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Effect of carrot juice on sensory quality and chemical composition of flavoured milk by using double tonned milk

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Abstract
The research work on effect of different combinations of carrot juice on sensory quality, chemical composition of flavoured milk was conducted during 2016-2017 in the department of Animal Husbandry and Dairying at College of Agriculture, Nagpur. Milk was standardized to 1.5 per cent fat and the flavoured milk was prepared with different combinations of milk and carrot juice viz.100:0 (T_1), 98:2 (T_2), 96:4 (T_3), 94:6 (T_4) and 92:8 (T_5) with five treatments and four replications in completely randomized design (CRD). Sensory evaluation carried out by the five judges, showed the different levels of carrot juice had a significant effect on sensory attributes such as colour and general appearance, taste, acceptability and overall acceptability of carrot flavoured milk. Flavoured milk prepared by blending with 6 parts of carrot juice (T_4) had secured the highest score (90.55). Similarly chemical properties viz., Acidity, ash significantly increased by treatment (94% double toned milk + 6 % carrot juice) when compared with control and other remaining treatments but fat, protein, total solids, SNF significantly decreased by the addition of increasing concentration (0-8%) of carrot juice. Thus, it is inferred that good quality flavoured milk with utilizing carrot juice can be prepared by 94 parts of double toned milk +6 parts of carrot juice, 8 per cent sugar and 0.1 per cent cardamom.

Keywords: Double tonned cow milk, carrot juice, sensory evaluation, chemical composition

Introduction
Importance of milk in human nutrition has been universally recognized. Nutrition scientists and dieticians have recommended minimum level of milk and milk product to be included in the items of daily consumption. Milk is considered as most perfect, satisfactory and ideal food in nature as it supplies body building protein, bone-forming minerals, health giving lactose and milk fat fatty acids elaborated by nature which is also referred as "Bank of Nutrients."

The flavoured milk is becoming an integral part of market milk industry because it has good consumer acceptance as a refreshing and nourishing milk beverage. Recent years have witnessed a large increase in the market penetration of flavoured milk into the total fluid milk market. Flavoured milk is gaining popularity day by day because it is a cheaper cold drink than non-milk based drinks and possesses more nutritive value.

Flavoured milks are the milk to which some flavours have been added. The very common flavours that are added to the milk are tea, coffee, cocoa and chocolate. Flavoured milk can be prepared and marketed for growing children and adults. Flavoured milk is refreshing drink and it is served as cold drink.

Carrots (*Daucus carota* L.) as one of the most popularly consumed vegetables are rich in functional food components such as vitamins (A, D, B, E, C, and K) and minerals (calcium, potassium, phosphorus, sodium, and iron). In carrots, β-carotene is present in a high concentration and can be considered as one of the most essential micronutrients because of its antioxidant activity and its property to act as a pro vitamin.

Vitamin A is most common dietary deficiency in the world so, food based strategies have regarded as a important measures for combating vit A deficiency (VAD) in many countries especially in agriculture based country. Among carotenoids, β-carotene theoretically possesses 100% Vit A activity. Hence carrot juice with highest content of carotene compared to several raw fruits and vegetables. If utilized to prepare carrot milk drink will combat VAD. (Simon, 1990) [16].

Carrot has a high concentration of β-carotene which is considered as the most essential micronutrient for human nutrition because of its antioxidant activity and property to act as a pro-vitamin A. It has been reported that 100 g of carrot contains between 6 mg and 15 mg of carotenoids, mainly β-carotene (2-10 mg). Carotenoids and other antioxidants present in carrot play an important role in the inhibition of certain types of cancers and heart related diseases due to their ability to interruption of oxidation process and formation of free radicals.

Materials and Methods

The present study was conducted on the studies on preparation of double tone lavoured milk blended with carrot juice at Department of Animal Husbandry and Dairy Science section, College of Agriculture, Nagpur during the year 2016-17.The material used and methods employed for conducting the experiments are as follows.

Materials

The whole, fresh, clean cow milk was obtained from from the Section of Animal Husbandry and Dairy Science, College of Agriculture Nagpur. Bulk milk sample was obtained in stainless steel container from the morning milking and the milk was filtered through the muslin cloth to avoid dirt and extraneous matter. The milk sample was analyzed for different milk constituent's viz., fat, protein, total solids, moisture and ash. Milk was standardized to 1.5 per cent by pearson's formula Carrot juice, Sugar obtained from the local market of Nagpur.

Preparation of carrot juice

Fresh carrots were purchased for preparation of juice from local market. Carrots were washed with clean water for removal of dust and soil adhered at surface then they were dried with the help of clean cloth. They were cut into small even sized pieces then these pieces were grinded with help of juicer to obtain fresh carrot juice.

Methods

Treatments included different combinations like;

T_1= 100 parts of double tone milk + 0 parts of carrot juice i.e. (Control)

T_2 = 98 parts of double tone milk + 2 parts of carrot juice

T_3 = 96 parts of double tone milk + 4 parts of carrot juice

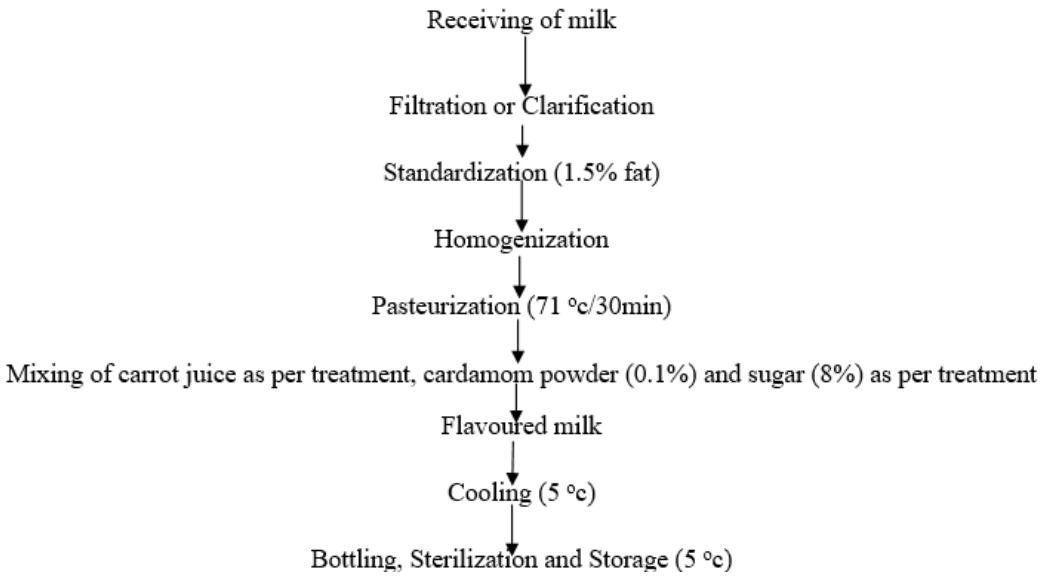
T_4 = 94 parts of double tone milk + 6 parts of carrot juice

T_5 = 92 parts of double tone milk + 8 parts of carrot juice

8.0% sugar and 0.1% cardamom were added for all treatments.

Procedure for preparation of flavoured milk: Method of preparation of flavoured milk suggested by De (2003) was used. Sugar was weighed as per proportion. At the same time milk was standardized to 1.5 per cent fat by using Pearson's Square method. The Milk was filtered and pre-heated to 35 to 40^{o}C. After standardization, boiling of milk was carried out. The sugar and carrot juice were added in milk. The mixture is then pasteurized at 71 ^{0}C/30 minutes. The mixture was then kept for cooling to room temperature and after cooling the mix was put in the sterilized bottle and kept under refrigeration storage at (5 ^{o}C) until use.

Flow chart for preparation of Flavoured milk



The observations were recorded for colour, general appearance and taste and overall acceptability by using 100-point scale (Pal and Gupta, 1985) [11] and on the basis of 9 point hedonic scale (Nelson and Trout, 1964) [10]. Fat content was determined by the fat percentage was directly read at the lower point of meniscus in Gerber's butyrometer as per the procedure recommended by the ISI bulletin no IS 1224 (part I) (Anonymous, 1977) [4]. Protein content was estimated by Micro-kjeldahl's method (Anonymous, 1961) [2]. Total solids was determined by gravimetric method (Anonymous, 1961) [2]. Solids not fat content was estimated by procedure described in ISI Handbook of food analysis (part XI) (Anonymous, 1981) [1]. The acidity percentage of milk was determined as per the procedure recommended in ISI Handbook of food analysis SP-18 (part XI) (Anonymous, 1981) [1]. The ash content in carrot flavoured milk is determined by procedure recommended in Handbook of food analysis. (Anonymous, 1967) [3]. Statistical analysis was done as per method suggested by Snedecor and Cochran (1994).

Results and Discussion

A) Sensory evaluation of flavoured milk

a) Colour and general appearance

The data from table 1 showed that the mean score for colour and general appearance of flavoured milk during various treatments T_1 (100:00), T_2 (98:02), T_3 (96:04), T_4 (94:06) and

T_5 (92:08) double tone cow milk to carrot juice were 24.91, 22.56, 23.86, 26.74 and 21.32 respectively. The highest score of 26.74 for colour and general appearance was obtained by treatment with 94 parts of double tone milk + 06 parts of carrot juice which was at par with treatment 100 parts of double tone milk +0 parts of carrot juice (24.91). The lowest score of 21.32 was obtained by treatment 92 parts of double tone milk + 8 parts of carrot juice. Similar results were obtained by Shirke *et al*. (2015) [15], who reported that that treatment 2 i.e. carrot flavoured milk with 4% carrot juice was preferred by judges among all other treatments and Rede *et al.* (2016) [12] reported that with increase in the days after manufacture of flavoured milk sensory scores for colour and general appearance decreases.

b) Taste

The data from table 1 showed that the score obtained for taste were 43.34, 41.04, 42.62, 45.39 and 40.84 for treatments T_1 (100:00), T_2 (98:02), T_3 (96:04), T_4 (94:06) and T_5 (92:08) double tone milk to carrot juice, respectively. The highest score of 45.39 for taste was obtained by treatment with 94 parts of double tone milk +06 parts of carrot juice which was at par with treatment 100 parts of double tone milk +0 parts of carrot juice (43.34).The lowest score of 40.84 was obtained by treatment 92 parts of double tone milk + 8 parts of carrot juice. Likewise similar result was reported by Shirke *et al*. (2015) [15] reported that highest scores for taste attribute of carrot flavoured milk was given by judges to the treatment 2 i.e. flavoured milk with 4% carrot juice. Repate *et al.* (2010) observed that sensory scores for taste attribute of safflower flavoured milk was decrease as the concentration of flavouring agent i.e. safflower milk increases.

B) Acceptability

The data from table 1 showed that the score obtained for acceptability were 15.52, 14.75, 16.82, 18.42 and 13.98 for treatments T_1 (100:00), T_2 (98:02), T_3 (96:04), T_4 (94:06) and T_5 (92:08) double tone milk to carrot juice, respectively. The highest score of 18.42 for acceptability was obtained by treatment with 94 parts of double tone milk +06 parts of carrot juice which was at par with treatment 96 parts of double tone milk +04 parts of carrot juice (16.82). The lowest score of 13.98 was obtained by treatment 92 parts of double tone milk + 8 parts of carrot juice. Likewise similar result was reported by Deore (2013) who reported that T_1 i.e. pineapple flavoured milk with 1.5 per cent fat had scored highest marks (17.50) while, T_3 i.e. pineapple flavoured milk with 3 per cent fathad scored the lowest marks (14) for acceptability of flavoured milk. Shirke *et al* (2015) [15] reported that highest score (18.66 out of 20) for acceptability was obtained in the flavoured milk prepared with 4 per cent of carrot juice.

a) Overall acceptability

The overall acceptability of flavoured milk was significantly affected by addition of carrot juice. Flavoured milk with treatment T_4 (8.55) was significantly superior over the rest of the treatment. The lowest score obtained by flavoured milk prepared without addition of carrot juice i.e control T_1 (6.50). The present results obtained in present investigation for overall acceptability are more or less in agreement with findings of Singh *et al.* (2005) they observed that sensory scores for overall acceptability increased up to some extent and then it gradually decreased.

Chemical composition

The data regarding chemical composition of Flavoured milk revealed that it had significantly ($P \leq 0.05$) increase Acidity (%), ash (%) than the control. Comparison between the treatment groups indicated that fat (%), protein (%), total solids (%) and SNF (%) significantly ($P \leq 0.05$) declined with increase in the concentration of carrot juice in the flavoured milk.

Fat

The data pertaining to fat content of flavoured milk with different levels of carrot juice are presented in table 2. The mean fat content percentage were 1.50, 1.47, 1.45, 1.42 and 1.40 per cent with treatments T_1 (100:0), T_2 (98:02), T_3 (96:04), T_4 (94:06) and T_5 (92:08) (Double tone milk to carrot juice), respectively. Fat content in flavoured milk was decreased as the proportion of carrot juice in the flavoured milk was increased. This might be due to very low fat content in carrot juice i.e. 0.20 per cent. Salwa *et al.* (2004).This investigation are agree with the results obtained by Kapgate (2015),who reported that highest fat content was found in T_1 (2.98 %) prepared with 1 parts of pineapple liquid concentrate and lowest fat content was noticed in T_5 (2.93 %) prepared with 3 parts of pineapple. It indicated that fat content in flavoured milk slightly decreased with the increased pineapple liquid concentrate.

Table 1: Effect of carrot juice on sensory evaluation and overall acceptability of Flavoured milk

Treatments Proportion (DTCM:CJ)	Parameters			
	Colour And general appearance (30)	Taste (50)	Acceptability (20)	Overall acceptability
T_1 (100:00)	24.91^b	43.34^b	15.52^c	6.50^e
T_2 (98:02)	22.56^d	41.04^d	14.75^d	7.53^c
T_3 (96:04)	23.86^c	42.62^c	16.82^b	8.04^b
T_4 (94:06)	26.74^a	45.62^a	18.42^a	8.55^a
T_4 (92:08)	21.32^e	40.84^e	13.98^e	7.00^d
SE (m) ±	0.47	0.38	0.43	0.11
CD at 5%	1.40	1.12	1.29	0.33

(DTCM -Double Tone Cow Milk, CJ- Carrot Juice, * $P < 0.05$)

Protein

Protein content in flavoured milk by the different levels of carrot juice ranged from and 3.31,3.26,3.21,3.18 per cent and 3.12 with treatments T_1(100:0),T_2(98:02),T_3(96:04), T_4 (94:06) and T_5(92:08) double tone milk to carrot juice, respectively. The results of present investigation are more or less in agreement with the findings of Dalim *et al.* which showed that average protein content of chickoo flavoured milk was 3.56 per cent. Shirke *et al*. (2015) [15] observed that highest total protein content was noticed in T_1 (3.35 %) prepared with 2 parts of carrot juice and lowest acidity content was noticed in T_4 (0.14%) prepared with 8 parts of carrot juice. It indicated that protein content in flavoured milk decreased with the increased carrot juice level.

Total solids

Total Solids content in flavoured milk by the different levels of carrot juice ranged from 11.34, 11.14, 10.93, 10.72 and 10.51 percent with treatments T_1 (100:0), T_2 (98:02), T_3 (96:04), T_4 (94:06) and T_5 (92:08) double tone milk to carrot juice, respectively. The results of present investigation are in agreement with the findings of Singh *et al.* (2005) they reported that increase in the level of carrot juice there was proportionately decrease in the total solids content of carrot flavoured milk. Likewise Repate *et al.* (2010) also noticed that increase of safflower milk concentration in milk during the manufacture of safflower flavoured milk there was decrease in the total solids content in flavoured milk

Solids not fat

The data presented in table 2 indicated that the average solids not fat content of flavoured milk with addition of carrot juice decrease proportionately. Solids not fat content in flavoured milk by the different levels of carrot juice ranged from 9.86, 9.71, 9.54, 9.34 and 9.16 per cent with treatments T_1 (100:0), T_2 (98:02), T_3 (96:04), T_4 (94:06) and T_5 (92:08) double tone milk to carrot juice, respectively. Rede *et al*. (2016) [12] reported that the solids not fat content in the flavoured milk were in range of 16.29 to 16.31 per cent and remains constant with the increase in storage interval at different temperature. The initial solid not fat in flavoured milk was 16.30 per cent at room temperature (T_1) during first hour and it remains same at refrigeration temperature (T_2) on first day of storage.

Acidity

The acidity content in flavoured milk with different levels of treatments ranged from 014, 0.15, 0.17, 0.19 and 0.21 per cent with treatments T_1 (100:0), T_2 (98:02), T_3 (96:04), T_4 (94:06) and T_5 (92:08) double tone milk to carrot juice, respectively. The acidity content in flavoured milk significantly increased with increase in the different levels of carrot juice. Rede *et al*. (2016) [12], who reported that the acidity in the flavoured milk increased with the increase in storage interval at different storage temperature. Acidity in flavoured milk were ranging from 0.14 to 0.37 per cent and 0.14 to 0.28 per cent at room temperature (T_1) and refrigeration temperature (T_2) respectively.

Ash

The data pertaining to ash content of flavoured milk with different levels of carrot juice are presented in table 2.The mean ash content percentage were 0.74,0.76,0.78,0.80 and 0.82 per cent with treatments T_1(100:0),T_2(98:02),T_3(96:04), T_4(94:06) and T_5(92:08) double tone milk to carrot juice, respectively. The results of present investigation are more or less in agreement with the findings of Jothylingam and Pugazhenthi (2013) they reported that ash content of dietic flavoured milk was ranging from 0.75 to 0.78 per cent.

Conclusions

It may be inferred that the superior, nutritional and medicinal quality flavoured milk can be prepared by addition of 94 parts of double toned milk and 6 parts of carrot juice with 8 per cent sugar and 0.1 per cent cardamom. Carrot flavoured milk contains 1.42 per cent fat, 3.18 per cent protein, 10.72 per cent total solids, 9.34 solids not fat, 0.19 per cent acidity and 0.80 per cent ash, respectively.

Table 2: Chemical composition of carrot flavoured milk

Constituents (DTCM:CJ)	Control T_1(100:00)	T_2 (95:05)	T_3 (90:10)	T_4 (85:15)	T_4 (85:15)	SE	CD at 5%
Fat	1.50^a	1.47^b	1.45^c	1.42^d	1.40^e	0.006	0.018
Protein	3.31^a	3.26^b	3.21^c	3.18^d	3.12^e	0.005	0.015
Total Solids	11.34^a	11.14^b	10.93^c	10.72^d	10.51^e	0.010	0.030
Solids not fat	9.86^a	9.71^b	9.54^c	9.34^d	9.16^e	0.010	0.030
Ash	0.74^e	0.76^d	0.78^c	0.80^b	0.82^a	0.010	0.030
Acidity	0.14^e	0.15^d	0.17^c	0.19^b	0.21^a	0.040	0.012

Values with different superscripts differ significantly (P<0.05)
(DTCM -Double Tone Cow Milk, CJ- Carrot Juice)

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