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Studies on textural properties of *Gulabjamun* prepared by blends of buffalo milk with sweet corn milk

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Abstract
Gulabjamun prepared by blends of buffalo milk with sweet corn milk was prepared from different proportion of sweet corn milk. The hardness of the finished product were found to be 1910.15, 2707.05, 2127.94 and 2913.20 gm for treatment T_0, T_1, T_2 and T_3, respectively and 4538.45 for market sample. Brittleness of the finished product was found to be 15.829, 15.520, 13.250, 16.654 and 18.200 cm. Cohesiveness of the finished product were found to be 0.24, 0.33, 0.35, 0.42 and 0.25. Elasticity of the finished product was found to be 7.77, 8.47, 8.97, 9.45 and 6.30 mm. Chewiness of the finished product was found to be 3681.95, 7571.99, 6782.91, 11753.16 and 7246.86 g-s. Gumminess of the finished product was found to be 473.44, 895.05, 756.13, 1245.54 and 1097.15 g.

Keywords: *gulabjamun,* sweet corn milk, texture.

Introduction

Gulabjamun, a popular *khoa* based sweet of India, is prepared from *khoa*, the traditional method of preparation involves blending of *khoa*, refined wheat flour (*Maida*) and backing powder to a homogeneous mass to obtain smooth dough along with small amounts of water. It made by frying *khoa* balls in ghee or vegetable oil and then dipping in sugar syrup of optimum concentration. Because of low shelf life and non-availability of *khoa* throughout the year, attempts were made to find out its substitute in the preparation of *gulabjamun*. (Rajorhia, 1989) [8]. The *gulabjamun* made from the commercial mixes is smooth and soft which finds some acceptance with consumer *Gulabjamun*, a popular *khoa* based sweet of India, is prepared from *khoa*, the traditional method of preparation involves blending of *khoa*, refined wheat flour (*Maida*) and backing powder to a homogeneous mass to obtain smooth dough along with small amounts of water. It made by frying *khoa* balls in ghee or vegetable oil and then dipping in sugar syrup of optimum concentration. Because of low shelf life and non-availability of *khoa* throughout the year, attempts were made to find out its substitute in the preparation of *gulabjamun*. (Rajorhia, 1989) [8]. the *gulabjamun* made from the commercial mixes is smooth and soft which finds some acceptance with consumers. But, the product lacks typical *gulabjamun* flavour and texture of the *khoa* based product. Many attempts were made to enhance the quality of *gulabjamun* made from the mixture of dairy and nondairy ingredients like WPC, WMP, SMP, *Khoa* powder *Maida*, Wheat flour, Soymilk etc. (Priya, 2012). When the *gulabjamun* is prepared from *khoa* generally *Maida*, Wheat flour and *suji* are used as a binding material in different proportion in *gulabjamun* mix. However, all these mixes are the source of protein, low in carbohydrates and fibrous material. According to a recently conducted survey by BM Birla Heart Research Institute (Chakarvarti, 2005).

Corn is one of the major cereal crops in the world. Among the numerous corn sub species grown sweet corn is become more important due to its taste and nutritional value has made it a valued crop in all countries. Corn is rich source of starch. Sweet corn and corn milk which is noted for its aroma and sweet taste. The corn is high in vitamin content particularly carotene and essential sulphur containing amino acid and it is also low in saturated fat and cholesterol. India is fast emerging as the country with the highest number of cardiac cases in the World. Reduced fat formulations need to be developed for such individuals, while preserving their basic food selection patterns. Researchers and medical boards have considered milk fat is a more saturated as compared to vegetable oils containing PUFA. Excessive fat (saturated) intake is a major causative factor in high blood pressure, coronary heart disease and has been

linked to a number of other disorders as well. Reports revealed that high dietary fat intake clotting time of blood. High intake of fat increase risk of heart attack because of high proportions of saturated fats in the diet. Many nutritionists believe that if fat intake is reduced to provide less than 30 per cent of the calories through fats and oil dietary fat would not be risk factor at all in heart disease (Sandhya, 2010) [10].

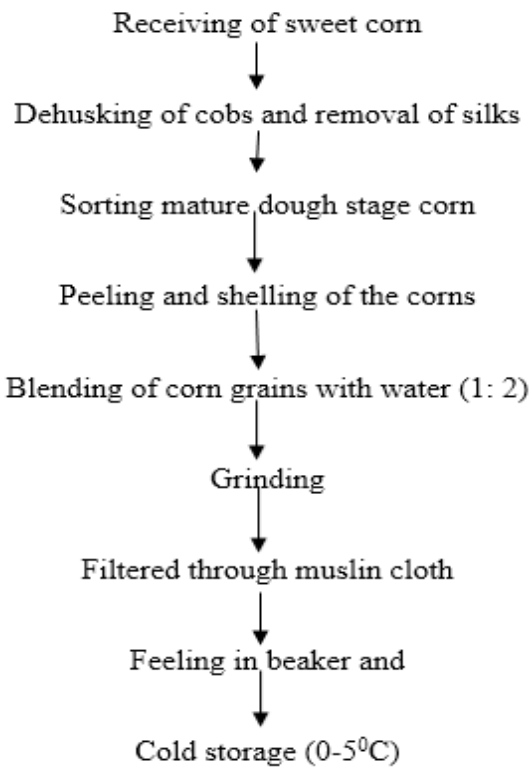
Materials and Methods

Materials

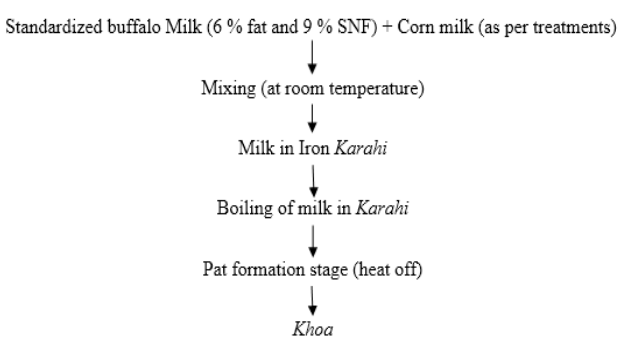
The whole fresh and clean buffalo milk required for present study was collected from Department of Animal Husbandry and Dairy Science, College of Agriculture, Latur. Milk was clarified before use to remove dirt and other extraneous matter. Fresh sweet corn variety, Masti (F_1 Hybrid) of Nuziveedu seeds Pvt. Ltd, will be purchased from local market of Latur city. Sugar, refined wheat flour (*maida*), Baking powder, Cardamom and Vegetable oil.

Methods

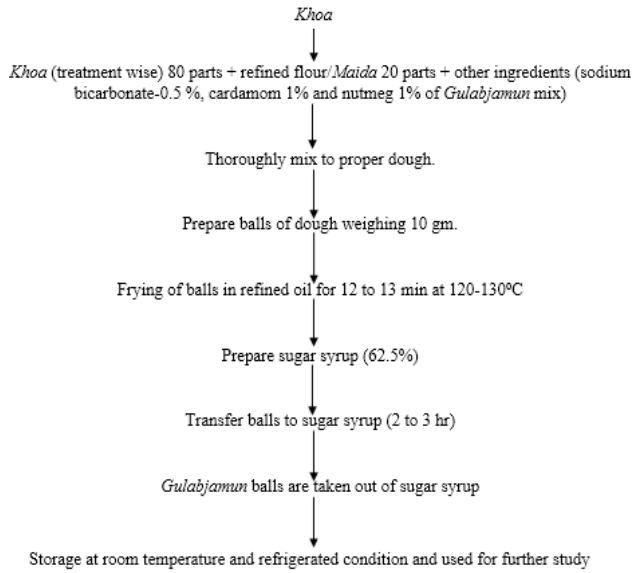
Flow chart for preparation of sweet corn milk



Flow chart for preparation of *khoa* from buffalo milk blended with sweet corn



Flow chart for preparation of *Gulabjamun* from *khoa* prepared by blending buffalo milk with sweet corn milk by Aneja R.P. slightly modified.



Analysis of *Gulabjamun*

Determination of hardness, brittleness, cohesiveness, elasticity, chewiness and Gumminess

Stable Micro System TAXT2i Texture Analyzer (Mode TPA2) was used for texture profile analysis (TPA) of *gulabjamun* at different stages. A P36R cylindrical probe with 5mm/s of pre-test, test and post-test speeds; and 50% compression was taken for TPA analysis. TPA is a "two-bite" test, which includes the first and second compression cycles. The first and second compression cycles indicate the force vs. time data during the first and second compression of the product by the instrument probe. The parameters recorded were hardness, brittleness, cohesiveness, elasticity, gumminess, and chewiness.

Hardness: The maximum height of curve during the first compression.

Brittleness: Height of first significant break of multi peak shape of first chew.

Cohesiveness: Ratio of area under second peak to that of first peak i.e. A2/ A1.

Elasticity: Test speed × distance on × axis from start of second bite to its peak.

Chewiness: Hardness × cohesiveness× elasticity.

Gumminess: Hardness × cohesiveness.

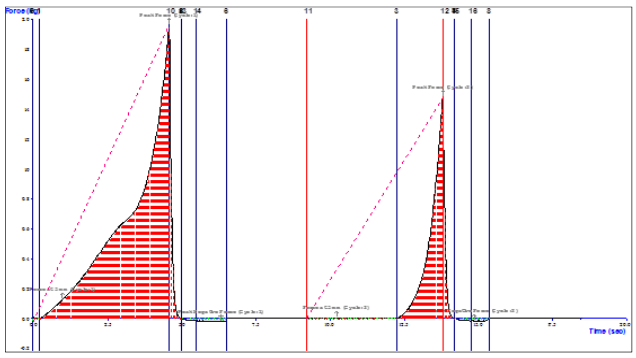


Fig 1: Graphical representation of hardness and brittleness in *gulabjamun* prepared from buffalo milk *khoa* (T_0) by Stable Micro System TAXT2i Texture Analyzer (Mode TPA2).

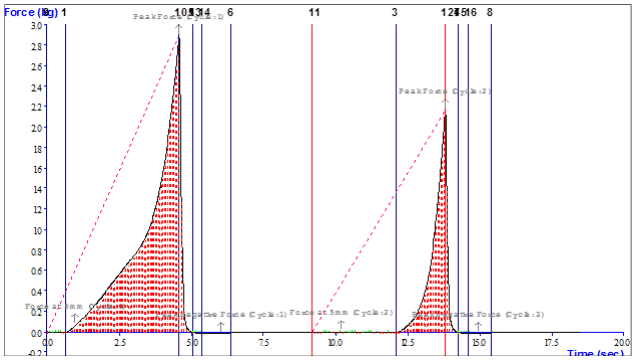


Fig 2: Graphical representation of hardness and brittleness in *gulabjamun* prepared by *khoa* of buffalo milk + Sweet corn milk (T_1) by Stable Micro System TAXT2i Texture Analyzer (Mode TPA2).

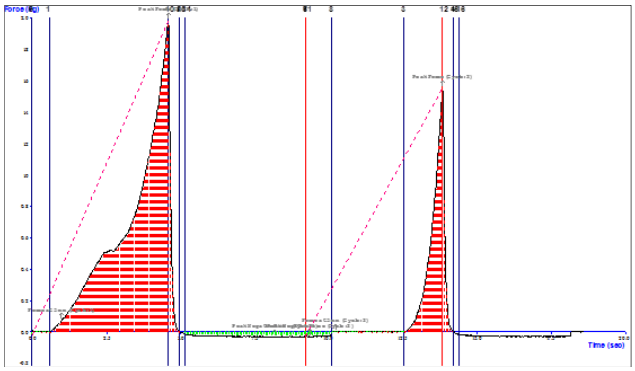


Fig 3: Graphical representation of hardness and brittleness in *gulabjamun* prepared by *khoa* of buffalo milk + Sweet corn milk (T_2) by Stable Micro System TAXT2i Texture Analyzer (Mode TPA2).

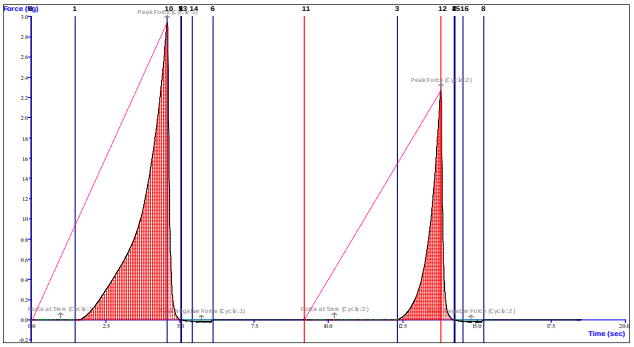


Fig 4: Graphical representation of hardness and brittleness in *gulabjamun* prepared by *khoa* of buffalo milk + Sweet corn milk (T_3) by Stable Micro System TAXT2i Texture Analyzer (Mode TPA2).

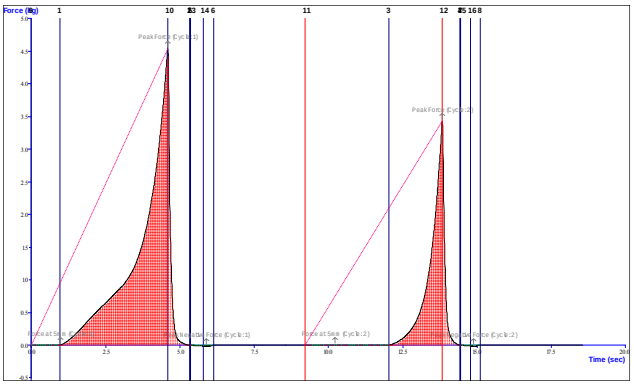


Fig 5: Graphical representation of hardness and brittleness in *gulabjamun* of market samples by Stable Micro System TAXT2i Texture Analyzer (Mode TPA2).

Results and Discussion

Treatments	Hardness	Brittleness	Cohesiveness	Elasticity	Chewiness	Gumminess
T_0	1910.15[a]	15.829[a]	0.24[a]	7.77a	4232.02[a]	564.65[a]
T_1	2707.05[b]	15.520[b]	0.33[b]	8.47[b]	7747.37[b]	937.42[b]
T_2	2127.94[c]	13.250[c]	0.35[c]	8.97[c]	6587.17[c]	749.98[c]
T_3	2913.20[d]	16.654[d]	0.42[d]	9.45[d]	11749.2[d]	1228.54[d]
Market sample	4538.45[e]	18.200[e]	0.25[e]	6.30[e]	7523.38[e]	1856.42[e]

The average values hardness of the finished product were found to be 1910.15, 2707.05, 2127.94 and 2913.20 gm for treatment T_0, T_1, T_2 and T_3, respectively and 4538.45 for market sample. The highest Hardness was recorded for treatment T_3 (2913.20 gm). The lowest Hardness was recorded for treatment T_0 (1910.15 gm). It was clear that Hardness were found to be in increasing order from T_0 to T_3. From these figures it's clear that the hardness (g) was increased with the increase in the sweet corn milk concentration level. But all experimental samples showing less hardness as compared to market samples may be due to different ingredient used for preparation and storage life. This might be due to reduction in porosity due to increasing level of sweet corn milk responsible for increase in carbohydrate content, decrease in protein and fat content and reduction in moisture content (Gulhati *et al*. 1992) [5]. Brittleness of the finished product was found to be 15.829, 15.520, 13.250 and 16.654 cm for treatment T_0, T_1, T_2 and T_3 respectively and 18.200 cm for market sample. The highest Brittleness was recorded for treatment T_3 (16.654 cm). The lowest Brittleness was recorded for treatment T_2 (13.250 cm). All the treatments were found to be significantly differed over each other. It was clear that brittleness found to be in no specific trend in respect to use of sweet corn milk from T_0 to T_3. This means sweet corn milk has not any significant effect on Brittleness of *gulabjamun*. It may be due to that sugar syrup, frying condition and un-mature ingredient of corn nullify the Brittleness effect of sweet corn milk in *gulabjamun*. Cohesiveness of the finished product was found to be 0.24, 0.33, 0.35 and 0.42 per cent for treatment T_0, T_1, T_2 and T_3 respectively and 0.25 per cent for market sample. The highest Cohesiveness was recorded for treatment T_3 (0.42). The lowest Cohesiveness was recorded for treatment T_0 (0.24). All the treatments were found to be significantly differed over each other. It was clear that Cohesiveness found to be in increasing order from T_0 to T_3. This might be due to increasing level of in sweet corn milk, responsible for development of gumminess. the average Elasticity of the finished product were found to be 7.77, 8.47, 8.97 and 9.45 per cent for treatment T_0, T_1, T_2 and T_3 respectively and 6.30 for market sample. The highest Elasticity was recorded for treatment T_3 (9.45 per cent). The lowest Elasticity was recorded for treatment T_0 (7.77 per cent). All the treatments were found to be significantly differed over each other. It was clear that Elasticity found to be in increasing order from T_0 to T_3. This might be due to increasing level of sweet corn milk.

Chewiness of the finished product was found to be 4232.02, 7747.37, 6587.17 and 11749.21 per cent for treatment T_0, T_1, T_2 and T_3 respectively and 7523.38 for market sample. The highest Chewiness was recorded for treatment T_3 (11749.21 per cent). The lowest Chewiness was recorded for treatment T_0 (4232.02 per cent). It was clear that Chewiness found to be in increasing order from T_0 to T_3. This might be due to increasing level of sweet corn milk. The average Gumminess of the finished product were found to be 564.65, 937.42, 749.98 and 1228.54 per cent for treatment T_0, T_1, T_2 and T_3 respectively and 1856.42 for market sample. The highest Gumminess was recorded for treatment T_3 (1228.54 per cent). The lowest Gumminess was recorded for treatment T_0 (564.65 per cent).

Conclusion

It was observed that as the blending of sweet corn milk increased, increase in hardness, brittleness, cohesiveness, elasticity, chewiness and gumminess content. It may therefore, be concluded that the blending of 30 per cent sweet corn milk with 70 per cent buffalo milk is fairly acceptable.

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