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OPTIMIZATION OF PRESSING PARAMETERS FOR SOFT BIFIDUS-CONTAINING CHEESES

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Abstract. This article presents the methodological foundations for optimizing the pressing parameters of fresh soft acid-rennet bifidus-containing cheeses using the Response Surface Methodology (RSM) and statistical analysis of experimental data in the Statistica 10 software environment (StatSoft, Inc., USA). The feasibility of developing recipes and technologies for fresh bifidum cheeses intended for health and wellness nutrition is substantiated. These products combine the traditional nutritional and biological value of milk protein products with the probiotic activity of bifid cultures. The influence of milk heat treatment and pressing parameters on the moisture content, structure, and active acidity (pH) of the target products is demonstrated. It was determined that when using high-temperature milk pasteurization (temperature 90±1ºC, duration 5±1 min) in the technology of fresh soft cheeses, achieving the standardized moisture level in the curd mass solely through self-pressing is impossible. The necessary condition for obtaining fresh soft cheese with a standardized moisture level is a combination of self-pressing and subsequent mechanical pressing of the curd mass. The pressing parameters – pressure, temperature, and duration – determine the moisture content, active acidity, organoleptic, and microbiological indicators of the finished product. The optimal pressing parameters for fresh soft acid-rennet bifidus cheese were determined: a temperature of 20–21ºC and a duration of 58–59 min. These parameters ensure stable moisture (60%), the required level of active acidity (5.40–5.41 pH), and probiotic properties of the curd mass. The technology for fresh soft acid-rennet bifidus cheese was industrially tested using the recommended optimal pressing regimen at SP "Fesenko L.S." (Nemyrych village, Cherkasy region). The results confirmed the necessity of including a pressing operation for the fresh soft acid-rennet bifidum cheese (following 60 minutes of self-pressing at 20–22ºC) and the correctness of the chosen pressing regimen. This regimen ensured the production of a finished product with high organoleptic characteristics, standardized physicochemical and microbiological indicators, and pronounced probiotic properties, evidenced by a high concentration of viable cells of bifidobacteria and lactobacilli: – (1.3–3.9)×1010 and (2.5–4.0)×1010CFO respectively..

Keywords: fresh soft cheese; pressing; optimization; response surface; temperature; moisture content; active acidity; bifidobacteria; lactobacilli; organoleptic, physicochemical, microbiological quality indicators; probiotic properties.

Introduction. Formulation of the problem

Contemporary trends in the dairy industry focus on creating products with enhanced biological value and functional effects, capable of promoting public health [1]. Fresh soft acid-rennet cheeses occupy a special place among these products, as they are characterized by a high dairy protein content, affordability, simpler technological processes (compared to hard and semi-hard cheeses), good consumer acceptance, and the absence of thermal treatment after curd formation, which helps preserve the viability of the starter microflora [1–3]. According to a survey [4], 51% of consumers aged 18–35 prefer fresh cheeses. Introducing bifidobacteria into such cheeses opens opportunities to form a new group of fresh bifidus-cheeses for wellness nutrition, combining the traditional nutritional and biological value of milk protein products with the probiotic activity of bifid cultures [2, 3].

Bifidobacteria are key representatives of the normal human gut microbiota, providing an immunomodulatory effect, suppressing pathogenic and conditionally pathogenic microflora, normalizing protein and lipid metabolism, preventing the development of cancerous tumors, and synthesizing vitamins while enhancing the absorption of calcium and magnesium [5, 6]. Introducing bifidobacteria into milk along with lactobacilli (mesophilic lactic acid lactococci or thermophilic streptococci) allows for increasing the physiological value of the target protein product, maintaining viable lacto- and bifidobacteria cultures throughout a long storage period, and forming a pleasant, fermented milk taste with balanced acidity.

However, the technological integration of bifidobacteria into fresh soft acid-rennet cheeses faces several limitations related to their sensitivity to high concentrations of organic acids, high temperatures, and mechanical stress [2, 3, 5, 6]. This issue is addressed by using adapted bifidobacteria cultures in combination with lactobacilli in the production of fermented bifidus products, as well as enriching the milk with fructose as a bifidogenic factor (fructose mass fraction – 0.1%) [6].

The production of soft bifidus-containing cheeses is promising for Ukraine due to [1, 4]:

– the demand for affordable, probiotic-enriched products for healthy nutrition aimed at preventing dysbiosis;

– the growing segment of the healthy nutrition market;

– the opportunity to expand the assortment of domestic fresh cheeses with added biological and physiological value;

– the limited availability of high-quality milk raw material suitable for cheesemaking;

– the insufficiently high level of dairy product consumption by the population

Analysis of recent research and publications

One of the critical stages in the technology of fresh soft acid-rennet bifidus-cheeses is milk pasteurization, as the heat treatment regimen determines both the microbiological safety of the product and the state of the casein-salt complex, the degree of protein hydration, and the structure of the future curd [7, 8].The Impact of Heat Treatment the traditional technology of fresh soft cheese production, moderately high milk pasteurization temperatures (78–80ºC) are applied with a holding time of 20–25 seconds. This allows for preserving the native properties of proteins and minimizing the thermal load on the food matrix [8, 9]. However, the introduction of health and wellness products with increased demands for microbiological safety and the stability of probiotic bifidobacteria cultures necessitates the use of a high-temperature milk heat treatment regimen. In this regard, it has been proposed [10] to use a high-temperature pasteurization regimen for standardized milk – temperature 90±1ºC for 5±1 minutes. This significantly enhances the microbiological safety, biological value, and stability of the target product, as well as its yield. Simultaneously, however, it substantially alters the structure of the protein curd. Increased temperature and duration of heat treatment led to enhanced denaturation of whey proteins (β-lactoglobulin and α-lactalbumin) and the formation of a denser protein matrix due to increased hydrophilic properties of casein [11, 12]. Consequently, a weaker and higher-moisture acid-rennet curd is formed, making it difficult to achieve the standardized moisture content (60%) in fresh soft cheeses through traditional self-pressing alone Pressing and Moisture Control.

In the traditional technology of fresh soft cheese production, forming is carried out by pouring, filling, or from a slab. Subsequently, the desired structure, moisture, and acidity are usually achieved through self-pressing of the cheese grain under its own weight, without external pressure. For example, in the technology of fresh soft acid-rennet cheese without maturation [9], forming is done by filling, and the required moisture and active acidity level (5.3-5.4 pH) is achieved by self-pressing 400±20g cheese heads for 60-90 minutes at a temperature of 20–22ºC [9]. This approach ensures soft consistency, high moisture, and favorable conditions for the survival and continued development of lactobacilli starter cultures. However, with elevated milk pasteurization temperatures, bound moisture is retained much more strongly within the protein structure, leading to an excess of the normative moisture level in the finished product [11, 12]. This negatively affects the consistency and structure of the cheese, as well as its microbiological stability [1, 9].

The processes of syneresis and whey separation during the forming, self-pressing, and pressing of fresh soft acid-rennet bifidus-cheeses are among the key factors that determine the conditions for the development of starter cultures (lactobacilli and bifidobacteria) in subsequent technological processes – salting, drying, packaging, and storage of finished products [9, 10, 13, 14]. For bifidus-containing fresh cheeses, controlling the water-holding capacity of the protein matrix and optimizing the moisture removal regimen through self-pressing (or self-pressing and pressing) is critically important. This is because microbiological, enzymatic, biochemical, and physicochemical processes in the product continue even after the cheese is formed and self-pressed [9].

The moisture content in the curd mass is one of the regulators of microbial growth and survival in fresh soft acid-rennet cheeses [1, 9, 15]. A high moisture level ensures greater substrate availability for lactic acid and bifidobacteria, increases the diffusion capacity of the medium, and facilitates the movement of low-molecular-weight components, including lactose, peptides, and mineral salts. At the same time, excessive moisture can create preconditions for the development of undesirable microflora, such as pseudomonads, yeasts, and molds, which shortens the product's shelf life [9, 14].

The release of moisture from the curd mass during self-pressing and pressing changes its consistency, affecting the density of the protein matrix, the distribution of microcapillaries that retain the whey, and oxygen availability [7–14]. Bifidobacteria, as obligatory anaerobes, survive better in cheeses with a fine-grained, uniform structure and limited oxygen diffusion. Insufficient syneresis and excessive moisture content can create an overly loose structure capable of accumulating oxygen, which inhibits their development [5, 6].

The moisture balance in the target product determines the level of active acidity, the ratio between lactic acid bacteria and bifidobacteria, the rate of accumulation of metabolites (in particular, lactic and acetic acids) during salting and storage, the behavior of yeast and other extraneous microbiota [5–8, 15–16]. Soft fresh cheeses with optimal moisture content have a stable microbiological profile, while samples with insufficient or excessive moisture more frequently show pH fluctuations, increased gas production, activation of yeasts as early as 5-7 days of storage (especially with increased moisture), and a reduction in bifidobacteria count by 1.5–3.0 times [15–16].

Therefore, there is a need to adjust the regimens of gel formation and whey separation, specifically – the application of pressing, which is typically not used in the technology of fresh soft acid-rennet cheeses. Preliminary experiments [10] indicate that after self-pressing the curd mass in the technology of soft bifidus-containing acid-rennet cheeses for 120 minutes at 20–22ºC, the standardized moisture content cannot be achieved. In contrast, in the control sample produced from traditionally pasteurized milk, the normative moisture content is achieved after 75 minutes of self-pressing at 20–22ºC.

In this context, the scientific substantiation of the pressing parameters for soft bifidus-containing acid-rennet cheeses is timely. This substantiation must consider the specifics of high-temperature pasteurization, the hydration properties of protein structures, and the behavior of the acid-rennet grain during syneresis. Optimizing the pressing parameters will allow for the creation of a technologically stable, safe, and functional product with a guaranteed moisture and acidity level and high viability of probiotic bifidobacteria cultures, which is important for expanding the assortment of domestic fresh probiotic cheeses.

Objectives and Research Tasks

The objective of this study was to substantiate the optimal pressing parameters for fresh soft acid-rennet bifidus-containing cheeses using mathematical modeling methods.

For achieve this goal, the following tasks were formulated and addressed:

To analyze the influence of milk heat treatment and press parameters of fresh soft cheeses on the mass fraction of moisture, structure, and active acidity (pH) of the target products.

To determine the optimal pressing parameters for fresh soft acid-rennet bifidus-cheese that ensure stable moisture, the required level of active acidity, and high probiotic properties of the curd mass.

To conduct industrial approbation of the technology for fresh soft acid-rennet bifidus-cheese using the recommended optimal pressing regimen for the curd mass.

To determine the quality indicators of the fresh soft acid-rennet bifidus-cheese produced using the recommended optimal pressing parameters under industrial conditions.

Research materials and methods

For the optimization of the pressing process parameters (temperature and duration) in the technology of soft bifidus-cheese, the Response Surface Methodology (RSM) was utilized [17, 18, 19, 20]. RSM is a set of mathematical and statistical techniques aimed at modeling and optimizing the parameters of technological processes (or food product formulations) and finding the relationship between experimental series of predictors to optimize the response function $\hat{y}(x,b)$, in its general form, the response function can be described by the following polynomial**:**

$$\hat{y}(x,b) = b_0 + \sum_{l=1}^{n} b_l x_l + \sum_{k=1}^{n} b_k {x_k}^2 + \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} b_{ij} x_i x_j , \quad (1)$$

where $x \in R^n$ is the vector of variables and b is the vector of parameters.

Modeling and processing of the obtained experimental data were performed using the *Statistica 10* (*StatSoft, Inc*., USA) [17].

The criteria for optimizing the temperature and duration of pressing for fresh soft acid-rennet bifidus-cheese were chosen as the moisture mass fraction in the product (*DM*, %) and the active acidity of the curd mass (*pH*) after pressing. Pressing was carried out under a pressure of 1-2kg per 1kg of curd mass, with pressure increasing 30 minutes after the start of pressing and re-pressing every 30 minutes. The independent factors varied in the experiment were the temperature during curd mass pressing (t,ºC) and the pressing duration (τ, min.). To optimize the moisture mass fraction and active acidity in fresh soft acid-rennet bifidus-cheese, a response function was chosen, which takes the form of a second-degree polynomial:

$$DM = b_0 + b_1 \times t + b_{11} \times t^2 + b_2 \times \tau + b_{22} \times \tau^2 + b_{12} \times t \times \tau , \quad (2)$$

$$pH = b_0 + b_1 \times t + b_{11} \times t^2 + b_2 \times \tau + b_{22} \times \tau^2 + b_{12} \times t \times \tau , \quad (3)$$

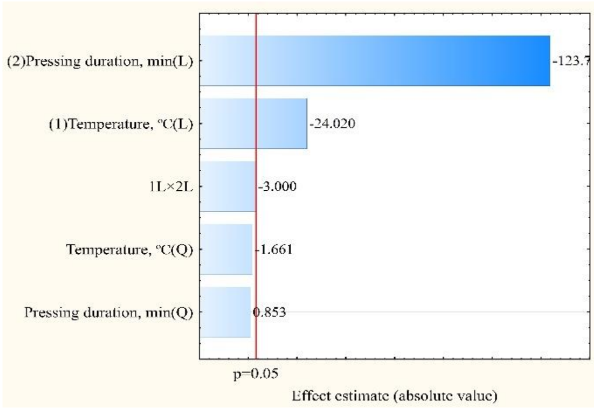
where DM is the moisture mass fraction in the fresh soft bifidus-cheese after pressing, %; pH is the active acidity of the fresh soft bifidus-cheese after pressing, pH; t is the temperature during pressing, ºC; τ is the pressing duration, min; b_0 is the constant; and b_1, b_{11}, b_2, b_{22}, b_{12} are the coefficients for each element of the polynomial.

The experimental studies utilized a complex of physicochemical and organoleptic research methods employed in the dairy industry to determine cheese quality indicators: the mass fraction of moisture and fat (%) were determined by the arbitration method according to DSTU 8552:2015 and the Gerber acid method according to DSTU ISO 1211, respectively; active acidity (pH) was determined by the potentiometric method according to DSTU 8550:2015; organoleptic indicators of the soft bifidus-cheese (taste and smell, appearance, consistency, color, pattern) were determined organoleptically; the quantity of bifidobacteria in the fresh soft bifidus-cheese was determined according to DSTU 7355:2013; the quantity of lactic acid bacteria and bacteria of the *E. coli* group was determined according to DSTU 7357:2013; and the quantity of molds and yeasts was determined according to DSTU ISO 6611/IDF 94:2007.

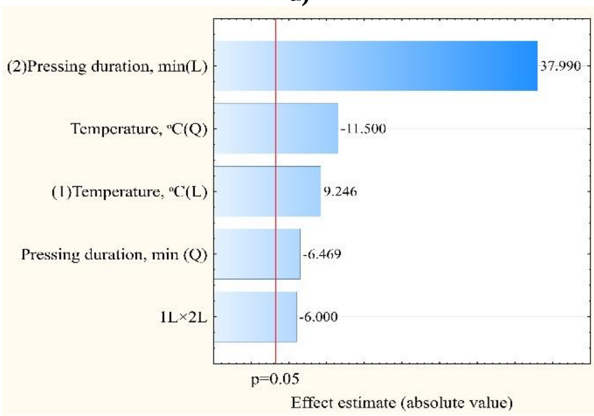
Results of the research and their discussion

The selection of levels and intervals for varying the pressing parameters of the fresh soft acid-rennet bifidus-cheese was carried out considering the exploratory research previously conducted [10]: the pressing duration was varied within 30–90 min, the temperature was varied within 18–24ºC, and the pressing pressure was 1–2kg per 1kg of curd mass. The design matrix and the experimental values of the response functions – active acidity and moisture mass fraction in the fresh soft acid-rennet bifidus-cheese are presented in Table 1.

To verify the significance of the regression coefficients (2) and (3), Pareto charts were constructed, which are presented in Figure 1 (L – Linear effect, Q – Quadratic effect).



a)



b)

Fig. 1 – Pareto diagram: a) – for regression (2); b) – for regression (3)

Table 1 – **Planning Matrix and Response Functions**

Experiment number	Temperature (t)		Pressing duration (τ)		Active acidity of fresh soft bifido cheese, pH	Mass fraction of moisture in fresh soft bifido cheese (DM), %
	Coded level	ºC	Coded level	min		
1	–1	18.9	–1	39.0	5.30	62.0
2	−√2	21.0	0	30.0	5.27	62.9
3	–1	23.1	+1	39.0	5.36	61.8
4	0	24.0	+√2	60.0	5.38	58.6
5	+1	23.1	+1	81.0	5.45	57.5
6	+√2	21.0	0	90.0	5.48	56.4
7	+1	18.9	–1	81.0	5.45	58.0
8	0	18.0	−√2	60.0	5.33	60.5
9	0	21.0	0	60.0	5.41	59.7
10	0	21.0	0	60.0	5.41	59.8
11	0	21.0	0	60.0	5.42	59.7
12	0	21.0	0	60.0	5.41	59.7

The specified Pareto charts show standardized coefficients, sorted by their absolute values. Analysis of the data in Figure 1, a) indicates that the quadratic effects of pressing duration and temperature in regression (2) are not significant, as the columns representing their estimates do not cross the vertical line corresponding to the 95% confidence limit. Therefore, these elements were excluded from regression (2).

The resulting equation with the calculated coefficients is:

$$DM = 68{,}01573 - 0{,}09914 \times t - 0{,}06791 \times \tau - 0{,}00170 \times t \times \tau \cdot \quad (4)$$

Analysis of the data in Fig. 2, b) shows that all coefficients in regression (3) are significant. The resulting equation with the calculated coefficients has the form:

$$pH = 2{,}28720 + 0{,}24154 \times t - 0{,}00508 \times t^2 + 0{,}01376 \times \tau - 0{,}00003 \times \tau^2 - 0{,}00034 \times t \times \tau$$

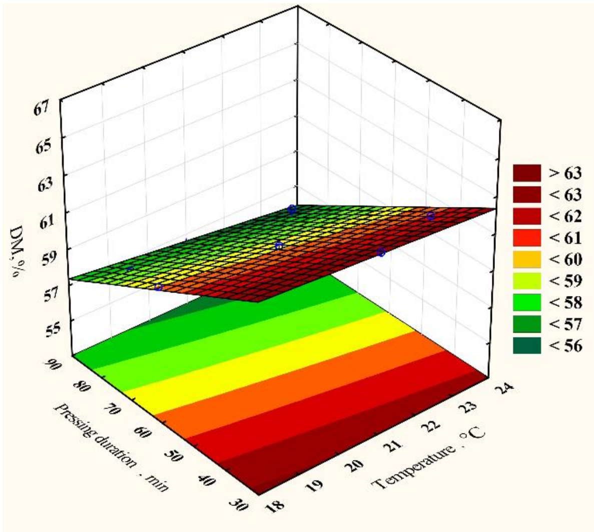
The adequacy of the developed models (4) and (5) was verified using analysis of variance (ANOVA). The significance level of lack of fit for the studied models (p<0,05), and the values of the coefficient of determination - $R^2 = 0.98305$ and $R^2_{adj} = 0.97670$ for model (4), and $R^2 = 0.96323$ and $R^2_{adj} = 0.93260$ for model (5) – indicate that models (4) and (5) adequately describe the experiment.

The combined influence of temperature and duration of pressing on the moisture mass fraction in the fresh soft acid-rennet bifidus-cheese after pressing and its active acidity, described by the polynomials (4) and (5), is presented in Figure 2 and Figure 3, respectively.

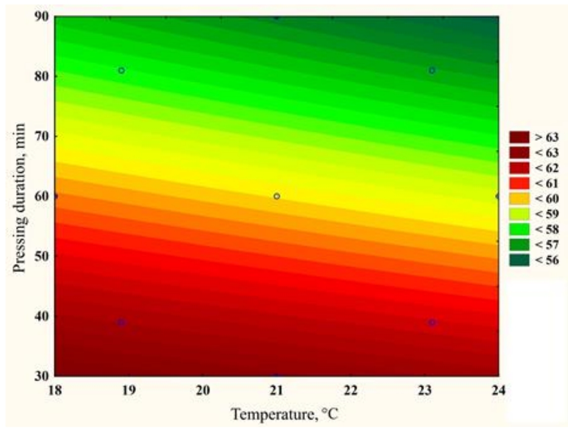
Analysis of the data presented in Figure 2 indicates that the moisture mass fraction in the target product decreases from 63.3% at a temperature of 18ºC and pressing duration of 30min to 55.8% at a temperature of 24ºC and pressing duration of 90min. Processing polynomial (4) in the Statistica 10 software package [17] shows that the desired moisture mass fraction in the fresh soft acid-rennet bifidus-cheese after pressing (59.9-60.0%) is achieved when the curd mass is pressed for 58-59 min at a temperature of 20–21ºC.

The active acidity of the acid-rennet curd during the production of the target product was 5.20–5.21 pH units at the moment of cutting. After forming and self-pressing, the acidity value changed due to the development of the starter microflora and the removal of some whey – to 5.25–5.26 pH and 5.14–5.15 pH, respectively.

During the pressing process, the development of lacto- and bifidobacteria continues within the curd mass, but due to whey removal, the active acidity of the curd mass increases (Figure 3): the minimum pH value (5.19 pH) is observed when pressing the curd mass at a temperature of 18ºC for 30 min, and the maximum pH (5.47 pH) is observed when pressing at 21ºC for 59 min. Further increasing the pressing temperature to 24ºC promotes more intensive development of bifido- and lactobacilli, resulting in lower values of the cheese's active acidity – 5.38 pH when pressing for 59 min and 5.42 pH when pressing for 90 min. Pressing the curd mass in the production of fresh soft acid-rennet bifidus-cheese using the optimal parameters (temperature 20-21ºC, duration 58–59 min) results in a product with an active acidity level of 5.40–5.41 pH (Figure 3).



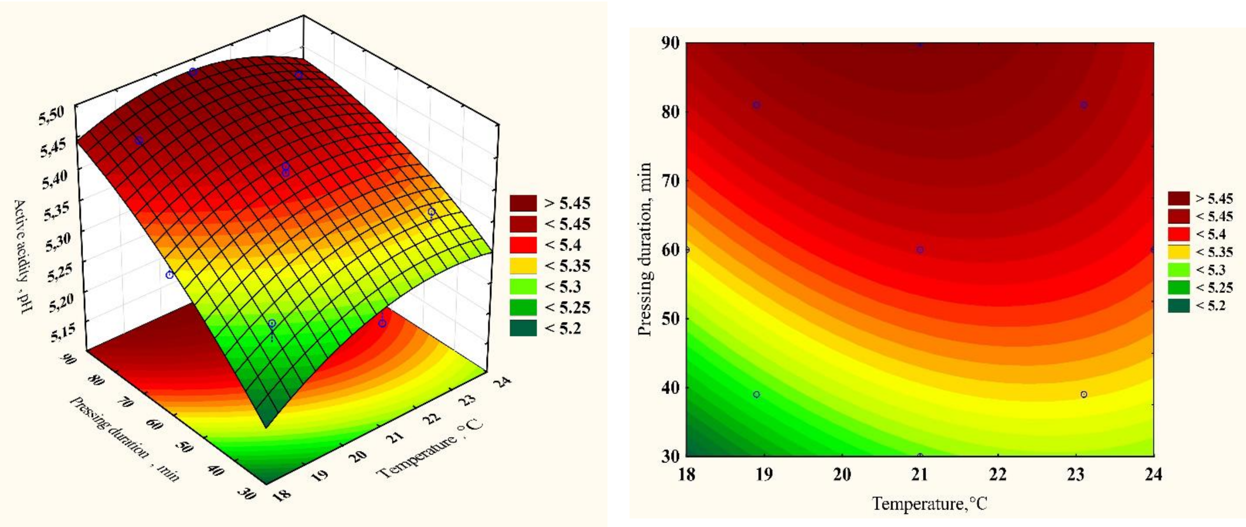
a)



b)

Fig. 2 – The effect of temperature and duration of pressing of fresh soft acid-rennet bifido cheese on the mass fraction of moisture in it: a) – response surface; b) – contour plot

Such acidity of the curd mass is favorable for the further development of bifido- and lactobacilli during salting, drying, packaging, and storage of fresh soft acid-rennet bifido-curd, which will ensure the normal course of microbiological, enzymatic, and biochemical processes and high probiotic properties of the target product.



a) **b)**

Figure 3 – Effect of temperature and pressing duration of fresh soft acid-rennet bifido-curd on the active acidity of the curd mass: a) – response surface; b) – contour plot

Approbation of Research Results.

The research results, obtained in the laboratory of the Department of Milk Technology, Oil and Fat Products and Beauty Industry of the Odesa National University of Technology, were approved in the production environment of SP "Fesenko L.S." (village Nemyrych, Cherkasy region). The determination of organoleptic, physicochemical, and microbiological indicators of fresh soft acid-rennet bifido-curd, obtained under production conditions, was carried out after the completion of the pressing process according to the recommended optimal regime (Table 2, Figure 4).

Table 2 – **Organoleptic, physicochemical, and microbiological indicators of fresh soft acid-rennet bifido-curd produced under the production conditions of SP "Fesenko L.S." (n=3, P≥0,95)**

Indicator name	Characteristics and value of the indicator
Organoleptic indicators	
Taste and smell	Clean, sour milk taste and aroma, without foreign flavors and odors
Appearance	The cheese has the correct shape of a low cylinder, the surface is flat, crisp prints from the perforated mold are clearly visible on the surface, which indicates the correctness of the self-pressing and pressing processes, as well as the removal of whey. The edges are smooth, without breaks, there are minimal irregularities along the periphery, typical of soft cheeses.
Consistency and structure	The consistency is tender, elastic-soft, not brittle, able to hold its shape. The structure is homogeneous, fine-grained, without visible voids or cracks. The surface is slightly shiny, typical of fresh soft acid-rennet cheeses.
Color	Milky white, without yellowness and foreign inclusions
Physico-chemical indicators	
Mass fraction of fat in dry matter of cheese, %	45.5 ± 0.5
Mass fraction of moisture, %	60.0 ± 0.1
Active acidity, pH	5.38 ± 0.01
Microbiological indicators	
Number of viable bifidobacteria cells, CFU/g	$(1.3–3.9) \times 10^{10}$
Number of viable cells of mesophilic lactic acid lactococci, CFU/g	$(2.5–4.0) \times 10^{10}$
Yeast and mold count, CFU/g	< 10
Coliforms in 0.1 g	Absent

Fig. 4 – Fresh soft acid-rennet bifido cheese after pressing

The obtained results confirmed the necessity of using the pressing operation for fresh soft acid-rennet bifido-curd (after the product's self-pressing for 60 min at a temperature of 20–22ºC and the correctness of the selected curd pressing regime – temperature 20–21ºC, duration 58-59 min, as these parameters ensured the production of a finished product with high organoleptic characteristics (Figure 1, Table 2), standardized physicochemical, microbiological indicators, and probiotic properties (Table 2), due to the high concentration of viable bifidobacteria and lactobacilli cells per 1 g of product – $(1.3–3.9)\times10^{10}$ and $(2.5–4.0)\times10^{10}$CFU respectively.

Further research is aimed at substantiating the parameters for salting and storage of fresh soft acid-rennet bifido-curds.

Conclusion

1. The influence of milk heat treatment and fresh soft cheese pressing parameters on the mass fraction of moisture, structure, and active acidity of the target products has been demonstrated. It was determined that when using high-temperature milk pasteurization (temperature 90±1ºC, duration 5±1 min) in the technology of fresh soft cheeses, it is impossible to achieve the standardized moisture level of the curd mass in the product solely through self-pressing. The necessary condition for obtaining fresh soft cheese with a standardized moisture level is self-pressing followed by pressing of the curd mass. The parameters of curd pressing – pressure, temperature, and duration – determine the mass fraction of moisture, active acidity, organoleptic, and microbiological indicators of the finished product.

2. The optimal pressing parameters for fresh soft acid-rennet bifido-curd were determined using the Statistica 10 software package *Statistica 10* (*StatSoft, Inc*., USA) – temperature 20–21ºC, duration 58–59 min, which ensure stable moisture (60%), the required level of active acidity (5.40–5.41 pH), and high probiotic properties of the curd mass.

3. Industrial approbation of the technology for fresh soft acid-rennet bifido-curd, using the recommended optimal curd pressing regime, was carried out at SP "Fesenko L.S." (village Nemyrych, Cherkasy region). The obtained results confirmed the necessity of using the pressing operation for fresh soft acid-rennet bifido-curd (after the products self-pressing for 60 min at a temperature of 20–22ºC) and the correctness of the selected curd pressing regime – temperature 20–21ºC, duration 58–59min, as these parameters ensured the production of a finished product with high organoleptic characteristics, standardized physicochemical, microbiological indicators, and probiotic properties, due to the high concentration of viable bifido- and lactobacilli cells per 1 g of product – $(1.3–3.9)\times10^{10}$ and $(2.5–4.0)\times10^{10}$CFU respectively.

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ОПТИМІЗАЦІЯ ПАРАМЕТРІВ ПРЕСУВАННЯ М'ЯКИХ БІФІДОВМІСНИХ СИРІВ

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Анотація. У статті наведено методологічні основи оптимізації параметрів пресування свіжих м'яких кислотно-сичужних біфідовмісних сирів із застосуванням методології поверхні відклику та статистичного аналізу експериментальних даних у програмному середовищі *Statistica 10 (StatSoft, Inc., USA)*. Обґрунтовано доцільність розроблення рецептур та технологій свіжих біфідо-сирів для оздоровчого харчування, які поєднують традиційну харчову та біологічну цінність білкових молочних продуктів з пробіотичною активністю біфідокультур. Показано вплив параметрів теплового оброблення молока та пресування свіжих м'яких сирів на масову частку вологи, структуру та активну кислотність цільових продуктів. Визначено, що при використанні у технології свіжих м'яких сирів високотемпературної пастеризації молока (температура 90±1ºС, тривалість 5±1хв.) неможливо досягти нормованого рівня вологості сирної маси у продукті лише шляхом самопресування. Необхідною умовою отримання свіжого м'якого сиру з нормованим рівнем вологи є самопресування та пресування сирної маси. Параметри пресування сирної маси – тиск, температура та тривалість – обумовлюють масову частку вологи, активну кислотність, органолептичні та мікробіологічні показники готового продукту. Визначено оптимальні параметри пресування свіжого м'якого кислотно-сичужного біфідо-сиру – температура 20–21ºС, тривалість – 58–59 хв., які забезпечують стабільну вологість (60%), необхідний рівень активної кислотності (5,40–5,41 pH) та пробіотичні властивості сирної маси. Проведено промислову апробацію технології свіжого м'якого кислотно-сичужного біфідо-сиру із використанням рекомендованого оптимального режиму пресування сирної маси на ФОП «Фесенко Л.С.» (с. Немирич, Черкаська обл.). Отримані результати підтвердили необхідність використання операції пресування свіжого м'якого кислотно-сичужного біфідо-сиру (після самопресування продукту протягом 60 хв. за температури 20–22ºС) та коректність обраного режиму пресування сирної маси, який забезпечив отримання готового продукту з високими органолептичними характеристиками, нормованими фізико-хімічними, мікробіологічними показниками та пробіотичними властивостями, обумовленими високою концентрацією життєздатних клітин біфідо- та лактобактерій у 1 г продукту – $(1{,}3–3{,}9)\times10^{10}$ та $(2{,}5–4{,}0)\times10^{10}$ КУО відповідно.

Ключові слова*:* свіжий м'який сир; пресування; оптимізація; поверхня відклику; температура; масова частка вологи; активна кислотність; біфідобактерії; лактобактерії; органолептичні, фізико-хімічні, мікробіологічні показники якості; пробіотичні властивості.