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USE OF ESSENTIAL OILS IN DAIRY PRODUCTS 3. ESSENTIAL OIL OF DILL (ANETHUM GRAVEOLENS)

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Abstract: *There are dairy products that were developed with an enriched composition through the addition of limseeds, sesameseeds, out flakes, honey, and essential oil of dill (Anethum graveolens).*

The effect of the additives on the process of the acidifying, syneresis, and the development of lactic acid bacteria was researched. It was found that they are good for the lactic acid process. The prepared products have very good organoleptic properties and can be successfully used for the purposes of functional food.

Keywords: *dairy products, titratable acidity, syneresis, lactic acid bacteria*

INTRODUCTION

Food is important to maintain and protect human health. A lot of traditional products (milk, fruits, vegetables, etc.) contain components with potential health benefits. New ones based on these food are being developed and they increase or join their useful components because of their benefits or desirable physiological effects. Today functional food based on milk takes up two-thirds of the total volume of the functional foods on the market as dairy foods are foods with naturally balanced composition of the essential nutrients such as protein, fats, carbohydrates, minerals, and enzymes. In the lactic acid products might be used: probiotics, dietary fibres (soluble and insoluble), vitamins, mineral elements, polyunsaturated fatty acids, essential oils, antioxidants, inulin, lactulose, etc. (Betored, E., et al. 2011, Cardarelli, H., et al. 2007, Kajiwara, S., et al. 2002, Panesar P. S. 2011, Roberfroid M. B. 2002).

In our previous work (Damyanova, St., et al. 2011) were prepared and examined dairy products containing linseed and sesame seeds, oat flakes, and honey. It was found that the products

have the properties of functional food and the additives have positive effect on the development of lactic acid process.

Interest in recent years is the use of essential oils in food products in order to increase their absorption by the human body, to enrich the composition, to improve the aroma, to prolong the durability, etc. (Amirdivani S., & Baba A. 2011, Georgiev, E., & Stoyanova, A. 2006, Gutierrez J., et al. 2009, Mohamed, S., et al. 2013, Thabet H., et al. 2014).

The results from our previous studies (Kostova, I., et al. 2014) show that the essential oil of dill has got antimicrobial activity but it does not inhibit the development of the lactic acid bacteria in dairy starter cultures.

The purpose of this work is to develop and examine dairy products with enriched composition by adding linseed, sesame seeds, oat flakes, honey and dill oil.

EXPOSITION

Materials and methods

The studies were conducted in laboratory conditions with cow milk which was obtained from Razgrad region, northeastern Bulgaria.

The physicochemical parameters of raw milk (fat, solids-nonfat (SNF), density, added water, protein) were determined by the milkanalyzer EKOMILK Company BULTEH 2000.

The microbiological parameters of the raw and pasteurized milk were tested by conventional methods (Slavchev, D., et al. 2003).

The fermented milk product with set coagulum (control) was prepared by a classical technology with the symbiotic starter culture of the strains *Lactobacillus delbrueckii subsp. bulgaricus* and *Streptococcus thermophilus* purchased by the company Selur Pharma Ltd.

The control sample was obtained by traditional technology for yogurt (Dimitrov, T., et al. 2008).

The studied samples (№ 1 to 3) were prepared by traditional technology by adding: oat flakes (6%), linseed (4%), sesame seed (2%) and honey (4%) (№ 1); essential oil (№ 2); the combination of the ingredients of the first and second examined samples (№ 3).

The additives used were purchased from the market, the essential oil of dill was obtained in laboratory conditions (Kostova, I., et al. 2014). The amount of the oil is 0.8 mg/kg of final product, which was consistent with the known literal data and our previous studies (Georgiev, E., & Stoyanova, A. 2006, Kostova, I., et al. 2014).

The prepared dairy products were analyzed on chemical, microbiological and organoleptic characteristics:

- The dynamics of the lactic acid process was monitored by the determination of the titratable acidity (°T) (Dimitrov, T., et al. 2008, Slavchev, D., et al. 2003).
- Microbiological research - total number of viable lactic acid bacteria - *Lactobacillus delbrueckii subsp. bulgaricus* and *Streptococcus thermophilus* were carried out by growing on the synthetic medium M17 and MRS (Merck) methodology of IDF (IDF-Standard 122C: 1996, IDF-Standard 149A: 1997).
- The organoleptic assessment of the lactic acid products was carried out according to BNS 15612-83 (BNS (Bulgarian National Standard) 15612-83).

RESULTS AND DISCUSSION

The milk used for the experimental work meets the requirements of raw cow milk (Commission Regulation (EC) No853/2004, Regulation № 4 the Ministry of Agriculture and Food 2008). Figure 1 presents the dynamics of the lactic acid process.

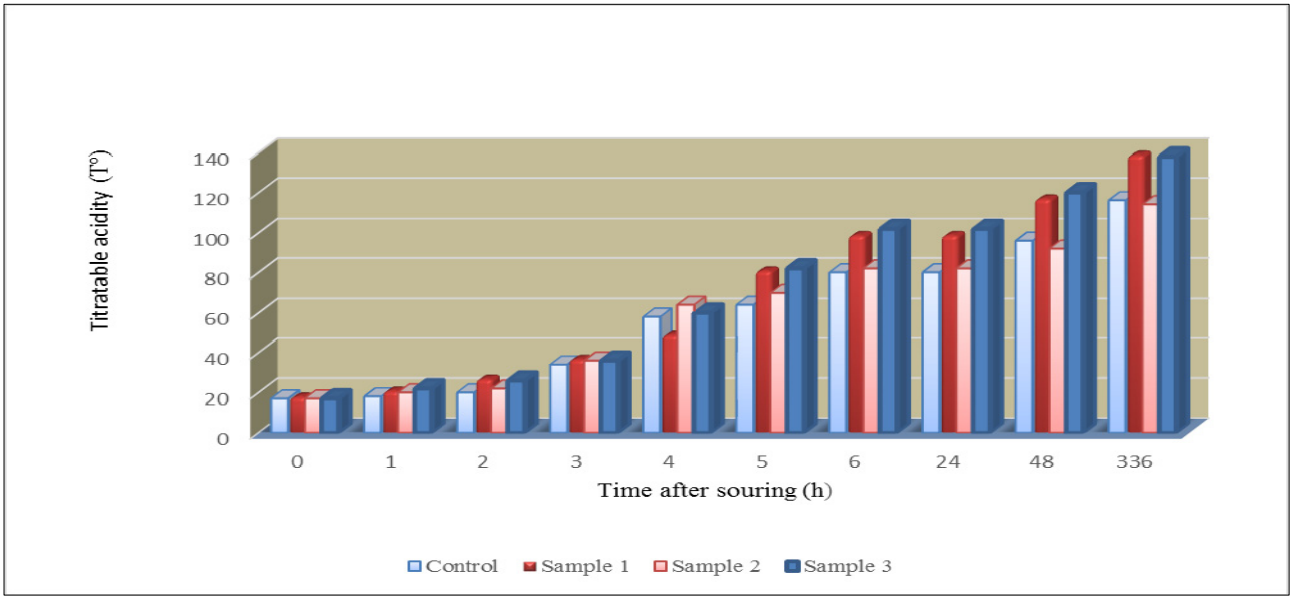

Fig. 1. Dynamics of the lactic acid formation

The results show raising in the titratable acidity in all four samples as a result of the metabolism of lactic acid bacteria. More active lactic process was found in the samples with additives and when they were combined with dill oil. For these samples the tendency to increase the acidity was maintained until the end of the study period as the 336th hour (14 days of the storage) the titratable acidity was higher than the control. The acid formation in these samples with added essential oil is the same like the control sample.

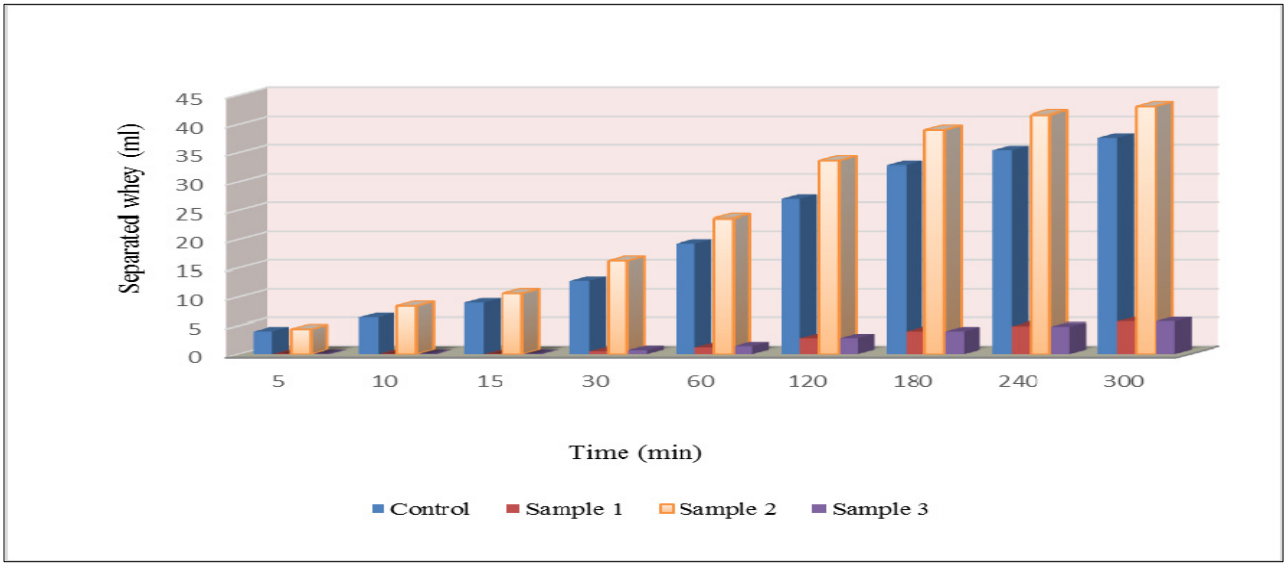

Fig. 2. Syneresis of the fermented milk products

Figure 2 presents the results for the values of the syneresis of the prepared dairy products. The amount of the separated whey for 5 hours is highest in the control sample (31.6 mL) and in the milk with dill oil (34 mL). Significantly less whey was separated in sample № 1 (4.4 mL) and in sample №3 (2.6 mL), because of the ability of oat flakes and seeds to connect the water that leads to reduction of the aqueous phase of the milk.

The effect of the additives on the development of the lactic acid bacteria *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus* in the tested products are shown in Figures 3 and 4.

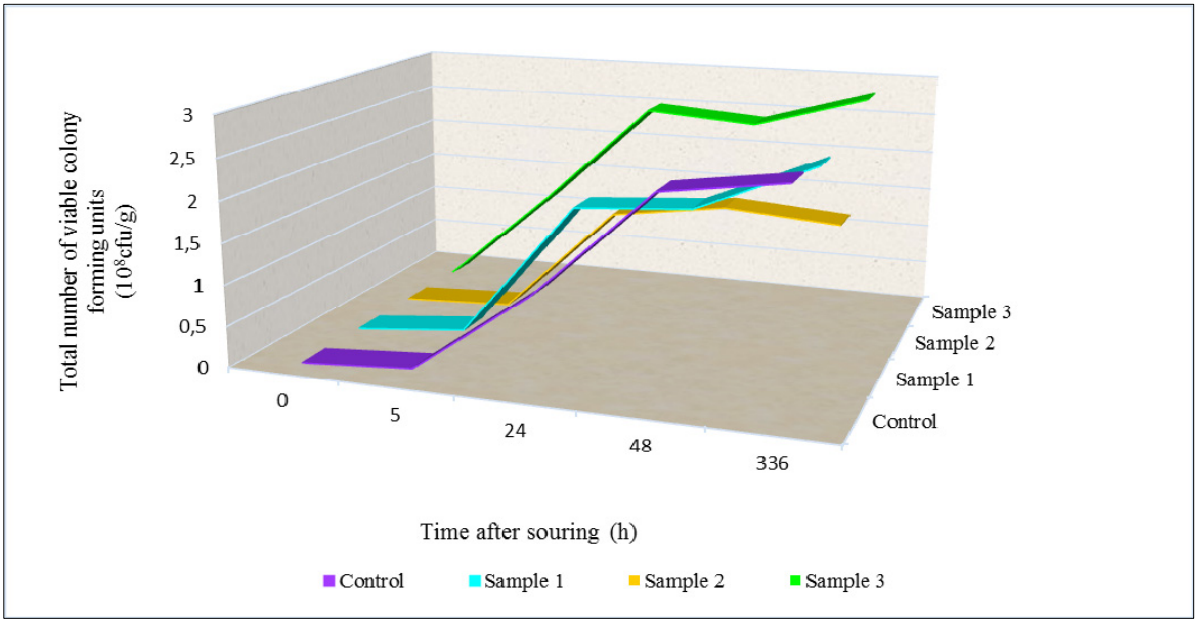

Fig. 3. The dynamics of the growth of *Lactobacillus delbrueckii subsp. bulgaricus*

It is obvious from the data obtained that with the exception of the dairy product with dill oil, all the rest samples during the first 24 hours cells of *Lactobacillus delbrueckii* subsp. *bulgaricus* growth actively. After that to the end of the study period (14th day) the number of the viable cells was kept relatively invariable as in the dairy products with additives in combination with dill oil (№1 and №3) it was higher content of the nutrients needed for the development of the lactic acid bacteria. The obtained results correspond to the prescribed values for the titratable acidity (Fig. 1).

In the examined samples the number of the viable cells of *S. thermophilus* was increased to 24th hour. Then the speed of the growth was kept relatively unchanged as at the end of the study period the number of cells increases faintly (Fig. 4). The lactic acid bacteria *S. thermophilus* develop more speed in the samples with the additives and they reach the largest number in combination of all additives and the essential oil (sample №3).

The dill oil to a certain extent inhibits the development of the lactic acid bacteria *L. delbrueckii* subsp. *bulgaricus* and *S. thermophilus,* that is related to its antimicrobial activity (Georgiev, E., & Stoyanova, A. 2006).

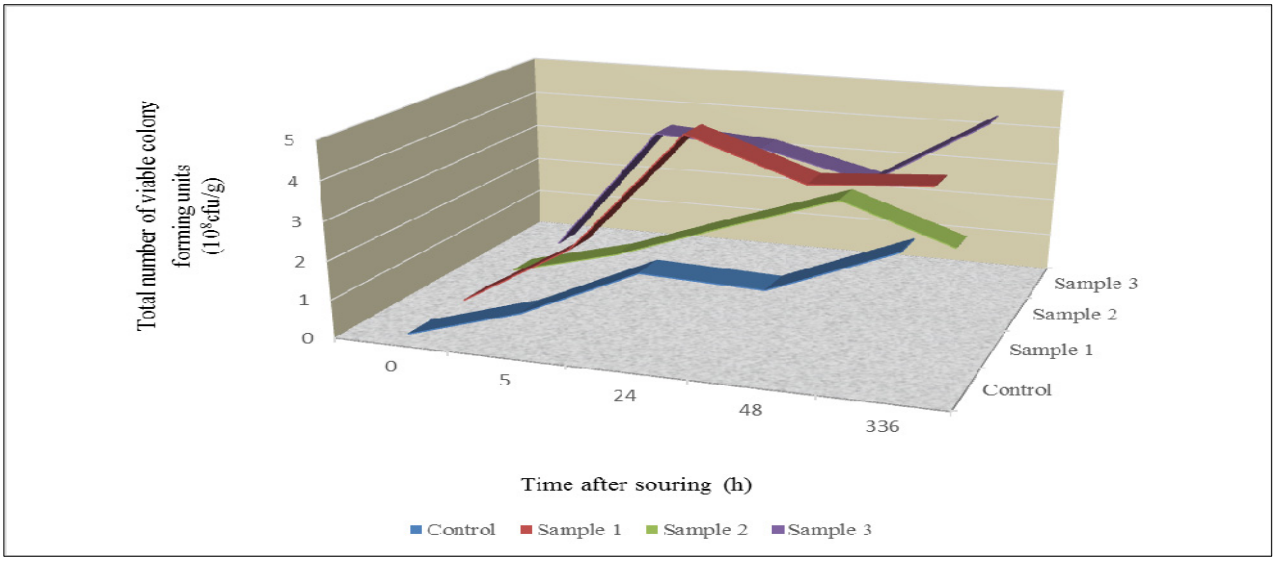

Fig. 4. The dynamics of cell growth of *Streptococcus thermophilus*

The data from the qualification of the obtained dairy products according to organoleptic parameters are presented in Table 1. The obtained products were characterized with very good and balanced lactic acid taste, thick and smooth coagulum, homogeneous consistence and structure.

Table 1. Organoleptic indicators

Parameters	Control Sample	№ 1	№ 2	№ 3
Surface	smooth	smooth	smooth	smooth
Colour	white with cream-coloured shade	white with cream-coloured shade	white with cream-coloured shade	white with cream-coloured shade
Type of coagulum	thick, smooth	thick, smooth	thick, smooth	thick, smooth
Structure after cutting	smooth surface with slight serum separation	smooth surface without serum separation	smooth surface with slight serum separation	smooth surface without serum separation
Consistency after whipping the coagulum	homogeneous, like cream	homogeneous, like cream	homogeneous, like cream	homogeneous, like cream
Taste and flavor	tasty specific lactic acid	tasty specific lactic acid with a hint of the used nuts and honey	tasty specific lactic acid with a hint of dill	tasty specific lactic acid with a hint of the used nuts and honey, and dill

CONCLUSION

Dairy products with added oat flakes, sesame seeds, linseeds, honey and essential oil of dill (*Anthum graveolens*) were prepared. The combination of these additives affects adversely on the speed of lactic acid process, syneresis, and their organoleptic parameters. The products have got the specific for the fruits of dill taste and aroma.

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