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Methods of preparation and standardization of herbal yoghurt by sensory evaluation

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Abstract

Yogurt is a dairy product made by fermenting milk with a yogurt culture. It provides protein and calcium, and it may enhance healthy gut bacteria. The present study investigate commonly used herbs *Aloe barbadensis* (*Aloe vera*), *Anethum graveolence* (dill), *Costus igneus* (insulin plant) and *Hibiscus sabdariffa* (roselle) on yoghurt formation. In the preparation of herbal yoghurt plants like *Aloe barbadensis*, *Anethum graveolens*, *Costus igneus* and *Hibiscus sabdariffa* were standardized for incorporation into yoghurt at the level of 14, 0.6, 0.7 and 0.6 per cent, respectively based on sensory evaluation using nine point scale method. Statistical analysis showed that these concentrations were optimum for inclusion in yoghurt based on significantly ($P<0.05$) higher sensory scores of sensory panel to the parameters like colour and appearance, flavour and taste, body and texture and overall acceptability.

Keywords: Herbal, yoghurt, sensory evaluation, preparation and standardization

1. Introduction

Yogurt is a dairy product made by fermenting milk with a yogurt culture. It provides protein and calcium, and it may enhance healthy gut bacteria. Yoghurt is a widely consumed functional food due to its good taste and nutritional properties. According to FAO/WHO (2003) [4] standards, yoghurt is 'the coagulated milk product obtained by lactic acid fermentation through the action of *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus salivarius* subsp. *thermophilus*' (Krasaekoopt *et al.*, 2005) [5]. The benefits of consuming these organisms include maintenance of gut health, increased bio-accessibility of lipids and proteins, reduced allergenicity of foods and those resulting from the production of B-group and K vitamins, short chain fatty acids, polyamines, ω -3 unsaturated fatty acids including conjugated linoleic acid, and bioactive metabolites (Stanton *et al.*, 2005). The present study investigate commonly used herbs *Aloe barbadensis* (*Aloe vera*), *Anethum graveolence* (dill), *Costus igneus* (insulin plant) and *Hibiscus sabdariffa* (roselle) on herbal yoghurt preparation and standardization of the methods and thus prepared herbal yoghurt is subjected to the sensory evaluation by using nine point scale method.

Materials and Methods

Herbs

Aloe barbadensis collected from campus of Veterinary College and Research Institute, Namakkal.

Anethum graveolens purchased from local markets of Kolar district, Karnataka.

Costus igneus and *Hibiscus Sabdariffa* collected from Horticulture College, GKVK campus, Bangalore. Figure 1 to 4

Five different concentrations of herbal yoghurt were prepared from each different herb for standardization and were denoted as

1. PY = Plain yoghurt without adding any herb as a standard yoghurt
2. ABY = *Aloe barbadensis* incorporated yoghurt
3. AGY = *Anethum graveolens* incorporated yoghurt
4. CIY = *Costus igneus* incorporated yoghurt
5. HSY = *Hibiscus sabdariffa* incorporated yoghurt

Different concentrations used for standardization of herbal yoghurt

Yoghurt	Concentration of herbs (per cent)				
PY	0	0	0	0	0
ABY	12	14	16	18	20
AGY	0.4	0.5	0.6	0.7	0.8
CIY	0.4	0.5	0.6	0.7	0.8
HSY	0.4	0.5	0.6	0.7	0.8

The herbal yoghurt was standardized by sensory evaluation based on Nine- point hedonic scale.

Method of extraction of herbs

Extraction of *Aloe barbadensis* gel

The extraction procedure was done as per the procedure of Chandegara and Varshney (2013) [3]. The gel extraction from *Aloe barbadensis* leaves had been carried out by removing of its exudates and its mucilage was scrapped out with blunt edged knife. This mucilage was stirred vigorously in a blender to homogenize. This solution was strained through a muslin cloth and filtered. The filtered gel was used for preparation of yoghurt.

Aqueous extraction of herbs

The aqueous/water extraction of herbs was carried out with the procedure described by Sumithra and Raaji (2013) [9] with slight modifications. The herbs obtained were cleaned and washed using running water. The excessive water was drained out and the herbs were dried out at room temperature in open air. After drying, the selected portions of herbs were to be used for the extraction. About six grams of dried herbal powder was mixed in 100 ml of water slowly and mixed thoroughly in an air tight conical flask by shaking the flask for thorough mixing of herbal powder. The powder was allowed to dissolve homogeneously in the water. Then the extract solution was filtered with Whatman no.1 filter paper. The filtrate extract was collected in the sterile petridish plates and allowed to dry in the incubator overnight at 40 °C. The dried extract was collected and made 100 percent solution by adding sterile distilled water at the ratio of 1:1 and stored in refrigeration until usage.

Yoghurt preparation

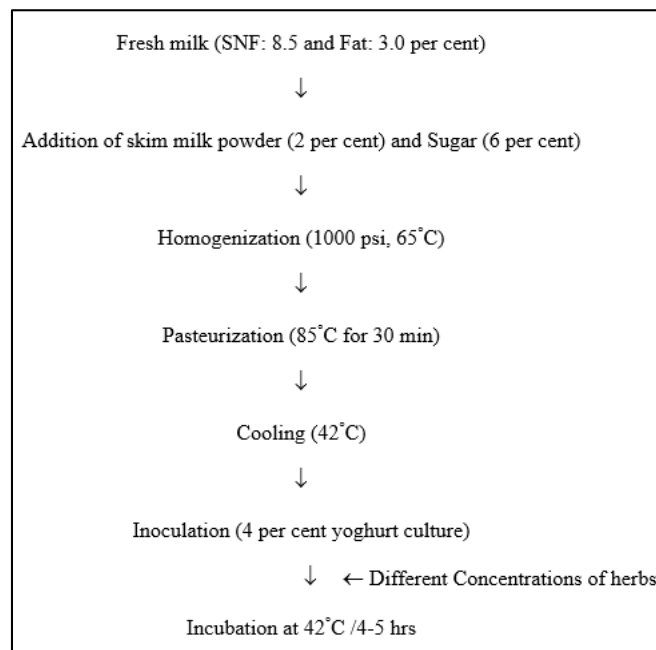
Propagation and maintenance of cultures

The freeze dried yoghurt cultures were transferred in to 12 per cent (w/v) reconstituted sterilized skim milk and incubated at 37 °C overnight. Sub culturing was done once in a week. Stock cultures of the yoghurt bacteria were maintained using MRS broth with 15 per cent added glycerol and stored at -20 °C.

Procedure for the preparation of probiotic yoghurt

Six batches of different herbal probiotic yoghurt were prepared using fresh milk. Skim milk powder at the rate of 2 per cent (w/v) and sugar at the rate of 6 per cent (w/v) were added to it and homogenized at 1000 psi. The contents were mixed well and pasteurized at 85 °C for 30 minutes, cooled to room temperature and inoculated with 4 per cent of yoghurt cultures containing *Lactobacillus delbrueckii* subsp. *bulgaricus*, and *Streptococcus salivarius* subsp. *thermophilus*. Different concentrations of herbs were added before incubation and mixed well and incubated at 42 °C for 4 to 5

hours and stored at 4 °C when the pH was reduced to 4.5. These yoghurts were then placed in the refrigerator for up to 21 days.



Flow diagram of preparation of probiotic yoghurt

Preparation of yoghurt extracts (Apostolidis *et al.*, 2006) [2]

Yoghurt samples were homogenized with autoclaved, sterile spatula. Homogenized samples were centrifuged two times at 10,000×g for 10 min, and the supernatant was collected. All experiments were performed within 4 days of sample extraction and were kept at 4 °C.

Results

The outcome of the present study is depicted in table 1 to 4 and are analysed by using proper statistical methods. different plants used in the study is depicted as Figure 1 to 4.

Standardization of optimum level of inclusion of *Aloe barbadensis* pulp Extract in yoghurt

Table 1 shows the mean±SE values of colour and appearance, flavour, body and texture and over all acceptability scores of different concentration

(12, 14, 16, 18 and 20 per cent) of *Aloe barbadensis* pulp extract incorporated yoghurt and their analysis of variance.

Statistical analysis revealed that no significant difference between different levels of inclusion of with regard to colour and appearance and flavour except at the concentration of 20 per cent, which scored significantly lower points.

Significant ($P<0.05$) differences were noticed between different levels of treatment (12, 14, 16, 18 and 20 per cent) of *Aloe barbadensis* pulp extract in yoghurt in body and texture and overall acceptability scores. *Aloe barbadensis* pulp extract concentration of 14 per cent recorded a significantly higher sensory score of 8.17 ± 0.31 and 8.17 ± 0.17 in both body and texture and overall acceptability, respectively. No significant difference between control and 14 per cent level of inclusion was observed in overall acceptability.

Table 1: Standardization of *Aloe barbadensis* incorporated yoghurt by sensory evaluation (mean±SE) Different superscripts in a column differ significantly $P<0.05$

Concentration (per cent)	Colour and Appearance	Flavour	Body and Texture	Overall acceptability
12	8.00 ^a ±0.00	8.33 ^a ±0.21	7.83 ^{ab} ±0.17	7.83 ^{ab} ±0.17
14	8.5 ^a ±0.22	8.33 ^a ±0.21	8.17 ^a ±0.31	8.17 ^a ±0.17
16	8.33 ^a ±0.21	8.33 ^a ±0.21	8.0 ^{ab} ±0.26	7.83 ^{ab} ±0.17
18	8.17 ^a ±0.17	7.67 ^a ±0.21	7.33 ^b ±0.21	7.33 ^b ±0.21
20	8.00 ^a ±0.00	6.83 ^b ±0.31	6.0 ^c ±0.26	6.5 ^c ±0.22
PY	8.17 ^a ±0.07	8.50 ^a ±0.09	8.33 ^a ±0.09	8.33 ^a ±0.09

Hence, *Aloe barbadensis* pulp extract concentration of 14 per cent was used in the preparation of yoghurt for further studies.

Standardization of optimum level of inclusion of *Anethum graveolens* extract in yoghurt

The mean±SE values of colour and appearance, flavour, body

and texture and over all acceptability scores of different concentration (0.4, 0.5, 0.6, 0.7 and 0.8 per cent) of *Anethum graveolens* extract incorporated yoghurt and their analysis of variance are presented in table 2.

Table 2: Standardization of *Anethum graveolens* incorporated yoghurt by sensory evaluation (mean±SE). Different superscripts in a column differ significantly $P<0.05$

Concentration (per cent)	Colour and Appearance	Flavour	Body and Texture	Overall acceptability
0.4	7.83 ^a ±0.16	7.83 ^a ±0.17	7.67 ^a ±0.21	7.83 ^{ab} ±0.17
0.5	7.83 ^a ±0.17	7.83 ^a ±0.18	7.50 ^a ±0.23	7.67 ^b ±0.21
0.6	8.0 ^a ±0.26	8.17 ^a ±0.17	7.50 ^a ±0.22	8.17 ^a ±0.16
0.7	7.5 ^a ±0.22	6.67 ^b ±0.21	7.33 ^a ±0.20	7.00 ^b ±0.00
0.8	7.5 ^a ±0.22	5.83 ^c ±0.31	7.33 ^a ±0.21	6.83 ^b ±0.17
PY	8.17 ^b ±0.07	8.50 ^d ±0.09	8.33 ^b ±0.09	8.33 ^c ±0.09

Incorporation of *Anethum graveolens* extract at different concentrations significantly ($P<0.05$) decreased the sensory scores between plain yoghurt and other treatments. However, reduction in the scores were within acceptable range.

No significant differences between treatments were observed in colour and appearance and body and texture. Significant ($P<0.05$) reduction in the flavour scores were observed at 0.7 and 0.8 per cent levels of inclusion compared to other treatments.

The concentration of 0.6 per cent recorded significantly highest ($P<0.05$) sensory value (8.17±0.16) in overall

acceptability and was considered to be optimum for the preparation of *Anethum graveolens* yoghurt for further studies.

Standardization of optimum level of inclusion of *Costus igneus* extract in yoghurt

Costus igneus extract was incorporated into yoghurt at the concentrations of 0.4, 0.5, 0.6, 0.7 and 0.8 per cent and the average sensory scores (mean±SE) for the different parameters are presented in table 3.

Table 3: Standardization of *Costus igneus* incorporated yoghurt by sensory evaluation (mean±SE) Different superscripts in a column differ significantly $P<0.05$

Concentration (per cent)	Colour and Appearance	Flavour	Body and Texture	Overall acceptability
0.4	7.83 ^a ±0.17	7.67 ^{ab} ±0.21	7.33 ^a ±0.21	7.67 ^{ab} ±0.21
0.5	7.67 ^{ab} ±0.19	7.67 ^{ab} ±0.18	7.50 ^a ±0.20	7.67 ^{ab} ±0.21
0.6	7.67 ^{ab} ±0.21	7.67 ^{ab} ±0.21	7.52 ^a ±0.22	7.50 ^{ab} ±0.22
0.7	7.67 ^{ab} ±0.22	7.83 ^a ±0.14	7.67 ^a ±0.21	7.83 ^a ±0.17
0.8	7.54 ^b ±0.24	7.17 ^b ±0.16	7.17 ^a ±0.17	7.17 ^b ±0.17
PY	8.17 ^c ±0.07	8.50 ^c ±0.09	8.33 ^b ±0.09	8.33 ^c ±0.09

Incorporation of *Costus igneus* extract at different concentrations significantly ($P<0.05$) decreased the sensory scores between plain yoghurt and other treatments. However, reduction scores were within acceptable range.

There was no significant difference observed between the concentration of 0.5, 0.6 and 0.7 per cent on colour and appearance. A higher significant value (mean±SE) of 7.83±0.17 and lower significant value of 7.54±0.24 were observed at the levels 0.4 and 0.8 per cent for colour and appearance.

With regard to flavour, 0.7 and 0.8 per cent levels recorded significantly ($P<0.05$) higher and lower sensory scores of 7.83±0.14 and 7.17±0.17, respectively.

Among treatments no significant difference in body and

texture was noticed wherein 0.7 per cent recorded a significantly ($P<0.05$) higher overall acceptability with a value of 7.83±0.17. Hence, the level of 0.7 per cent of *Costus igneus* was considered to be optimum and used for further analysis.

Standardization of optimum level of inclusion of *Hibiscus sabdariffa* extract in yoghurt

Table 4 shows the mean±SE values of colour and appearance, flavour, body and texture and over all acceptability scores of different concentration (0.4, 0.5, 0.6, 0.7 and 0.8 per cent) of *Hibiscus sabdariffa* extract incorporated in yoghurt and their analysis of variance.

Table 4: Standardization of *Hibiscus sabdariffa* incorporated yoghurt by sensory evaluation (mean±SE) Different superscripts in a column differ significantly $P<0.05$

Concentration (per cent)	Colour and Appearance	Flavour	Body and Texture	Overall acceptability
0.4	7.50 ^{ab} ±0.22	7.33 ^{ab} ±0.21	7.50 ^{ab} ±0.22	7.50 ^{ab} ±0.22
0.5	7.50 ^{ab} ±0.22	7.33 ^{ab} ±0.21	5.50 ^{ab} ±0.22	7.33 ^{ab} ±0.21
0.6	7.83 ^a ±0.17	7.67 ^a ±0.21	7.67 ^a ±0.21	7.83 ^a ±0.17
0.7	7.33 ^{ab} ±0.21	6.83 ^b ±0.17	7.17 ^{ab} ±0.17	7.17 ^b ±0.17
0.8	7.17 ^b ±0.17	6.33 ^c ±0.21	7.00 ^b ±0.00	6.50 ^c ±0.22
PY	8.17 ^c ±0.07	8.50 ^d ±0.09	8.33 ^c ±0.09	8.33 ^d ±0.09

Incorporation of *Hibiscus sabdariffa* extract at different concentrations significantly ($P<0.05$) decreased the sensory scores between plain yoghurt and other treatments. However, reduction in scores were within acceptable range.

Significant differences ($P<0.05$) were observed between parameters of colour and appearance (0.6 and 0.8 per cent), flavour (0.7 and 0.8 per cent) and body and texture (0.6 and 0.8 per cent).

The levels of inclusions of 0.6 and 0.8 per cent recorded scores of 7.83±0.17, 7.67±0.21 and 7.67±0.21 and 7.17±0.17, 6.33±0.21 and 7.00±0.00 for colour and appearance, flavour and body and texture, respectively.

Among treatments a significantly ($P<0.05$) higher sensory score of 7.83±0.17 in overall acceptability was recorded at 0.6 per cent and this level was considered ideal for the preparation of *Hibiscus sabdariffa* yoghurt for further studies.

Discussion

The herbs like *Aloe barbadensis*, *Anethum graveolens*, *Costus igneus* and *Hibiscus sabdariffa* were standardized for incorporation into yoghurt at the level of 14, 0.6, 0.7 and 0.6 per cent, respectively based on sensory evaluation. Statistical analysis showed that these concentrations were optimum for inclusion in yoghurt based on significantly ($P<0.05$) higher sensory scores of sensory panel to the parameters like colour and appearance, flavour and taste, body and texture and overall acceptability.

These results are supported by Amirdivani (2008) ^[1] who used *A. graveolens* at the rate of 0.8 per cent of aqueous extract for the preparation of yoghurt to determine the antidiabetic and antihypertensive properties. Similarly, Rasdhari *et al.* (2008) ^[7] found that addition of *Hibiscus sabdariffa* calyx extract at the 0.6 to 0.8 per cent to yoghurt to have higher score in almost all sensory attributes. Shaaban *et al.* (2010) ^[8] reported 0.3 per cent of lemon grass essential oil as an optimum level of addition to yoghurt based on the sensory qualities.

Kumari *et al.* (2011) ^[6] reported that addition of tulsi at 0.3 per cent resulted in better compactness of body and closely smooth texture of the yoghurt compared to other treatments and concluded that the tulsi paste at 0.3 per cent level improved the taste and flavour, colour and appearance, body and texture and also overall acceptability.

Yadav and Shukla (2014) ^[10] found that addition of cinnamon and green tea at one per cent level resulted in better compactness of the body and closely smooth texture of the yoghurt.

Variation in the level of addition of plant extracts compared to the level of addition of herbs used in previous studies may be attributed to variation in the chemical composition of herbs.

Figures depicting the different plants used in the preparation of herbal yoghurt**Fig 1:** *Anethum graveolens***Fig 2:** *Aloe barbadensis***Fig 3:** *Costus igneus*



Fig 4: *Hibiscus sabdariffa*

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Conclusion

All the herbal yoghurts were standardized by sensory evaluation based on 9-point hedonic scale. The optimum level of ABY, AGY, CIY and HSY for the production of herbal yoghurt were standardized at 14, 0.6, 0.7, 0.6 per cent, respectively

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