians have good reputation about cleaning and wholesomeness. Egyptian people and Syrian migrants are attracted to Syrian food products, among the most popular Syrian dairy products locally produced in Egypt are Akawi, Halloumi, and Mudaffara cheeses, that are available in a variety of shapes, rounds, cubes, and balls. They are often served as part of a meze, snack, salad, and sandwich or directly eaten with bread (Ozer et al., 2002; Hayaloglu and Fox 2008; Hilali et al., 2011).

Traditionally Syrian cheeses are made from unpasteurized ovine and caprine milks, or a mixture of them. But recently bovine milk may be involved, according to regulations; their production shall involve pasteurization of milk and addition of starter cultures, followed by salting and pressing (Papademas and Robinson, 1998; SASMO, 2007; Hilali et al., 2011).

Soft cheese is a perishable product which can be contaminated by pathogenic and/or spoilage microorganisms subsequently may cause economic losses through decrease the shelf life or deteriorate quality of the product and may cause health risks to consumer (Manal et al., 2022).

The quality of soft cheese is affected by some environmental, technological, and hygienic parameters including salt concentration, pH values, heat treatment, addition of natural or chemical preservatives and packaging techniques (Lore et al., 2005; Enas et al., 2022). Food loss by spoilage or contamination economically affects both the food industry and the consumers. Syrian cheese can be compromised by use of low-quality material, inadequate processing, or inadequate storage conditions, affecting its quality and shelf life through proteolysis, lipolysis and lactic acid fermentation that led to the generation of volatile compounds that significantly influence the cheese flavor (Lorenzo et al., 2018; Geronikou et al., 2020; Nájera et al., 2021).

Despite all its desirable nutritional and sensory characteristics, cheese has been known to cause foodborne illnesses and disease outbreaks due to the presence of chemical, physical and/or especially microbiological hazards that contaminate the cheese before, during or after the production process. Nowadays, food safety issues have become a major concern

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for many people all over the world due to the emergence of microbial foodborne pathogens (WHO, 2015; Todd, 2016; Mohamed et al., 2023). The influx of Syrian migrants in the area has led to traditional methods of making Syrian cheese that are not up to date with modern safety standards (Yadav et al., 2019). Furthermore, the lack of a unified food safety system in the region has led to a higher risk of contamination by certain pathogens (El-Sayed et al., 2022). Epidemiologic surveillance summaries of foodborne diseases clearly indicate that consumer behaviors such as ingestion of raw/under cooked foods and poor hygienic practices are important contributors to outbreaks of foodborne diseases (Patil et al., 2004).

The growing popularity of Syrian cheese in the Egyptian market makes it a viable option for consumers and an attractive opportunity for businesses. Therefore, the current cross-sectional study was subjected to evaluate such products popularity and availability to the Egyptian consumer in addition to accessing the consumer Knowledge, Attitude and Practices (KAP) toward Syrian cheese safety and quality parameters.

Materials and methods

Study area and Sampling Method

A cross-sectional study was conducted from January 2023 to May 2023 among different Egyptian consumers in Greater Cairo governorates (Cairo, Giza and Kalyobia) that present a potential consumer market for dairy products especially cheeses and has recorded the highest consumption of cheese in 2020 in Egypt (Global Data, 2021).

The study was applied through an online questionnaire designed in Arabic language, "the native language in Egypt", using Google Form. The participants were requested to participate in this survey through social media (Facebook, Telegram, WhatsApp, and LinkedIn). All participants freely participated in the study and for that reason they were excused from written consent. Also, objectives of this study were explained clearly before the beginning of sharing in the survey.

Sample size determination

The total sample size for this study was determined using probability proportionate sampling technique, by using a formula from raosoft.com website (Raosoft, 2004) with 0.05 desired degree of accuracy or 5% error term, 95% confidence interval and proportion of population to be included in the sample (P) is 0.1. The total number of populations inserted was 100 million and a sample of 385 was needed. The total number of participants in this questionnaire was 407 to cover the needed sample size with space to exclude incomplete participation.

Survey Instrument

A Structured questionnaire was set to gather information from public population in Egypt on Syrian cheese varieties sold in markets, to stand on the degree of consumption rate, and purchasing perceptions. The survey was also conducted to access the knowledge, attitude, and practices of consumer on different Syrian cheeses quality, safety, and storage conditions.

The questionnaire included thirty questions divided into 4 sections:

The first section has four questions; covered the respondent's sociodemographic characteristics (Age, gender, education, and occupation). Questions about sociodemographic information were selected according to Fahmy et al. (2015).

The second section contained seven questions dealing with consumption data base e.g., consumer familiarity with Syrian cheese, alongside with the purchasing perception criteria from the consumer point of view.

The third section included nine questions about Attitude and Practice of the consumer towards Syrian cheeses e.g., attitude and practices related to cheese quality, spoilage signs, storage attitude and safety issues. The fourth section included ten questions to explore the knowledge level of the consumer about cheese spoilage, quality parameters, hazards in cheese, food poisoning, and ideal preservation of the product.

Questions of section three and four cover the KAP parameters were guided by Ahmed et al. (2018).

A pilot study was agreed by ten researchers to assess the relevancy, reliability, clearance, and adequacy of the questionnaire before use.

Statistical analysis

The results of the survey study were summarized as percentages (%) for categorical variables. The Statistical Package for Social Science (SPSS) for Windows (Version 26.0, Chicago, IL) was used for analysis of data.

Results and Discussion

Recently, Syrian cheeses continued to gain popularity in the Egyptian market, therefore it is essential to identify the factors contributed to this success. One possible factor is the unique taste and texture of Syrian cheese, which appeals to Egyptian consumers. The taste is described as tangy and salty, with a distinct flavor that sets it apart from other cheeses. Additionally, the texture of Syrian cheese is crumbly yet creamy, which makes it an ideal ingredient for many Egyptian dishes. Another reason for the popularity of Syrian cheeses could be its affordability compared to other imported cheeses. As, nowadays Syrian cheeses are not imported but produced locally by some Syrian immigrants in Egypt, which make it relatively cheaper and accessible than other imported cheeses. Also, the marketing strategies employed by Syrian cheese manufacturers played a role in this success (Abou-Donia, 2008; Sakr et al., 2011).

Figure 1 showed the sociodemographic profile of the four hundred and seven (407) participants responded to the questionnaire. The participant gender was male (34%) and female (66%); the highest participants percentage (76%) aged from 20- 40 years and the lowest was 3% for more than 60 years; the education level of participants was a maximum 64% (bachelor or equivalent degree) and a minimum 1% (high school graduates) and the occupational situation regarding the health field was 57% (health field workers) and 43% (non-health field workers). These results could be attributed to the selection of online pathway for survey distribution, this new technology in data collection is advantaged in covering more areas and categories of participants with minimum effort and time consumption, but its disadvantage may be the restrictions in participant's age and education who can deal with the online technique.

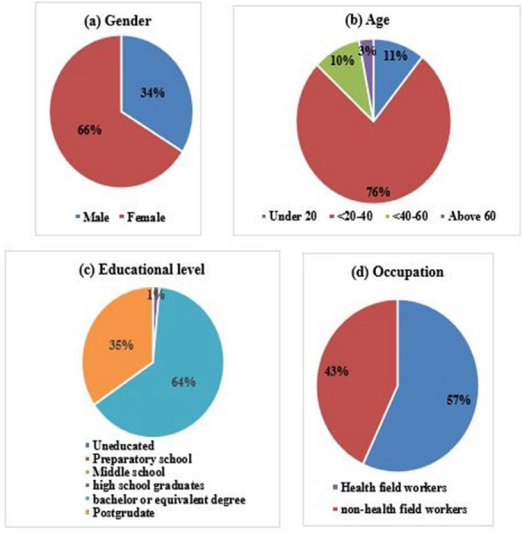

Fig. 1. Scociodemographic profile among the study group.

Data illustrated in Figure 2, explored the extent of the Egyptian con-

sumer's knowledge of Syrian cheeses and their consumption rates. It was found that 51% of the responders like to eat, while about 34.5% of them don't know these types of cheese. At the same aspect, 70% of the responders prefer the Egyptian types of cheese.

According to Abou-Donia, 2008 Medaffarah and Halloumi are the most commonly produced pickled types of Syrian cheese in Egypt. While recently, other types of Syrian cheese, with different additives and modified processing techniques, had been introduced to the market. Responders stated that Halloumi cheese is the most preferable type (41.90%), followed by Akawi (24.35%) and Mudaffara (22.5%). The intended use of these types of cheese is indirect (47.8%) as ingredient in food, most of them 81.5% stated that they consume these cheeses in some traditional Syrian products (Kunafa, Manakish and Pizza).

Figure 2 illustrates that 73.4% of responders do not know the real type of milk used in production of Syrian cheese. Syrian cheeses are traditionally made from ovine and caprine milks; however, recently due to shortage in these types, cow's milk is included in their production (Kaminarides et al., 2000; El-Demerdash et al., 2008).

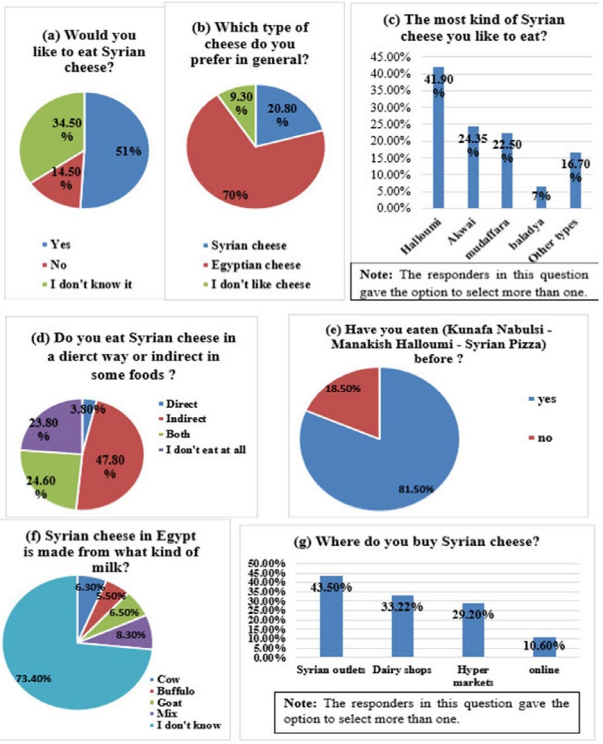

Fig. 2. Syrian cheeses purchasing perceptions and familiarity to the Egyptian consumer.

Regarding the sales outlet of Syrian cheese, 43.5% of responders buy them from Syrian outlets, 33.2% (dairy shops), 29.20% (hypermarkets) and 10.6% buy online, indicating the diversity of the methods of production and the applied GMPs.

The next part of questions in this questionnaire was directed towards the consumer attitude about Syrian cheese selection criteria and practices of storage. In Figure 3a, 41% of the responders considered the products as one of the highest quality ones. Most of the responders (64.2%) considered Syrian cheese flavor as the main criterion for product selection during purchasing (Figure 3b). Cheese quality has been defined for many years by manufacturers as cheese produced constantly and economically, while for consumers the quality standard for cheeses is ultimately determined by the eating quality (appearance, flavor, texture, functionality, and nutritive value) (Paul et al., 2017; Paul and John, 2022).

Food safety is a concern worldwide and according to the World Health Organization; developing countries including Egypt are probably more at risk of foodborne illness because they have limited disease surveillance, prevention, and control strategies (Todd, 2016). Therefore, we deliberately asked questions about previous incidence of injury or allergy from Syrian cheese, trying to find out the real incidence of such cases. Even though, the answers explored that only 5% of the responders suffered from consuming Syrian cheese and only 3% have allergy from Syrian cheese as milk product (Figure 3 c and d). These percentages are consistent with reality, as the reported cases of food poisoning from cheeses or even milk allergy in Egypt didn't increase too much from these percentages in last years (Tosson et al., 2023).

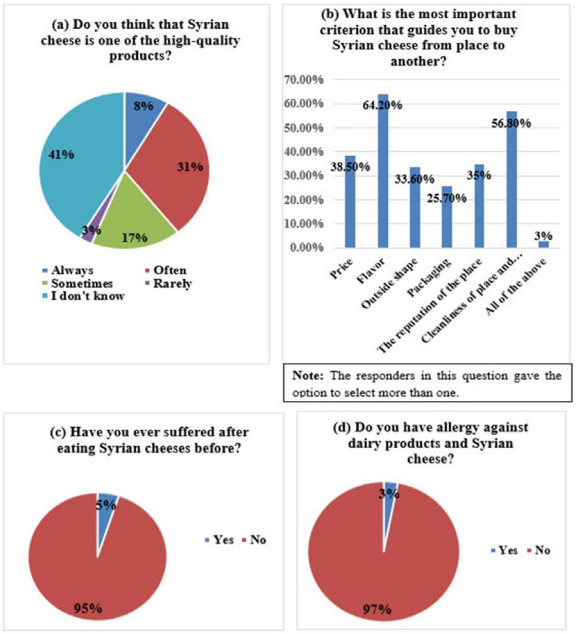

Fig. 3. Distribution among the study group attitude and practices about Syrian cheeses safety and quality.

Quality and safety of Syrian cheeses after purchasing are not only dependable on the product hygienic quality, but also on several storage parameters till consumption. Improper food storage by holding it at improper temperatures or for longer times than directed, together with cross contamination, were the commonest contributors to foodborne disease and spoilage (Kirchner et al., 2021). Unfortunately, most of respondents (67.5%) stated that they store the product in refrigerator till consumption regardless of the expiry date (Figure 4a). Also, by asking them about keeping cheeses inside its brine solution during storage, 40% answered by yes, while 44% buy their cheese without brine solution (Figure 4b). The brine solution plays an important role in ripened cheese preservation during storage via controlling the microbial growth and different enzymatic activities. In addition, brining promotes curd syneresis and specifies the final product physical properties including flavor, taste, aroma, and texture (Abd El-Aziz et al., 2015). 64.7% of the responders stated that the product didn't spoil during long storage in refrigerator with or without brine (Figure 4c). This may be due to the small, purchased portion of the product.

Numerous potentials are used to prevent microbial contamination during the traditional cheese production. These potentials include application of sanitary and hygienic guidelines, physical control measures like heat treatment of milk and efficient packaging. Different chemical preservatives e.g., sorbic acid, sodium benzoate, hydrogen peroxide, nisin, natamycin and potassium sorbate are used to control microbial contamination; conserve the physical, chemical, and nutritive value; and extend the shelf life of the product. Potassium sorbate (E 202) is the most widely used chemical preservative in cheese industry at 0.025 to 0.1% levels to be effective against yeasts, molds, and some bacteria (Awaad et al., 2020 and Awaad et al., 2023). Results in Figure (4d) showed that most respondents (64.4%) agree with the concept of using these chemical preservatives within the permissible limits to maintain safety and quality of the product. On the other hand, by asking the participants about the

legality of adding chemical preservatives to cheeses, about 43.5% of the responders didn't know the correct answer and 38.6% of them correctly answered that it is allowed (Table 1).

The potential impacts on human health by using these chemicals are the reasons for the continuous seeking for natural alternatives with high antimicrobial efficacy without impairing the cheese physicochemical and sensory quality. These natural antimicrobials may include essential oils, different plants extracts, polysaccharides, polypeptides, and enzymes as active ingredients (Ahmed et al., 2021; Lima et al., 2021). The use of natural alternatives for cheese preservation was highly accepted by the responders with an agreement percentage 92% (Figure 4e).

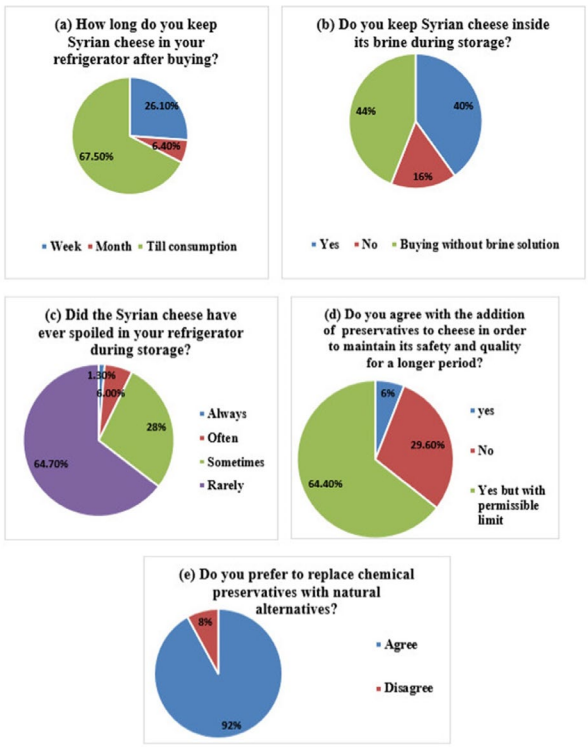

Fig. 4. Distribution among the study group attitude and practices about Syrian cheeses preservation issues.

Food safety is essential issue for food industry, public health, and economy. Evaluating consumer knowledge about food safety is highly crucial to develop and implement food safety policies and effective risk communication within food chain (Sibel, 2020). Lately several studies were directed to conduct different surveys to reveal consumer knowledge and behaviors related to food safety especially in Arab countries (Ahmed et al., 2018; Hassan et al., 2018; Mitri et al., 2018; Edget et al., 2020; Hamed et al., 2021; Owais et al., 2022). In the current survey, participants were asked 10 questions to evaluate their basic knowledge about cheese safety, quality and effective storage standards in general. The correct answers and percentages reflecting the consumer's knowledge degree were tabulated in Table 1.

The term hazard refers to agents or foodstuff conditions that impairs consumer health. Hazards are divided into physical, chemical, or biological hazards that originate from raw materials, semi-finished, or finished product during processing (Suherman et al., 2021). Conrado et al. 2016 estimated different hazards and risk factors in cheese plants that can influence contamination of cheese and concluded that microbial contamination was the most significant hazard.

In the current study, only 33.5% of the participants knew that biological hazards are the most significant hazards transmit through cheese, while the majority (35%) didn't know the answer and the rest considered other hazards more significant (results not given). That reflects the poor knowledge of the consumer about the meaning of hazards, their incidence or significance. In contrary, the greatest percentage of participants had a satisfactory knowledge about food poisoning probability through cheese consumption (77.3%), common symptoms of food poisoning (87.8%) and that bacteria are the most common cause of food poisoning (53%). That sounds very satisfactory knowledge level of consumers about foodborne diseases including food poisoning (Table 1).

The Institute of Food Science and Technology defined shelf life as "the period of time during which the food product will remain safe with certain to retain its desired sensory, chemical, physical, microbiological and functional characteristics" (Karima and Khalil, 2019). To extend the shelf life of Syrian cheeses and maintain its quality as long as possible, adequate conditions should be maintained during storage. This is the consumer role at home, therefore, consumers in our questionnaire were asked several questions to ascertain their knowledge about cheese optimum storage requirements. Only 8% of the responders knew that the shelf life of Syrian cheeses as most ripened cheeses could extend to one month as stated in the Egyptian standards (EOS, 2005), while the majority 73.4% didn't know the answer (Table 1).

As for optimum storage temperature, most of the responders were well informed about the importance of storing cheeses in refrigerator with average temperature 4-6°C (47%) indicating high knowledge (Table 1). Rukiye et al. 2022 reviewed the effect of storage temperature on physicochemical properties, texture profile, functional properties, and sensory behavior of cheese, and concluded that cheese storage from 4 to 10 °C is the best for cheese quality and safety as well.

Cheese spoilage is indicated by visual signs including fungal growth, slimy or greasy texture, abnormal taste, different discoloration, and off

Table 1. The consumer knowledge about Syrian cheese quality, safety and storage conditions among the study group.

Question	Correct answer	Percentage of correct answer
Cheese is a source of any of the following hazards significantly?	Biological	33.50%
Could cheese be a source of disease transmission and food poisoning?	Yes	77.30%
What are the main symptoms of food poisoning?	Digestive (vomiting-diarrhea-abdominal pain)	87.80%
What is the most common microorganism causing food poisoning in cheese?	Bacteria	53%
What is shelf life of Syrian cheese?	Month	8%
What is the right temperature for preserving Syrian cheese?	Inside the refrigerator (4-6°C)	47%
What are the obvious signs that indicate spoilage of cheese during storage?	All of the above (change in color- taste- odor, mold appearance, slimy yellow layer on cheese)	60.40%
What are the most common microorganisms causing spoilage in cheese?	Fungi (Yeast and Mold)	43.30%
Do you think that the high salt content in Syrian cheese is one of its preservations means?	Yes	66.20%
Is the addition of chemical preservatives during the manufacture of Syrian cheese legally allowed?	Yes	38.60%

flavors. The developed defects depend on the species and number of microorganisms causing spoilage and type of cheese. Spoilage may appear as a single undesirable change or multiple changes (Gamal et al., 2019). That was clear to the consumer, as 60.4% of the responders correctly answered this question about cheese spoilage signs during storage (Table 1).

Yeasts and molds are among the most important spoilage microorganisms threaten cheese stability and quality even during cold storage. From other side, they also impair the public health due to their ability to produce mycotoxins (Karima and Khalil, 2019). By asking about the most common cause of cheese spoilage, 43.3% of the responders had a good knowledge; that fungi (yeast and mold) are the common cause, while the highest count of responders (44.3%) wrongly answered the question and considered bacteria as the common cause (Table 1). Awaad et al., 2020 found that 100% and 80% of the examined ripened cheese samples sold in Egyptian markets were not comply with the Egyptians Standard (EOS, 2005) for the presence of yeast and mold, respectively.

The stability of milk and dairy products during storage depends on several factors including salt percentage and salting technique, that enhance the taste and control the growth of spoilage microorganisms and the subsequent cheese degradation (Karima and Khalil, 2019). Removal of whey from cheese curds helps to reduce the water available for microbial growth, reducing the likelihood of microbial spoilage and pathogen growth (Guinee and Fox, 2004). This information about salt importance for Syrian cheese preservation was clear to most of the responders (66.2%) (Table 1).

Conclusion

Consumers are one of the important elements in the food safety chain when considering a "From Farm to Fork approach", it is essential to enrich the consumers' awareness regarding food safety. Therefore, an effective and continual food safety education is important to improve consumer's knowledge on food safety.

In the current study, despite the good level of consumer knowledge about the basic food safety, quality, and storage rules, when this knowledge is transformed into realistic practices, the matter turns into serious errors that may have a great impact on the health and safety of the consumer. This calls for the appropriate authorities to start a food safety culture awareness program that emphasizes all food safety guidelines. Also, the use of media tools could lead to behavioral changes that will reduce the risk of foodborne illness and decrease levels of product loss.

At the same time, Syrian cheese manufactures in Egypt are recommended to apply GMPs, in adherence to the legal and statutory regulations, with efficient labeling. Also, it's important to enhance the consumer awareness about storage of Syrian cheese by keeping it in brine from purchasing till consumption

Conflict of interest

The authors declare that they have no conflict of interest.

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