EFFECT OF BANANA PULP ON SENSORY CHARACTERISTICS OF NON-DAIRY YOGHURT PREPARED FROM SOYMILK, PEANUT MILK AND FINGER MILLET FLOUR

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ABSTRACT

The study has been undertaken to investigate the difference in the sensory characteristics of non-dairy yoghurt prepared by combining soymilk and peanut milk in the ratios 80:20, 60:40, 40:60 and 20:80 respectively, along with finger millet flour @ 5, 10, 15 percent and banana pulp @ 20, 30 and 40 percent. The sensory evaluation was done by the panel of 5 trained judges based on the hedonic scale rating to judge the acceptability of the developed product. Firstly, the sensory evaluation of non-dairy yoghurt (without banana pulp) was done by taking plain yoghurt as control and on the basis of that judgment four best samples were chosen which were further used for the sensory evaluation of the non-dairy yoghurt (with banana pulp) by mixing it with different percentage of banana pulp. From the result, it can be concluded that the non-dairy yoghurt prepared by combining 60:40 soymilk and peanut milk, 15 percent finger millet flour and 40 percent banana pulp was found to have the highest sensory score when compared to other treatments.

Keywords: Non dairy yoghurt, organoleptic properties, soymilk, peanut milk, finger millet flour

1. INTRODUCTION

In recent years, the consumer demand for a new range of dairy products have been increased, including yoghurts, which have functional properties and low fat content with different flavors and colors especially designed for children resulting its increase in the market share. Yoghurt is a coagulated dairy product obtained by the lactic acid fermentation of milk by bacteria i.e. *Streptococcus thermophilus (ST), Lactobacillus delbrueckii ssp. bulgaricus* (FAO/WHO, 1977; Fadela *et al*., 2009). Addition of these two cultures results in acidification of milk and synthesis of aromatic compounds (Sahan *et al*., 2008; Serra *et al*., 2009).

Though yoghurt can be made from the milk of many animals, cow's milk is the most commonly used. Soymilk is also a good alternative to dairy milk and is widely available in markets. In comparison to full fat cow's milk, soymilk has a lower fat content, low saturated fat, no cholesterol and free of lactose (Zhang, 2000, Trindade *et al*., 2001). In addition to this it has low carbohydrate content, provides a good source of protein, and contains higher amount of iron, thiamine, and niacin than cow's milk. Peanut milk derived from peanut (*Arachis hypogeal*), is a non-dairy beverage created using peanuts and water. Similar to soybeans, the peanuts have also been reported to contain bioactive phytochemicals, particularly isoflavones (genistein, daidzein, and biochanin A) and trans-resveratrol. The high levels of the isoflavones in peanut products are mainly due to heat-induced conversion of conjugate glycosides to aglycons. The availability of genistein and trans-resveratrol has been reported as significantly higher in the processed peanuts; hence peanut milk is also highly healthful as that of soybean milk with added advantage of not having strong beany flavour. Ragi or finger millet (*Eleusine coracana*) is one of the common millets in several regions of India. Of all the cereals and millets, ragi or finger millet has the highest amount of calcium and potassium, higher dietary fiber, minerals, and sulfur containing amino acids compared to white rice, the current major staple in India.

With the advent of health foods, there has been a growing trend to fortify the milk product with fruits. Yogurt has been proved to be appropriate product to make almost complete food by incorporating economical nutrient source. Banana (*Musa paradisiaca*) is one of the most important marketable tropical fruits and is the ideal food source to provide vitality. It contains three natural sugars: sucrose, fructose and glucose which provide instant energy, as well as fiber that can help in restoring normal bowel action. Besides, they are also a valuable source of vitamin B_6, vitamin C and potassium. Thus, the present study focuses on the usage of health nutri cereal for manufacture of non-dairy yoghurt with improved sensory quality.

2. MATERIALS AND METHODS

2.1. Preparation of raw materials

Traditional yoghurt cultures i.e. *Streptococcus thermophilus* and *Lactobacillus bulgaricus* (NCDC-144) was obtained from National Collection of Dairy Cultures, Dairy Microbiology Division at N.D.R.I. Karnal, Haryana, India. Soy milk was prepared by blending the soybean with water with a household blender for 5 min. The water added for grinding process was about three to four times of the weight of soybean. After that the slurry was added with water, to obtain soybean water ratios of 1:10. The soybean slurry was then passed through the double layered cheesecloth to yield soybean milk which was then heated at 82°C for 10 minutes for pasteurization. For the preparation of peanut milk, whole peanuts was first washed and soaked with the peanut and water ratio of 1:2 (w/v) for seven hours at room temperature. After draining, the peanuts were de-skinned and then grounded to obtain smooth peanut slurry. The water added for grinding process was about three to four times of the weight of peanut. The slurry then was added with water, to obtain peanut water ratios of 1:10. The peanut slurry obtained was then passed through the double layered cheese cloth to yield peanut milk which was then dispended into the heating tank at 82°C for 10 minutes for pasteurization. The finger millet flour was prepared by grinding the finger millet in a household blender to obtain a fine powder. To prepare banana pulp, fully ripe banana were washed properly and the peel was removed. The pulp was then prepared by blending the banana in a household blender.

2.2. Preparation of control:

The control i.e. plain yoghurt was prepared by first pasteurizing the milk at 80°C for 5 minutes and cooled to temperature of 42°C. After cooling yoghurt culture (*Streptococcus thermophilus* and *Lactobacillus bulgaricus*) @ 1.5% was added and incubated at 42 °C until the desired titratable acidity (0.4 - 0.5 %) was reached. The yogurt was then cooled to 5°C.

2.3. Preparation of non-dairy yoghurt:

To develop the standard non-dairy yoghurt appropriate proportion of soy milk (SM) and peanut milk (PM) were blended in the following ratios: 80:20, 60:40, 40:60 and 20:80, respectively. The finger millet flour (FF) was added to each ratio of soy-peanut milk @ 5, 10 and 15 percent. On the basis of sensory evaluation of non-dairy yoghurt samples (without banana pulp), the best treatments from each combination of soya milk and peanut milk along with finger millet flour were further combined with banana pulp (BP) @ 20, 30 and 40 percent. The preparation of non-dairy yoghurt is shown in the following schematic diagram (Figure 2.1 and 2.2).

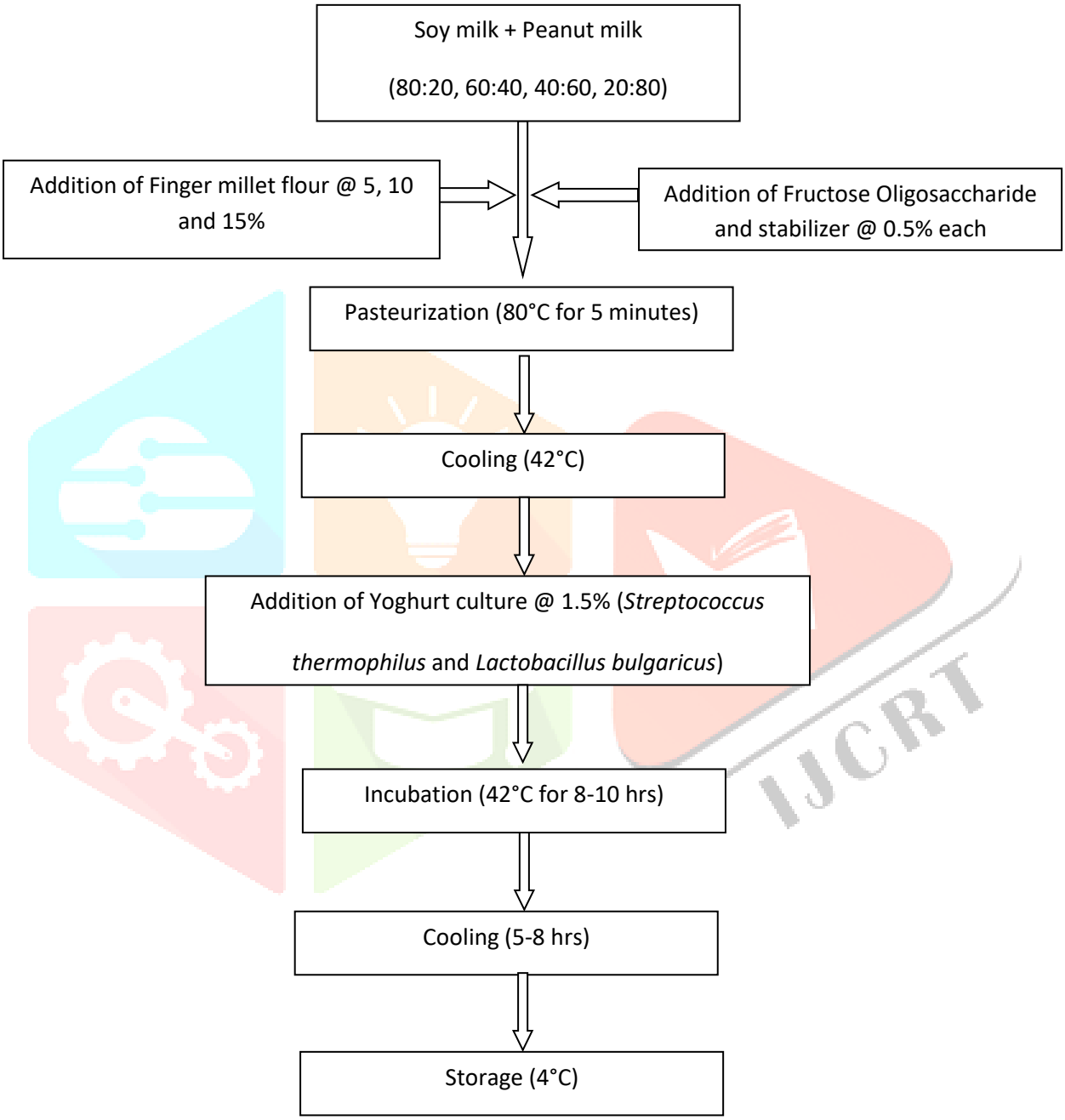
2.4. Sensory Evaluation

The evaluation was done by 5 trained panelists at Warner College of Dairy Technology, SHUATS. Judgments for non-dairy yoghurt (without banana pulp) were done through rating products on a 9 point hedonic scale (Ranganna, 2009) with plain yoghurt as control. The corresponding descriptive terms ranging from 9 ‘like extremely’ to 1 ‘dislike extremely’ having different quality attributes such as color and appearance, body and texture, flavor and taste, and overall acceptability. On the basis of judgement, the best treatments from each combination of soya milk and peanut milk were further combined with banana pulp along with finger millet flour and the prepared samples were again evaluated rating products on a 9 point hedonic scale having different quality attributes such as color and appearance, body and texture, flavor and taste, and overall acceptability.

2.5. Statistical Analysis

To determine the statistical significance of sensory characteristics of non-dairy yoghurt samples, they were analyzed using SPSS software by ANOVA at a 5% significance level. All values are expressed as mean and standard deviation of five parallel measurements.

Fig 2.1. Schematic diagram for the preparation of non-dairy yoghurt (without banana pulp)



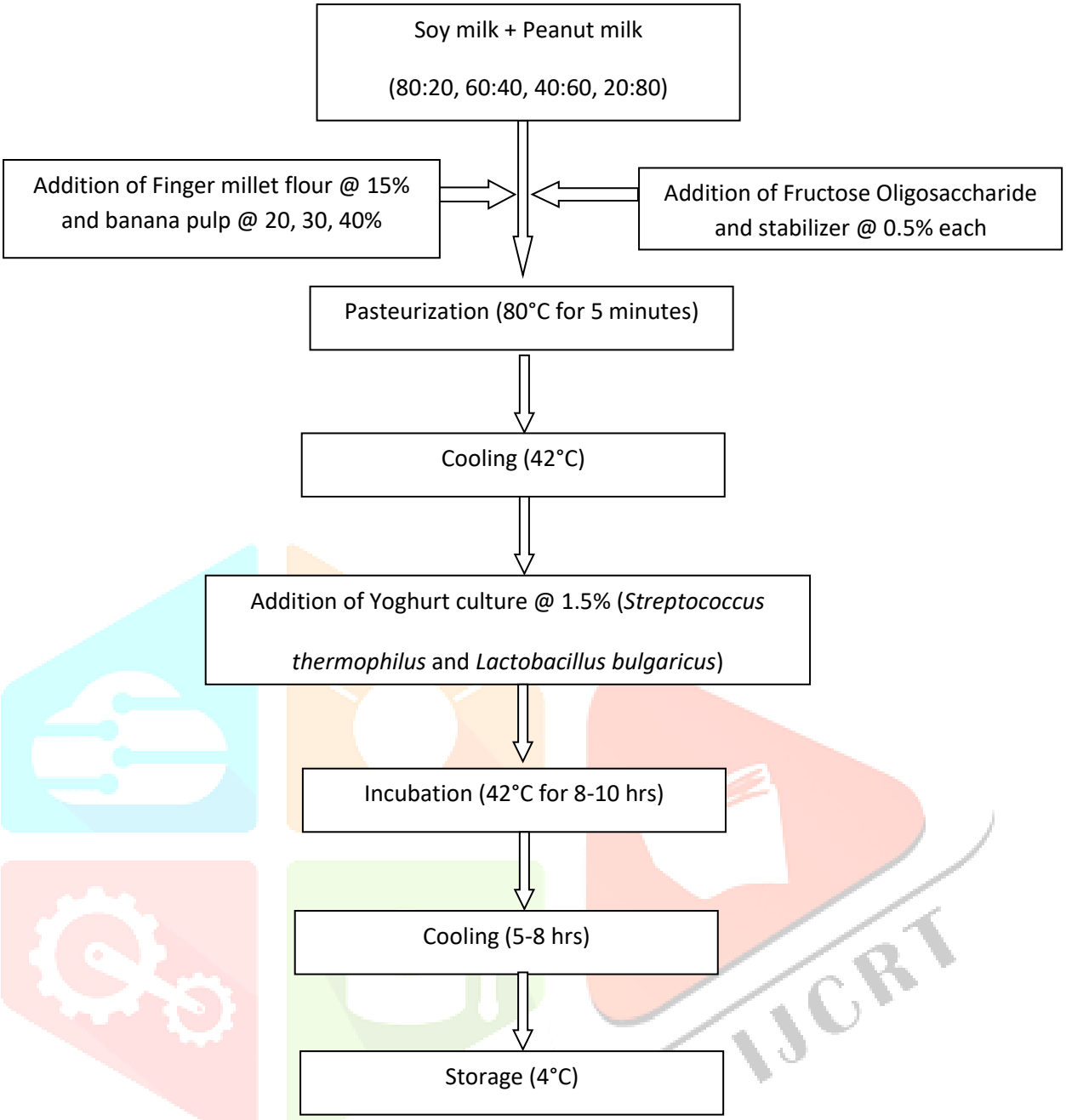


Fig 2.2. Schematic diagram for the preparation of non-dairy yoghurt (with banana pulp)

3. RESULTS AND DISCUSSION

Sensory evaluation is an important and best method for evaluating the organoleptic properties of various products which provide quality measure as well as production control. The parameters studied under sensory evaluation includes color and appearance, body and texture, flavor and taste and over all acceptability. To select the preferred level of finger millet flour in the non-dairy yoghurt prepared by combining soymilk and peanut milk in different ratios, the sensory quality was assessed by a panel of 5 trained judges and best product was selected based on the results from the hedonic score card. Food acceptance and preference are functions of product quality. Mostly color is the initial sensory characteristic perceived by the consumer and it tends to modify other perceptions such as flavor and aroma (Garcia-Perez *et al*., 2005). From the result it can be observed that there was a significant difference ($P<0.05$) in the scores of color and appearance among all treatments with T_0 i.e. plain yoghurt having the highest mean value of 8.800 ± 0.447 followed by T_2F_3 (60:40 SM:PM, 15% FF ; 8.000 ± 1.225) as shown in Table 3.1. The highest score for body and texture was recorded for the samples containing 15 per cent finger millet four and lowest for samples containing 5% finger millet flour which shows that viscosity of non-dairy yoghurt increases with the increase in the level of finger millet flour. Mugocha *et al.* (2000) reported that with the increasing

levels of finger millet gruel, syneresis decreased which might be due to the starch acting as a stabilizer thus, preventing the separation of the liquid from the gel. Among the different combination treatments, the highest score value was recorded in T_2F_3 (7.600±0.548) followed by T_1F_3 (80:20 SM:PM, 15% FF; 7.400±1.140) when compared to T_0 (Control; 8.600±0.548).This could be due to the reason that peanut milk contains more total solid content than soymilk. The average score for flavour and taste as well as overall acceptability was found to be greater in T_0 followed by T_2F_3 (60:40 SM:PM, 15% FF) whereas lowest score was observed in T_4F_1 (20:80 SM:PM, 5% FF). The lower acceptability of prepared non-dairy yoghurt containing the greater percentage of peanut milk could be due to the presence of slightly beany flavour which decreases with the increase in the percentage of finger millet flour addition in the prepared sample. The results of sensory evaluation for non-dairy yoghurt (without banana pulp) indicates that among the different combination ratios of soymilk and peanut milk, T_2F_3 (60:40 SM:PM, 15% FF) was better accepted in terms of all the sensory attributes followed by T_1F_3 (80:20 SM:PM, 15% FF), T_3F_3 (40:60 SM:PM, 15% FF) and T_4F_3(60:40 SM:PM, 15% FF) when compared with other treatments along with plain yoghurt as control (T_0) score as shown in Figure 3.1. These four treatments mixed along with banana pulp @ 20, 30 and 40% were further evaluated by a panel of 5 trained judges and best product was selected based on the results from the score card.

Yogurt has been proved to be suitable product to make almost complete food by incorporating inexpensive nutrient source (Boghara and Mathur, 2000). The incorporation of fruits in yoghurt preparation improved composition properties, enhances taste and gives the product a delicious pleasing flavor that contains refreshing flavor of fruit and beneficial effect of yoghurt. From table 3.2., it can be concluded that incorporation of fruit increases the acceptability of the product. Fruit dahi is widely popular due to its partially masked acetaldehyde flavor compared to plain dahi (Tamime and Robinso, 1999). The non-dairy yoghurt containing 40% of banana pulp was found to have the highest sensory score while least sensory score was observed in the product containing 20per cent banana pulp. Besides this the color and appearance of the product was also enhanced when it was compared with the scores of non-dairy yoghurt prepared without banana pulp. Usually, fruit pulp facilitates in maintaining the textural properties of finished product. The body and texture as well as flavour and taste of the non-dairy yogurt also seems to be improved with the addition of banana pulp as the pectin and fructose present in fruits improves consistency and viscosity of yogurt by getting mixed with, and hence mouth feel is improved (Nongonierma *et al.*, 2007; Tromp *et al.*, 2004). Higher solid and fiber content in fruit pulp may be associated with increasing viscosity and consequently improve the textural properties of fruit yogurts (Roy *et al.*, 2015). Similar finding was similar reported by Farahat and El-Batawy (2013) who reported that the textural quality of stirred fruit yogurts improves when compared with plain yoghurt. When compared, the highest overall acceptability was observed in $T_2F_3B_3$ (60:40 SM:PM, 15% FF, 40% BP) having the average score 8.200±0.447 followed by $T_2F_3B_2$ (60:40 SM:PM, 15% FF, 30% BP) and $T_1F_3B_3$ (80:20 SM:PM, 15% FF, 40% BP) which were at par which each other having the score 8.000±0.707 (Figure 3.2).

CONCLUSION

From the present study it can be concluded that the non- dairy yoghurt prepared by combining soymilk and peanut milk in the ratio 60:40 along with 15per cent finger millet flour and 40per cent banana pulp ($T_2F_3B_3$) was the most acceptable product when compared with other treatments. The product having least acceptable sensory scores was $T_4F_1B_1$ (20:80 SM:PM, 15% FF, 20% BP). Thus, the addition of banana pulp not only increases its nutritional quality but also increases the acceptability of the product by enhancing its taste, flavour, color as well as texture properties.

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Table 3.1. Sensory characteristics of non-dairy yoghurt (without banana pulp)

Treatments	SM:PM	FF (%)	Color and Appearance	Body and texture	Flavour and Taste	Overall Acceptability
T0	Control		8.800±0.447	8.600±0.548	8.600±0.548	8.600±0.548
T_1F_1	80:20	5	7.400±0.548	6.600±0.894	6.400±.548	6.800±0.837
T_1F_2	80:20	10	7.600±1.140	7.000±0.707	6.600±0.894	7.000±0.707
T_1F_3	80:20	15	7.800±0.447	7.400±1.140	6.800±0.837	7.200±0.447
T_2F_1	60:40	5	7.600±0.548	6.800±0.837	6.800±0.837	7.000±0.707
T_2F_2	60:40	10	7.800±0.837	7.200±1.304	7.000±0.707	7.200±0.837
T_2F_3	60:40	15	8.000±1.225	7.600±0.548	7.200±0.837	7.400±0.894
T_3F_1	40:60	5	7.200±1.304	6.400±0.548	6.200±1.095	6.600±0.548
T_3F_2	40:60	10	7.400±0.548	6.800±0.837	6.400±0.894	6.800±0.837
T_3F_3	40:60	15	7.600±0.548	7.200±0.837	6.600±0.894	7.000±0.707
T_4F_1	20:80	5	7.000±0.707	6.200±0.837	6.000±0.707	6.400±0.548
T_4F_2	20:80	10	7.200±1.304	6.600±1.673	6.200±0.837	6.600±0.894
T_4F_3	20:80	15	7.400±1.140	7.000±1.000	6.400±0.548	6.800±0.447

SM:PM= Soymilk: Peanut milk, FF= Finger millet flour
Values are means ± standard deviation from five parallel observations

Table 3.2. Sensory characteristics of non-dairy yoghurt (with banana pulp)

Treatments	SM:PM	FF (%)	BP (%)	Color and Appearance	Body and texture	Flavour and Taste	Overall Acceptability
$T_1F_3B_1$	80:20	15	20	8.000±0.707	7.600±1.140	7.400±0.548	7.600±0.584
$T_1F_3B_2$	80:20	15	30	8.200±0.837	7.800±0.837	7.600±1.140	7.800±1.304
$T_1F_3B_3$	80:20	15	40	8.400±0.894	8.000±0.707	7.800±0.837	8.000±0.707
$T_2F_3B_1$	60:40	15	20	8.200±0.837	7.800±1.304	7.600±1.140	7.800±0.447
$T_2F_3B_2$	60:40	15	30	8.400±0.548	8.000±1.000	7.800±0.837	8.000±0.707
$T_2F_3B_3$	60:40	15	40	8.600±0.548	8.200±0.447	8.000±0.707	8.200±0.447
$T_3F_3B_1$	40:60	15	20	7.800±1.304	7.400±0.548	7.200±1.304	7.400±0.548
$T_3F_3B_2$	40:60	15	30	8.000±1.000	7.600±1.140	7.400±0.548	7.600±0.548
$T_3F_3B_3$	40:60	15	40	8.200±0.447	7.800±0.837	7.600±0.548	7.800±0.447
$T_4F_3B_1$	20:80	15	20	7.600±0.548	7.200±1.304	7.000±1.000	7.200±0.447
$T_4F_3B_2$	20:80	15	30	7.800±0.837	7.400±0.548	7.200±0.837	7.400±0.894
$T_4F_3B_3$	20:80	15	40	8.000±1.225	7.600±0.548	7.400±0.548	7.600±0.548

SM:PM= Soymilk: Peanut milk, FF= Finger millet flour, BP= Banana pulp
Values are means ± standard deviation from five parallel observations

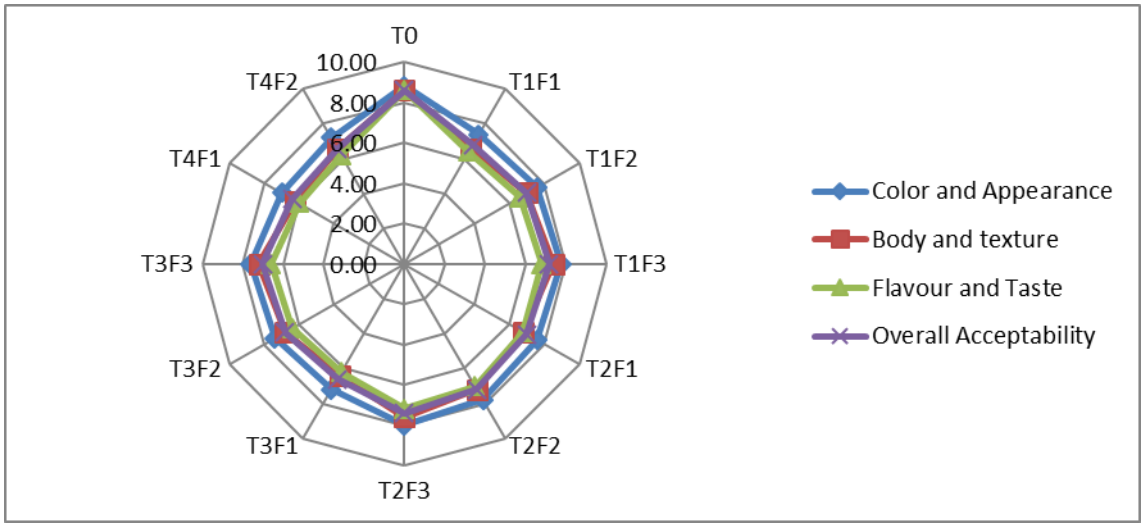

Fig 3.1. Sensory evaluation of non-dairy yoghurt (without banana pulp)

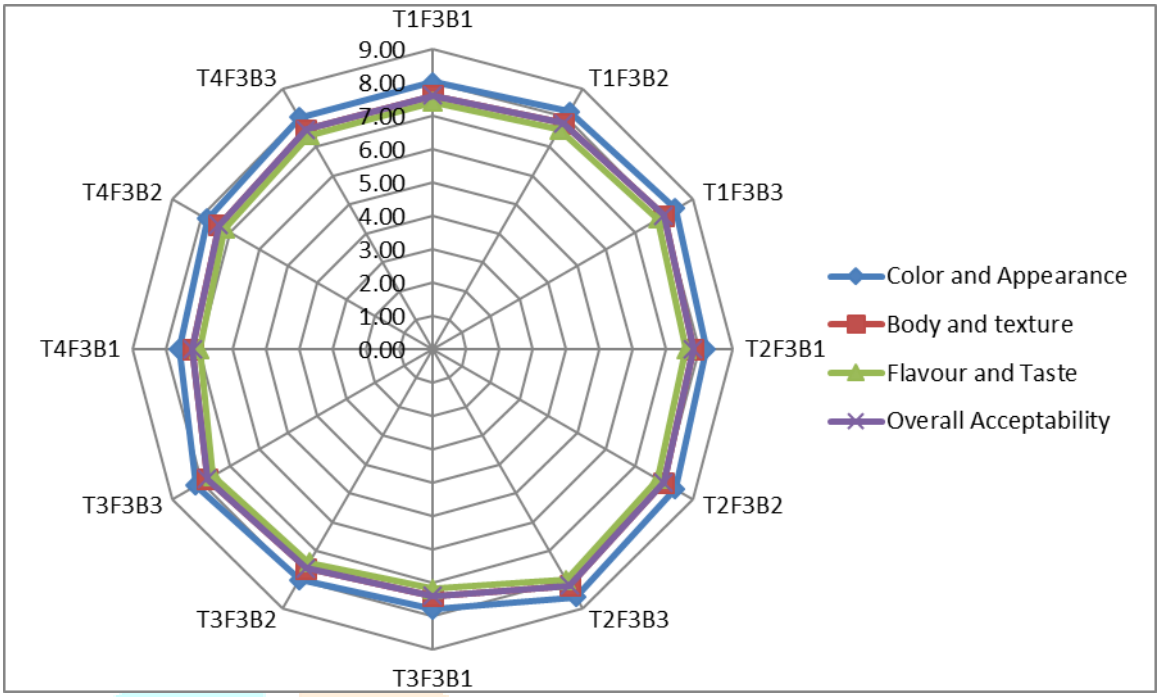

Fig 3.2. Sensory evaluation of non-dairy yoghurt (with banana pulp)

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