

Development of drinking yoghurt by incorporating corn (*Zea mays*) milk and corn seeds

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Introduction

Cereal grains are considered as important sources of dietary proteins, carbohydrates, vitamins, minerals and fiber for people all over the world (Chavan and Kadam, 1989). Corn (*Zea mays*) is locally grown cereal that can be purchased at low price from several areas in Sri Lanka. Corn milk is considered as a new innovation, especially in making yoghurt based products. Vegetable based corn milk yoghurt is an alternative to substitute the cow milk based yoghurt. Drinking yogurt is the fastest growing food and beverage category in worldwide (Yasni and Maulidya, 2013). However, still value added drinking yoghurts are rare in Sri Lankan market. Adding cereal grains is a perfect way to upgrade a drink to a nutritious breakfast. Therefore, this study was conducted to develop yoghurt by incorporating corn (*Zea mays*) milk and corn seed to cow milk.

Methodology

The study was carried out at Lucky Lanka Milk Processing Com. Ltd (LLMP), Matara and Uva Wellassa University. Six experimental trials with different treatments were conducted. In trial I, mature fresh corn seeds, mature boiled corn seeds and germinated corn seeds were separately used to extract corn milk and the best extract of corn milk was evaluated by sensory properties (odor, taste, color and mouth feel) using untrained panelist. In trial II the most compatible sugar (8%, 9% and 10% w/v) and gelatin (0%, 0.2% and 0.4% w/v) levels for different corn milk percentages (5%, 10%, 15% and 20% w/v) were identified. After selection of appropriate combinations of sugar and gelatin levels, trial III was done to select the best corn milk incorporation level by narrow down the corn milk percentages (6%, 8%, 10%, 12% and 14%). Preserved in sugar syrup and boiled corn seeds were crushed into two sizes (> 3.15 mm and 2 mm –3.15 mm) to prepare different types of corn seeds. Trial IV was carried out to select best corn seeds particles on the textural basis and trial V was done to assess the consumer acceptability for the presence of corn seeds in the corn milk incorporated drinking yoghurt. Finally three treatments (trial VI) were prepared and evaluated on sensory, chemical and microbiological properties. The sensory evaluation was done using 35 untrained panelists. In chemical analysis, proximate analysis (moisture content, crude fat, total solid, crude protein, ash and crude fiber content) was conducted. pH value and titratable acidity were evaluated and microbiological analysis was done for Yeast and Moulds, and *Escherichia coli* for three weeks in one day interval. The sensory data were analyzed using Friedman

nonparametric test. Complete Randomized Design was conducted and data obtained from chemical and microbiological tests were analyzed by Analysis of Variance using the General Linear Model procedure of SAS. Significant means of treatments were separated using the Least Significant Difference test ($P < 0.05$).

Result and Discussion

In trial I, boiled corn seeds (mature) based method was selected to extract corn milk. Other two methods were rejected due to the unpleasant odour and taste which may be due to the activation of various food enzymes and breaking down the higher molecular components to simple molecules during germination.

Eight per cent sugar (w/v) for 5% corn milk (w/v) and 10% sugar (w/v) for other 10%, 15% and 20% corn milk (w/v) incorporation levels were selected due to desirable sweetness. The gelatin level (w/v) was selected as 0% due to the presence of appropriate drinking yoghurt properties including texture, mouth feel, appearance and viscosity. The whey separation has been prevented by stabilizing effect of corn starch in corn milk.

In sensory evaluation, 8% corn milk incorporation level was significantly highly preferred by panelist with respect to mouth feel, taste and overall acceptability ($P < 0.05$). However, there is no significant difference in color and aroma of the three treatments ($P > 0.05$) (Figure 01). Addition of corn milk had no influence to change colour and aroma of the product.

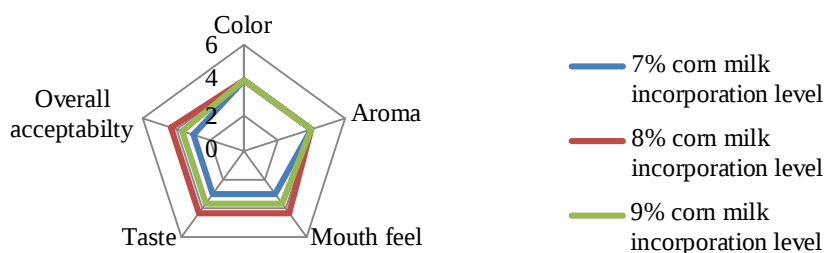


Figure 01. Web diagram for level of corn milk incorporation in sensory evaluation

In trial IV, sugar syrup based method was rejected due to hardness of the seeds and crushed boiled corn seeds were selected. Further, the sensory results revealed that the preference (taste, aroma, mouth feel, color and overall acceptability) for corn seeds > 3.15 mm or 2 mm to 3.15 mm particles incorporated drinking yoghurt is less whereas preference for corn milk incorporated drinking yoghurt without corn seeds was high. The observed difference is due to the disturbance for the drinkable property of product by presence of corn seed particles. The composition of the selected corn milk incorporated drinking yoghurt is given in Table 01.

There was a significant difference between treatments for change in pH with the storage period ($P < 0.05$). pH values of the T8 (with preservative) and control were not changed dramatically. Control of pH by potassium sorbate could be due to inhibition of the activity of starter culture by inhibiting various enzymes in microbial cell (Rajapaksha *et al.*, 2013).

There was a significant difference between treatments with respect to acidity ($P < 0.05$) and titratable acidity increased significantly with storage period and in treatments without preservatives. According to Rajapaksha *et al.* (2013), titratable acidity of yogurts increased over the time and acidity of yoghurt without potassium sorbate increases drastically than other treatments reflecting the inhibitory activity of potassium sorbate on post fermentation.

Table 01. Composition of select corn milk incorporated drinking yoghurt

Raw material	Percentage	Quantity (g)
Milk	79.54%	867.03
Dairy cream	1.03%	11.33
SMP	1.42%	15.49
Corn milk	8.00%	87.20
Sugar	10.00%	109.00
Total	100.00%	1090.00

There were no contaminations with Coliform and *Escherichia coli* and thus safe for human consumption. There were no yeast colonies in T8 and control sample. At day 11, yeast colonies were exceed the SLS standards of <1000 only in T7 (without preservative).

Proximate analysis revealed all the physiochemical characteristics of corn incorporated drinking yogurt (protein, fat, ash, fiber and total solid), except moisture significantly higher compared to plain drinking yoghurt ($P < 0.05$). Usually drinking yoghurt does not contain fiber. However, due to addition of corn, milk fiber was increased up to 0.5%.

Conclusion

Eight per cent corn milk incorporation level with selected sugar (10%) and gelatin (0%) level has best consumer preference with respect to the taste, mouth feel and overall acceptability ($P < 0.05$). Moreover, drinking yoghurt without corn seed particles is preferred by the panelists. Shelf life of product without potassium sorbate is around 11 days at 4 °C with respect to microbiological analysis and physiochemical analysis.

References

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