International Journal of Science and Research Archive
eISSN: 2582-8185
Cross Ref DOI: 10.30574/ijsra
Journal homepage: https://ijsra.net/

(RESEARCH ARTICLE)

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Changes in fat globules during the ripening of crumbly cheese

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International Journal of Science and Research Archive, 2026, 18(01), 118-122

Publication history: Received on 24 November 2025; revised on 29 December 2025; accepted on 31 December 2025

Article DOI: https://doi.org/10.30574/ijsra.2026.18.1.3358

Abstract

The production of cheese and dairy products, in general, is of great importance to the global population. In this context, cheese attracts particular interest. As is well known, the taste and rheological properties of cheese are dependent on its fat content.

The presented study examines the changes occurring in fat globules during the ripening and aging of cheese. Structural changes in fat were observed using a binocular microscope (US1). It is noteworthy that the localization of fats during different stages of cheese aging occurs in various ways.

Keywords: Fat; Cheese; Milk; Localization; Microscope.

1. Introduction

Among food products worldwide, cheese can be considered the most demanded. There are many varieties of cheese, influenced by the diversity of technologies and specific production methods that have been passed down since ancient times. As a result, cheese represents a cultural symbol for many countries.

Georgia is no exception, which is conditioned by its diverse climate and geographical location. Almost every region of Georgia has preserved traditional methods of cheese production. For example, Tusheti is known for "Guda'' cheese, Imerety for "Imeretian'' cheese, Samegrelo for Megrelian "Sulguni'', Svanety for "Narchvi'' cheese, Adjara for "Shirshvela'' cheese (preserved in butter), and so on.

The traditional method of producing Svaneti cheese "Narchvi" was granted the status of an Intangible Cultural Heritage of Georgia in February 2022 [1] and is distinguished both by its taste characteristics and its production technology (Fig. 1). "Narchvi" belongs to the category of crumbly cheeses and is characterized by a high fat content (50% on a dry matter basis).

Svaneti is a high-mountain region, where winters are severe, and therefore, during the winter, livestock is milked less. For this reason, the Svan people are prepared cheese in late spring and summer, when the cattle are grazing on fresh green grass. During this period, the milk is collected, and the cheese is ripened over 3–6 months.

Based on the traditional technology of "Narchvi" cheese, we developed a production scheme and manufacturing technology for crumbly cheese, which was recognized by the National Intellectual Property Center of Georgia ("Sakpatenti") and granted invention status (U 2025 2226 Y).

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Cheese, based on its fat content, can be classified as high-fat, medium-fat, low-fat, or fat-free. The fat content in cheese is determined as a percentage (%) per 100 g of dry matter [3].

Figure 1 Svanetian "Narchvi" cheese

When determining the fat content of cheese, it is also important to consider the conditions of its ripening; specifically, ripening can occur either in brine or in a dry environment.

It should also be noted that the fat present in cheese does not increase cholesterol levels in the human body, since milk fat is mainly composed of conjugated linolenic acid, which, paradoxically, helps prevent fat accumulation (the formation of deposits) in the body [4].

The present article examines the changes in the size and structure of fat globules at different stages of cheese ripening.

2. Experimental Part

To study the fat content of milk, cheese was prepared from high-fat (4.1%) pasteurized milk, to which calcium chloride, rennet, and solutions of pure culture lactic acid bacteria were added. In the next stage, the curd was cut, and the cheese mass was separated from the whey. The separated mass underwent cheddaring on an iron vat (it is essential to remove as much whey as possible from the mass), and dry salt (3%) was added. To investigate the fat content of milk, cheese was produced from high-fat (4.1%) pasteurized milk. Calcium chloride, a coagulating enzyme (rennet), and solutions of lactic acid bacteria from pure cultures were added to the milk. In the next stage, the coagulated mass was cut and separated from the whey. The separated curd was subjected to cheddaring on an iron surface to ensure maximum removal of whey, after which dry salt (3%) was added. The thoroughly mixed and crushed mass was placed into boxes with holes made of broadleaf wood (broadleaf wood was used because coniferous wood imparts bitterness to cheese). The holes ensured air circulation within the cheese mass in order to prevent overheating during the ripening period and to avoid the creation of optimal conditions for the growth of mold bacteria (Fig. 2). At the next stage, pressing was carried out at a pressure of 0.1 MPa for 2 hours, followed by crushing of the cheese mass, during which the adhered cheese particles separated into individual grains. The crushed and pressed cheese grains placed in wooden boxes were transferred to a ripening chamber and matured at 14 °C for 15 days.

Figure 2 Wooden boxes for cheese ripening

The fat content of the cheese aged for 15 days was found to be 21.42%, which indicates that the cheese can be classified as high-fat.

To determine the structural changes of fat globules during the ripening period, observations were carried out on thin cheese samples using a binocular/digital microscope (US1) on the first, seventh, and fifteenth days of ripening (Figures 3 - 5).

The images obtained through microscopic observation clearly indicate that the fat globules undergo structural modifications during the ripening process. Specifically, their localization and enlargement occur, which in turn enhances the organoleptic characteristics of the matured cheese.

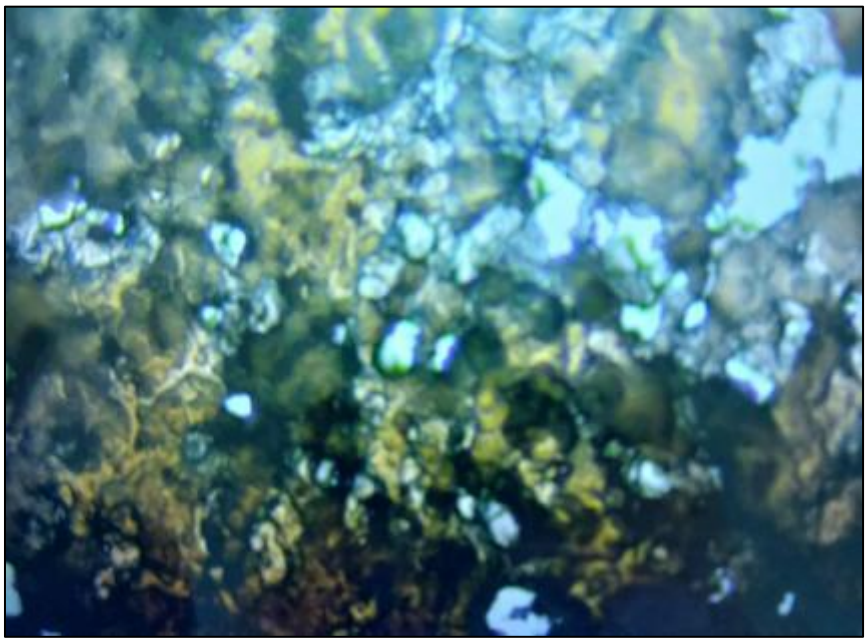

Figure 3 Day 1 – Fat structure in the cheese at 400× magnification

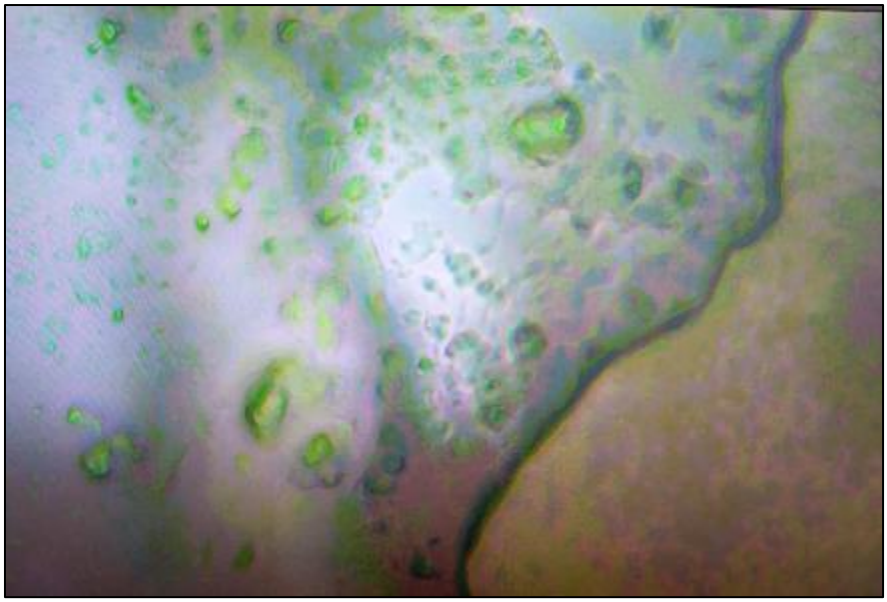

Figure 4 Day 7 – Fat structure in the cheese at 40× magnification

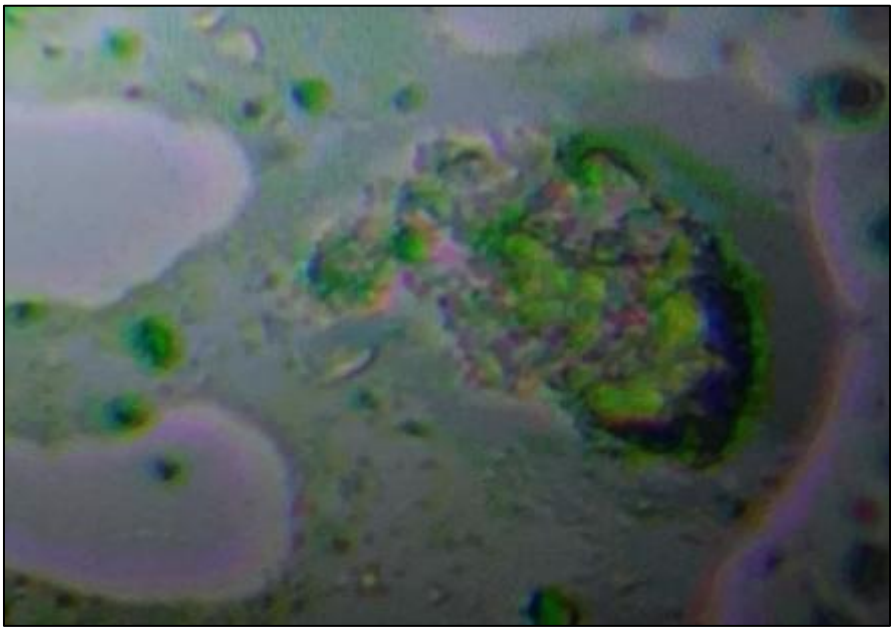

Figure 5 Day 15 – Fat structure in the cheese at 40× magnification

On the first day, immediately after cheese production and prior to placement in the ripening chamber, observation of the fat globules at 40× magnification proved challenging, as the fat was nearly uniformly distributed throughout the cheese matrix. Therefore, observations were conducted at 400× magnification. By the seventh and fifteenth days, the fat structure became clearly discernible at 40× magnification, with the fat globules appearing more aggregated and localized.

In general, under the established conditions, cheese is stored in a dry state (in wooden boxes) for a period of six months.

3. Conclusion

Based on the experiments and observations, it can be concluded that in cheese ripened in wooden boxes, the structure of fat globules undergoes localization of fat bodies, which positively affects the organoleptic properties. Furthermore, the organoleptic characteristics and nutritional value of the cheese are significantly influenced by phenolic compounds transferred from the wooden material into the cheese.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] National Agency for Cultural Heritage Preservation of Georgia. Order of the General Director. [cited 2025 Dec 24].

[2] National Intellectual Property Center of Georgia (Sakpatenti). Certificate. Case No.: U 2025 2226 Y, Utility Model. Application Date: 26 Dec 2024, Registration Date: 08 Oct 2025.

[3] Kanajia S., Khetra Y. Cheese Technology , USCCA, Agrimoon.com, 2016.

[4] Samuel Furse, Alexandre G Torres , Albert Koulman. Fermentation of Milk into Yoghurt and Cheese Leads to Contrasting Lipid and Glyceride Profiles. Nutrients. doi: 10.3390/nu11092178, 2019 Sep 11;