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Optimization of different levels of coconut aqueous extract on sensory quality of dahi

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Abstract

The study was undertaken to optimize process for developing dahi by enriched with coconut aqueous extract and its effects on sensory attributes, physico-chemical aspects, microbial aspects and shelf life. Dahi, the Indian curd, is a well-known fermented milk product consumed by large section of the population throughout the country. Coconut aqueous extract is lactose free, unlike cow milk, and can be used as a milk substitute by those with lactose intolerance. Coconut aqueous extract and fat is an excellent source for preparation of filled milk, infant formulae and margarine. The sensory scores awarded for overall acceptability of dahi was 8.33 for control as against 8.16, 8.33 and 8.00 for 5, 10 and 15 per cent coconut aqueous extract levels respectively. The dahi with 10 per cent coconut aqueous extract secured highest average flavor, body and consistency and sensory scores compared to other level per cent coconut aqueous extract. Addition of coconut aqueous extract level at 10 per cent was found to be optimum because it improves better texture and consistency compared to other samples. Further increase in the level of incorporation of coconut aqueous extract, the sensory scores were reduced and quality of product was unsatisfactory with showing significantly lower score of colour and appearance due to dull appearance with thick viscous body and pronounced coconut oil flavour.

Keywords: Dahi, coconut aqueous extract, sensory quality

Introduction

Dahi, the Indian curd, is a well-known fermented milk product consumed by large section of the population throughout the country, either as a part of the daily diet or as a refreshing beverage. About 8% of total milk production is used for dahi making. In India, dahi is largely made at individual homes using traditional kitchen recipes, involving milk of buffaloes, cows and goats; generally, a mixture of cow and buffalo milk is used. Milk is boiled and cooled, inoculated with dahi starter, usually the left over from the previous day's stock and undisturbed at ambient temperature for four to six hours until it acquires a thick consistency.

Dahi is produced by using mixed mesophilic cultures of *Lactococcus lactis* *ssp. lactis*, *L. lactis* *ssp. cremoris*, *L. lactis* *ssp. diacetylactis* along with *Leuconostoc* species and lactose fermenting yeasts. Dahi is generally consumed in its original form as an accompaniment to the meal or it may be converted into raita. Dahi may be consumed as such as sweet or savory drink as a dessert containing sugar, spices, fruits, nuts, etc. An extensive all India survey work on dahi revealed that there were two types of dahi prevalent in the country for direct consumption viz. a sweet/mildly acidic variety with a pleasant flavor and a sour variety with a sharp acidic flavour.

Coconut (*Cocos nucifera* of the Family *Palmae*) grows extensively in more than 90 countries and is eaten as a snack usually for pleasure. Coconut is a fruit rich in fiber (aids digestibility), iron, and other minerals. Coconut also serves as an excellent source of raw materials for the development of dairy-like products. Coconut aqueous extract is the liquid that comes from the grated meat of a brown coconut (it is different from coconut water). The colour and rich taste of coconut aqueous extract can be attributed to the high oil content. Most of the fat is saturated fat.

It has no cholesterol, contains many vitamins, minerals and electrolytes, including potassium, calcium and chloride (Amarasiri and Dissanayake, 2006) [1]. It has many uses, most of which build up the immune and the body's defense system (Mensink *et al.*, 2003) [6]. It contains a large proportion of lauric acid, a saturated fat that raises blood cholesterol levels by increasing the amount of high-density lipoprotein cholesterol, which is also found in significant amounts in breast milk and sebaceous gland secretions (Amarasiri and Dissanayake, 2006) [1].

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This may create a more favourable blood cholesterol profile. Coconut aqueous extract is lactose free, unlike cow milk, and can be used as a milk substitute by those with lactose intolerance. Development of yoghurt product from coconut aqueous extract would help reduce the problem of hunger and malnutrition in the country as well as serve as alternative diet for lactose intolerant people. It would also diversify coconut utilization other than eating as snacks (Edem and Elijah 2016) [2].

Coconut aqueous extract and fat is an excellent source for preparation of filled milk, infant formulae and margarine. It is popular for its characteristic nutty flavour and nutritional content. Coconut aqueous extract is extracted from freshly grated Coconut meat, it undergoes progressive deterioration and after a few hours at room temperature (28°C-30°C), it is spoiled. This spoilage is attributed to its high content of fat, moisture and other organic compound. Coconut is an indispensable ingredient in many of the traditional cuisines of Southeast Asian countries including India. Fat in coconut is similar to fat in mother's milk and have similar nutritional effects (Mensink, 2003) [6].

Materials and methods

Whole milk

Pasteurized and homogenized milk obtained from Student Experimental Dairy Plant (SEDP), Dairy Science College, Hebbal, Bengaluru, was used for the preparation of coconut aqueous extract and kiwi fruit pulp enriched dahi.

Starter cultures

Dahi cultures such as *Lactococcus lactis* ssp. *lactis*, *Lactococcus lactis* ssp. *diacetylactis* in the form of Freeze Dried Direct Vat Set (FD-DVS) was obtained from Chr-Hansen, Mumbai.

Mixed starter culture was used in the preparation of coconut aqueous extract and kiwi fruit pulp enriched dahi. The stock cultures were maintained in yeast glucose chalk litmus milk and sub-cultured once in 21 days, whereas the working cultures were maintained in sterile skim milk.

Preparation of working culture.

The working cultures were obtained from the freeze-dried direct vat set cultures by dissolving in luke warm distilled water.

Coconut aqueous extract

The edible portion (kernel) of coconut was collected carefully in such a way that no waste was present. Grated coconut and some portion of water taken and blended. After blending, the milk was filtered by a clean cloth and kept in a plastic bottle.

Procedure for preparation of control dahi.

The procedure followed by Lee and Lucey (2010) for preparation of control dahi was adopted with suitable modifications.

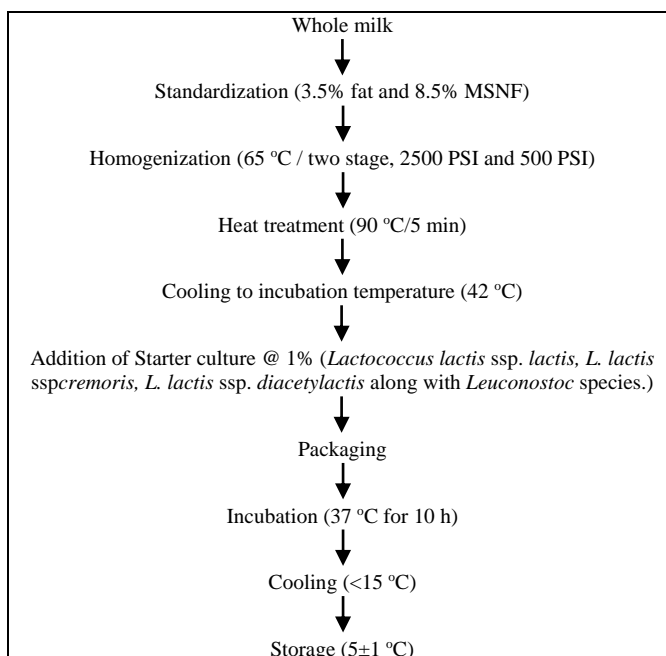


Fig 1: Flow diagram for the preparation of control dahi

To optimize the effect of different levels of Coconut aqueous extract on sensory quality of Dahi

Coconut aqueous extract was used in preparation of dahi at 5, 10 and 15 percent levels and thus the obtained product analyzed for sensory characteristics like color and appearances, body and texture, flavor and over all acceptability.

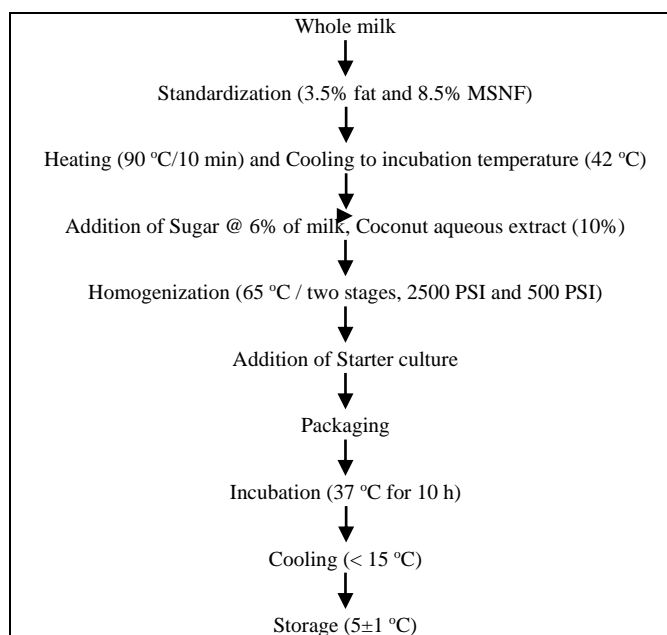


Fig 2: Flow chart for preparation of coconut aqueous extract enriched dahi

Chemical analysis of coconut aqueous extract and kiwi fruit pulp enriched dahi

Fat

Fat content in dahi samples was determined by Gerber method as per IS: SP 18 (Part XI) 1981.

Total Solids (TS)

Total solids of milk, Dahi samples were determined as per IS: SP 18 (Part XI) 1981.

Titrateable acidity

Acidity was measured as per method described in IS: SP 18 (Part XI) 1981.

pH

pH was measured using a digital pH meter. (Elico Pvt.Ltd.) at 25 °C. About 20 ml of representative samples were used for pH meter.

Microbiological analysis of coconut aqueous extract and kiwi fruit pulp enriched dahi.

In order to determine safety of the product coliform and yeast & mold count were enumerated.

Coliform count

Coliform count was determined by method as per IS: SP 18 (Part XI) 1981.

Yeast and Mold count

Yeast and Mold count was determined by method as per IS: SP (Part XI) 1981.

Sensory evaluation

Coconut aqueous extract and kiwi fruit pulp enriched dahi samples were given to a panel of five judges for sensory evaluation. Each judge was supplied with standard score card of a total of 9 Point Hedonic Scale (Annexure-1) for colour and appearance, body and texture, flavor and overall acceptability. The scores given by panel of judges were then statistically analyzed. The samples were code numbered to avoid identification and bias.

Statistical analysis

The data was analyzed using R software {R Programme, R-Version 3.1.3(2015-3-09), Copyright © 2015} both one way and two way Completely Randomed Design (CRD) which is the most appropriate for the study. Data on the response variables were collected for three replications for each of these treatments. ANOVA tables were prepared to analyse the data and where the F value was significant the critical difference was calculated and used to identify where significant differences existed and was indicated in the table use superscripts. The formula for the critical difference (CD) is

$$CD = \frac{\sqrt{2-MSS(E)}}{R} t\alpha$$

Where, MSS (E) = Mean Sum of square of the error.

R = number of replications.

t α =table t value of the α level of significance.

Multiple linear regressions were carried and were the response variables as dependent and the factor (treatments) as independent variables. It was estimated and the coefficients were tested for significance. The data was analyzed using R

software {R Programme, R-Version 3.1.3 (2015-3-09), Copyright © 2015} R foundation for statistical computing.

Results and Discussion

Chemical composition of cow milk and coconut aqueous extract

The chemical composition of cow milk and coconut aqueous extract are presented in Table 1. The cow milk was found to contain 87.59, 3.63, 3.50, 4.12, 0.65 and 0.12 per cent of moisture, fat, protein, carbohydrate (lactose), ash and titratable acidity (% lactic acid) respectively.

The coconut aqueous extract had 75.88, 19.13, 2.02, 2.81, 0.60, 0.16 and 3.10 per cent of moisture, fat, protein, carbohydrate (polysaccharide), ash, acidity and crude fiber respectively. The coconut aqueous extract had high content of fat and ash as compared to cow milk, while it had lower content of carbohydrate and protein. Coconut aqueous extract had good amounts of crude fiber (3.10%) whereas cow milk does not contain fiber. Coconut aqueous extract was white in colour and bland taste, while cow milk was pale yellow in colour with very mild sweetness.

The results obtained for fat content was higher, than the value given by Hamad *et al.*, (2014). This can be attributed to the quantity of dilution with the distilled water. The carbohydrate content of the coconut aqueous extract (2.81 per cent) was lesser than the cow milk (4.12 per cent). Cow milk contains the lactose, a sweet taste oligosaccharide while coconut aqueous extract is devoid of this, but contains lesser amount of polysaccharide. Whereas coconut aqueous extract contains crude fiber of 3.10 per cent.

The results obtained for ash contents were almost similar, whereas the value reported for ash content of coconut aqueous extract was higher than the value given by Hamad *et al.*, (2016). This is due to the fact that, the coconut aqueous extract contains higher content of minerals. The coconut aqueous extract showed 75.88 per cent of moisture in the present study.

Physico-chemical characteristics of cow milk and coconut aqueous extract

Constituents (%)	Cow milk	Coconut aqueous extract
Moisture	87.59	75.88
Fat	3.63	19.13
Protein	3.50	2.02
Carbohydrate	4.12	2.81
Acidity (% LA)	0.12	0.16
Ash	0.65	0.80
Crude fiber	Absent	3.10

All values are average of three replicates.

To optimize the effect of different levels of coconut aqueous extract on sensory quality of dahi

The sensory scores pertaining to colour and appearance, body and texture, flavor and overall acceptability of product as adjudged by a five panel of judges during sensory evaluation of control and experimental dahi by incorporation of various levels of coconut aqueous extract presented in Figure 1.

Colour and Appearance

The mean scores for colour and appearance of control sample was 8.16 as against 8.16, 8.17 and 7.65 for dahi incorporated with 5, 10, 15 per cent levels of coconut aqueous extract respectively.

The effect of different levels of coconut aqueous extract on sensory quality of dahi

Levels of coconut aqueous extract (%)	Colour & Appearance	Body and Texture	Flavour	Overall acceptability
Control	8.16 ^a	8.16 ^a	8.16 ^a	8.33 ^a
5	8.16 ^a	8.00 ^a	8.00 ^a	8.16 ^a
10	8.17 ^a	8.33 ^a	8.16 ^a	8.33 ^a
15	7.65 ^b	7.83 ^b	8.00 ^a	8.00 ^a
CD($P \leq 0.05$)	0.42	0.48	NS	NS

Note

All values are average of three trials.

Similar superscripts indicate nonsignificance at the corresponding critical difference.

Control – Plain Dahi.

There was decrease in the colour and appearance scores with increase in coconut aqueous extract levels. The highest score (8.17) with respect to colour and appearance was recorded for dahi containing 10 per cent level of coconut aqueous extract. Statistical analysis revealed that a different level of coconut aqueous extract has significant effect on colour and appearance of dahi.

Body and texture

The mean sensory scores for body and texture of control sample was 8.16 as against 8.00, 8.33 and 7.83 for dahi incorporated with 5, 10 and 15 per cent levels of coconut aqueous extract respectively.

The control and all levels of coconut aqueous extract added dahi showed non-significant difference. The highest score with respect to body and texture of 8.33 was recorded for dahi containing 10 per cent level of coconut aqueous extract whereas, lowest score of 7.83 was awarded to product with 15 per cent. Statistical analysis revealed that a different level of coconut aqueous extract has significant effect on body and texture of dahi.

Flavour

The mean sensory scores for flavour of control sample was 8.16 as against 8.00, 8.16, 8.00 for dahi incorporated with 5, 10 and 15 per cent levels of coconut aqueous extract respectively. There was decrease in the sensory scores with increase in coconut aqueous extract levels. The highest score with respect to flavour of 8.16 was recorded for dahi containing 10 per cent level of coconut aqueous extract whereas; lowest score of 8 was awarded to product with 5 and 15 per cent.

The control and all levels of coconut aqueous extract added dahi showed non-significant difference. Statistical analysis revealed that a different level of coconut aqueous extract has non-significant effect on flavour of dahi.

Overall Acceptability

The sensory scores awarded for overall acceptability of dahi was 8.33 for control as against 8.16, 8.33 and 8.00 for 5, 10 and 15 per cent coconut aqueous extract levels respectively. The dahi with 10 per cent coconut aqueous extract secured highest average sensory scores of 8.33 compared to 5 and 15 per cent coconut aqueous extract. While the lowest score of 8.00 was secured by dahi with 15 per cent coconut aqueous extract.

Statistical analysis revealed that a different level of coconut aqueous extract has non-significant effect on overall acceptability of dahi. Therefore, in all the subsequent

experiments dahi was incorporated with 10 per cent level of coconut aqueous extract.

The effect of various levels of coconut aqueous extract on the sensory quality of dahi is presented in Table 2. There was statistical significant difference ($P \leq 0.05$) in colour and appearance scores of control (8.16), 5(8.16), 10(8.16) and 15(8.00) per cent treated samples. But 5 and 15 per cent samples show significantly lower score of colour and appearance due to dull and dark appearance respectively. Rakib *et al.* (2016) [7] reported that the dahi prepared with added higher levels (15 to 20 per cent) of coconut aqueous extract showed significantly lower score (7.50) of colour and appearance due to dark and dull appearance.

Sample 10 per cent was awarded maximum body and consistency score of 8.33 compared to control (8.16), 5(8.00) and 15(7.83) per cent levels. Addition of coconut aqueous extract level at 10 per cent was found to be optimum because it improves better texture and consistency compared to other samples. Rakib *et al.* (2016) [7] reported that the dahi prepared with added coconut aqueous extract at 5 to 10 per cent level showed improved body and consistency and also for colour and texture compared to other samples.

Similarly, 10 per cent was awarded with maximum flavour score of 8.16 compared to other samples. This could be due to the improvement in the taste of the product prepared by blending of coconut aqueous extract at 10 per cent level. But at 5 and 15 per cent level, matured coconut taste was noticed in the product. Hence judges awarded lower score. Kolapo and Olunamiwa in 2012 [4] reported that the fortification of coconut aqueous extract with soy milk at 10 per cent level in soy yoghurt not only improve the taste but is also helpful in nutrition and health since it contains no cholesterol or lactose and only small quantities of saturated fatty acids; in addition to its advantage of low cost. The 10 per cent sample was awarded better appearance, consistency and flavour score. This in turn was awarded maximum overall acceptance score of 8.33 compared to 5 (8.16) and 15 (8.00) per cent levels.



Fig 3: Control dahi



Fig 4: Coconut aqueous extract enriched dahi

Conclusion

Dahi was enriched by incorporating coconut aqueous extract at various levels at 5, 10 or 15 per cent. Among them 10 per cent incorporation showed higher sensory scores with respect to colour and appearance, body and texture, flavour and overall acceptability. It secured maximum overall acceptability scores of 8.33 out of 9.00 as against 8.33 for control sample. Further increase in the level of incorporation of coconut aqueous extract, the sensory scores were reduced and quality of product was unsatisfactory with showing significantly lower score of colour and appearance due to dull appearance with thick viscous body and pronounced coconut oil flavor.

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