STUDY ON SENSORY CHARACTERISTICS OF INULIN ENRICHED STERILIZED FORTIFIED FLAVOURED MILK DRINK

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Abstract: The effect of various levels of inulin on the inulin enriched sterilized flavoured milk drink is developed and fortified with iron and vitamin A. The product was prepared by replacing milk fat with inulin at 0, 1, 2, 3 and 4 % levels. The product was also fortified with vitamin A and iron. The sensory evaluation of the product was carried out on different attributes using 9 point hedonic scale. The effect of various levels of inulin on the sensory characteristic of sterilized fortified flavoured milk drink was investigated. The level of inulin had significantly influenced the sensory characteristics of product. The product containing 1% milk fat and 2% inulin (T_3) was found to be more acceptable than all treatments.

Keywords: Inulin, Sterilize, Milk

INTRODUCTION

India is the largest milk producer in the world and according to department of Animal Husbandry the milk production in 2011- 12 is about 127.3 Million Tones (http://www.nddb.org/English/Statistics/Pages/Milk-Production.aspx). Milk is mostly consumed in the world wide as it packed with essential nutrients than any other single food. It is a major ingredient in thousands of beverages and foods. Milk comes in many varieties and its health benefits are well-re-searched and documented.

Other beverages including soft drinks contribute to energy intake and provide fewer nutrients. But milk is the only key source of macronutrients, calcium, magnesium, phosphorus, vitamin D, vitamin A, riboflavin, vitamin B-12, and potassium for children and teenagers for optimal health and growth (Fiorito et al., 2006; Moore, 2006 and Huth, 2006).

Flavored milks provide another option for meeting the daily recommended intakes of nutrients including calcium particularly for children. It is available in traditional flavors such as chocolate as well as innovative flavors including strawberry, vanilla, pista etc. and most popular milk choice in schools due to its highly palatable nature. Milk or other dairy products are close to ideal food that contains all nutrients required for newborn, adults and older ones; however, it is generally poor source of iron (0.52 mg/l) as against calcium (1277.3 mg/l) and phosphorus (963.28 mg/l). Iron deficiency is the most common micronutrient deficiency in the world affecting 1.3 billion people i.e. 24% of the world population (El Behairy *et al.* 2011). From a nutritional point of view, iron is one of the most studied elements because its deficiency affects about one third of the world's population. Diet is the best way to meet all of the nutritional requirements for this element.

There is growing concern about health among consumers, and they look forward for products that carry "healthy image". Though flavourd milk is a rich source of protein, minerals, its high fat contents and lack of fiber limits its consumption. The fat can be easily replaced using soluble fiber i.e. inulin. Due to the replacement of fat by inulin fat-soluble vitamins, such as vitamins A and D, are lost but they can be replaced through fortification. Several clinical investigations have proved that all fibers either soluble or insoluble are equally important for health.

Inulin, a soluble fibre extracted from chicory roots, is accumulating value in the functional food market, as ongoing research finds the ingredient has several health, nutritional and technological benefits. Consumption of high fiber diets reduces risk of chronic diseases, diabetes and intestinal cancer (Meijers, 2010). Inulin attracts water and form a gel, which slows down digestion. It delays the emptying of your stomach and makes you feel full, which helps control weight. Slower stomach emptying may also affect blood sugar levels and have a beneficial effect on insulin sensitivity, which may help control diabetes (Kelly, 2009).

The benefits of inulin ingestion are not only limited to its condition as a dietetic fibre, but also include aspects related to its prebiotic (stimulation of growth of health-promoting bacteria e.g. bifidobacteria) nature, and the regulation of intestinal flora in the colon (Kolida *et al.*, 2002). In addition, inulin has unique technological properties such as fat, sugar replacer, texture agent etc (Tako *et al.*, 2007). In order to exploit the benefits of inulin, it is incorporated in to flavoured milk manufacturing as a fat replacer and also fiber enrichment.

Therefore, an investigation has been carried out to know the effect of replacement of milk fat with various levels of inulin on the sensory characteristics of sterilized fortified flavoured milk.

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MATERIAL AND METHOD

Raw Material

The fresh cow milk was procured from a private dairy farm and cane sugar from local market of Raipur. Food grade inulin powder (Cosucra group Warcoing, Belgium) was procured from Vilco Ingredients Pvt. Ltd. Mumbai. Iron (II) sulfate heptahydrate cryst. purified Ferrous Sulfate from Merck Pvt. Ltd. and vitamin A Acetate from Loba Chemicals Pvt. Ltd. were used for food fortification.

Preparation of Inulin enriched Sterilized Fortified Flavoured Milk Drink

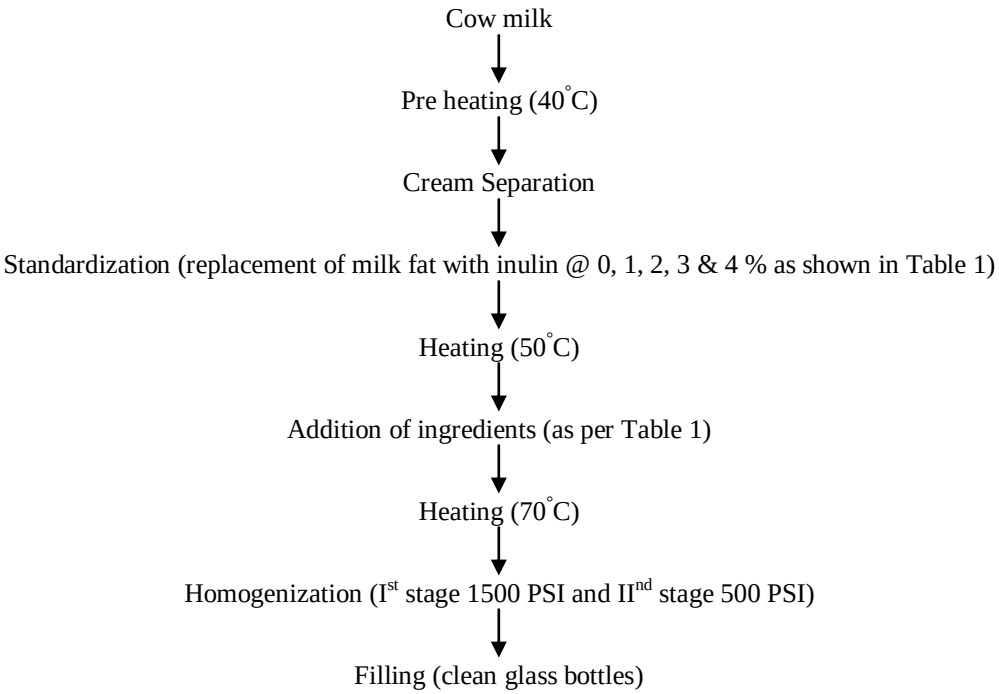
For the preparation of inulin enriched sterilized fortified flavoured milk drink, the fresh cow milk was separated and standardized and the milk fat was replaced with inulin @ 0, 1, 2, 3 and 4% levels constituting treatment details viz. T_1 (3 % milk fat + 0 % inulin), T_2 (2 % milk fat + 1 % inulin), T_3 (1 % milk fat + 2 % inulin), T_4 (0 % milk fat + 3 % inulin) and T_5 (0 % milk fat + 4 % inulin). The product was also fortified with iron and Vitamin A based on daily intake level, while sugar and stabilizer were kept constant at 7% and 0.05% respectively. The Table 1 shows the various treatment details and proportion of ingredients and all five lots of products were prepared.

Table-1: Treatment details and proportions of ingredients

	Per cent				
Treatment / Ingredients	**T_1 (3% MF + 0% Inulin)**	**T_2 (2% MF + 1% Inulin)**	**T_3 (1% MF + 2% Inulin)**	**T_4 (0% MF + 3% Inulin)**	**T_5 (0% MF + 4% Inulin)**
Cow Milk	69.110	44.789	20.986	0.000	0.000
Skim Milk	23.827	47.148	69.951	89.937	88.937
Inulin Powder	0.000	1.000	2.000	3.000	4.000
Sugar	7.000	7.000	7.000	7.000	7.000
Vitamin A	0.012	0.012	0.012	0.012	0.012
Iron	0.001	0.001	0.001	0.001	0.001
Stabilizer	0.050	0.050	0.050	0.050	0.050
Total	100.00	100.00	100.00	100.00	100.00

The sterilized fortified flavoured milk drink was prepared as per procedure given by Bhardwaj and Beniwal (2009) with slight modifications to optimize the level of inulin and the flow chart shows the manufacturing detail (figure 1). The prepared products was subjected to sensory evaluation using 9-point Hedonic scale (Amerine 1965) by a panel of 6 judges.the experiment was replicated four times.

Figure: 1 Preparation of inulin enriched sterilized fortified flavoured milk drink



Crown Corking

In Bottle Sterilization (121°C/15 min, 15psi)

Cooling and Storage (Room temp.)

RESULTS AND DISCUSSION

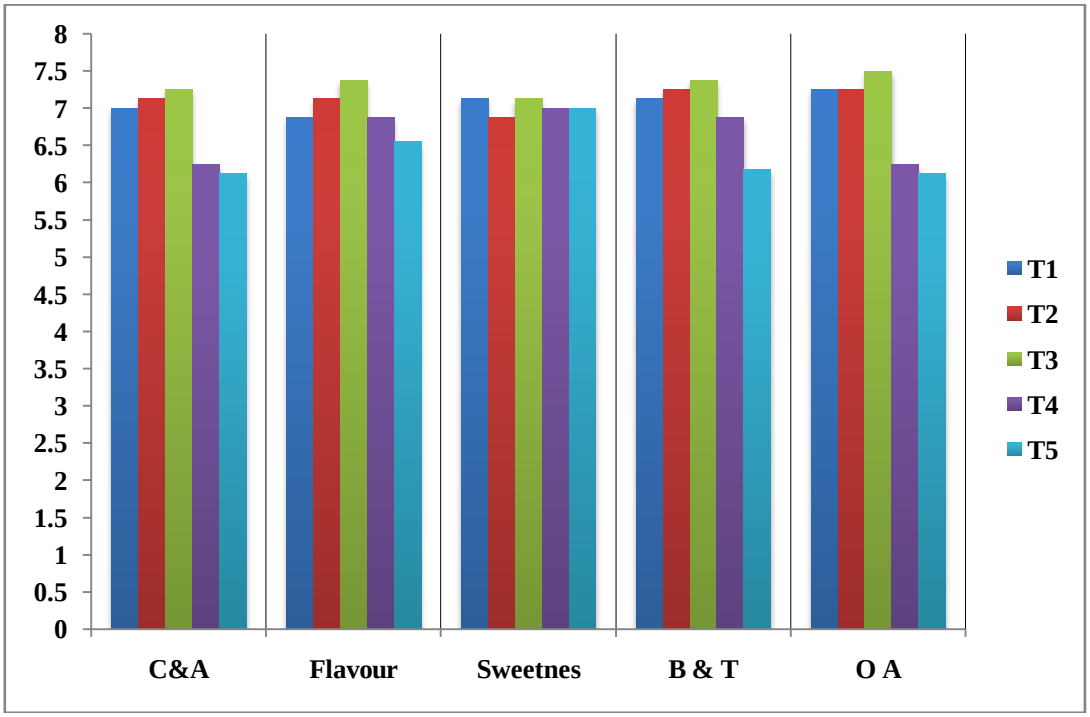
The sensory evaluation of five lots of inulin enriched sterilized fortified flavoured milk drink (T_1, T_2, T_3, T_4 and T_5) with different levels of inulin i.e. 0%, 1%, 2%, 3% and 4% was performed by the panel of 6 trained judges based on 9 point hedonic scale. The sensory scores in fresh condition on body and texture for treatments T_1, T_2, T_3, T_4 and T_5 samples were recorded to be 7.125, 7.25, 7.375, 6.875 and 6.175 respectively (Table 2). It means the inulin addition improved the body and texture of low fat flavoured milk drink because of the gelling properties of inulin but higher percentage thickens the product. The overall acceptability scores for treatments T_1, T_2, T_3, T_4 and T_5 were found to be 7.375, 7, 7.5, 6.25 and 6.125 respectively and graphically indicated in figure 2. It showed slightly increase in overall acceptability scores with addition upto 2 % inulin but decreased in 3 and 4 % inulin (fig. 2).

Table 2: Effect of treatments on different parameters of sensory evaluation in inulin enriched sterilized fortified flavoured milk drink

Particulars	Treatments				
	T1	T2	T3	T4	T5
Colour & Appearance	7.00	7.13	7.25	6.25	6.13
Flavour	6.88	7.13	7.38	6.88	6.55
Sweetness	7.12	6.87	7.13	7.00	7.00
Body & Texture	7.13	7.25	7.38	6.87	6.18
Overall Acceptability	7.25	7.25	7.50	6.25	6.13

Note: All scores are average of three

Fig. 2: Effect of treatments on different parameters of sensory evaluation in inulin enriched sterilized fortified flavoured milk drink



It may be concluded that the inulin enriched sterilized fortified flavoured milk drink prepared from 1% fat and 2% inulin (T_3) was found to be higher overall acceptability as compare to control i.e. T_1 (3% fat and 0% inulin). Treatment T_3 was shown similar mouhfeel and other charecteristics with respect to control (T_1) than any other treatments. It means 1% fat and 2% inulin addition posses same characteristic as 3% fat.

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