

APTEFF, 40, 1-220 (2009)
DOI: 10.2298/APT0940063M

UDC: 637.146.3:663.88:637.05
BIBLID: 1450-7188 (2009) 40, 63-69
Original scientific paper

TEXTURAL CHARACTERISTICS OF FERMENTED MILK BEVERAGES PRODUCED BY KOMBUCHA

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Rheological properties of fermented dairy products are very important parameters of the product quality. The behaviour of gel formed during fermentation of milk is influenced by a great number of factors, such as: milk composition, starter culture, flavourings addition, etc. The aim of this research was to examine the influence of fat content, and kombucha inoculum concentration on textural characteristics of fermented milk beverages: firmness, consistency, cohesiveness and viscosity index after production and during 10 days of storage. Higher fat content of beverage affects the firmness, consistency, cohesiveness and viscosity index, while higher amount of inoculum in beverages has an opposite effect on textural characteristics of samples during storage.

KEY WORDS: Milk, fermentation, kombucha, textural characteristics

INTRODUCTION

Fermented milk beverages are very important in human nutrition due to their high nutritive value and high content of valuable components. The dairy beverages included in this group of food products differ by kind of milk, fermentation type, consistency, milk fat content, additives, etc. (1).

Kombucha is a symbiosis of yeast and acetic acid bacteria, which is traditionally cultivated on black tea with sucrose addition. Product of this cultivation is a pleasant, slightly sour and slightly carbonated refreshment beverage. The previous findings showed that kombucha can be cultivated on different substrates such as black and green tea, beer, coca-cola, wine, molasses, topinambure extract, herbs and whey (2, 3).

Besides refreshment effect, due to products of metabolic activity, kombucha beverage has a wide range of prophylactic and therapeutic properties. Kombucha is used to treat headache, arteriosclerosis, reuma, problems with metabolism and immune system, burns, skin injuries, etc.

Antibiotic activity of kombucha towards *Helicobacter pylori*, *Escherichia coli*, *Staphylococcus aureus* and *Agrobacterium tumefaciens* has been proved, mostly due to the production of acetic acid during fermentation (4-6). Organic acids produced during

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fermentation are responsible for most of the characteristics of kombucha. The role of kombucha in detoxication is probably connected with the ability of glucuronic acid to bind toxins.

Kombucha fermented beverage is suitable for milk fermentation (7, 8). The physico-chemical and sensory characteristics of obtained beverage pointed to the possibilities and necessity of further technological investigations of this group of high-nutritive functional milk beverages.

Generally, rheological properties of fermented dairy products affect significantly the quality of the product. The viscosity and gel structure are influenced by a great number of factors, including milk composition, especially contents of fat and proteins. In the case of low fat products, behaviour of proteins during the gelation process is of particular importance (9).

The aim of this research was to examine the influence of different milk fat content and kombucha inoculum concentration on textural characteristics of fermented milk beverages: firmness, consistency, cohesiveness and viscosity index after production and during 10 days of storage.

EXPERIMENTAL

Pasteurized, homogenized milk of 1.0% and 2.2% of fat content („AD IMLEK Beograd - Novosadska mlekarara division“ Novi Sad) was used for dietary fermented milk beverages production in the laboratory conditions.

The following materials were used for fermentation:

- 1) probiotic starter culture – Delvo-Yog MY-721, „DSM Food Specialites“ Netherlands, 0.005%;
- 2) inoculum (I) – tea fungus cultivated in black tea with addition of sucrose (substrate), as C-atom source was concentrated by microfiltration (using ceramic membrane - pores diameter 200 nm; temperature 25°C, pressure 40 kPa and fluid flow 5 L/min).

Fermented milk beverages were produced from milk with 1.0% and 2.2% fat content according to the technological process previously described in the literature (10).

Plan of experiment is presented in Table 1.

Table 1. Plan of experiment

No	Sample	Fat content (%)	Inoculum (%)
1	1.0% fat 10% I	1.0	10
2	1.0% fat 15% I	1.0	15
3	2.2% fat 10% I	2.2	10
4	2.2% fat 15% I	2.2	15

Fermented milk beverage samples were analyzed by Texture Analyser TA XP (Stable Micro System, Godalming, England) through a single compression test, using a back extrusion cell (A/BE) disc (diameter 35 mm; distance 30 mm; speed 10 mm s⁻¹) and an extension bar, using 5 kg load cell. Firmness, consistency, cohesiveness and index of viscosity were measured at 5°C during 10 days of storage .

RESULTS AND DISCUSSION

Firmness

The change of firmness in samples obtained from milk of 1.0% and 2.2% of fat by adding 10% and 15% of kombucha inoculum, after production and during storage is presented in Fig. 1.

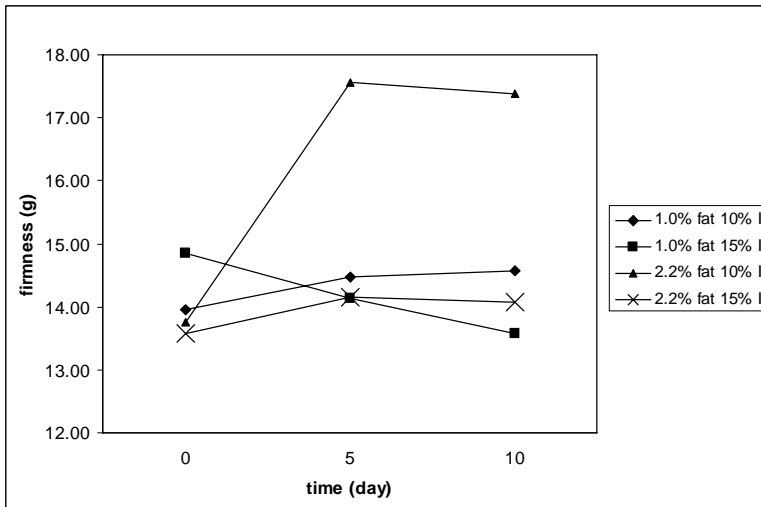


Fig. 1. Firmness of samples after production and during storage

The firmness of sample 1 (1.0% fat 15% I) was the highest (14.85 g). A decrease of firmness after storage was found in sample 2 (1.0% fat 15% I), and the lowest value after 10 days (13.58 g). The highest increase of firmness during storage was determined in sample 3 (2.2% fat 10% I). The obtained results show that higher fat content affects the increase of beverage firmness, while the higher amount of inoculum in beverage decreases the firmness of samples during storage. It is known that the increase of milk fat increases the firmness of yoghurt samples (11), while the increase of inoculum amount results in a decrease of firmness due to dilution, i.e. lower dry matter content in the sample. The biggest difference in firmness was noticed on the fifth day of storage and it was by 22.6% higher in sample 3 (2.2% fat 10% I) than in the other samples.

Consistency

Fig. 2 presents the change of consistency of samples produced from milk of 1.0% and 2.2% milk fat by adding 10% and 15% of kombucha inoculum, after production and during storage for 5 and 10 days.

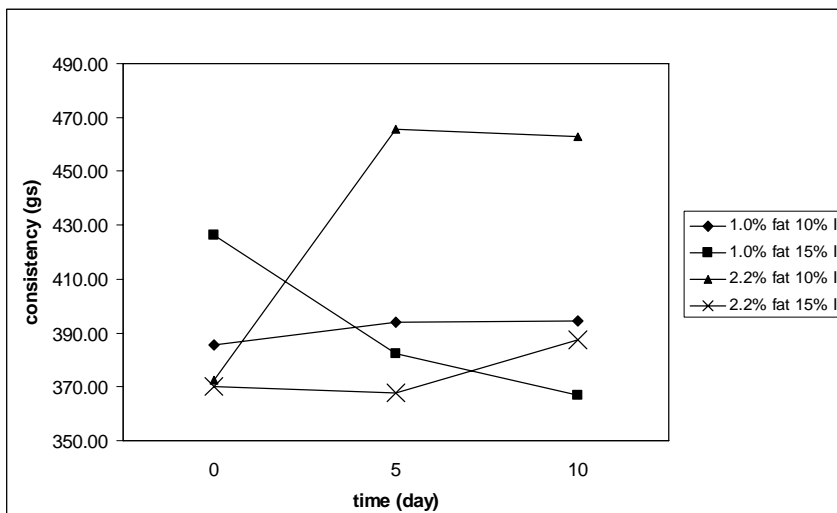


Fig. 2. Consistency of samples after production and during storage

The consistency value indicates the density of the product. It is evident that the higher the value of the consistency, means the higher the product density. The results show the same trend as in the firmness analysis of fermented milk beverages. The highest consistency value after production (426.34 gs) was found with sample 2 (1.0% fat 15% I). However, the consistency of this sample decreased during storage, and after 10 days the consistency value was the lowest (367.02 gs). The highest increase of consistency during storage was found for sample 3 (2.2% fat 10% I). It can be seen that the obtained value of consistency for the sample produced from milk with 2.2% of fat and 15% of kombucha inoculum, increases by 29.0% between 5 and 10 days. Consistency of fermented milk beverage with 1.0% of fat shows an opposite trend compared to milk with 2.2% of fat. It is obvious that the increase of milk fat content results in an increase of the consistency level, while the increase of inoculum amount leads to a decrease of the consistency value of samples during storage.

Cohesiveness

Fig. 3 shows the change of cohesiveness of fermented milk beverage samples during 10 days storage.

Samples produced from milk of 2.2% fat have greater cohesiveness after production. Fermented milk beverage sample made with 10% of inoculum showed the highest cohesiveness during storage, and the measured values were in the range from -7.72 g after production to -12.60 g after 10 days of storage. The lowest cohesiveness after production (-6.07 g) and after 10 days of storage (-9.53 g) was found for sample 2 (1.0% fat 15% I). The difference of cohesiveness values during storage between samples produced from milk of 1.0% fat is 23% on average during the storage, and it is significantly lower than for samples made from milk of 2.2% fat (63%). The obtained results show that higher

milk fat content affects the increase of cohesiveness, while the effect of inoculum amount increase is opposite, i.e. the cohesiveness of produced fermented milk beverage decreases.

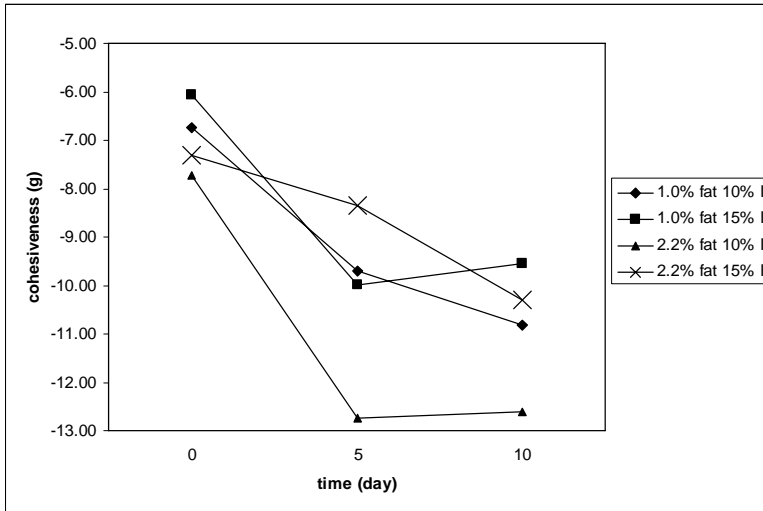


Fig. 3. Cohesiveness of samples after production and during storage

Viscosity index

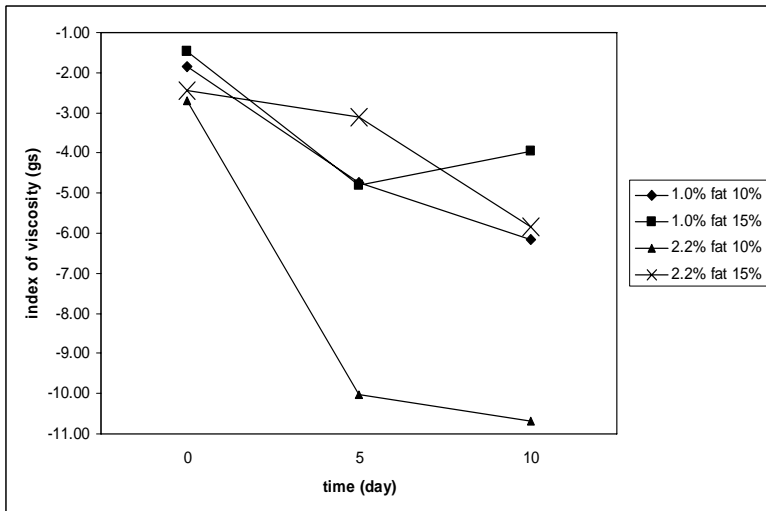


Fig. 4. Viscosity index of samples after production and during storage

Similarly to cohesiveness, the lower measured value of the viscosity index, means the higher viscosity index (Fig. 4). The viscosity index after production and after 10 days of

storage was measured in sample 3 (2.2% fat 10% I), -2.70 gs and -10.68 gs, respectively. Samples made from milk of 2.2% milk fat had higher viscosity index after production. The lowest viscosity index after production (-1.48 gs) and after 10 days storage (-3.96 gs) was determined in sample 2 (1.0% fat 15% I).

The obtained values are similar to the results of fermented milk beverages obtained from milk of 0.9% fat using concentrated tea fungus inoculum, 1.5% and 3.0%, regarding the decrease of textural characteristic values at increased concentrations of inoculum (10).

CONCLUSION

Samples that contained higher level of fat had much better textural characteristics from those of fermented milk beverages produced from milk of 1.0% fat content. Significant change of textural characteristics was noticed during the first 5 days of storage. Generally, the sample produced from milk of 2.2% fat with addition of 10% kombucha inoculum has the best textural characteristics during storage.

ACKNOWLEDGEMENT

This research is part of the project TR-20008 which is financially supported by the Ministry of Science and Technological Development of the Republic of Serbia.

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ТЕКСТУРАЛНЕ ОСОБИНЕ ФЕРМЕНТИСАНИХ МЛЕЧНИХ НАПИТАКА ДОБИЈЕНИХ ПРИМЕНОМ КОМБУХЕ

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Реолошке особине ферментисаних млечних производа представљају веома важан фактор за квалитет производа. Својства гела добијеног ферментацијом млека зависе од различитих фактора, као што су: састав млека, starter култура, ароме, итд. У раду је испитан утицај садржаја млечне масти (1,0% и 2,2%), и различитих концентрација инокулума комбухе (10% и 15%) на текстуралне особине ферментисаних млечних производа: чврстоћу, конзистенцију, кохезивност и индекс вискозитета, након производње и током 10 дана складиштења. Добијени резултати показују да повећање садржаја млечне масти доводи до повећања чврстоће, конзистенције, кохезивности и индекса вискозитета узорака. Ферментисани млечни напци произведени са већом концентрацијом инокулума комбухе имају ниже вредности текстуралних карактеристика. Највеће промене текстуралних карактеристика у узорцима уочавају се током првих 5 дана складиштења.

Received 22 July 2009
Accepted 1 October 2009