

Original Research Article

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## Studies on Quality Characteristics on Sweetened Stirred Dahi prepared by using Honey and Flaxseed Powder

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### ABSTRACT

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Dahi is a traditional fermented dairy product prepared by lactic acid fermentation of milk. In the present study, Flaxseed and Honey has been added to Dahi in different proportions. Trials were conducted to adjudge the most acceptable levels of Honey (6% and 9%) and Flaxseed powder (3%, 6% and 9%) on the basis of sensory scores. Based on organoleptic scores the final optimized product contains 9% Honey and 6% Flaxseed Powder which was highly acceptable. The Dahi prepared without addition of Honey and Flaxseed Powder was treated as control. The optimized product contained 7% Fat, 4.19% Protein, 0.86% Ash, 20.82% Carbohydrate, 32.86% Total solid. It had 0.76% Titratable Acidity, 7.12 mg/100g ascorbic acid Antioxidant activity and 5.73 % Crude Fibre. Addition of Flaxseed powder increased the fibre content of Dahi.

### Introduction

Dahi or Curd is a traditional fermented milk product and is nutritionally as well as therapeutically beneficial for human beings (Yadav *et al.*, 2007). People who has a lactose intolerance syndrome can easily digest Dahi. Dahi is a good source of proteins, B vitamins and calcium which are much easier for the body to digest than when they are present in fresh milk. With the advent of health foods, Dahi is valued for controlling the growth of intestinal bacteria and incurring intestinal

diseases like constipation, diarrhoea and dysentery. It is also found effective in lowering blood cholesterol. Dahi is not only popular for its therapeutic value but its nutritive value is also unique (Laxminarayana *et al.*, 1952). Starter cultures such as *Streptococcus lactis*, *Streptococcus diacetylactis* and *Streptococcus cremoris* alone or in combination with or without *Leuconostoc species* and *Lactobacillus acidophilus*, *Lactobacillus bulgaricus*, and *Streptococcus thermophilus* are used for Dahi preparation (IS: 9617, 1980).

Honey is a natural sweet, viscous substance naturally available mono-saccharides i.e., fructose and glucose. It consists of powerful antimicrobial effects against pathogenic and non-pathogenic micro-organisms (yeasts and fungi) even against those that developed resistance to many antibiotics. Honey has an antibacterial activity and is attributed both to physical factors (acidity and osmolarity) and other chemical factors (hydrogen peroxide, beeswax, volatiles and pollen). Honey is essentially a highly concentrated two sugars: dextrose (31%) and levulose (38%) with small amounts of at least 22 other more complex sugars. Honey also contains a good proportion of sucrose (1.3%). Glucose and fructose are the only mono-saccharides in Honey. Honey also consists of a number of bioactive compounds viz., phenolic compounds, carotenoid and its derivatives, flavonoids, organic acids, Maillard reaction products, ascorbic acid and other compounds which function as antioxidants (Bogdanov *et al.*,2008).

Flaxseed or linseed (*Linum usitatissimum*) is an oil seed whose composition has 14% fat, 28% dietary fibers, 20% protein, 7.7% moisture, 3.5% ash and 1% simple sugars. The amount of fat in flaxseed ranges from 38 to 47%. Flaxseed has a unique fatty acid profile being fairly low in saturated fatty acids and rich in ALA, the essential  $\omega$ -3 fatty acid which is approximately 23g ALA per 100g. Of the total fatty acids in Flaxseed, saturated fatty acids constitute 9%, mono-saturated fatty acids 18% and poly-unsaturated fatty acids 73%.

Of the unsaturated fatty acids,  $\alpha$ -linoleic acid (ALA) constitutes the majority at 59% of the total fatty acids making flaxseed one of the richest sources of the fatty acids (Bhatty, 1993; Oomah *et al.*, 1993). Flaxseed has been considered as the source of increased interest in the field of diet and disease research due to

its biologically active components including pre-biotic properties of flaxseed and in its beneficial effects on neurological and hormonal disorders, cardiovascular diseases, decreased risk of cancer, particularly of the mammary and prostate gland, anti-inflammatory activity, laxative effect and osteoporosis. Dietary fibers, lignans and  $\omega$ -3 fatty acids present in flaxseed have a protective effect against diabetes risk (Adlercreutz, 2007). The present study aimed at studying the Physico-Chemical characteristics of Dahi when it is being incorporated with Flaxseed powder and Honey.

## **Materials and Methods**

### **Procurement and Collection of Raw materials**

Full cream milk, Sugar, Flaxseed, Dabur Honey was collected from local market of Prayagraj, (Uttar Pradesh) for the preparation of Sweetened Stirred Dahi. Starter Culture was collected from NCDC, NDRI, Karnal and used for preparation of Sweetened Stirred Dahi.

### **Procedure for preparation of Sweetened Stirred Dahi**

Fresh whole milk procured from local market of Naini, Prayagraj was standardized to 6 % fat and 9 % MSNF. Then Sugar was added about 6% to the milk which was pre-heated to 60°C and homogenized. Final heat treatment 90°C for 10mins, the mix is cooled to 30°C and inoculated with NCDC-167 culture at the rate of 2%. Then the product is divided into two containers where the first container is added with 6% honey and the other with 9% Honey. The product is poured into plastic cups or bowl and incubated at 35-38°C for 4-5 hours. After incubation the cups/bowl are added with Flaxseed powder according to the

treatments i.e., 3 %, 6 % and 9% and are stirred for mixing the curd and flaxseed together. Then, the products are kept refrigerated at 5°C for storage.

### **Treatment Combination**

In the present study, Six treatments were formulated viz. T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> where in T<sub>0</sub> is control Sweetened Stirred Dahi (100%D), T<sub>1</sub> was prepared with 6% Honey and 3% Flaxseed powder (100%D + 6%H + 3%F), T<sub>2</sub> was prepared with 6% Honey and 6% Flaxseed powder (100%D + 6%H + 6%F), T<sub>3</sub> was prepared with 6% Honey and 9% Flaxseed powder (100%D + 6%H + 9%F), T<sub>4</sub> was prepared with 9% Honey and 3% Flaxseed Powder (100% D + 9%H + 3%F), T<sub>5</sub> was prepared with 9% Honey and 6% Flaxseed Powder (100%D + 9%H + 6%F) and T<sub>6</sub> was prepared with 9% Honey and 9% Flaxseed Powder (100%D + 9%H + 9%F).

### **Sensory or Organoleptic Score**

The sensory evaluation of Sweetened Stirred Dahi samples was done by a panel of judge using a 9 point hedonic scale. The experienced Technical staff members of the Warner college of Dairy Technology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj served as a judging team and evaluated the samples of different treatment of Sweetened Stirred Dahi. Numerical score were allocated for flavour, Body and Texture, Colour and appearances and Overall acceptability of sample.

### **Physico-Chemical Properties**

Determination of Fat content in product was determined by Gerber method, Carbohydrates (%) to be estimated by Lane Eynon method, SP: 18, Part XI, (1981), Total Solids content was determined as per the procedure laid down in IS: SP: 18, Part XI (1981). Moisture

was determined by using an electric Hot air oven. Protein content of Sweetened Stirred Dahi was determined by using Micro Kjeldal method as per IS: SP 18 (Part XI) 1981. Titratable Acidity was measured as per method described in IS: SP 18 (Part XI) 1981. Crude fibre content was done as per AOAC (1995) Determination of Antioxidant Activity was done as per DPPH method as described by Blois (1958).

### **Microbial Analysis**

The Coliform count, Yeast and mold count and Lactic Acid Bacteria Count was estimated by as per the manual of Dairy Bacteriology ICAR (1972).

### **Statistical analysis**

Data were analyzed using Analysis of Variance (ANOVA) and Critical Difference (C.D.) in WASP Software and excel software. The values obtained were analyzed statistically as per standard procedure. The data was analyzed statically by analysis of variance at 5% level of significance.

### **Results and Discussion**

The present study was undertaken for Studies on quality characteristics of Sweetened Stirred Dahi prepared by using Honey and Flaxseed powder. The results obtained from the analyzed data are presented under Physico-Chemical properties, Microbiological analysis and Statistical analysis.

#### **Effect of addition of Flaxseed powder and Honey on Organoleptic Score of Dahi**

Flavour score in Sweetened Stirred Dahi samples of different treatments and control are T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> was found to be 7, 7.08, 7.5, 7.24, 7.28, 7.78 and 7.24. The highest mean flavour score was recorded in

the Sweetened Stirred Dahi sample T<sub>5</sub> (7.78) followed by T<sub>2</sub> (7.50), T<sub>4</sub> (7.28), T<sub>6</sub> (7.24), T<sub>3</sub> (7.24), T<sub>1</sub> (7.08) and T<sub>0</sub> (7.00).

Body and Texture score in Sweetened Stirred Dahi samples of different treatments and control are T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> was found to be 7.02, 7.18, 7.08, 6.94, 7.18, 7.08 and 6.94. The highest mean Body and Texture score was recorded in the Sweetened Stirred Dahi sample T<sub>1</sub> (7.18) followed by T<sub>4</sub> (7.18), T<sub>2</sub> (7.08), T<sub>5</sub> (7.08), T<sub>0</sub> (7.02), T<sub>3</sub> (6.94) and T<sub>6</sub> (6.94).

Colour and Appearance score in Sweetened Stirred Dahi samples of different treatments and control are T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> was found to be 6.96, 7.38, 7.48, 7.28, 7.38, 7.48 and 7.28. The highest mean Colour and Appearance score was recorded in the Sweetened Stirred Dahi sample T<sub>5</sub> (7.48) followed by T<sub>2</sub> (7.48), T<sub>1</sub> (7.38), T<sub>4</sub> (7.38), T<sub>3</sub> (7.28), T<sub>6</sub> (7.28) and T<sub>0</sub> (6.96).

Overall Acceptability score in Sweetened Stirred Dahi samples of different treatments and control are T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> was found to be 7.00, 7.16, 7.26, 7.18, 7.26, 7.42 and 7.18. The highest mean Overall Acceptability score was recorded in the Sweetened Stirred Dahi sample T<sub>5</sub> (7.42) followed by T<sub>2</sub> (7.26), T<sub>4</sub> (7.26), T<sub>3</sub> (7.18), T<sub>6</sub> (7.18), T<sub>1</sub> (7.16) and T<sub>0</sub> (7.00).

### **Effect of addition of Flaxseed powder and Honey on Physico-Chemical Properties of Dahi**

Total Carbohydrate in Sweetened Stirred Dahi samples of different treatments and control are T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> was found to be 11.05, 17.49, 17.79, 18.13, 20.19, 20.82 and 21.13. The highest mean Total Carbohydrate Percentage was recorded in the Sweetened Stirred Dahi sample T<sub>6</sub> (21.13) followed by T<sub>5</sub> (20.82), T<sub>4</sub> (20.19), T<sub>3</sub> (18.13), T<sub>2</sub> (17.79), T<sub>1</sub>

(17.49) and T<sub>0</sub> (11.05). Similar observation were made by Sarker *et al.*, (2018) who conducted the study on Dahi (Curd) preparation from milk with different levels of carrot (*Dacus carota*) juice incorporating 0%, 5%, 10%, and 15 %. This result also agrees with Munzur *et al.*, (2004) who found that carbohydrate content of dahi was remarkably increased with addition of banana. The results indicate that, increased in proportion of Honey and Flaxseed powder increased the carbohydrates percentage of Sweetened Stirred Dahi with significant differences ( $P < 0.05$ ).

Fat content in Sweetened Stirred Dahi samples of different treatments and control are T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> was found to 5.90, 6.40, 7.19, 7.87, 6.24, 7.00 and 7.70. The highest mean Fat content was recorded in the Sweetened Stirred Dahi sample T<sub>3</sub> (7.87) followed by T<sub>6</sub> (7.70), T<sub>2</sub> (7.19), T<sub>5</sub> (7.00), T<sub>1</sub> (6.40), T<sub>4</sub> (6.24) and T<sub>0</sub> (5.90). The results agree with the report of Rahman *et al.*, (2016) found that Fat percent of control Dahi was somewhat higher than the Dahi. Sweetened Stirred Dahi indicates that increased in proportion of Honey and Flaxseed powder increased the fat percentage of Sweetened Stirred Dahi with significant differences ( $P < 0.05$ ).

Protein content in Sweetened Stirred Dahi samples of different treatments and control are T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> was found to 3.39, 3.76, 4.27, 4.76, 3.68, 4.19 and 4.66. The highest mean Protein percentage was recorded in the Sweetened Stirred Dahi sample T<sub>3</sub> (4.76) followed by T<sub>6</sub> (4.66), T<sub>2</sub> (4.27), T<sub>5</sub> (4.19), T<sub>1</sub> (3.76), T<sub>4</sub> (3.68) and T<sub>0</sub> (3.39). The result agreed with the work of Islam *et al.*, (2017) who found that plain Dahi contained a higher amount of protein than fruit Dahi. It indicates that increased in Honey and flaxseed powder, increases the protein content of Sweetened Stirred Dahi with significant

differences ( $P < 0.05$ ). The result of ANOVA reveals that the F (Cal) value was greater than the table value of F Tab at 5% level of significance. Therefore, the difference was significant, indicating significant effect of treatments on protein percent of Sweetened Stirred Dahi.

Moisture content in Sweetened Stirred Dahi samples of different treatments and control are T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> was found to be 78.94, 71.58, 69.90, 68.85, 68.34, 67.14 and 65.60. The highest mean moisture content was recorded in the Sweetened Stirred Dahi sample T<sub>0</sub> (78.94) followed by T<sub>1</sub> (71.58), T<sub>2</sub> (69.90), T<sub>4</sub> (68.85), T<sub>3</sub> (68.34), T<sub>5</sub> (67.14) and T<sub>6</sub> (65.60). The results are similar to the report of Prakash (2016) where the moisture content was found lower in T<sub>3</sub> (86.11%) followed by T<sub>2</sub> (86.31%), T<sub>1</sub> (86.49%) and T<sub>0</sub> (86.68%). It indicates that increased in Honey and flaxseed powder decreases the moisture content in Sweetened Stirred Dahi. The difference was significant, indicating significant effect of treatments on moisture content.

Titrateable Acidity in Sweetened Stirred Dahi samples of different treatments and control are T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> was found to be 0.71, 0.72, 0.74, 0.77, 0.73, 0.76 and 0.78. The highest mean Titrateable Acidity was recorded in the Sweetened Stirred Dahi sample T<sub>6</sub> (0.78) followed by T<sub>3</sub> (0.77), T<sub>5</sub> (0.76), T<sub>2</sub> (0.74), T<sub>4</sub> (0.73), T<sub>1</sub> (0.72) and T<sub>0</sub> (0.71). The results are similar to the report of Desai *et al.*, (2013) who found that the Titrateable acidity of fruit Dahi was significantly increased due to the addition of fruit juice/pulp.

Mustafa (1997) prepared Dahi by using different types of seasonal juice and observed that acidity content of Dahi increased due to the addition of fruit juice in Dahi. Sweetened Stirred Dahi indicates that increased in proportion of Honey and flaxseed powder, Acidity percentage of sweetened stirred dahi

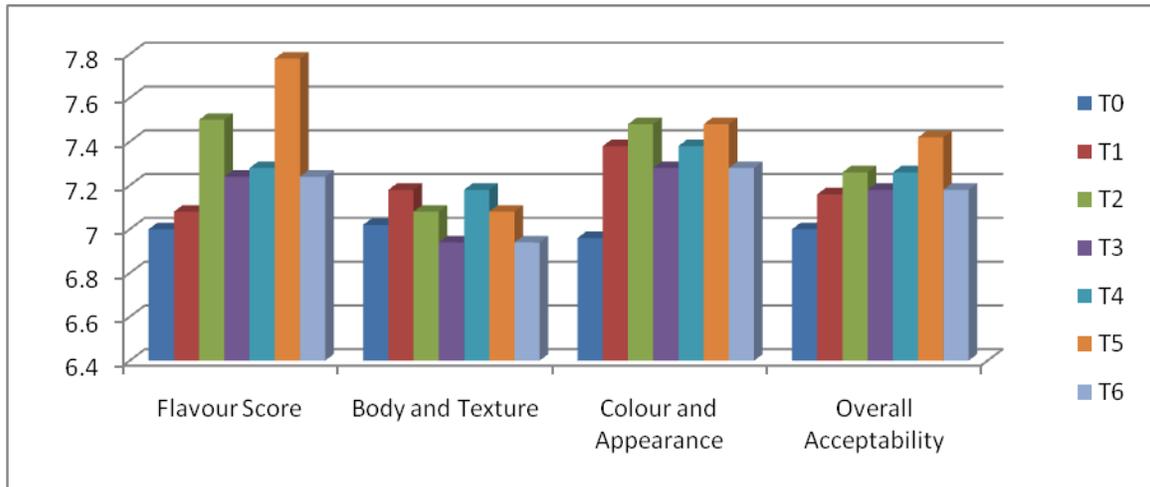
was also increase with significant differences ( $P < 0.05$ ). Ash content in Sweetened Stirred Dahi samples of different treatments and control are T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> was found to be 0.71, 0.76, 0.77, 0.85, 0.86, 0.91 and 0.92. The highest mean Ash content was recorded in the Sweetened Stirred Dahi sample T<sub>6</sub> (0.92) followed by T<sub>3</sub> (0.91), T<sub>5</sub> (0.86), T<sub>2</sub> (0.85), T<sub>4</sub> (0.77), T<sub>1</sub> (0.76) and T<sub>0</sub> (0.71). The findings of this study agrees with the work of Mustafa (1997) and Desai *et al.*, (2013). Both researchers found that addition of fruit juice increased the ash percentage in Dahi. The results indicates that increased in Honey and flaxseed powder increases the ash content in Sweetened Stirred Dahi. The difference was significant, indicating significant effect of treatments on ash percent.

Antioxidant Activity in Sweetened Stirred Dahi samples of different treatments and control are T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> was found to be 0.43, 4.28, 6.04, 7.7, 5.30, 7.12 and 8.66. The highest mean antioxidant activity content was recorded in the Sweetened Stirred Dahi sample T<sub>6</sub> (8.6) followed by T<sub>3</sub> (7.7), T<sub>5</sub> (7.12), T<sub>2</sub> (6.04), T<sub>4</sub> (5.30), T<sub>1</sub> (4.28) and T<sub>0</sub> (0.43).

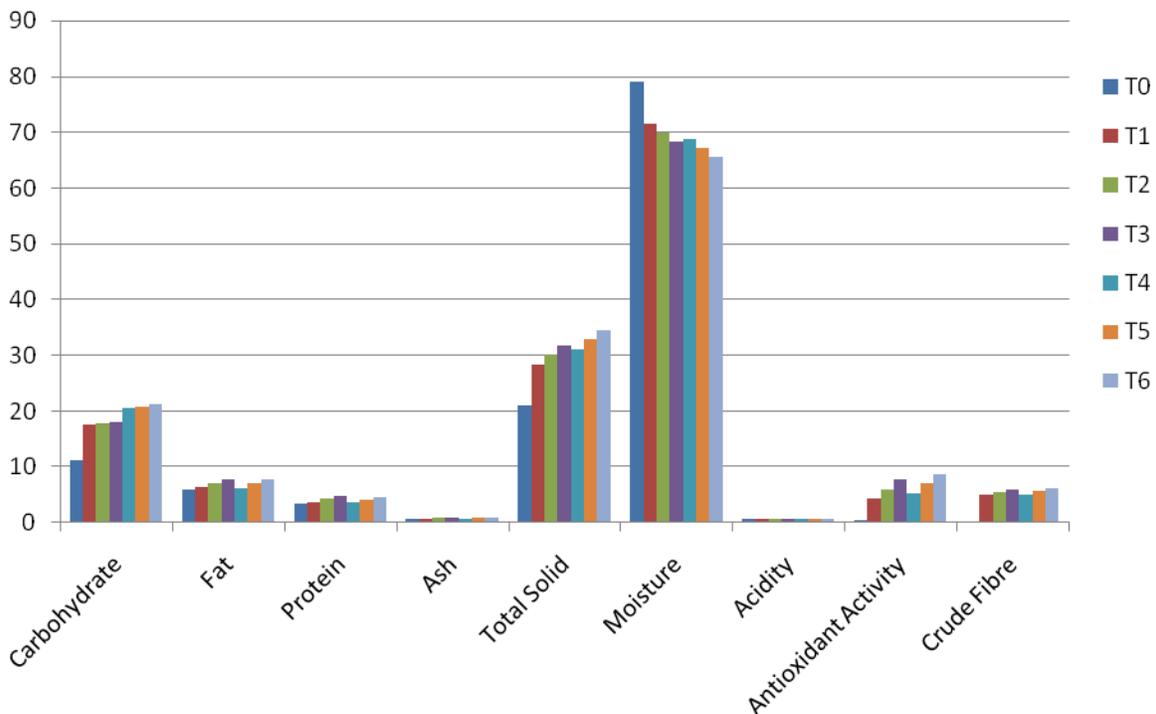
Similar observation were made by Srivastava *et al.*, (2015) which revealed that the inclusion of herbs extracts in the yoghurt significantly altered the antioxidant properties of the yoghurt samples.

It indicates that increased in Honey and flaxseed powder increases the Antioxidant activity percentage with significant differences ( $P < 0.05$ ). The significant difference was further analyzed statistically to find out the C.D. between and within the different treatment combinations. The difference between the mean values was greater than the C.D. value, 0.09. Therefore, the difference was significant.

**Fig.1** Graph of average Organoleptic Score of Control and experimental sample of Sweetened Stirred Dahi



**Fig.2** Graph of average Physico-Chemical analysis of Control and experimental sample of Sweetened Stirred Dahi



Crude Fibre content percentage in Sweetened Stirred Dahi samples of different treatments and control are T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> was found to be 0.17, 4.99, 5.46, 5.97, 5.05, 5.73 and 6.09. The highest mean Crude Fibre content percentage was recorded in the

Sweetened Stirred Dahi sample T<sub>6</sub> (6.09) followed by T<sub>3</sub> (5.97), T<sub>5</sub> (5.73), T<sub>2</sub> (5.46), T<sub>4</sub> (5.05), T<sub>1</sub> (4.99) and T<sub>0</sub> (0.17). Similar observation were made by Syama (2014) in the study of Quality Attributes of Probiotic Dahi Incorporated with Foxtail Millet where

Crude fiber content was nil for control sample since it is devoid of millet flour. The results also indicate that increased in Honey and flaxseed powder increases crude fibre content in Sweetened Stirred Dahi with significant differences ( $P < 0.05$ ). The result of ANOVA reveals that the F (Cal) value was greater than the table value of F (Tab) at 5% level of significance. Therefore, the difference was significant, indicating significant effect of treatments on Crude fibre content percentage of Sweetened Stirred Dahi.

### **Effect of addition of Flaxseed powder and Honey on Microbial analysis of Dahi**

Yeast and Mould count in Sweetened Stirred Dahi samples of different treatments and control are T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> was found to be 1.98, 2.29, 1.58, 1.09, 0.69 and 2.59. The highest mean Yeast and Mould Count was recorded in the Sweetened Stirred Dahi sample T<sub>6</sub> (2.59) followed by T<sub>1</sub> (2.29), T<sub>2</sub> (2.03), T<sub>0</sub> (1.98), T<sub>3</sub> (1.58), T<sub>4</sub> (1.09) and T<sub>5</sub> (0.69). But Rahman *et al.*, (2016) on this study found that the yeast count was 81.66, 142.66, 151.33, 193.66 and 217.33 per g Dahi with 0, 5, 10, 15 and 20 % apple juice and the average mould count per g were 4.03, 6.36, 7.43, 8.66 and 9.33. The result of ANOVA reveals that the F (Cal) value was greater than the table value of F (Tab) at 5% level of significance. Therefore, the difference was significant, indicating significant effect of treatments on Yeast and mould count of Sweetened Stirred Dahi. Lactic Acid Bacteria Count in Sweetened Stirred Dahi samples of different treatments and control are T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> was found to be 7, 11.60, 15.20, 18, 10.40, 14 and 18.20. The highest mean Lactic Acid Bacteria Count was recorded in the Sweetened Stirred Dahi sample T<sub>6</sub> (18.20) followed by T<sub>3</sub> (18), T<sub>2</sub> (15.20), T<sub>5</sub> (14), T<sub>1</sub> (11.60), T<sub>4</sub> (10.40) and T<sub>0</sub> (7). In Patil *et al.*, (2015) study, it was suggested that, to have maximum therapeutic value, the fermented

milk product should contain population of viable cells of probiotic culture more than 10<sup>6</sup>cfu/ml at the time of consumption.

Sweetened Stirred Dahi indicates that increased in proportion of Honey it decreases yeast and mould but flaxseed powder increased the yeast and mould count of Sweetened Stirred Dahi with significant difference ( $P < 0.05$ ).

Coliform Count in Sweetened Stirred Dahi samples of different treatments and control are T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub> and T<sub>6</sub> was found to be 0.4, 2.1, 5.28, 8.1, 3.16, 6.22 and 9.1. The highest mean Coliform Count was recorded in the Sweetened Stirred Dahi sample T<sub>6</sub> (9.1) followed by T<sub>3</sub> (8.1), T<sub>5</sub> (6.22), T<sub>2</sub> (5.28), T<sub>4</sub> (3.16), T<sub>1</sub> (2.1) and T<sub>0</sub> (0.4).

From the study conducted, it can be concluded that value addition of Sweetened Dahi can be done by incorporating Honey and Flaxseed powder at different ratios.

Based on Organoleptic Score the treatment which was considered to be optimized is T<sub>5</sub>. T<sub>5</sub> has 4.19% Protein, 7% Fat, 32.86% Total solid, 67.14% Moisture, 0.86% Ash Content, 20.82% Carbohydrate and 0.76% Titratable Acidity. Antioxidant activity and Crude Fibre content for optimized product is 7.12 mg/100g ascorbic acid and 5.73 %.

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