



## ORIGINAL ARTICLE

# Studies of Sensory Parameters And Production Cost Of Sweet Corn Milk Prepared Using Sweet Corn

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### ABSTRACT

The two type milk produced from sweet corn i.e. from un-boil corn i.e. corn milk -1 and sweet corn milk from boil corn i.e. corn milk -2 was prepared by using sweet corn. Recorded the score of sweet corn milk 1&2 the sensory parameters such as colour & appearance score was 6.2 and 8.2, flavour score 7.0 and 7.5, body & texture score was 7.2 and 8.5, test score obtained as 4.5 and 5.0 and overall acceptability score as 6.7 and 7.4 respectively. The consumption of raw sweet corn milk is not acceptable to drink but may be found milk is suitable to blend in buffalo or cow milk for preparation of different milk products. The production cost for 1 per lit. cost of production of sweet corn milk for corn milk -1 and corn milk -2 was Rs. 13.50 and 14.75, respectively.

**KEY WORDS-** Sweet corn, Sweet corn milk, Sensory parameters

Received 08.02.2017

Revised 11.03.2018

Accepted 14.04.2018

### CITATION OF ARTICLE

Katore V. D., P. V. Padghan, R. A. Patil, Y. N. Patil and Patil S. P. Studies of Sensory Parameters And Production Cost Of Sweet Corn Milk Prepared Using Sweet Corn. **Adv. Res. Agri. Vet Sci.**, Volume 5 [3] May 2018: 15-20

### INTRODUCTION

Sensory evaluation has been defined as a scientific method used to evoke, measure, analyze and interpret those responses to products as perceived through the senses of sight, smell, touch, taste, and hearing (Stone and Sidel, 1993). Maize (*Zea mays*) is one of the important food crops in India. Corn grains contain carbohydrate in the form of starch, sucrose, fiber, and pentosan. The botanical name of Sweet corn is *Zea mays rugosa* and it is popularly known by many names as Indian corn, sweet corn, sugar corn, pole corn or even just corn. It is a variety of maize with high sugar content. Sweet corn (*Zea mays Saccharata*) and corn milk which is noted for its aroma and sweet taste contain saturated fatty acids (palmitate and stearat) and unsaturated fatty acids (oleat and linoleat). The corn protein has good amino acid composition, although it contains a little part of lysine and triphthopan. A 100 gm of corn milk contained 24 IU of vitamin A, 0.020 mg of vitamin B<sub>1</sub>, 0.030 mg of vitamin B<sub>2</sub>, 0.020 mg of vitamin B<sub>6</sub>, 3.7 mg of vitamin C and 0.520 mg of niacin and very popular, especially among health conscious consumers, since it has nutritional benefits over other types of vegetable drink, it is also low in saturated fat and cholesterol. Due to its pleasant taste and nutritive value, it overcomes the problems of lactose intolerance and saturated fat of cow milk (USDA, 2004). Corn grains can be processed into corn milk, corn milk powder, corn-yoghurt, corn flakes, etc. which has healthy function, because it does not contain cholesterol. As the very few work has been found on use of sweet corn milk for preparation of dairy products except sweet corn milk yoghurt (Piyawan *et al.*, 2010). To check the possibility of use of sweet corn milk in milk products, it is essential to develop the method of its preparation, know the physico-chemical properties of sweet corn milk. The importance of physico-chemical properties to the processor are to developed quality product, to evaluate the effect of processing on textural quality of product and to access the standards of raw materials. Till today, very little information is available on the physicochemical properties of sweet corn milk. The finding of this research may provide sufficient basis to conclude that use of sweet corn milk and modern processing technology for its production with acceptable quality at cheaper price as compared to whole milk could be manufactured and marketed in India. Possibility of reducing the price of milk and milk products is to replace the commercially expensive milk products in part or whole by using cheaper edible non-milk origin ingredients like corn. The non-dairy solids can be successfully substituted in place of milk solid for preparing milk products. Such production will be comparatively cheap and

within the purchasing power of the weaker sections of society who normally cannot purchase milk products.

Hence, efforts have been made to prepare milk using sweet corn milk after thinking the significance of traditional knowledge, their combination with scientific know-how with expectation to use it as a non-dairy ingredient like soya milk for preparation different food formulation particularly milk products.

### Material and Method

The material used and methods employed during the course of present investigation for preparation sweet corn milk from sweet corn are as under.

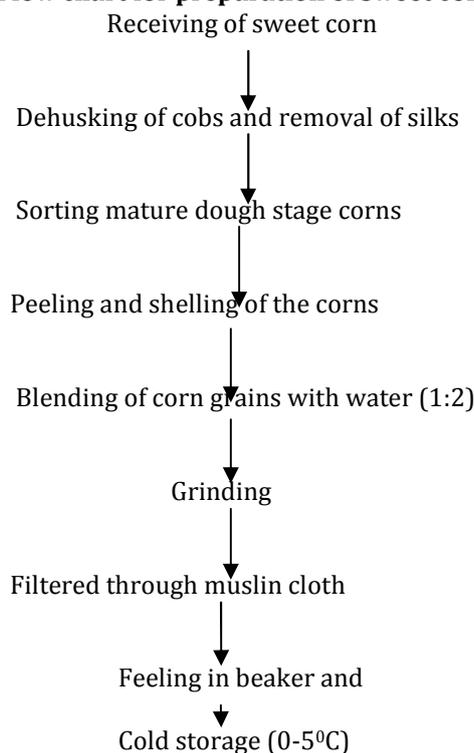
#### Sweet corn

Fresh sweet corn variety Masti (F1, Hybrid) of Nuziveedu seeds Pvt. Ltd was purchased from the local market of Latur city and used for the experimental purpose. The sweet corn was selected at dough stage (milky) for milk preparation.

#### Preparation of sweet corn milk:

The sweet corn milk was prepared as per the method Piyawan *et al.* (2010) with slight modification. The sweet corn variety, Masti (F1, Hybrid) of Nuziveedu seeds Pvt. Ltd was use after harvested on the 23<sup>rd</sup> day (at dough stage). Masti (F1, Hybrid) variety of maize is mostly grown in the local area of Marathwada region of Maharashtra state. To prepare the corn milk, the sweet corn cobs were firstly husked and then washed with water. The seeds were then separated from the cleaned cobs using knives. The sweet corn milk was prepared by two ways, first the fresh raw corn seeds (dough stage) was directly extracted using a fruit extractor to produce milk. In second method, before extracting, the seed was boiled in water for 5 minutes at 100°C and then extracted. In both type, the proportion of seed and water was kept 1:2, as shown in Figure. The corn milk solution was then filtered through a clean muslin cloth and stored at 5°C until use.

#### A. Flow chart for preparation of sweet corn milk



#### Sensory properties

Sensory evaluation of developed corn milk was done by semi expert panel of judge by 9 point hedonic scale. The sensory properties such as colour and appearance, flavour, body and texture, taste and overall acceptability were studied.

#### Cost of production of sweet corn milk.

The cost of production of sweet corn milk was worked out by considering the prevailing market rate of ingredients and material for the year 2013-2014.

## RESULT AND DISCUSSION

### Standardization of method for preparation of sweet corn milk:

The sweet corn milk was prepared as per the method Piyawan *et al.* (2008) and sample prepared in lab are shown in Plate 1.

### Preheat treatment of corn seed:

The sweet corn milk was prepared by two ways, first the fresh raw corn seeds (dough stage) was directly extracted using a fruit extractor to produce as sweet corn milk of un-boiled corn (SCMUBC) i.e. Corn milk-1. In second method, before, extracting the seed was boiled in water for 5 minutes at 100°C and then extracted called as sweet corn milk of boiled corn (SCMBC) i.e. Corn milk-2. The proportion of seed and water was kept 1:2. as shown in Figure 3.1. The corn milk was then filtered through a clean muslin cloth and stored at 5°C until further use. The milk prepared by boiling seed showed more viscosity, uniform consistency and similarity with cow milk. Both types of milk were considered for further study.

### Optimization of addition of water:

The quantity of water to be add during the preparation of sweet corn milk was tried in the proportion of corn seed: water as 1:1, 1:1.5, 1:2 and 1:2.5. At proportion 1:1 and 1:1.5 the consistency of corn milk was found very high, not match with normal milk and found difficult for staining. Whereas, at 1:2.5 proportion much thin milk was obtained. Acceptable quality of sweet corn milk was obtained at the ratio of seed: water as 1:2.



Plate -1:A.Sweet corn milk of un-boiled corn, B- Sweet corn milk of boiled corn.

### Sensory quality of sweet corn milk.

The milk samples prepared from sweet corn grains were subjected for the sensory attributes such as colour and appearance, flavour, taste, body and texture and overall acceptability by a semi panel of judges using a 9 point Hedonic scale and the data so obtained were analyzed by using Completely Randomized Block Design (CRBD). The scores given by judges for different parameters were recorded and subsequently discussed in the foregoing table.

### Colour and appearance of sweet corn milk:

The score obtained for colour and appearance of corn milk -1 and corn milk -2 is tabulated in Table. 1. It is revealed from table that the mean score for colour and appearance of corn milk -1 and corn milk -2 were

as 6.82 and 8.32, respectively. It is clear that mean score of corn milk -2 is higher than corn milk -1, this result due to method of preparation of milk impart uniform colour.

**Table No. 1. Colour and appearance of sweet corn milk:**

Type of Milk	Replications				Mean
	R1	R2	R3	R4	
Corn Milk-1 (SCMUBC)	6.8	6.9	6.7	6.9	6.82 <sup>a</sup>
Corn Milk-2 (SCMBC)	8.2	8.5	8.4	8.2	8.32 <sup>b</sup>
S.E ± 0.0629					C.D @ 5per cent = 0.2176

The values with different small letters superscripts row wise differ significantly at 5per cent level of significance

The values recorded for colour and appearance of corn milk in the present investigation are comparable with the findings of below mentioned research workers.

It was conducted by different scientist that the food material are responsible for colour variation in final products prepared from strawberry, orange and grapes showing colour variation ( Hossian *et al.* 2012,) Ignatius *et al.* (2010) studied the development of low aflatoxin soy-corn milk and reported that colour of soy-corn milk was combination of orange and yellow. It reflected that carotenoids of sweet corn contributed to the soy-corn milk colour.

#### **Flavour of sweet corn milk:**

The flavor of any food product is an important attributes as far as consumer liking is concerned. The score obtained for flavor of corn milk -1 and corn milk -2 is tabulated in Table 2. It was observed from table that the mean score for flavour of corn milk -1 and corn milk -2 were as 7.0 and 7.5, respectively. It is clear that mean score of corn milk -2 is higher than corn milk -1, this result due to sweet corn contain volatile substance of acetaldehyde acetone and ethanol which could contribute to the aroma similar result reported by Ignatius *et al* (2010).

**Table No. 2. Flavour of sweet corn milk:**

Type of Milk	Replications				Mean
	R1	R2	R3	R4	
Corn Milk-1 (SCMUBC)	7.1	7.0	6.8	7.0	6.97 <sup>a</sup>
Corn Milk-2 (SCMBC)	7.8	7.9	7.7	7.5	7.72 <sup>b</sup>
S.E ± 0.075					C.D @ 5per cent = 0.2595

The values with different small letters superscripts row wise differ significantly at 5 per cent level of significance

Piyawan *et al.* (2010) studied the characteristics and shelf life of corn milk yogurt; reported that the *trans*-2-nonenal, tridecane, ethyl acetate, ethyl palmitate, ethyl linoleate and ethyl oleate were the most important flavour compounds of fresh corn milk while tridecane, n-heptanal, ethyl linoleate, dodecane, furan and ethyl oleate were the major flavour compounds for the corn milk mixture.

The same result reported by Azanza *et al.* (1996) and Tracy (2001) who reported that ethanol, acetaldehyde, methanethiol and hydrogen sulfide were the main aroma compounds of heated sweet corn.

#### **Body and Texture of sweet corn milk:**

The body and texture is main parameter in food as far as the consumer liking is concerned. The score obtained for colour and appearance of corn milk -1 and corn milk -2 is tabulated in table no. 3. It is observed from table that the mean score for body and texture of corn milk -1 and corn milk -2 were as 6.97 and 7.72 respectively. It is clear that mean score of corn milk -2 is higher than corn milk -1; this result may be due to method of preparation of milk in case of corn milk -2 prepared by preheat treatment.

**Table No. 3. Body and Texture of sweet corn milk:**

Type of Milk	Replications				Mean
	R1	R2	R3	R4	
Corn Milk-1 (SCMUBC)	7.5	7.6	7.8	7.2	7.52 <sup>a</sup>
Corn Milk-2 (SCMBC)	8.2	8.5	8.4	8.5	8.40 <sup>b</sup>
S.E ±0.1015					C.D @ 5per cent = 0.3513

The values with different small letters superscripts row wise differ significantly at 5per cent level of significance

#### **Taste of sweet corn milk:**

The score obtained for taste of corn milk -1 and corn milk -2 is tabulated in table no. 4.15. It was observed from table no. 4. that the mean score for taste of corn milk -1 and corn milk -2 were as 4.45 and 4.95

respectively. Here one thing is clear from table sensory data that mean score of corn milk is more than 6.00 i.e. acceptable on 9 point hedonic scale but the score obtained for taste was lower than 6.00 , not accepted by judges due to its starchy test and gave less score. This may be due to the more starch content in corn milk and hence not suitable as drink in pure form. But it may be used in blend form with milk of cow and buffalo for preparation of different milk products or may be improved by adding some flavor and taste masking compound, which need to investigate by doing further study on this aspect.

**Table No. 4. Taste of sweet corn milk:**

Type of Milk	Replications				Mean
	R1	R2	R3	R4	
Corn Milk-1 (SCMUBC)	4.0	4.5	4.8	4.5	4.45 <sup>a</sup>
Corn Milk-2 (SCMBC)	4.9	4.8	5.1	5.0	4.95 <sup>b</sup>
S.E ± 0.1258		C.D @ 5per cent = 0.4452			

The values with different small letters superscripts row wise differ significantly at 5per cent level of significance

Ignatius *et al* (2010) studied the development of low aflatoxin soy-corn milk and reported that the higher sweet corn proportion resulted the higher score of taste. This might be due to the flavour of sweet corn given masking effect on the beany flavour of soybean. Here more problem of beany flavour of milk due to soybean, which was not in this study.

#### **Overall acceptability of sweet corn milk:**

Overall acceptability can be considered as a complex characteristic of food that determines its value or acceptability to consumer. Quality is judged by both subjective and objective tests. The subjective tests are the sensory tests and whereas the objective tests are the chemical, microbiological and nutritive tests. The score obtained for colour and appearance of corn milk -1 and corn milk -2 is tabulated in table no. 5. It was observed from table no. 4.16 that the mean score for colour and appearance of corn milk -1 and corn milk -2 were as 6.75 and 7.22, respectively. It is clear that mean score of corn milk -2 is higher than corn milk -1.

**Table No. 5. Overall acceptability of sweet corn milk:**

Type of Milk	Replications				Mean
	R1	R2	R3	R4	
Corn Milk-1 (SCMUBC)	6.8	6.7	6.8	6.7	6.75 <sup>a</sup>
Corn Milk-2 (SCMBC)	7.0	7.3	7.2	7.4	7.22 <sup>b</sup>
S.E ± 0.0637		C.D @ 5per cent = 0.2204			

The values with different small letters superscripts row wise differ significantly at 5per cent level of significance

It is revealed from above tables that corn milk -1 and corn milk -2 was significantly differ from each other at 5 per cent level of significant for colour and appearance, flavour, taste, body and texture and overall acceptability on the 9 point hedonic scale. As consumption of raw sweet corn milk was acceptable on the 9 point hedonic scale as per of its body and texture, color, flavor and overall acceptability. But not found suitable for test which is major concern for consumption. Hence thus milk is suitable to blend in buffalo or cow milk for preparation of different milk products. But it is not suitable to drink. Such milk were used the different scientist to develop the milk products like *yogurt, gulabjamun, dahi, shrikhand* by Piyawan *et al.*, 2010; Sujata Patil, 2014; Nain Deshmukh, 2014 and Rekha Mane, 2014, respectively.

#### **Cost structure of sweet corn milk:**

Preparation of sweet corn milk were rated as per the prevailing marketing price in the financial year 2013-2014 to estimate cost required for the preparation of sweet corn milk or material required viz. sweet corn cobs, other charges such as labour, fuel, electric charge etc. was consider and work out the cost on the basis of per 100 and 1 litter sweet corn milk. The cost may be lowered when mechanized process and large scale purchasing for the large scale production of corn milk production will be carried out. The cost production of sweet corn milk for experimental samples as per in Table. 6.

Table. 6: Cost structure of sweet corn milk:

S. No.	Particulars	Cost (Rs./kg)	Corn Milk-1 (SCMUBC)		Corn Milk-2 (SCMBC)	
			Qty. (per lit/ kg)	Amt. (Rs)	Qty. (per lit)	Amt. (Rs)
1.	Sweet corn (Kg)	24	50	1200.00	50	1200.00
2.	Labour charges	--	--	200.00	--	200.00
3	Fuel charges	--	--	25.00	--	100.00
4.	Miscellaneous charges	--	--	50.00	--	50.00
5.	Total cost per 100 kg	--	--	1350.00	--	1475.00
6.	Total cost per kg	--	--	13.50	--	14.75

It was observed from table 6 as per lit. Cost of production of sweet corn milk for corn milk -1 and corn milk -2 was Rs13.50 and 14.75 respectively. The production of corn milk -2 was highest than the corn milk -1 this difference due to the additional fuel charge for boiling the corn seed for 5 min at 100°C.

### CONCLUSION

Sweet corn grains can be processed into sweet corn milk. The finding of this research may provide sufficient basis to conclude that use of sweet corn milk as ingredient like soya milk for the production of milk products with acceptable quality at cheaper price as compared to whole milk could be manufactured and marketed in India, particularly weaker sections of society who normally cannot purchase milk products.

### ACKNOWLEDGEMENT

The authors thanks to the Vasandrao Naik Marathwada Krishi Vidyapith, Parbhani And College of Agriculture, Latur (MS).

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