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The Cultivation of Kefir Corns in Cheese Milk Whey.

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ABSTRACT

The article presents the results of experiments on cultivation of kefir corns in cheese milk whey with the aim of rational using of secondary dairy raw materials and biomass obtaining of kefir corns for next using in animal husbandry. Obtaining cheese whey and cultivation of kefir corns were carried out in the laboratory of the Department of Technology of Meat and Dairy Products Mari State University. Positive results were obtained for 3 types of cheese milk whey (natural, fat-free, skimmed salted),a precipitant increase of biomass of the kefir corns was observed. All types of whey can be used as an environment for the cultivation of kefir corns biomass, which can be used in production calf milk replacer for other fodder means in animal husbandry.

Keywords: whey, kefir, secondary waste, animal husbandry

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INTRODUCTION

Analysis of domestic and foreign records shows that, in general, the problem of rational using of milk whey is not completely solved in any country. The tendency to avoid the pollution of rivers and reservoirs make producers of dairy products in different countries look for the most acceptable ways of industrial processing of whey.

Average, about 9 kg of whey is released in production of 1 kg of cheese, which is not always subjected to further processing, although it can be a full-value raw material after isolation of its constituents (proteins, lactose).

Milk whey contains the sources of carbon nutrition, readily assimilated by many types of microorganisms, and various growth factors, that puts it in the row of the most valuable nutrient medium for obtaining products of microbial synthesis. Very important fact is that the using of whey does not require special complex preparations, and the culture medium after growing microorganisms in it can be used for food and feed purposes without treatment.

One of the possible ways of using whey is using it as an environment for the obtaining kefir corns biomass in the production of calf milk replacer for animal husbandry.

MATERIALS AND METHODS

The leaven on kefir corns is a symbiosis that is formed in long-term development of lactobacilli, yeast, acetic acid and aroma-forming bacteria. Microorganisms of kefir corns behave as a holistic organism: they grow together, reproduce, transmit their structure and properties to the next generations of corns [1].

Kefir grains are called corns because in milk they increase in size just like pop-corn. In fact, kefir corns do not grow, but increase in volume due to the deposition of milk casein on them. Proteins of kefir, coagulating and forming clots, trap the microflora of kefir inside, including lactic acid bacteria and yeast.

There is some experience in using of kefir corns grown on whey and their using in cheese-making in recent works of D.V.Zipaev [2, 3, 4].

The obtaining cheese whey and cultivation of kefir corns was carried out in the laboratory of the Department of Technology of Meat and Dairy Products Mari State University. The cheese whey, obtained during the production of «Brynza» brine-ripened cheese, was divided into three types: natural, fat-free (obtained by separation of natural whey) and salted (obtained by adding salt to fat-free whey - in quantity of 1.5% of the volume of whey). Kefir corns were cultivated in different type of various medium under the following regimes:

- ratio of kefir corns and whey 1:40;
- ambient temperature of cultivation is 20 ± 2 ° C;
- periodicity of replacing the culture medium - 24-26 hours.

Before the introduction of kefir corns, the whey was pasteurized at a temperature of 72-76 ° C with an exposure time of 20 seconds, cooled to a temperature of 20 ± 2 ° C. The titrated acidity of the medium prepared for cultivation was determined every day (pasteurized three-species cheese whey) in order to account for the increase in acidity [5].

For the set up the experiment there were used 36 liters of whey at all (12 liters of whey of each type, respectively). As containers for the cultivation of kefir corns 700 ml glass beakers were used, wrapped with lightproof material (cardboard) and covered with gauze covers. The glasses were washed daily with a solution of hot water and baking soda to prevent the growth of the secondary microflora on their walls.

All types of whey were tested every day before and after cultivation, its acidity, density, amount of dry substances, protein mass fraction, mass fraction of casein and mass fraction of lactose were determined. Whey was poured into a glass beakers with a pre-prepared sample of kefir corns in the ratio of kefir corns:

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whey - 1:40. The entire process, including the preparation of whey for pouring and determination of the titrated acidity of the used and used medium, as well as the washing of instruments and equipment, took an average of 2-3.5 hours.

At the beginning of the experiment, the amount of kefir corns in each batch was 10 grams. Every 7 days after the beginning of the experiment there was weighing on the technochemical weights of the biomass of kefir corns after cultivation. At the end of the experiment, the medium after cultivation was analyzed by physicochemical and organoleptic parameters. All received facts were entered into the tables and processed statistically.

RESULTS AND DISCUSSION

The control of the increase of kefir corns in the biomass was carried out by periodic weighing of seven days during a month. The results are shown in Table 1 and at the Figure 1.

The increase of kefir corns mass at the average was 53% in natural whey, 47% in fat-free unsalted, and 38% in skimmed salted. The largest increase for the month (5.2 times) was observed in the batch with natural whey, slightly lower (4.5 times) - in medium with fat-free whey. The increase of the mass of corn, cultivated in skimmed salted whey was minimal, but a 3.6-fold increase was noted here. Thus, in developing the technology for growing a mass of kefir corns for industrial purposes, it is possible to use secondary dairy raw materials of cheese factories, i.e., whey, both cheese natural and fat-free and salted.

Table 1: The increase of kefir whey biomass throughout the experiment

Cultivationperiod, weeks	Mass of the kefir corns in mediums of cultivation, g		
	Natural	Fat-free	Skimmed salted
Start of experience	10,00±0,21	10,00±0,22	10,00±0,21
1	20,21±0,90	18,81±0,11	16,56±1,00
2	30,14±0,91	28,11±0,42	22,78±0,13
3	40,90±0,37	36,25±0,08	28,98±0,50
4	51,70±0,16	44,39±0,05	35,66±0,12

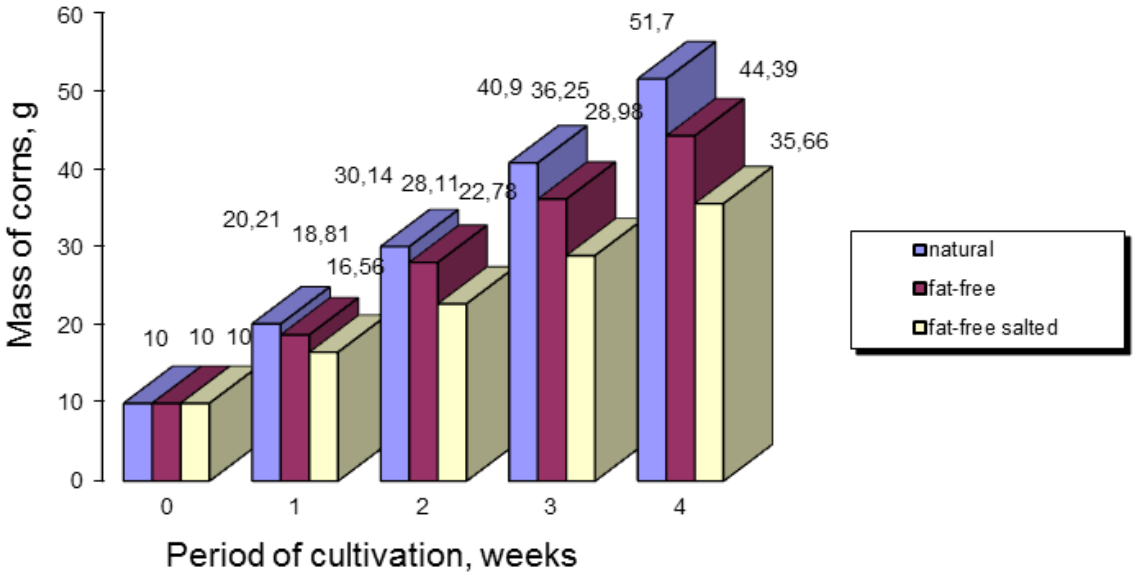

Figure 1: The increase of kefir whey mass, cultivated in different mediums.

We analyzed the medium after the daily cultivation of kefir corns for organoleptic (color, odor, consistency) and physico-chemical (titratable acidity, density, mass fraction of moisture, solids, milk fat, protein, lactose, ash, of dry non-fat milk solids) indicators in three replicates.

The color of all three types of whey from light green to light yellow, the smell is pure, sourish (intrinsicfor milk whey), consistency is a homogeneous liquid with the presence of flakes, without extraneous impurities. The results of physico-chemical researches are presented in Table 2.

Towards to the original whey, the percentage of moisture in all mediums has slightly increased. The mass fraction of milk fat remained unchanged. The total amount of dry matter, as well as mass fraction of dry non-fat milk solids, protein, lactose, ash was declined.

Density has decreased, but titratable acidity has increased due to the fact that the least stable components of whey are subjected to enzymatic hydrolysis as a result of the action of lactic acid bacteria. As a result, titrated acidity increases, pH decreases, whey turbidity increases.

Table 2: Physico-chemical parameters of medium after the cultivation

Indicators	Cheese pasteurized whey		
	Natural	Fat-free	Skimmed salted
Mass fraction,%: –Moisture	93,58±0,60	95,12±0,26	91,68±0,64
–Protein	1,17±0,04	0,86±0,01	1,05±0,09
–Milkfat	0,49±0,07	0,05±0,01	0,05±0,01
– Lactose	3,96±0,15	3,11±0,45	4,46±0,34
– Ash	0,80±0,19	0,86±0,21	2,28±0,09
– Drymatter	6,42±0,60	4,88±0,26	7,94±0,64
– Of dry non-fat milk solids	4,76±0,67	3,97±0,26	6,74±0,64
Titratable acidity, ° T	53,00 ±0,71	49,17±0,74	48,17±0,89
Density, kg / m^3	1023,4±0,31	1023,4±0,92	1028,6±0,50

According to the results, it can be concluded that the acidity of the whey of three types (natural, fat-free, skimmed salted) was conformed with the rates at which the most rapid growth of the kefir corns biomass (10-12 ° T) is observed.

Also, we checked the titrated acidity of the whey every day after cultivation [6]. The analysis of the obtained information is presented by us for the first week, and not for the entire experiment. This is due to the fact that the results on the titrated acidity of the medium during the entire cultivation of the kefircorns biomass were almost identical (Table 3).

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Table 3: Titratable acidity of medium after the cultivation, ° T.

Repeatability of analysis	Typeofused whey		
	Natural	Fat-free	Skimmed salted
1st week:			
Day 1	53,00	52,00	48,50
Day 2	54,00	53,00	49,50
Day 3	56,00	48,00	48,17
Day 4	54,00	48,00	48,17
Day 5	50,00	48,00	48,00
Day 6	51,50	49,17	48,00
Day 7	52,00	49,50	48,00
On average per day:	52,93±0,80	49,71±0,83	48,43±0,22

As can be seen from Table 3, the greatest increase in titrated acidity is observed in natural whey, the lowest - in skimmed salted. In our opinion, this is due to the fact that natural whey has a higher content of dry maters to other types of whey, that increases the acidity of the medium in cultivating the biomass of kefir corns [7].

The content in skimmed salted whey of 1.5% table salt antagonistically affects to the development of biochemical processes during the cultivation of kefir corns, thereby the acidity of the medium reduces.

CONCLUSION

The vital activity of microorganisms largely depends on mediums conditions. When the conditions change, the metabolic processes in the microbial cells of the kefir corns can be appropriately reconstructed, and this often has a temporary reversible character. The ability to reversibly change of physiological properties arose in microorganisms as a result of evolutionary adaptation to the changing conditions of the external environment. The study of the relationship between the certain medium's conditions and specific aspects of the life of microorganisms makes it possible to regulate the growth, development and metabolism of the latter. Supporting the necessary conditions for the cultivation of kefir corns, it is possible to control the course of enzymatic processes to a certain extent and accumulate biomass with given properties.

Thus, all types of whey can be used as a medium for cultivation of kefir corns biomass, which can be used for the production of calf milk replacer and for other fodder products in the animal husbandry.

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