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Microbiological, physicochemical analysis and sensory evaluation of herbal yogurt

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Abstract
The objective of the research work is to incorporate Cinnamon leaves in yogurt and to study the effect of cinnamon extract on physicochemical analysis of prepared Herbal yogurt. Yogurt was prepared by standardized to 3.5% low fat milk and 11% SNF with herb cinnamon at 0.5, 1 and 1.5 percentage and served as Ca_1, Ca_2 ,Ca_3 respectively. Product was evaluated for physicochemical analysis (moisture, fat, protein, total solid, pH and acidity) and Sensory evaluation of the prepared yogurt was carried out using nine point hedonic scales. The data obtained were statistically analyzed using analysis of variance and critical difference techniques. Addition of cinnamon with 1 percent resulted in better compactness of the body and closely smooth texture of the yoghurt as compared to the other treatments including control yogurt. It can be concluded from the results obtained that the addition of green tea extract at 0.5 per cent, 1.0 per cent, 1.5 per cent level improved the taste and flavour, colour and appearance, body and texture and also overall acceptability of herbal yogurt. Total viability was higher in Treatment Ci_3 yogurt shows good result in comparison of plain yogurt.

Keywords: cinnamon, Yogurt, physicochemical Analysis and Sensory evaluation, *L. bulgaricus*, *S. thermophilus.*

1. Introduction
Yogurt is a well-known fermented dairy food, which is usually manufactured from cow's milk with or without the addition of some natural derivatives of milk, and possesses a gel structure that is the result of coagulation of the Milk protein by lactic acid produced by Streptococcus thermophilus (*S. thermophilus*) and Lactobacillus bulgaricus (*L. bulgaricus)* (Robinson,2003). Yogurt is a coagulated milk product that results from the fermentation of lactic acid in milk by *Lactobacillus bulgaricus* and *Streptococcus thermophilus* [2]. It has a smooth texture and a mildly sour and pleasant flavor. It is obtained from pasteurized or boiled milk soured by naturally occurring, or lactic acid fermenting bacteria i.e. *Lactobacillus bulgaricus and Streptococcus thermophilus* [7].
Cinnamomum zeylonium (Cinnamon) as widely been consumed as spices and food preservation. Cinnamon are added to food products in the form of essential oils and various extract. Cinnamon shows antioxidant activity, antimicrobial assay. It also shown potential antipyretic, antiallergenic activities. The antimicrobial and antioxidant properties of essential oils obtained from cinnamon. These beneficial characteristic could increase food safety and shelf life of fatty rich food and processed food product. All beneficial effects of tea have been attributed to the strong antioxidative activity of the tea phenolic compounds, known as tea catechins. In the present scenario, the herbal products are gaining more popularity over synthetic products in the world market. This is occurring due to some side effect of synthetic products on the body [1].

2. Material and Methods
2.1 Herbs: Cinnamon leaves are purchased from local market of Allahabad.

2.2 Preparation of starter culture
Starter culture was prepared by inoculating in pasteurized and homogenised milk with the following yogurt bacteria mixture *Lactobacillus bulgaricus* and *Streptococcus thermophilus.* The milk bacteria mixture was incubated at 41 ^{0}C overnight and yogurt formed was stored at 4 ^{0}C and used for 2 weeks.

2.3 Preparation of herbal water extract: Herbal water extract was prepared by soaking each herb in distilled water (1:10) overnight followed by centrifugation (2000 rpm; 15 min at 4 ^{0}C). The supernatant was harvested and refrigerated and used in the preparation of herbal yogurt.

2.4 Herbal yogurt preparation

Homogenized and pasteurized milk was purchased from local market of Allahabad. Starter culture (2%) consisting of *L. bulgaricus* and *S. thermophilus*, Skim milk powder (2 g), herbal water extract were dissolved in 1L of milk. was added to correct the milk solid contain (9.8%). The mixture were aliquot into plastic cups, plain yogurt was prepared essentially in the same manner without herbs (pH 4.5) and Incubation was carried out at 41 ^{0}C.

2.5 Chemical analysis

Fresh curd weight was estimated of uncontaminated samples. Total solids (TS), protein, Moisture, Ash and Fat contents of fresh samples were also determined yoghurt samples were periodically analyzed after 0, 3,5 and 7 days of cold storage for their titratable acidity (TA %). The pH values were measured using a digital laboratory pH meter.

2.6 Enumeration of probiotic bacteria

Enumeration of *Lactobacillus* spp was carried out by aseptically mixing yogurt sample (1 ml) with 9 ml of buffered peptone water (Oxoid, UK). The sample was thoroughly mixed and serial dilutions were performed using peptone water as the diluents. Empty petri dishes were inoculated with 1ml of diluted yogurt, followed by the addition of 15 ml melted (45 °C) MRS agar. The petri dishes were covered and the contents mixed thoroughly by gentle tilting and swirling. The petri dishes were inverted and incubated anaerobically (Revco Ultima) at 37 °C for 24-48 hours.

Streptococci was enumerated by initially placing 15 ml of melted (45 °C) M17 into a petri dish followed by cooling of agar to temperature to allow solidification. The agar was then inoculated by spreading the surface evenly with 0.1 ml of diluted yogurt. The colonies formed were counted after 24-48 hour incubation at 37 °C. Viable microbial count was calculated as follows:

$$\text{cfu/ml} = \text{cfu/plate} \times \text{dilution factor}$$

Where cfu is colony forming unit

2.7 Statistics

The statistical analysis was performed using 2 way analysis of variance (ANOVA).

3. Results

3.1. Protein content

Fig 1.1 show the Average protein percent of cinnamon yogurt. Treatment Ca_3 shows highest protein content 3.45 and the lowest one is recorded for control (T_0)3.414 .The differences in value were significant (P > 0.05).

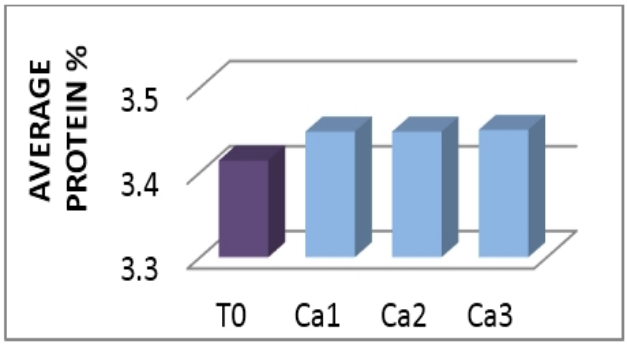

Fig 1.1: Average protein percent of control and cinnamon yogurt

3.2. Fat content

Fig 1.2 show the Average protein percent of Cinnamon yogurt. T_0 shows highest Fat content is T_0 (3.424) and the lowest one is recorded for Ci_3 (3.414) .The differences in value were non-significant (P < 0.05).

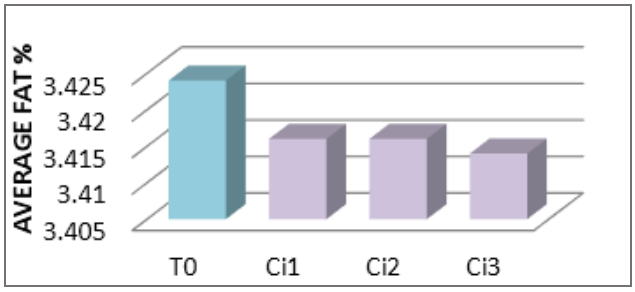

Fig 1.2: Average Fat percent of control and cinnamon yogurt

3.3. Moisture content

Fig 1.3 show the Average protein percent of cinnamon yogurt treatment Ci_3 shows highest moisture content 78.5 and the lowest one is recorded for control (T_0)75.61. The differences in value were Significant (p>0.05).

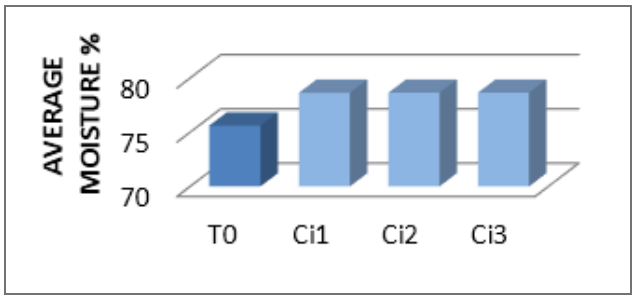

Fig 1.3: Average Moisture percent of control and cinnamon yogurt

3.4. Ash content

Fig 1.4 show the Average Ash percent of cinnamon yogurt. Treatment Ci_3 shows highest Ash content for T_0 (0.684) and the lowest one is recorded for control (Ca_3) 75.61. The differences in value were significant (P > 0.05). (Ci_3) 75.61. The differences in value were significant (P > 0.05).

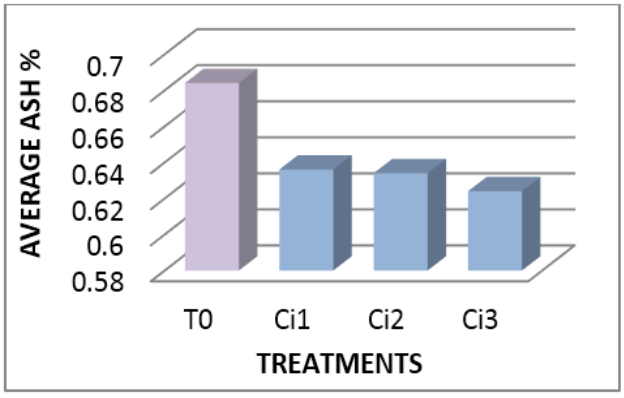

Fig 1.4: Average Ash percent of control and cinnamon yogurt.

3.5. pH percent

Fig 1.4 show the Average pH percent of cinnamon yogurt .Treatment Ci_3 shows highest Ash content for T_0 (4.46) and the lowest one recorded for control (Ca_3)4.25.

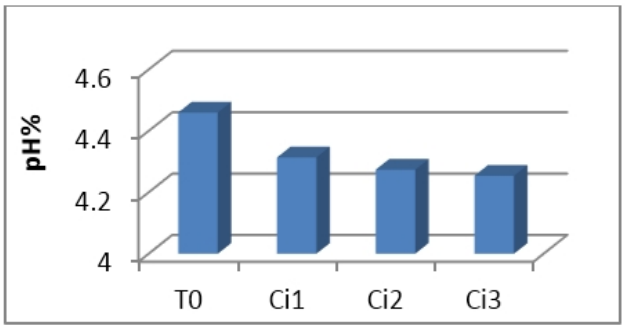

Fig 1.5: Average pH percent of control and green tea yogurt

3.6. Acidity content

Fig 1.6 show the Average Ash percent of green tea yogurt. Treatment Ci_3 shows highest Ash content for T_0 (0.684) and the lowest one is recorded for control (Ci_3)75.61. The differences in value were significant (P>0.05).

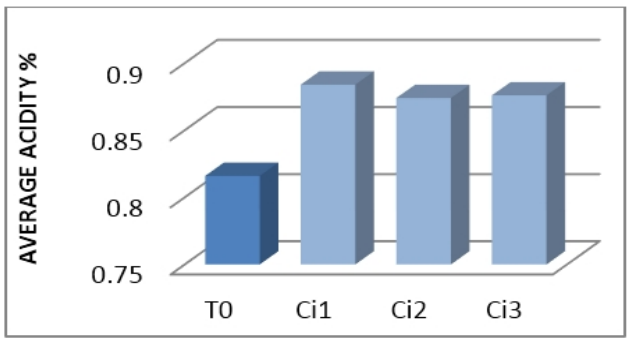

Fig 1.6: Average Acidity percent of control and cinnamon yogurt

3.7. Sensory evaluation

Fig 1.7 show the data of sensory character (flavour and taste, Body and texture, colour and appearance and overall acceptability) of cinnamon yogurt and Ci_2 recorded as best

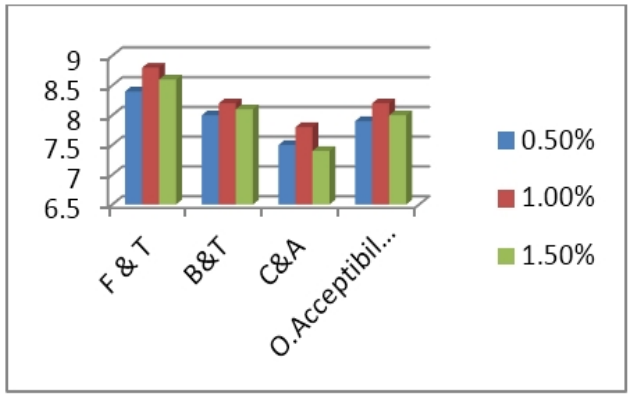

Fig 1.7: Sensory character of cinnamon yogurt. Where-F&T-flavour and Taste, B& T-Body and Texture, C&A-Colour and Appearance, O.A Overall Acceptability

3.8. Microbiological Analysis

Fig. 1.8 Show the data of Total viable count of control and Herbal yogurt and found that Treatment Ci_3 (100.2) for *L. bulgaricus* and (44.6) recorded highest viability for *S. thermophilus.*

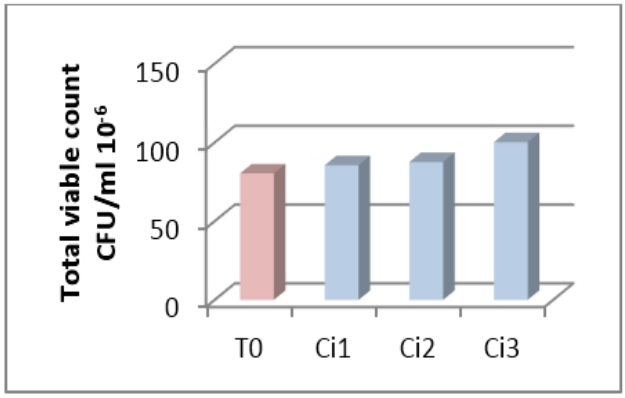

Fig 1.8: Viable count of *L. bulgaricus* in Control and Cinnamon yogurt

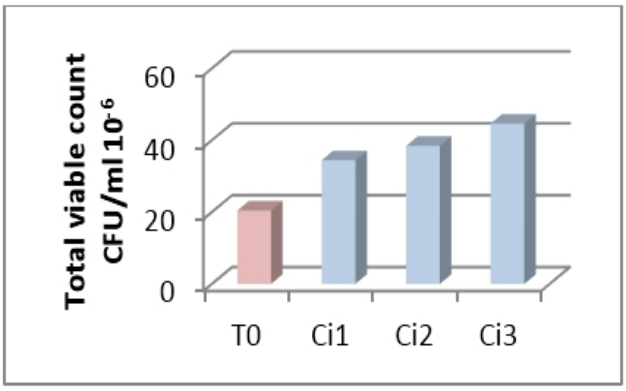

Fig 1.9: Viable count of S. thermophilus in Control and Cinnamon yogurt

4. Discussion

In the present studies, yogurt formed may be characterized physically by its smooth viscous gel structure and organoleptically by its taste and flavour (Debbie, L *et al.*, 1991). Under normal fermentation condition, the main

products of metabolism are lactic acid, acetic acid, acetaldehyde, ethanol and diacetyl, all of which contributed to the specific sour flavor of fermented yogurts. Herbs contain phytochemicals and this may play important role in causing undesirable organoleptic properties of herbal-yogurts. This is because most herbs contain a unique richness and diversity of metabolites responsible for their taste and flavour. Cinnamon yogurt was considered by the panelist as the most undesirable in overall taste followed by control yogurt in comparison to plain-yogurt. The present study was supported by (Marhamatizadeh *et al.*, 2012) [10] that increase in concentration of herbs promote the growth and Viability of Probiotic bacteria in yogurt.

5. Conclusion

It can be concluded from our study that Cinnamon shows good protein source and treatment Ci_2 (1%) cinnamon yogurt enhance the flavour and taste of yogurt and recorded as best in Overall Acceptability. It was also concluded from research that as the amount of Herbal extract increases in yogurt it affects the Viability in yogurt. Therefore, addition of cinnamon extract in the process milk used for making yogurts is recommended because cinnamon is a natural herbal product with a wide range of beneficial and nutritional properties; this makes this new yogurt a functional food.

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