The use of laminaria in the manufacture of soft cheeses

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Abstract. This article presents a research on the use of iodine-containing dietary supplements – kelp in the formulation of soft cheese. The kelp brought in experiences options formula before thermocycling coagulation in the amount of 0.2 % by weight of the formula. In control supplement laminaria has not imposed. All kinds of cheese, both a control, and test samples were manufactured from the same batch of milk as raw material. Technological process of establishing fortified with iodine thermocycling cheese included the following operations: preparation of the milk to thermocycling coagulation; heating; the introduction of the flavoring component and thermocycling coagulation of milk proteins; formation; selfpressing the curd; salting; form of pale malt; cooling; packaging; storage. The results showed that the introduction of kelp powder does not degrade the quality of the cheese but gives it a certain spicy flavour peculiar to seaweed and is a product of functional purpose.

1. Introduction
Diseases associated with iodine deficiency are common noncommunicable diseases in the Mari El Republic [1]. For the prevention of iodine deficiency disorders the products which are rich in iodine are introduced in food. One of the main sources of natural iodine is kelp. It is stated that the use of these algae improves vitamin and mineral content of the product. The kelp is included in the recipes of different food products [2, 3]. Thus, the developed composition comprising a curd base and preventive phyttonutrients in the form of a powder made from dried kelp, Linden flowers, chamomile and rosehips; there is a method of production of drinks from whey, providing for the boiling of Japanese kelp; the technology is also known of preparation of liquid dairy products with seaweed [4].

In this regard, of particular interest was the inclusion of kelp in the composition of soft cheese obtained by thermoacid method for the enrichment of the product with iodine. Termonology method of coagulation of proteins is rarely used, however it has wide prospects in view of several advantages [5, 6]. In particular, the quality of raw materials less demanding than the production of other types of cheese and in this way the components of milk more effectively used [7].

The aim of this work was to develop a formulation of soft cheese without maturation with the inclusion in its composition of seaweed and correction technology of thermocycling cheese at the stage of its introducing.

For the production of soft cheese the raw cow's milk was used that meets the requirements of Technical regulations of the Customs Union "On the safety of milk and dairy products" - 033 - 2013 and State Standart 31449-2013 “Raw cow’s milk. Specifications”, auxiliary materials used as coagulants of milk proteins: calcium chloride, acetic acid, dried seaweed "kelp" produced by experienced Arkhangelsk seaweed plant (Technical Conditions 9284-039-00462769-02).
Studies to determine the physics-chemical characteristics of raw materials and finished product were carried out according to conventional methods.

2. Experimental part

Organoleptic characteristics of milk (color, smell, texture, taste) has been tested in accordance with State Standard 31449-2013 "Milk cow's raw. Technical conditions". Table 1 shows data on the physico-chemical parameters used milk as raw material. Organoleptic kelp was a natural for dried seaweed color: from light-olive to greenish white to dark olive or greenish brown to black-green.

| Indications                        | Requirement the quality of milk in cheese making | The average value of the samples |
|-----------------------------------|--------------------------------------------------|---------------------------------|
| Density, kg/m³ no more            | 1027                                             | 1029                            |
| Acidity, °T                       | 16–19                                            | 18                              |
| Mass fraction of fat, % not less  | 3.2                                              | 4.1                             |
| Mass fraction protein, % not less | 2.8                                              | 3.0                             |
| Mass fraction of Dry nonfat milk residue, % not less | 8.2 | 8.57 |
| Cleanliness group                 | Not lower II                                     | I                               |

Smell – without foreign discrediting signs characterizing dried seaweed. The protein content in 100 g of kelp was 0.9 g; fats – 0.2; carbohydrates – 3.0 per cent. Energy value of the product was 17 kcal.

Production of cheese was made by traditional technology and meet the requirements of the technical conditions of production of cheese "Trump card" (Technical Conditions 9225-001-00511692-2009). All variants of the samples, both control, and test samples were manufactured from raw materials of the same batch of milk as raw material.

The technological process of production of cheese of type "Trump card", with the addition of kelp, included the following operations: reception of milk and the preparation for thermocycling coagulation; heating; addition of flavoring component and termoacid coagulation of milk proteins; formation; selfpressing the curd; salting; form of pale malt; cooling; packaging; storage and quality assessment.

Kelp was introduced into the milk mixture before thermocycling coagulation (options # 2 and # 3). In control simple supplement laminaria has not imposed.

At the beginning of the cheese making process, all raw milk was heated to a temperature of 93–95°C. Next, with constant stirring in experimental samples 0.2% by weight of the dairy mix the seaweed was introduced, in the production of #2 was added dry seaweed, and in the production of N 3 – hydrated beforehand.

Then simultaneously food acetic acid were added in all 3 sample in the amount of 0.15%. For complete deposition of milk proteins, together with the coagulant made aqueous solution of calcium chloride (20 g of anhydrous salt per 100 kg) Produced flocculent clot was kept at a temperature below 90°C for 3 minutes to seal. The pop-up mass laid out in the form. Selfpressing took 2-3 hours (the first hour spent flipping the cheeses every 15 minutes; on the 2nd and 3rd hour – turning was carried out every 20-30 minutes). Further the heads were lowered into the prepared brine (18% of the mass fraction of salt in solution temperatures of 8-12 °C) for 30 minutes.

After salting the cheese was sent to the cooling and subsequent packaging. Cooling of the cheese is carried out at a temperature of 4±2°C and relative humidity (80±5°C). At the stage of formation of the cheese head a difference was already noticed in consistency (figure 1).

In the control sample when selfpressing was taking place a gradual removal of free moisture and the formation of a delicate homogeneous mass; and in the samples with seaweed occurred more rapid
dehydration of the cheese grains, while very thick consistency achieved with a sample of hydrated seaweed.

![Image of cheese grains]

**Figure 1.** The beginning of cheese mass forming.

3. Results and Considerations

Table 2 shows the physics-chemical characteristics of three samples of cheese.

| Indications                | Sample #1 Control | Sample #2 Experiment | Sample #3 Experiment |
|----------------------------|-------------------|----------------------|----------------------|
| Mass fraction moisture, %  | 63.33±0.16        | 57.23±0.12           | 57.09±0.16           |
| Mass fraction of dry       | 36.68±0.16        | 42.28±0.83           | 42.21±0.55           |
| substances, %              |                   |                      |                      |
| Mass fraction of fat in dry| 45.54±0.59        | 46.05±0.20           | 45.67±0.52           |
| substance, %               |                   |                      |                      |
| Acidity, °T                | 70.5±0.71         | 75.52±0.12           | 71.0±1.41            |

Based on data taken from the table, we see that the highest acidity was observed in the sample No. 2 and constitute 72.52±0.12°T. It is on 5.02°T more than in control and 4.52°T more than in model 3. Mass fraction of moisture of cheeses in model 3 was slightly lower in comparison with the control sample on 1.68%. The higher difference in moisture content of 2.54% was noted when comparing the control sample and sample No. 1.

Counting in the dry matter, fat content was within normal limits and were put in the control 45.54±0.59, in the sample N 1 46.05±0.20, and in model # 3 – 45.67±0.52%.

Thus, the introduction of the dietary supplement of seaweed in the manufacture of thermoacid cheese changes in physics-chemical parameters, but do not adversely affect the product as a whole, all indexes are within the limits corresponding to the requirements of State Standart 32263-2013. Tasting score of fresh pickled cheeses are presented in table 3.

For the evaluation of soft cheeses the scoring of 20-point scale evaluation was used for such factors as taste and smell; texture; colour. The maximum number of 10 points was given for taste and smell; 5 points for consistency, and color of the product. At the evaluation of the main indicators of the developed cheese were 10 tasters.
The introduction of kelp as a food supplement in the experimental cheese samples did not reduce the assessment of organoleptic characteristics. When tasting evaluation, all samples were rather highly ranked.

### Table 3. The results of the taste evaluation of fresh cheeses.

| Indications        | Sample #1 Control | Sample #2 Experiment | Sample #3 Experiment |
|--------------------|-------------------|----------------------|----------------------|
| Appearance         | Cheese has no crust. The surface is wrinkled, moist, without mucous | Cheese has no crust. The surface is wrinkled, moist, without mucous. Scrap income supplements present, evenly distributed throughout the cheese surface | Cheese has no crust. The surface is wrinkled, moist, without mucous. Scrap income supplements present, evenly distributed throughout the cheese surface |
| Taste and smell    | Clean sour, with a bright smell of pasteurization. Modestly salty | Clean spicy, peculiar smell of kelp. Modestly salty, spicy flavor | Clean spicy, characteristic made of kelp smell. Modestly salt, spicy flavor |
| Colour             | Weak-creamy, uniform, equal throughout the whole mass | Slightly creamy, equal throughout the whole mass, with green patches of seaweed | Slightly creamy, equal throughout the whole mass, with green patches of seaweed |
| Consistency        | Gentle, homogeneous, moderately dense | Gentle, homogeneous, denser in comparison control and sample N 3 | Gentle, homogeneous, moderately dense, slightly brittle |

So, in the control sample the taste and smell was assessed at 9.7±0.16 points; cheese sample N 2 9.8±0.14 points, and the cheese sample N 3 – 9.5±0.28 points.

It was observed that the most dense texture after molding of the cheese mass had a sample N 2. Some tasters noted a slightly brittle consistence in the cheese sample N 3 and a lighter feel particles of seaweed. In model # 2, the inclusions of particles of seaweed was not felt.

The color of all cheese samples were rated almost equally high 4.9 points. The results of the tasting evaluation are presented in table 4.

Highest total points scored the cheese with hydrated kelp 19.5 points out of 20 possible, while the control sample of cheese scored 19.2 points, and the production of cheese sample N 3 – 19.0 points.

Therefore, dietary supplement of seaweed changed the organoleptic characteristics of the final product to some extend, adding the product savory taste of kelp, slightly crumbly dough consistency with greenish patches of food additives.

### Table 4. Tasting evaluation of the data generated thermoacid cheese.

| Indications        | Sample #1 Control | Sample #2 Experiment | Sample #3 Experiment |
|--------------------|-------------------|----------------------|----------------------|
| Taste and smell    | 9.7±0.16 4.98%    | 9.8±0.14 4.30%       | 9.5±0.22 8.95%       |
| Consistency        | 4.6±0.17 11.23 % | 4.8±0.14 8.78%       | 4.6±0.23 15.20%      |
| Colour             | 4.9±0.11 6.45 %  | 4.9±0.12 6.45%       | 4.9±0.11 6.45 %      |
| Total score        | 19.2          | 19.2             | 19.5              |


4. Summary
On the basis of the investigations made we came to the conclusion that for thermocycling enrichment of cheese with iodine should be recommended the use as a functional food supplement seaweed – kelp in the amount of 0.2% by weight of the formula of milk mixture.

References
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