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Rahul A Kirdat
Department of Animal Husbandry and Dairy Science, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Balasaheb D Patil
Department of Animal Husbandry and Dairy Science, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Sachin P Ramteke
Department of Animal Husbandry and Dairy Science, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Corresponding Author:
Rahul A Kirdat
Department of Animal Husbandry and Dairy Science, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Preparation of flavoured milk using beetroot juice as natural colorant

Rahul A Kirdat, Balasaheb D Patil and Sachin P Ramteke

Abstract
The present study was carried out with objectives to optimize the levels of cow milk; soymilk and beetroot juice in flavoured milk, to study the sensory qualities of flavoured milk. The levels of cow milk, soymilk and beetroot juice for final experimental trials were finalized in pre-experimental trials on the basis of sensory evaluation. The levels were selected as 100, 90, 80 and 70 per cent cow milk, 10, 20 and 30 per cent soymilk and 2 and 3 per cent beetroot juice for further study. The sensory evaluation was carried out in respect of colour and appearance, flavour, consistency, taste and overall acceptability.

Keywords: Flavoured milk, soymilk, beetroot juice, natural colorant

Introduction
India is highest milk producer in the world. Today's India milk production is 155.5 MT. As per scientific recommendation of ICMR the per day per capita consumption of milk is 285 g milk, however per capita availability of milk in India is only 337g during the year 2016-17 (NDDB National Statistics, 2016). Half of the milk produced in the country is utilized as fluid milk and rest is converted into traditional milk products. From these some part of milk is used for making special milk like flavoured milk, soft curd milk, fermented milk, standardized milk, recombined milk and humanized milk.

Flavoured milk is generally made from low fat milk (1.5 per cent fat and 9 per cent SNF). It is flavoured, sweetened and heat treated for extending its shelf life. Now days, there is a trend for health foods. The health conscious consumers show great interest in low calorie milk and milk products. Flavoured milk in which sugar and flavouring agents colouring matters are added in the milk, it contain all the constituents of milk. It is good source of proteins, carbohydrates and minerals. It provides energy and water to digest the food, regulate body temperature and prevent dehydration. Soy based foods may provide additional benefits for the consumer due to their hypolipidemic, anti-cholesterolemic, anti-atherogenic properties and reduced allergenicity. They provide an alternative source of protein for people who are allergic to milk protein (Bean, 1966) [2].

Soy milk in particular has occupied a unique position in the diet of Indian population, because they form a major and cheap source of proteins, calories, minerals and some vitamins. A variety of acceptable foods can be developed from soybeans to fit in the Indian diet. Soy milk based yogurt offers a considerable appeal for a growing segment of consumers with certain dietary and health concerns. It has advantages over milk yogurt including reduced level of cholesterol and saturated fat as well as low level of lactose. (Liu, *et al*. 1997) [8]. Amongst all the sources of vegetable proteins, soybean assumes the most prominent position on account of its high protein. It contains 40% protein and 20% oil. (Bahareh Hajirastamloo, 2009) [1].

Beetroot is a good source of protein, dietary fibre, important vitamins, minerals and rich in carbohydrates and betaine, but very low in fat and free from cholesterol (McCance and Widdowson, 1995) [9]. It has anti-carcinogenic properties and provides a way to boost immune system. Specific anti-carcinogens are bound to their colouring matter of Beetroot, help in fighting against cancer (Edenharder, *et. al.*, 1994; Kapadia, *et. al.*, 1996) [3, 5]. Beetroot are known for being rich in nutrients and low on calorie, having a calorific value of 43.0 per 100g. It also constitutes traces of Beta Carotene. Considering the facts about the soy milk, beetroot and their health benefits it is decided to prepare flavoured milk with beetroot juice as colouring agent.

Materials and Methods

Materials

Fresh cow milk was procured from RCDP on Cattle, MPKV, Rahuri Dist. Ahmednagar. The soybean was obtained from the Central Farm of post graduate institute, Rahuri. The seeds were cleaned and used for preparation of soymilk. Good quality, crystalline, clean sugar was purchased from Rahuri Local Market. Beetroots were purchased from local market of Rahuri, Dist. Ahmednagar.

Methodology

Preparation of soymilk

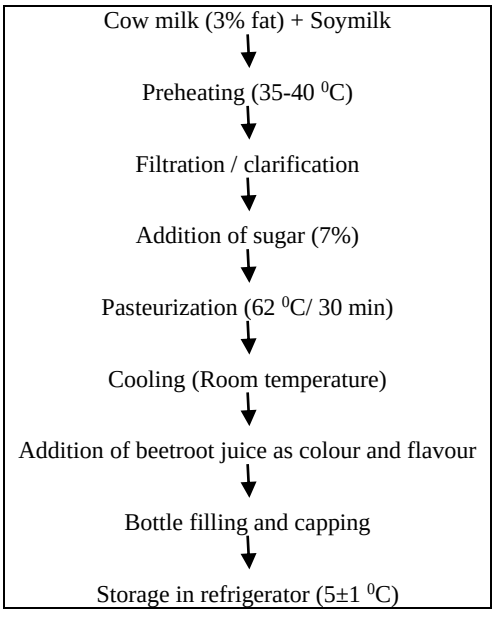
The soymilk was prepared as per the method suggested by Kapoor et al. (1977) [6] with slight modification. In each trial, 250 gm soybean seeds were washed in hot water and soaked overnight in 0.3 per cent solution of sodium bicarbonate. Dehulling of soybean seeds and addition of 2 lit. Warm water (40-50 ^{0}C). The mixture was grinded to make paste, boiled for 2 minutes and filtered through double layer muslin cloth to remove the solid portion.

Beetroot extract

Selected fresh beetroot purchased from local market, washed in tap water, peeled and sliced with the help of knife, the slices are blended and taken in muslin cloth, pressed in basket press. The beetroot extract obtained was stored at refrigerated temperature (4 ^{0}C).

Preparation of flavoured milk from blends of cow, soymilk and beetroot juice

Cow milk was standardized to 3.0% fat. A pre-determined level of soymilk was blended with cow milk as pre-experimental trials and the mixture was heated up to boiling. A sugar was added @ 7% in all treatments and allows cooling at room temperature with continuous stirring. Drops of beetroot juice as natural colorant and flavour were added with stirring for uniform distribution of flavour as per pre-experimental trials. This flavoured milk was filled in 100 ml capacity glass bottle with crown cap and stored in refrigeration condition before sensory evaluation.



Flow chart for preparation of flavoured milk using beetroot juice as natural colorant

Pre-experimental trials

Pre-experimental trials were conducted to decide the level of addition of beetroot juice (i.e. 1% to 5%) and soymilk (10% to 50%) for preparation of flavoured milk. The samples of beetroot juice and soymilk incorporated flavoured milk were subjected to sensory evaluation. On the basis of result of sensory evaluation, the levels of soymilk and beetroot juice were finalized for experimental trials.

Treatment details

Treatments for the preparation of flavoured milk from cow milk blended with different levels of soymilk and beetroot juice were finalized as bellows:

T_0- 100% cow milk + 2% to 3% beetroot juice
T_1- 90% cow milk + 10% soymilk+2% and 3% beetroot juice
T_2- 80% cow milk + 20% soymilk+2% and 3% beetroot juice
T_3- 70% cow milk + 30% soymilk+2% and 3% beetroot juice

Analytical Methods

Sensory Analysis

The samples of flavoured milk prepared in all treatment combinations were subjected to the sensory evaluation by panel of 6 semi-trained judges. It was judged for colour and appearance, flavour, consistency, taste and overall acceptability using "9 point hedonic scale" developed by (Gupta, 1976) [4].

Statistical Analysis

The data obtained in the present investigation was tabulated. The data was analysed statistically by using Factorial completely Randomized Design (FCRD) as per Panse and Sukhatme, (1985) [11].

Results and Discussion

Sensory qualities of flavoured milk

Colour and Appearance

It was observed from the table 1 and 2 that the mean score for colour and appearance of the flavoured milk ranged between 8.55(T_2) to 6.93 (T_3) and 8.35(T_2) to 6.55(T_3) respectively. It was clear from table 1 and 2 mean values that treatment T_2 (3% beetroot juice) scored the highest score. This indicates that, increase in proportion of soymilk and beetroot juice in the blend decreases the score for colour and appearance of flavoured milk. As the proportion of soymilk in the blend increases there were increased in the intensity of dull colour and increases proportion of beetroot juice in the blend there were increase in the intensity of red colour this was not favourable for consumer acceptance.

Flavour

It was observed significant differences in all treatment to each other of flavour score for flavoured milk. The mean score for flavour in Table 1 and 2 were varied from 7.73, 8.18, 8.65, 6.93 and 7.55, 8.0, 8.45, 6.85 for the treatment samples T_0, T_1, T_2 and T_3 respectively. This indicates that increase in proportion of soymilk and beetroot juice in the blend decreases the score for flavour of flavoured milk. As the proportion of soymilk increase there was increased in the beany flavour of flavoured milk.

Consistency

The treatment differences in the mean scores of consistency were found to be significant. The mean score in Table 1 and 2 ranged from 8.68(T_0) to 6.68(T_3) and 8.78(T_0) to 7.10(T_3),

respectively. Comparison between table 1 and 2 related with consistency shown the treatment T_0 (100 part cow milk + 3% beetroot) had thicker and more acceptable consistency. These indicated that increase in proportion of soymilk in the blend in different levels reduced the score for consistency of flavoured milk and increase in proportion of beetroot juice in the blend in different levels increase the score for consistency of flavoured milk. This might be decrease due to higher moisture content (89.40%) and lower total solid content (10.60%) in soymilk and increase due to lower moisture content (86.60%) and higher total solid content (13.40%) in beetroot juice. Sowonola (2005) [12] studied nutritional and sensory qualities of soymilk Kunnu blends and reported that decrease in consistency score was due to increase in the proportion of soymilk in the blend. The consistency score decreased from 8.1 to 4.4.

Taste

It was observed from the table 1 and 2 that the mean score for taste of the flavoured milk ranged between 8.28(T_2) to 6.58(T_3) per cent and 8.38(T_2) to 6.73(T_3) per cent, respectively. Comparison between table 1 and 2 related with taste shown the treatment T_2 (80 part cow milk + 20% soymilk + 2% beetroot juice) had more acceptable taste. This might be decrease due to the beany flavour of soymilk and increase due to high percent of carbohydrate present in beetroot juice. There were significant differences in all treatment to each other of taste score for flavoured milk.

Overall acceptability

From Table 1 and 2, it was seen that the addition of different levels soymilk and beetroot juice in the cow milk samples significantly influenced the overall acceptability of the product. The mean sensory score of experimental flavoured milk samples under different treatments in Table 1 and 2 were ranged from 8.58 (T_2) to 6.93 (T_3) and 8.45 (T_2) to 6.63 (T_3), respectively. The highest sensory score 8.58 was observed in treatment T_2 (80 part cow milk + 20 part soymilk + 2% beetroot juice) over the rest of sample treatments. The results obtained were in agreement with Katra and Bhargava (1990) [7]. They prepared rasogolla from soymilk blends with cow milk. They observed that the overall acceptability score for rasogolla decreased with increased proportion of soymilk in the blend.

Table 1: Sensory quality of flavoured milk (Beetroot juice of 2%)

Treatment	Colour and Appearance	Flavour	Consistency	Taste	Overall accept-ability
T_0	7.58^b	7.73^b	8.68^d	7.20^b	7.58^b
T_1	8.08^c	8.18^c	8.15^c	7.75^c	8.13^c
T_2	8.55^d	8.65^d	7.55^b	8.28^d	8.58^d
T_3	6.93^a	6.93^a	6.68^a	6.58^a	6.93^a
SE	0.03	0.04	0.07	0.06	0.03
CD at 5%	0.11	0.12	0.19	0.17	0.10

Table 2: Sensory quality of flavoured milk (Beetroot juice of 3%)

Treatment	Colour and Appearance	Flavour	Consistency	Taste	Overall accept-ability
T_0	7.43^b	7.55^b	8.78^d	7.40^b	7.48^b
T_1	7.95^c	8.00^c	8.33^c	7.90^c	7.95^c
T_2	8.35^d	8.45^d	7.70^b	8.38^d	8.45^d
T_3	6.55^a	6.85^a	7.10^a	6.73^a	6.63^a
SE	0.06	0.05	0.04	0.04	0.05
CD at 5%	0.15	0.16	0.13	0.12	0.14

Conclusion

It may be concluded that good quality flavoured milk can be prepared from combination of 80% cow milk + 20% soymilk + 2% beetroot juice. It also proved that blending of soymilk with cow milk for the preparation of flavoured milk to the maximum extent of 30% was acceptable and economical. Flavoured milk prepared from all the combination was accepted by all the judges.

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