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Original Research Article

Preparation and Quality Evaluation of Soy Corn Yoghurt

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Abstract

Soy corn yoghurt is a vegan friendly product prepared by using soymilk as the major ingredient. The aim of this study was to assess the effect of corn milk addition (0, 10, 20, 25 & 30%) on the quality of soy yoghurt. The samples were subjected to sensory evaluation for consumer acceptability and data were subjected to statistical analysis. From sensory evaluation and statistical analysis 10% corn milk inclusion was selected as the best product ($p<0.05$). The yoghurt thus prepared using 10% corn milk had total solids 22.04%, moisture content 78.62%, protein 4.84%, fat 3.29%, carbohydrate 12.57%, ash 0.81%, acidity 0.68% and pH 4.58. Both control and 10% corn milk incorporated yoghurts were stored under refrigeration 6 ± 1^0 C and analyzed at 2 days interval till 10 days. Yoghurts with corn milk and control were organoleptically acceptable upto 10 and 6 days respectively. Acidity and syneresis increased but pH decreased with storage time in both samples.

Keyword: soybean, corn, milk, yoghurt,

Introduction

Yoghurt is a fermented milk product obtained by souring milk using a pure culture of *Lactobacillus bulgaricus* and *Streptococcus thermophilus* (Aryana and Olson,2017). It can be manufactured from liquid cow milk, powdered milk and vegetable milk (soy milk) as base material (Makinen et al., 2016). Soybean, a plant protein which is cheaper could serve as an alternative to cow milk. It contains up to 40% protein compared with 1.0 to 5.6% protein content of most animal milk. There is no denying that soybean products have many health benefits. These health benefits are mainly derived from the quality of the soy proteins and from the isoflavones and daidzein (Thompson, 1994).

Maize, also known as corn, is a large grain plant first domesticated by indigenous people in southern Mexico about 10000 years ago. It has become a staple food in many parts of the world, with total production surpassing that of wheat & rice. However, not all of this maize produced is consumed directly by human. partof the maize produced is used for corn ethanol, animal feed and other maize products, such as corn starchand corn syrup (Makinen et al. 2016).

Soymilk-based yogurt, namely, soy yoghurt or sogurt, is produced by the fermentation of soymilk using lactic acid bacteria (Yang and Li, 2010). The basic material for soya yogurt preparation is soya milk, which is water extract of whole soybean. It is an off-white emulsion/suspension containing the water soluble protein , carbohydrates and oil of soybean (Penhasi. 2014).

Material and Methods

Preparation of soymilk

The soymilk for the study was prepared by INSTOY (Atakisi and Arioglu, 1983) method with some modification. The process is described as follows. The whole soybeans (100g) were cleaned and 0.005% of baking soda was added in to 500 mL of boiling water. Soybeans were put into boiling water (90-95^{o}C) for 5 minutes for blanching. The blanched soybean was drained by rinsing with hot water (80-85^{o}C). Again 1000 mL of water was boiled by adding 0.005% baking soda (by wt.) and again blanched the previous blanched sample for further 5 minutes. Excess water was drained and grinding of soybean was done by adding 1000mL of hot water for 3 minutes(soybean: water = 1:5). The grinded mass was cooled up to room temperature (27 ^{0}C) and filtered through a cheese cloth by squeezing. The

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filtered solution was used for yoghurt production.

Preparation of corn milk

500mL distilled water was boiled and 0.25 g of baking soda was added. Corn (100g) were put into boiling water and kept for 5 minutes for blanching. Draining and rinsing was done with hot water. Blanched corn was added into grinder for grinding setting the high speed (corn : water =1:5). The grinded mass was cooled up to room temperature (27°C) and filtered through a cheese cloth by squeezing. The filtered mass (corn milk) was used for yoghurt preparation.

Preparation of yogurt

Soymilk and corn milk were separately preheated to 45-50ºC with continuous agitation and corn milk was mixed with soymilk at the rate of 10, 20, 25, and 30%. Skim milk powder was added at the rate 10%. Then milk was again heated to 70 ^{0}C and sugar was added at the rate of 4% and stirred well. Pasteurization was done at 85 ^{0}C for 30 minutes. The pasteurized milk was cooled to 44 ^{0}C and inoculation with 10^7 CFUml^{-1} cultures of *Lactobacillus species* was done. It was incubated at 42 ^{0}C for 4 h. Set type soy yogurt thus obtained was cold stored at 4±2 ^{0}C. Control was prepared without addition of the cornmilk by following the same step.

Physical and Chemical Analysis

The soy corn yoghurt was analyzed for moisture and total solidsby hot air oven method according to Ranganna, (2000), fats according to Gerber method described in NDDB, (2001), protein by Micro-Kjeldahl method according to Rangana, (2000), ash (Rangana, 2000) and acidity (NDDB, 2001). The testing of syneresis was done by using the drainage method (Tiwari, 2003) with slight modification. A cup of set yogurt was taken out from the cold storage. The yoghurt was weighed and drained on muslin cloth for 30 min at room temperature (27ºC). The syneresis was expressed as the percentage weight of the whey separated from the gel over the initial weight of the gel. Sensory evaluation of the sample was carried out by using 9- points hedonic scale as per Rangana (2000).

Data Analysis

The experimental data were analyzed by using the analysis of variance (ANOVA) at 5% level of significance using Genstat 3 Discovery edition, 2010. The significant difference was studied by least significant difference (LSD) method at 5% level of significance.

Results and Discussion

Soy yoghurt were prepared by replacing soymilk with corn milk at te rate of 0,10,20,25& 30% by vol. keeping the SMP constant (10%). The samples were subjected for organoleptic evaluation and storage stability study.

1. Proximate composition of soymilk

The soymilk prepared was analyzed for the proximate composition and the results are shown in table 1.

Table 1. Proximate composition of soymilk

Parameters	values*
Total solids (%)	8.83 ± 0.21
Moisture content (%)	91.17 ± 0.83
Protein (%)	3.79 ±0.01
Fat (%)	2.38 ± 0.07
Carbohydrate (%)	2.23 ±0.41
Ash (%)	0.43 ± 0.02
Acidity (%)	0.121 ±0.01
pH	6.78 ± 0.01

*Values are the means of triplicate determinations.

The moisture content of soymilk was 91.17%, protein 3.79%, fat content 2.38%, ash content 0.43% and carbohydrate 2.23%. the results were similar with those of pandurand (2012). According to Bai et al. 2013, the composition of soymilk was moisture 90.69%, total solids 9.39%, protein 3.86%, fat 2.4%, carbohydrate 2.28%, ash 0.71% and acidity 0.13% while (Pyo et al. 2005) reported soybean milk with total solids 13.15%, pH 6.7, acidity 0.20%, protein 5.8% and fat 2.75%. (Pyo et al. 2005) stated the variation in the results to the origin of soybean, processing condition and the ratio of soybean to water used for soymilk preparation.Acoording to (Bhattarai et al. 2008),

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2. Effect of corn milk addition on sensory quality of soy yoghurt

Samples were prepared by addiing10, 20, 25,&30% corn milk and one without using corn milk which is known as control. These samples were coded as A for control, B for yogurt containing 10% cornmilk, C for yogurt containing 20% corn milk, D for yoghurt containing 25% corn milk and E for yoghurt containing 30% corn milk. These samples were subjected to sensory evaluation in terms of appearance, flavor, texture and overall acceptability and the scores so obtained were subjected to statistical analysis. The mean sensory score of the soy yoghurt is shown in figure 2. From the sensory score, we coclude that 10% corn milk addition was best in terms of appearance, flavor, mouth feel and overall quality. This results were similar to the results obtained by Pyo et al. 2005.

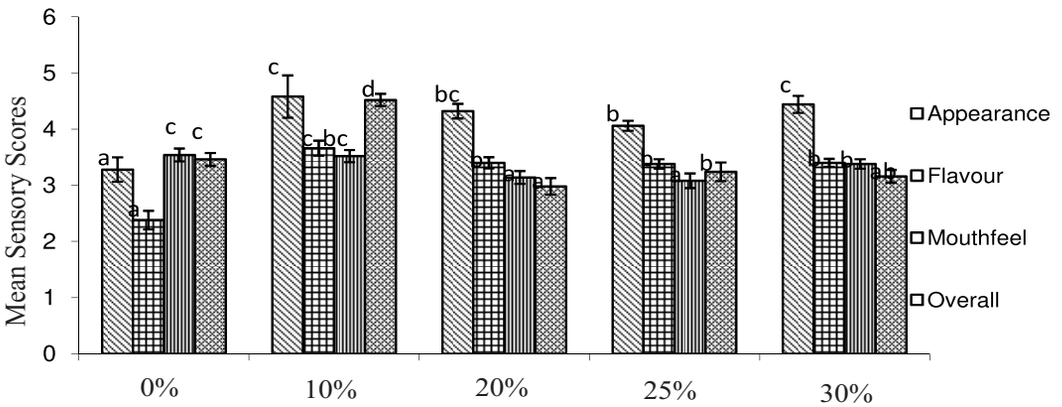

Fig 1. Comparison of soy yoghurt prepared from 10%, 20%, 25% and 30% corn milk and control
*Values on the top of the bars bearing similar superscript are not significantly different at 5% level of significance. Vertical error bars represent ± standard deviation of scores given by panelists.

3. Effect of storage time on acidity

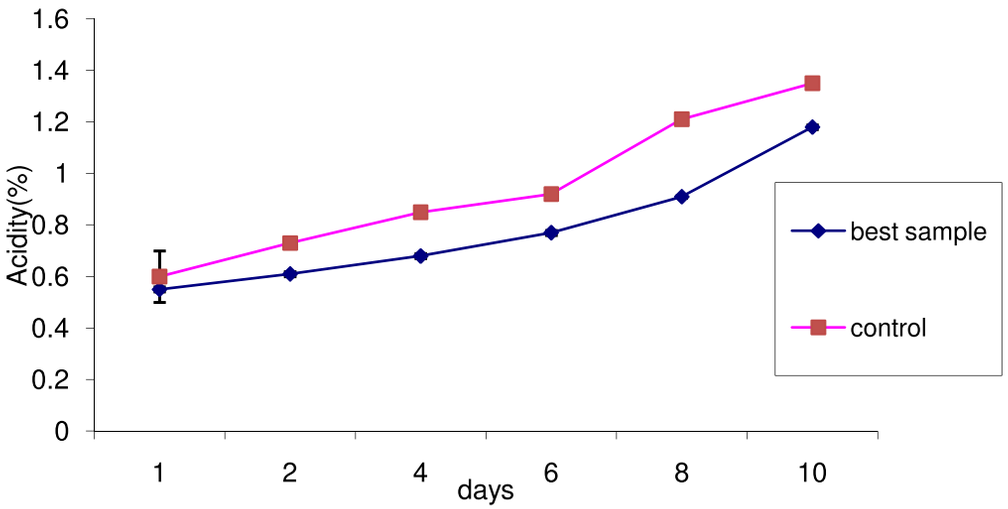

Fig 2. Effect of storage time in acidity

The effect of acidity with the storage time was found that acidity increased throughout the storage period in both samples. From the graph, it can be seen that the rate of increase of acidity in 10% corn milk added sample was lesser than that in control sample (0% Corn milk). Maximum increase was recorded in control sample as compared to other treated samples. this results was similar to results obtained by pandurang 2012. According to (Bhattarai et al. 2008), sensory evaluation of peanut based milk yoghurt with different stabilizers on the basis of appearance, texture and overall acceptability were in the order gelatin>control>propylene>glycol alginate>guar gum>high methoxy pectin>k-carrageenan>carboxy methyl cellulose at 5% level of significance.

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4. Effect of storage time on pH

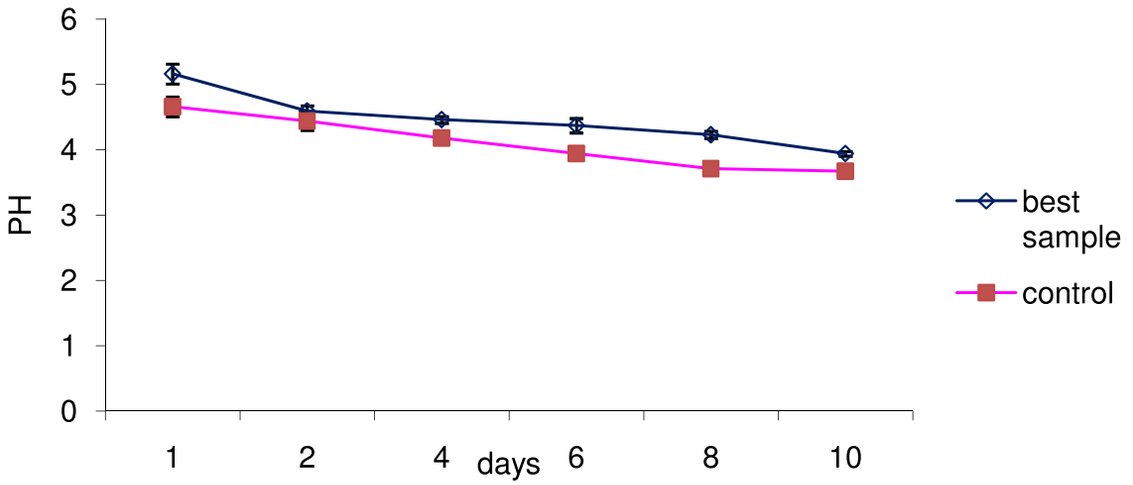

Fig 3. Effect of storage time on pH

The effect of pH during torage period is shown in fig.5. pH decreased throughout the storage period in both samples. From the graph, it can be seen that the rate of decrease of pH in best sample was lesser than that of control sample. Similarly, (Jawalekar et al. 1993) reported that texture was affected significantly during storage in both yoghurt treated with starch and gelatin. However, addition of gelatin as stabilizer had a remarkable improvement in scores of experimental yoghurt for body and texture.(Gauche et al. 2009) reported that pH was decreased from 4.14 to 3.62 in case of control and 4.23 to 3.75 in case of gelatin treated yoghurt from first to tenth days. From his analysis, it was concluded that pH decreased throughout the storage period and the decrease of pH was due to the formation of lactic acid by certain bacteria of yoghurt. It was also reported earlier that pH decrease with increase in the storage period.

5. Effect of storage time on syneresis

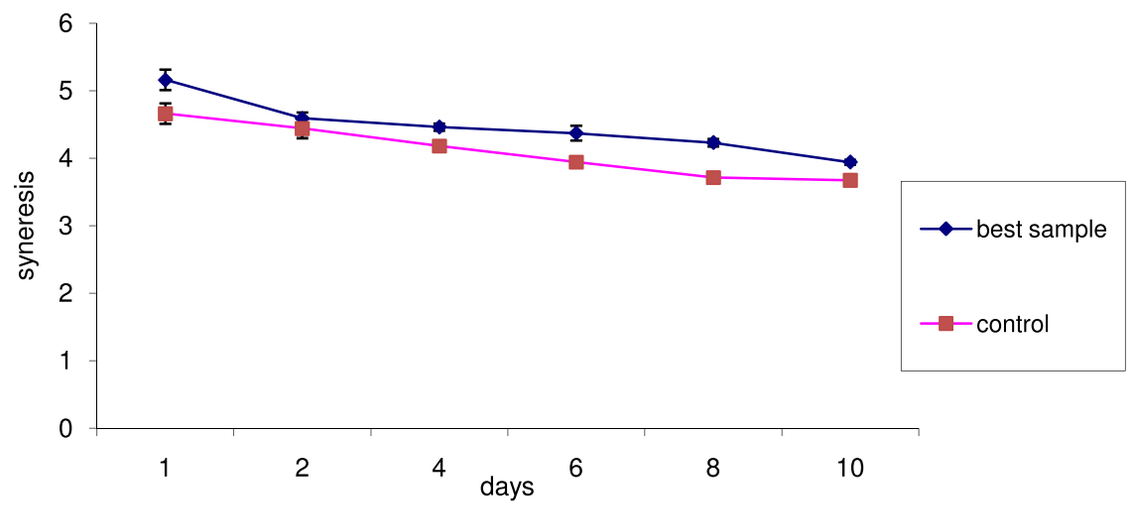

Fig 4. Effect of storage time in syneresis

The syneresis effect on yoghurt with the storage time were significant.syneresis increased throughout the storage period in both samples. From the graph, it can be seen that the rate of increase in corn milk added sample was lesser than that in control sample. Gauche et al. 2009 reported that untreated yoghurt samples showed a higher increase in syneresis as compared to the yoghurt sample treated with stabilizer. In yoghurt sample treated with stabilizer and control, the syneresis increased with the storage time but it was significantly lower in treated sample. He concluded that use of stabilizer can help to retard/reduce syneresis and give better quality.Bhattarai et al. 2008 reported that gelatin increased firmness and prevented serum separation in yoghurt and extended the shelf life of yoghurt.

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6. Proximate composition of the soycorn yoghurt

The yoghurt thus prepared using 10% corn milk was subjected for the proximate analysis and the results thus obtained are given in table 2.

Table 2. Proximate composition of soycorn yoghurt

Parameters	values*
Total solids (%)	22.03 ± 0.31
Moisture content (%)	78.62 ± 0.98
Protein (%)	4.84 ± 0.59
Fat (%)	3.29 ± 0.08
Carbohydrate (%)	12.57 ± 0.47
Ash (%)	0.81 ± 0.02
Acidity (%)	0.68 ± 0.04
pH	4.58 ± 0.03

*Values are the means of triplicate determinations.

The moisture content of soy corn yoghurt was 78.62%, protein 4.84%, fat content 3.29%, ash content 0.81% and carbohydrate 12.57%. the results were similar with those of pandurand (2012). the values are incresed than soymilk due to addition of corn milk.

sensory evaluation of peanut based milk yoghurt with different stabilizers on the basis of appearance, texture and overall acceptability were in the order gelatin>control>propylene>glycol alginate>guar gum>high methoxy pectin>k-carrageenan>carboxy methyl cellulose at 5% level of significance. Among sensory attributes, flavour is considered to be the most important factor for determining consumer's acceptance also reported a decrease in the flavour of yoghurt during storage intervals, the flavor of the prepared yoghurt was acceptable for five days and liked by panelists. Lactic acid fermentation reduced beany flavorsin soybean products ((Park et al. 2005).

Conclusions

On the basis of the sensory evaluation in terms of appearance, flavor, texture and overall acceptability, the optimum level of SMP for the soy yoghurt preparation was found to be 10%.Yoghurt with 10% corn milk was found to be significantly better than yoghurt with 20%, 25%, and 30% corn milk and without corn milk when evaluated on the basis of sensory attributes. It was sensorically acceptable up to 10 days while yoghurt without corn milk was accepted up to 6 days when evaluated in terms of appearance, flavor, texture and overall acceptability. Acidity and syneresis were significantly lower while pH was significantly higher in yoghurt treated with corn milk than in yoghurt without corn milk. Acidity and syneresis increased with storage time but pH decreased with storage time.

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