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Contents

Effect of bee products on the structural, mechanical and physico-chemical properties of yogurt

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Abstract

Introduction. Is proposed to increase yogurt's biological and probiotic value by addition of bee products. Is determined by their effect on consumer properties.

Materials and Methods. The raw materials used normalized milk starters of sublimation drying acacia honey royal jelly, bee pollen. The rheological parameters were determined using rotational viscometers. The degree of syneresis was determined by filtering Water-retaining capacity by centrifugation. To determine the relative viscosity using viscometer expiration.

Results and discussion. The study of effective viscosity of the samples showed that the addition of honey to yogurt in an amount 5% increases the effective viscosity during a slight fracture of the bunch at 28 ± 1% and decreases during the high fracture at 72,5±2,5%. Samples with honey and royal jelly had destroyed the fastest and had the highest degree of fluidity – 0,451, but their thixotropic ability was higher than in controls. Adding honey to yogurt, royal jelly and pollen in combination helps to stabilize the viscosity and accelerate recovery after the destruction of its structure. This will help improve the consistency after pouring by the reservoir way of production. The least resistance to moisture exchange had samples with a mixture of honey and royal jelly – 42 ml WRC = 52%. The highest – with 5% of honey – 39 ml,и WRC – 55%, respectively. The sample containing honey, royal jelly and pollen had a not the highest properties syneresis of the studied samples yogurt – 40ml и WRC – 54,5%, but all parameters exceeded the control. Titrated acidity of the yogurt samples with five percent of honey grew faster during 9 days compared with the control and other samples. On the sixth day of storage, it was more than 150° T. This is above the allowed level for 10° T.

Conclusions. The best performance had a prototype, which was composed of honey, royal jelly, pollen in number – 5; 0,2 and 0,15%, respectively.

Introduction

The primary structure of yogurt, its preservation and restore during the production and during the warranty period depends on the processes of the bunch and acid coagulation of casein. Formation of a clot is done by converting the colloidal system of milk free-dispersed state (sol) in conjugate-dispersed (gel). Small amount of thixotropic-negotiable bonds is typical for yoghurt.

Structural and mechanical (rheological) properties, water-retaining capacity and syneretic properties of yogurt depend on the composition of milk, modes of thermal and mechanical treatment and in many ways - on the dose and type of biological agents that provide the milk fermentation. Stimulate their development in yogurt can using natural bee products [1-3].

Fillings and dose of their application affects yoghurt consistency. The extent and nature of this influence is investigated sensory and using more objective – instrumental and analytical methods.

Russian scientists have conducted research in this area and found, among other things, the positive effects of honey (honey mass fraction in the final product – 10%) on the organoleptic properties of the product prototypes [4].

Krasnikova L.V. and others. (2011) studied the rheological properties of the functional whey dessert with honey adding and found that the organoleptic and structural and mechanical properties of a dessert improved [5].

The data with the results of study of the effect of royal jelly on rheological, synergetic properties and acidity in fresh yogurt and during its storage have not been found either in Russian or Ukrainian sources.

The aim of the research was to determine the effect of bee products for texture and acidity of the yogurt.

Objects served:

- prototypes yogurt obtained in the laboratory using natural biologically dresser – honey, royal jelly and bee pollen from cow's milk with a mass fraction of fat – 3,2%;
- control samples obtained in similar conditions without adding any extenders.

Materials and Methods

The present study was performed at the National University of Life and Environmental Sciences of Ukraine, Kiev.

The raw materials used to produce yogurt were: normalized milk base, starters of sublimation drying series of DVS-culture, acacia honey, frozen royal jelly, bee pollen crushed to a particle size of 5-10 microns.

The fat content regulated to the desired level in a milk, homogenized using pressures of 15 MPa, and at a temperature range between 55 and 65° C. Milk was inoculated with 2.5% of commercial yogurt culture (containing *Str. Thermophilus, Lbm. Acidophilum* and *Lbm.bulgaricum* in the ratio 1:1:1) at 30-40° C °C. Samples were incubated until pH 4.6 was reached. Samples were immediately cooled to 4°C and held at that temperature during 14 days.

The fat content regulated to the desired level in a milk , homogenized using pressures of 15 MPa, and at a temperature range between 55 and 65°C. Then Milk was heated 87±2° C for 12±3min.

To determine the relative viscosity using viscometer expiration.

Measurements of viscosity were done with rotational viscometer, as formerly described by Denin Djurdjević et al., 2001 [6]. Cylindrical measuring system S1 were used with cylinder diameter ratio of 0,94.

Strain rate varied from 0 to 140s^{-1}. Counting was performed in 10 min. after turning on the appropriate speed at 8-10° C.

The degree of syneresis was determined by filtering 100 ml of sample yogurt (on the sixth day of storage) through a filter paper for 3 h with a temperature of 10±2° C.

Water-retaining capacity (WRC) by centrifugation at separation factor F = 1000 [7]. A sample of yogurt (10 cm^3) was centrifuged for 60 minutes with 15 min. step and measured the volume of centrifugate in ml.

Active acidity measured by pH-meter Checker. All samples startered until they reached the acidity of 102,5 T and pH – 4,5 (fresh). Cooled to 10±2° C and traced the growth dynamics of acidity on the third, sixth and ninth days of storage in the refrigerator in a sealed package.

All studies were performed three times repeatability. Statistical analysis of the experimental data was performed using Excel, confidence level of $P \leq 0,05$.

Result and discussion

Results of the study of effective viscosity of the samples showed that the addition of honey to yogurt increases the effective viscosity during a slight fracture of the bunch at 28 ± 1% and decreases during the high fracture at 72,5 ± 2,5%.

Samples with honey and royal jelly had destroyed the fastest and had the highest degree of fluidity – 0,451, but their thixotropic ability was higher than in controls. Adding honey to yogurt, royal jelly and pollen in combination helps to stabilize the viscosity and accelerate recovery after the destruction of its structure. This will help improve the consistency after pouring by the reservoir way of production. As a result of relative viscosity (Fig. 1) becomes clear that the investigated samples can be attributed to pseudo-plastic fluids [6].

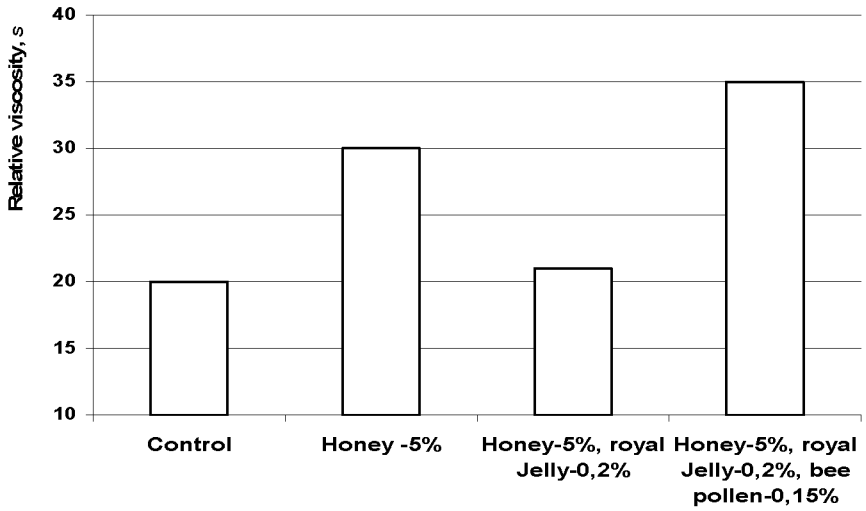
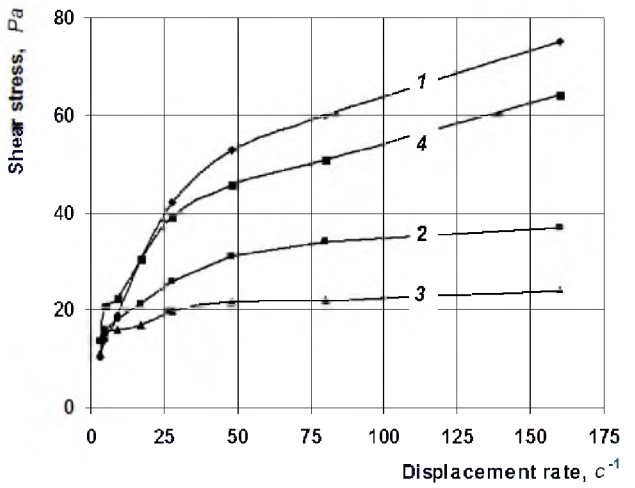


Fig. 1. Relative viscosity of different yogurts

All samples had the same character flow (Fig. 2). However, for the structure destruction of investigated samples it requires less efforts at 40,7 ± 26% than for the controls. This is positive for technological process of yoghurt manufacture with bee products by reservoir method.



1 – Control;

2 – Honey -5%;

3 – Honey – 5%, royal jelly – 0,2%;

4 – Honey – 5%, royal jelly – 0,2%, bee pollen – 0,15%.

Fig. 2. Shear stress of yogurt samples

The research capacity of dairy clusters to give moisture independently and under the influence of centrifugal force (Fig. 3) showed that the least resistance to moisture exchange had samples with a mixture of 5% of honey and 0,2% of royal jelly– syneresis = 42 ml, WRC = 52%. The highest – with 5% of honey – 39 ml, 55%, accordingly. The sample containing 5% of honey, 0,2% of royal jelly and 0,2% of pollen had a not the highest properties syneresis of the studied samples yogurt, but all parameters exceeded the control.

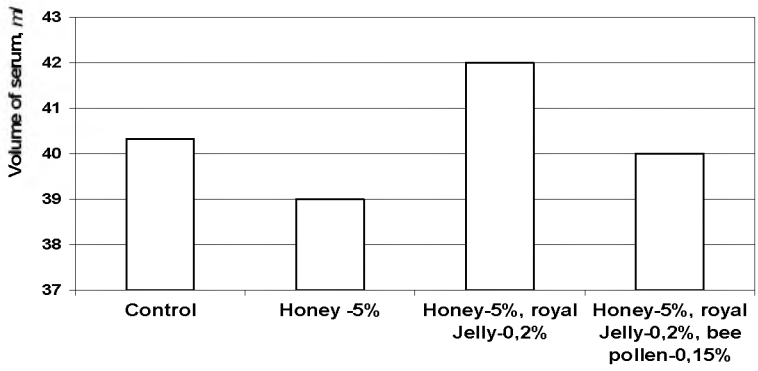


Fig. 3. Synergistic properties of yogurt samples

Bee products affect the growth rate of the acidity of yogurt (table). Titrated acidity of the yogurt samples with five percent of honey grew faster during 9 days compared with the control and other samples. On the sixth day of storage, it was more than 150° T. This is above the allowed level for 10° T.

Growth acidity of yogurt with different content of fillers

Treatments	Storage periods (days)			
	Fresh	3	6	9
Titrated acidity, °T				
Control	102,5	115,0	129,0	147,5
Honey – 5%	102,5	131,5	150,4	196,3
Honey – 5%, royal Jelly – 0,2%	102,5	117,8	137,0	160,9
Honey – 5%, royal Jelly – 0,2%, bee pollen – 0,15%	102,5	117,8	125,3	139,3
Active acidity, pH				
Control	4,50	4,37	4,20	3,93
Honey – 5%	4,50	4,28	4,00	3,30
Honey – 5%, royal Jelly – 0,2%	4,50	4,35	4,04	3,37
Honey – 5%, royal Jelly – 0,2%, bee pollen – 0,15%	4,50	4,32	4,21	4,03

The combination of honey, royal jelly and pollen stabilized the acidity of investigated yogurt specimen and for nine days held it within the framework of acceptable level [8]. Perhaps this is due to antibacterial properties of royal jelly and bee pollen stimulating properties.

Yogurt made with the addition of some bee products and their combinations, acquired new physical and chemical properties and properties of consistency. The best performance had a sample, which was composed of honey, royal jelly, pollen in number – 5; 0,2 and 0,15%, respectively. He is best restored after the destruction of the structure of the bunch, had the desired viscosity, well maintained in the structure of the bunch moisture. The acidity of the yogurt that contains: natural bee products, initially tends to accelerate growth, compared to the control sample acidity. This is probably due to stimulating properties of fillers made with respect to the dairy process.

Conclusions

Treatment of normalized bovine milk bee products, may be, a promising direction to improve of yogurt. Honey, royal jelly and bee pollen showed significant effect on rheological and sensory characteristics of yogurts.

From the foregoing results it could be concluded that, yoghurt can be successfully made using 5% bee honey, 0.2% royal jelly, 0,2% bee pollen. The final product is best restored after the destruction of the structure of the bunch, had the desired viscosity, well maintained in the structure of the bunch moisture.

The acidity of the yogurt with natural bee products has a tendency to accelerate growth , compared to the control sample acidity.

This is probably due to stimulating properties of fillers made with respect to the dairy process. The data obtained will form the basis biotechnology of yogurt with bee products.

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