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THE INFLUENCE OF SELECTED PREBIOTICS ON THE GROWTH OF LACTIC ACID BACTERIA FOR BIO-YOGHURT PRODUCTION

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Background. Prebiotics are a category of nutritional compounds grouped together, not necessarily by structural similarities, but by ability to promote the growth of specific beneficial (probiotic) gut bacteria. Fructooligosaccharides (FOS) and inulin are among the most famous prebiotic compounds. In order to improve viability of probiotic bacteria during storage, fermented food should be supplemented with prebiotics.
Material and methods. Yoghurts were produced from skimmed milk powder and prebiotics (FOS, inulin or resistant starch), which were added at concentrations of 1%, 2% and 3%. Yoghurts were stored in +4°C for three weeks. Every week each kind of fermented drink was examined in order to check the growth of lactic acid bacteria. Apparent viscosity and texture of bio-yoghurt were determinated during refrigerated storage.
Results. The FOS and inulin addition to yoghurt caused an increase in the numbers of all bacteria in comparison to control yoghurt obtained without addition of prebiotics. The viable counts of *Str. thermophilus*, *Lb. acidophilus* and *Bifidobacterium* sp. when 1% of FOS was added to yoghurt were about 9 log cfu/g, 7.8 log cfu/g and 7.7 log cfu/g, respectively. In the presence of 1% of inulin, streptococci and bifidobacteria reached the growth at the level 8.8 log cfu/g and 7.5 respectively. Hardness and adhesiveness of yoghurt obtained with addition resistant starch increased systematically during 21 days of refrigerated storage.
Conclusions. The numbers of lactic acid bacteria in obtained bio-yoghurts were sufficient in 97% of samples (10^6-10^9 cfu/g) according to FAO/WHO protocols. Generally, viability of bacteria was sufficient for 14 days and then their numbers decreased but usually not below 10^6 cfu/g. Prebiotics as FOS and inulin added to bio-yoghurt exhibited stimulatory effect on growth *Lb. acidophilus* and *Bifidobacterium* sp. Addition of prebiotics caused an increase in apparent viscosity and hardness (in case of FOS) and decrease in syneresis of obtained bio-yoghurts.

Key words: LAB, storage, yoghurt, texture, syneresis

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INTRODUCTION

Yogurt is a common dairy product consumed in the world. The addition of probiotic bacteria to yoghurt improves its functionality and health effects. Probiotics such as *Lactobacillus* and *Bifidobacterium* spp. are bacterial members of the normal human intestinal flora, that exert several beneficial effects on human health and well-being. They produce short-chain fatty acids and improve the intestinal microbial balance, resulting in the inhibition of bacterial pathogens, reduction of colon cancer risk, improving the immune system and lowering serum cholesterol levels [Fooks et al. 1999, Tannock et al. 2000, Saarela et al. 2002, Tamime and Robinson 2007]. The efficiency of added probiotic bacteria depends on dose level and their viability must be maintained throughout storage, and they must survive the gut environment [Kailasapathy and Chin 2000, Vinderola et al. 2000, Aryana et al. 2007]. In order to improve these features of probiotic bacteria, fermented food should be supplemented with prebiotics. There are non-digestible food ingredients that beneficially affect the host by selectively stimulating the growth and/or activity bacteria in the colon (probiotics). Fructooligosaccharides (FOS) and inulin are among the most famous prebiotic compounds [Buriti et al. 2007, Cardarelli et al. 2007].

FOS and inulin improve bioavailability of minerals such as calcium, magnesium and iron, increase activity of beneficial live active cultures and inhibition of harmful bacteria in the digestive tract. Inulin facilitates the digestion of high protein diets, retards fat absorption, provides roughage preventing constipation, remains in digestive tract providing satiety without carrying of extra calories, lowers blood cholesterol and triglycerides, helps with blood glucose control for diabetics and decreases incidence of colon cancer [Aryana et al. 2007]. These substances are added to milk products in order to support the viability of probiotic strains to make these products, synbiotics, beneficial for consumers' health.

It is very important that the following products maintain sufficient probiotic content at the end of shelf-life, because probiotics are by definition live microorganisms and consumers expect their beneficial effects after ingestion of the products [FAO/WHO 2002]. Probiotic dairy product should contain at least 10^6-10^7cfu/mL of viable probiotic bacteria at the time of consumption [Boylston et al. 2004]. However, in fermented products various probiotic lactobacilli and bifidobacteria show the decline in their viability during storage [Akalin et al. 2007, Paseephol and Sherkat 2009].

The aim of this work was to research the influence of selected prebiotics: FOS, inulin and resistant starch on the growth and viability of bacteria for bio-yoghurt production (mixed culture ABT1) and settle the most beneficial probiotic-prebiotic combination, which fulfills the therapeutic requirement of presence 10^6 cfu/ml (g) for all storage period of the synbiotic products. The effect of selected prebiotic addition on rheological properties and syneresis of bio-yoghurt during refrigerated storage was also investigated.

MATERIAL

The commercial lyophilised culture (ABT1) containing a mix of *Streptococcus salivarius* ssp. *thermophilus* (ST), *Lactobacillus acidophilus* (LB) and *Bifidobacterium* sp. (BB) strains were used for yoghurt production. They were kindly delivered by courtesy of Chr. Hansen (Cząstków Mazowiecki, Poland). It was in lyophilized form prepared for direct inoculation of milk.

Skim milk powder (SMP) containing 35.06% of protein, was purchased from Biomlek (Chełm, Poland) and the commercially produced oligofructose (FOS) (Orafti®P95, Belgium), Frutafit® – inulin (IN) (Sensus, Holland), resistant starch Hi – Maize 1043® (RS) (National Starch & Chemical, Germany) were used.

METHODS

Bio-yoghurt production

Skim milk powder was reconstituted at 30°C with moderate mixing using a magnetic stirrer. The dispersions were refrigerated at 4°C for 24 h to allow full hydration of the powders. Yoghurt was prepared from skim milk and prebiotics, which were added at concentrations: 1%, 2% and 3%. The mixtures were placed in a glass jars and heated at 85°C for 30 min [Gustaw et al. 2006, 2009]. They were allowed to cool to the incubation temperature (40-42°C), subsequently inoculated with ABT1 bacteria culture (0.1 g/1000 cm^3) at 40°C and fermented until pH 4.7 was reached. After incubation yoghurts were stored in +4°C for three weeks. Every week each kind of fermented drink was examined in order to check the growth of lactic acid bacteria.

Microbiological analysis

Serial decimal dilutions in sterile peptone water (0.1%) were prepared from every yoghurt kind (1 g sample). Then 1 cm^3 of aliquots was plated over selected culture media as follows: M-17 agar for ST, M-MRS agar for LB and TPY agar for BB. The method of count plate was used in two repetitions. ST and LB were incubated in 37°C aerobically for 48 h and BB was incubated anaerobically (GasPak System – Oxoid) in the same temperature and time.

Determination of pH

The pH of yoghurt was measured using a digital pH-meter (model CP-401, Elmetron, Zabrze, Poland).

Syneresis index

The syneresis index (determined in triplicate) was considered as the amount of drained liquid (g) per 100 g of sample after 24 h storage at 4°C.

Rheological measurements

Apparent viscosity of the yoghurts was measured at 20°C using a Brookfield DV-II+ viscometer (Stoughton, MA, USA) with a Helipath countershaft (F) at 0.3 rpm. The texture analyses were performed by two sequential penetration events (TPA test) at the crosshead speed 1 mm/s, 70% deformation, separated by a relaxation phase of 30 s using a TA-XT2i texture analyser (Stable Microsystems, Goaldming, UK) equipped with cylindrical probe (1 cm diameter).

Statistical analysis

Analysis of variance (ANOVA) was applied on chemical and microbiological data using the Statistica 8.0 program. Differences among means were tested for significance by Tuckey's test. The level of significance was set at 95%.

RESULTS AND DISCUSSION

The pH values of yogurt samples during refrigerated storage are shown in Figure 1. The pH values for all yogurt types ranged from 4.62 to 4.20 during the storage. Average pH value of yoghurt obtained with the 1% probiotic addition was found to be lower than the control samples. Yoghurts obtained with the 1% IN and RS addition exhibited the lowest pH values throughout the storage period. Akalin and others [2004, 2007] also reported that pH values of yoghurt containing fructooligosaccharides was found to be lower than yoghurt without supplementation during refrigerated storage for up to 28 days. For all samples analysed, the pH values decreased throughout the storage period. Similar tendencies for pH values were observed for commercial yogurts containing probiotics during their storage [Shah et al. 2000].

The changes in the viable counts of ST, LA and BB in probiotic yoghurts during refrigerated storage are presented in Figures 2-8. The analysis showed that the amount of lactic acid bacteria (LAB) was at the required level, between 10^6-10^9 cfu/g from the beginning of bio-yoghurt production to the termination of refrigerated storage. Results obtained for control yoghurt showed that ST was present at the level 8.3-8.8 log cfu/g during storage time. The amount of LA was 7.2 log cfu/g but after two weeks it decreased to 6.5 log cfu/g. The numbers of BB were at the level 6.5-7.1 log cfu/g and sustained stable. Vinderola et al. [2000] during commercial yoghurts examination showed that *Str. salivarius* ssp. *thermophilus* was present at the level about 9 log cfu/g for entire storage time (4 weeks) at 5°C. They also report that counts of probiotic strains decreased during storage that is convergent with observations in this work. Vinderola et al. [2000] observed that initial counts of probiotic bacteria ranged from 10^6 to 10^7 cfu/ml, while the final counts were lower than 10^4 cfu/ml.

Carr and Ibrahim [2005] investigated the level of bifidobacteria in commercial yoghurts in North Carolina. In 76% of products viable cultures of these probiotics were found, but their populations were at or below 6.0 log cfu/ml [Carr and Ibrahim 2005]. Bolin et al. [1998] analysed the viability of *L. acidophilus* strains in milk cultures in refrigeration conditions (7°C) and showed that the number of bacteria significantly decreased during storage time (35 days). The mean difference between initial count (7.97 log cfu/ml) and end count (6.21 log cfu/ml) was 1.76 log cfu/ml [Bolin et al. 1998]. Dave and Shah [1997] researched the viability of bacteria from commercial starter cultures during yoghurt manufacture and storage. Two of them contained *Str. salivarius* ssp. *thermophilus*, *Lb. acidophilus* and *Bifidobacteria*. Authors observed that the number of lactic cocci increased up through 5-15 days and then decreased, but for 35 days the level of these bacteria was above 10^8 cfu/g. The count of *Lb. acidophilus* was in the range of 1.8-3.8 × 10^7 cfu/g after incubation but decreased during storage and recommended level of 10^6 cells was maintained only for 20-25 days. Bifidobacteria were observed on the level 10^6 or 10^9 cfu/g depending on the kind of starter culture and the medium used for enumeration. Decrease of the number of these bacteria was also observed but it was above the recommended limit of 10^6 thought the storage period [Dave and Shah 1997].

The FOS addition to yoghurt caused an increase in the numbers of all bacteria in comparison to control yoghurt obtained without addition of prebiotics (Fig. 2-3). The viable counts of ST, LA and BB when 1% of FOS was added to yoghurt were about 9 log cfu/g, 7.8 log cfu/g and 7.7 log cfu/g, respectively. FOS at the concentration of 1% was useful for LA because the amount of these bacteria was stable for entire storage time (Fig. 3). At higher FOS concentrations (2 and 3%) significant decreases in all bacteria numbers were observed during refrigerated storage (Fig. 2, 3).

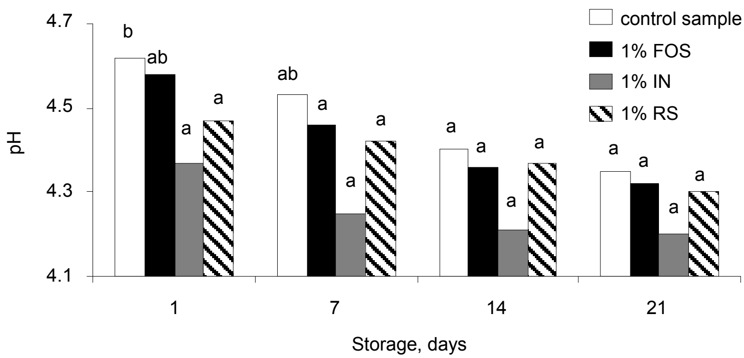

Fig. 1. The changes pH of yoghurts obtained with addition of 1% prebiotics during storage. Different superscript letters (a-b) denote significant difference

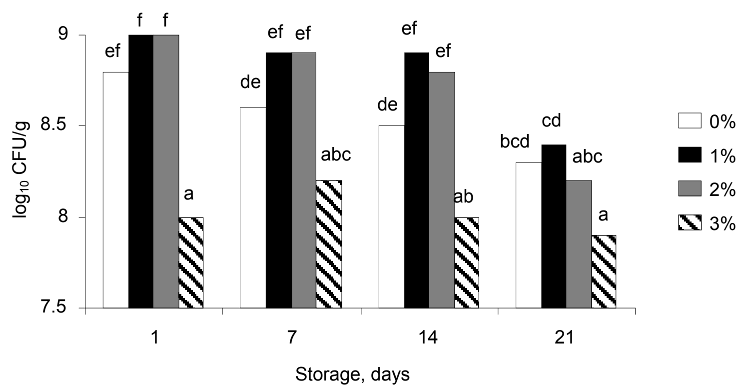

Fig. 2. Growth of *Streptococcus thermophilus* in yoghurts with different concentrations of FOS during storage. Different superscript letters (a-f) denote significant difference

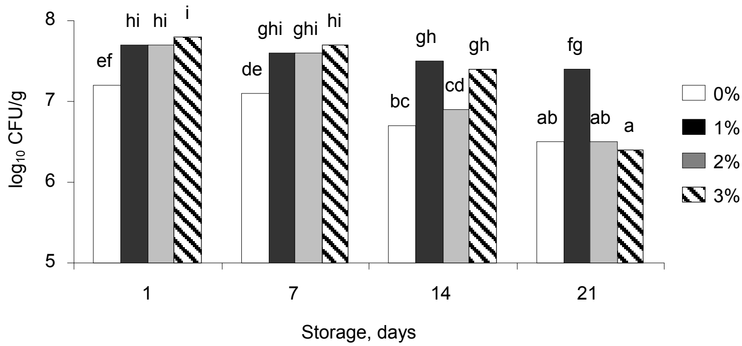

Fig. 3. Growth of *Lactobacillus acidophilus* in yoghurts with different concentrations of FOS during storage. Different superscript letters (a-i) denote significant difference

The changes in the viable counts of ST, LA and BB in probiotic yoghurts obtained with the IN addition during refrigerated storage are presented in Figure 4, 5 and 6. Growth of all bacteria was greatly enhanced in yoghurts obtained with this prebiotic. In the presence of 1% of IN, streptococci and bifidobacteria reached the growth at the level 8.8 log cfu/g and 7.5 respectively. In the case of yoghurt obtained with the 1% IN addition, the number of viable ST counts significantly increased after 7 days of storage (Fig. 4).

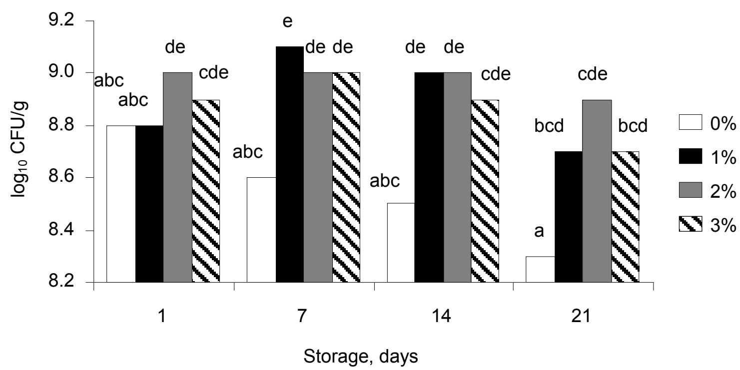

Fig. 4. Growth of *Streptococcus thermophilus* in yoghurts with different concentrations of inulin during storage. Different superscript letters (a-e) denote significant difference

The yoghurts obtained at all IN concentrations, viable counts of ST decreased at about 0.1-0.4 logarithmic cycle during storage (Fig. 4). The growth of LA was the highest for yoghurt obtained with the 1 and 2% of IN after 1 day of cold storage (7.7 and 8.1 log cfu/g, respectively). The number of viable LA counts increased in the case of yoghurts containing IN after 7 days. During the subsequent storage the significant decrease in LA amount about 2 log cfu/g was observed (Fig. 5). Generally, the survival rate of BB during the storage of yoghurts containing IN was more satisfactory than

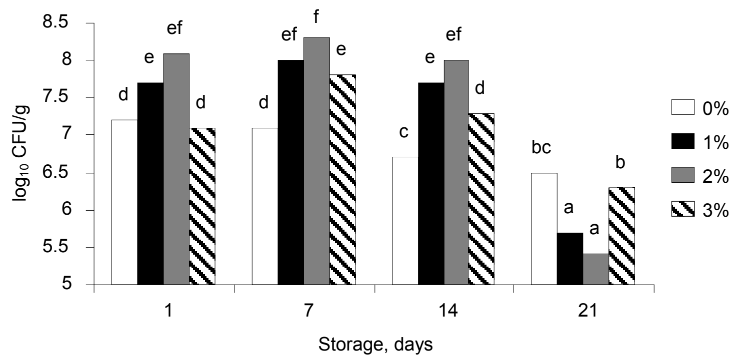

Fig. 5. Growth of *Lactobacillus acidophilus* in yoghurts with different concentrations of inulin during storage. Different superscript letters (a-f) denote significant difference

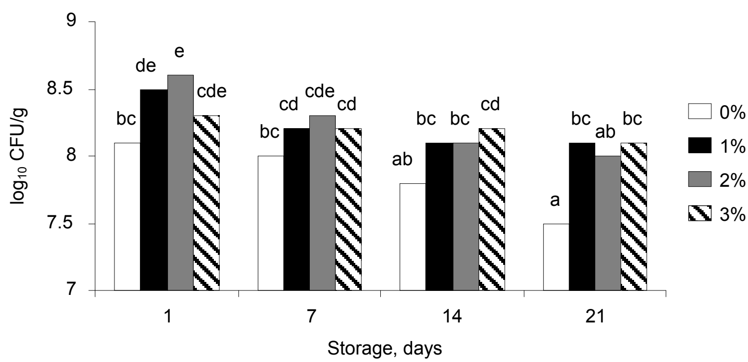

Fig. 6. Growth of *Bifidobacterium* sp. in yoghurts with different concentrations of inulin during storage. Different superscript letters (a-e) denote significant difference

in control yoghurt (Fig. 6). The viable counts of BB for yoghurts obtained with IN were higher by over 0.5 log order than those in control yoghurt after 3 week storage. In the paper by Aryana et al. [2007], the influence of inulin chain length on *Lb. acidophilus* growth was investigated. The researchers observed that chain length of prebiotic demonstrated the beneficial effect on *Lactobacillus* counts. Similar observations were noted by Aryana and McGrew [2007] who analysed the viability of *Lb. casei* in yoghurts with oligofructose and inulin during refrigerated storage. At the beginning of storage the number of *Lb. casei* was about 7.5 log cfu/g regardlessly of kind of prebiotic used and it declined to the level 6.9 log cfu/g [Aryana and McGrew 2007]. In the paper by Ozer et al. [2005], the effect of lactulose (0.25%, 2.5%) and inulin (0.5%, 1.0%) supplementation on the growth of *Lb. acidophilus* LA-5 and *B. bifidum* BB-02 in yoghurt was studied. Authors showed that the used prebiotics did not affect the growth of starter yoghurt bacteria and *Lb. acidophilus* LA-5, however they stimulated the growth of *B. bifidum* BB-02 [Ozer et al. 2005]. Akalin et al. [2004] studied the growth of yoghurt bacteria and bifidobacteria in yoghurts containing chicory fructooligosaccharide during storage at 4°C for 28 days. The decrease in all bacteria was observed during storage period, but bifidobacteria were affected by strain type and the presence of FOS. The level of *B. animalis* was at the level 3.59-2.25 × 10^7 cfu/g when FOS was added to yoghurt [Akalin et al. 2004]. In the studies of Jukham et al. [2007] *Lb. acidophilus* growth was significantly more satisfactory with oligofructose in comparison to inulin, but the number of prebiotic strain was lower than in the control yoghurt and decreased during refrigerated storage by 1 log unit in control yoghurt and by 0.4 and 0.3 log unit in the presence of inulin or oligofructose, respectively. The count of *Lactobacillus* was on the level 10^7-10^8 cfu/g in yoghurts with the 2-5% inulin and 1-5% oligofructose addition [Jukham et al. 2007].

It has been shown that resistant starch at the concentrations of 1-3% was beneficial for lactic acid bacteria growth for yoghurt production. The number of viable of LA and BB significantly increased for yoghurts obtained with the 2-3% RS addition (Fig. 7, 8).

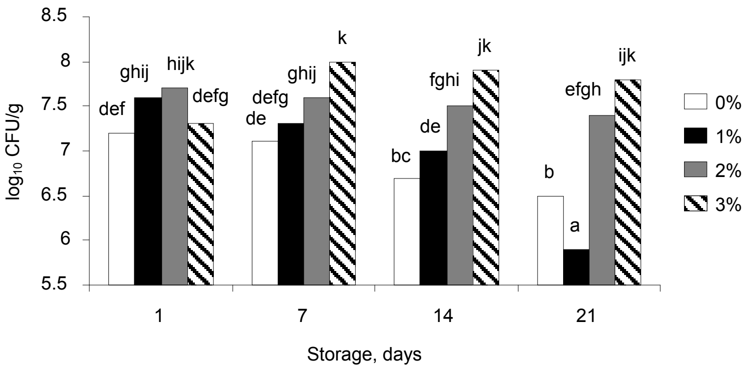

Fig. 7. Growth of *Lactobacillus acidophilus* in yoghurts with different concentrations of resistant starch during storage. Different superscript letters (a-k) denote significant difference

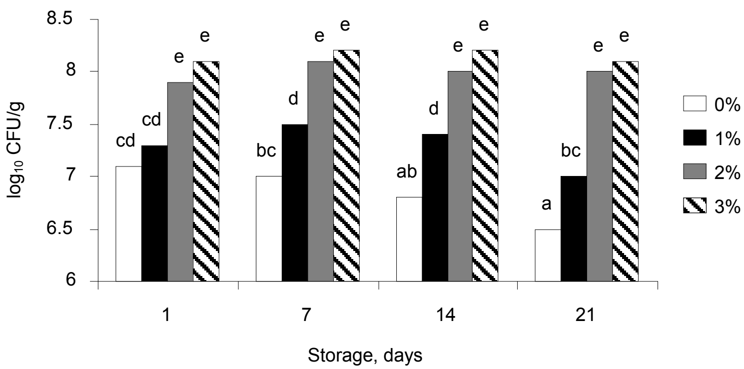

Fig. 8. Growth of *Bifidobacterium* sp. in yoghurts with different concentrations of resistant starch during storage. Different superscript letters (a-e) denote significant difference

During refrigerated storage the number of these lactic bacteria in yoghurts was quite stable. High amylase corn starch added to yoghurt deteriorated a *Lb. acidophilus* LAFTI L10 and *Lb. casei* LAFTI L26 growth in comparison to inulin [Donkor et al. 2007].

Dairy products with a lowered fat content and aimed at lowering the daily energy intake may lack the mouthfeel associated with foods containing fat. Inulins, oligofructose and resistant starch changed rheological properties of low-fat set yoghurt (Table 1).

Table 1. Apparent viscosity, instrumental texture parameters and syneresis of yoghurts produced with addition of different prebiotics during 21 days of cooled storage. Different superscript letters (a-c) denote significant difference

Parameter	Storage days	Type of yoghurt			
		control yoghurt	1% FOS	1% IN	1% RS
Hardness TPA, N	1	0.39^{a} ±0.02	0.47^{a} ±0.04	0.39^{a} ±0.02	0.32^{a} ±0.02
	7	0.42^{a} ±0.03	0.46^{a} ±0.03	0.39^{a} ±0.03	0.37^{b} ±0.01
	14	0.44^{a} ±0.03	0.46^{a} ±0.03	0.39^{a} ±0.03	0.37^{b} ±0.02
	21	0.45^{a} ±0.02	0.47^{a} ±0.02	0.39^{a} ±0.02	0.41^{b} ±0.01
Adhesiveness, mJ	1	0.8^{a} ±0.1	0.8^{a} ±0.1	1.2^{a} ±0.2	0.7^{a} ±0.0
	7	1.3^{b} ±0.2	1.0^{a} ±0.1	1.0^{a} ±0.2	0.9^{b} ±0.1
	14	1.1^{ab} ±0.2	1.0^{a} ±0.0	0.9^{a} ±0.0	1.0^{bc} ±0.1
	21	1.1^{ab} ±0.2	0.9^{a} ±0.1	0.9^{a} ±0.1	1.1^{c} ±0.0
Apparent viscosity, Pa·s	1	0.79^{a} ±0.05	0.84^{a} ±0.07	0.75^{a} ±0.01	0.65^{a} ±0.01
	7	0.78^{a} ±0.03	0.83^{a} ±0.08	0.82^{a} ±0.08	0.75^{b} ±0.01
	14	0.76^{a} ±0.08	0.81^{a} ±0.06	0.84^{a} ±0.08	0.84^{c} ±0.03
	21	0.78^{a} ±0.03	0.82^{a} ±0.05	0.84^{a} ±0.07	0.90^{c} ±0.06
Syneresis, %	1	5.3^{c} ±0.3	4.1^{b} ±0.1	4.9^{c} ±0.8	1.5^{b} ±0.1
	7	4.2^{c} ±0.5	3.8^{b} ±0.3	2.9^{b} ±0.5	1.2^{b} ±0.1
	14	2.9^{b} ±0.6	2.2^{a} ±0.4	1.4^{a} ±0.0	1.2^{b} ±0.3
	21	1.3^{a} ±0.1	1.8^{a} ±0.2	1.4^{a} ±0.1	0.4^{a} ±0.0

The composition of processing milk, especially content of dry matter, protein and carbohydrates is one of the basic factors influencing sensory features, texture and rheological properties of yoghurt. The 1% FOS addition caused significant increase in apparent viscosity and hardness of bio-yoghurt in comparison to control yoghurt. It could be assumed that FOS is the part of the structural network being formed during fermentation and structuring of yoghurt. In the case of other probiotics, no improvement in terms of rheological properties was observed for yoghurts (Table 1). Domagała et al. [2005] examined the influence of storage time of yoghurt obtained with the 2% oat – maltodextrin addition. They observed that the apparent viscosity of examined yoghurts decreased during storage time. As reported by Tamime and Robinson [2007], higher contents of solids in the yoghurt promote greater viscosity of final products.

Hardness and adhesiveness of control yoghurt increased systematically from 0.39 N to 0.45 N after 21 days of refrigerated storage. The similar effect was observed in the case of yoghurts obtained with addition of 1% of RS. Texture of yoghurts obtained with the 1% of FOS and IN was similar during 21 days of refrigerated storage (Table 1). The investigations of sensory quality changes, rheological properties, texture of natural yoghurts and yoghurts with addition of different carbohydrates during storage were carried out by many authors [Akalin et al. 2004, 2007, Domagała et al. 2005, Ksenkas 2010, Paseephol and Sherkat 2009]. Hardness and adhesiveness of yoghurts obtained with the 2% oat – maltodextrin addition increased during refrigerated storage for 21 days [Domagała et al. 2005]. Similar results were obtained during storage of probiotic Torba yoghurt [Ksenkas 2010].

The control yoghurt exhibited high value of syneresis (Table 1). The volume of separated whey systematically decreased from 5.3% to 1.3% after 21 days of refrigerated storage. The 1% prebiotic addition caused decrease in yoghurt syneresis. The most significant decrease in syneresis was observed during refrigerated storage of yoghurt obtained with the addition of RS (Table 1). Addition of inulin and FOS to set yoghurt caused significant decrease in syneresis [Nastaj and Gustaw 2008]. Prebiotics added are the water-structuring agents, hence act as a thickeners and can form complexes (H-bridge formation) with the protein aggregates in the yoghurt.

CONCLUSIONS

The numbers of lactic acid bacteria in bio-yoghurts were sufficient in 97% of samples (10^6-10^9 cfu/g) according to FAO/WHO protocols. Generally, viability of bacteria was required for 14 days and then their numbers decreased, but usually not below 10^6 cfu/g so bio-yoghurts sustained their functional properties for entire time during refrigerated storage. Prebiotics as FOS and inulin added to bio-yoghurt exhibited stimulatory effect on the *Lb. acidophilus* and *Bifidobacterium* sp. growth. The most effective prebiotic for *Str. thermophilus* was resistant starch at concentrations 2% and 3%. Acidity of yoghurts corresponded with bacteria activity and was the highest for products with the 2% and 3% resistant starch addition. The storage time of yoghurt significantly influenced the values of most its rheological parameters. In the case of FOS, the addition of prebiotics caused an increase in apparent viscosity and hardness values and decrease in syneresis of obtained bio-yoghurts. During refrigerated storage an increase in apparent viscosity and decrease in syneresis of bio-yoghurts was observed.

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WPŁYW WYBRANYCH PREBIOTYKÓW NA WZROST BAKTERII FERMENTACJI MLEKOWEJ PODCZAS PRODUKCJI BIOJOGURTU

Wstęp. Probiotyki są składnikami zaliczanymi do jednej kategorii ze względu na zdolność do promowania wzrostu bakterii probiotycznych, pomimo iż często nie mają podobnej budowy. Najbardziej znanymi prebiotykami są oligofruktoza (FOS) i inulina. Prebiotyki są dodawane do żywności fermentowanej w celu poprawy przeżywalności bakterii probiotycznych podczas przechowywania.
Materiał i metody. Jogurty produkowano z mleka odtłuszczonego w proszku i prebiotyków (FOS, inulina lub skrobia oporna), dodawanych w ilości 1%, 2% i 3%. Przechowywano je w temp. +4°C przez 3 tygodnie. Ilość bakterii fermentcji mlekowej sprawdzano w odstępach siedmiodniowych. Badano lepkość pozorną i teksturę biojogurtów podczas przechowywania w warunkach chłodniczych.
Wyniki. Dodatek FOS i inuliny wpływał na wzrost ilości wszystkich badanych bakterii w porównaniu z jogurtem otrzymanym bez dodatku prebiotyków. Ilość bakterii *Str. thermophilus*, *Lb. acidophilus* i *Bifidobacterium* sp. w napojach fermentowanych otrzymanych z 1-procentowym dodatkiem FOS wynosiła odpowiednio 9 log cfu/g, 7,8 log cfu/g i 7,7 log cfu/g. W produktach uzyskanych z dodatkiem 1-procentowej inuliny, ilość bakterii *Str. thermophilus* i *Bifidobacterium* sp. kształtowała się na poziomie 8,8 i 7,5 log cfu/g. Twardość i przylegalność produktów z dodatkiem skrobi opornej wzrastały systematycznie podczas 21 dni przechowywania w warunkach chłodniczych.
Wnioski. Liczba bakterii fermantacji mlekowej w otrzymanych biojogurtach była w 97% badanych próbek na poziomie odpowiednim (10^6-10^9 cfu/g), zgodnie z zaleceniami FAO/WHO. Generalnie, przeżywalność bakterii była wystarczająca przez pierwszych 14 dni, a w ostatnim tygodniu przechowywania ilość bakterii zmniejszała się, ale zwykle do ilości nie mniejszej 10^6 cfu/g. Prebiotyki takie, jak FOS i inulina, dodane do biojogurtów, stymulowały wzrost *Lb. acidophilus* i *Bifidobacterium* sp. Dodatek prebiotyków wpływał na zwiększenie wartości lepkości i twardości (FOS) oraz zmniejszenie synerezy otrzymanych biojogurtów.

Słowa kluczowe: bakterie fermentacji mlekowej, przechowywanie, jogurt, tekstura, synereza

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