Indian Journal of Natural Sciences *www.tnsroindia.org.in ©IJONS*

Vol.16 / Issue 91 / August / 2025 International Bimonthly (Print) – Open Access ISSN: 0976 – 0997

RESEARCH ARTICLE

Formulation and Evaluation of Strawberry Flavored Cotton Seed Milk

Shobana.C[1]*, Usharani B[1], Rohini D[2], Inbatamilan S[3], Lavanya Devi M[3], Logeshwari M[2] and Shobana V[2]

[1]Associate Professor, Department of Biochemistry, Vels Institute of Science and Technology and Advanced Studies (Deemed-to-be University), Chennai, Tamil Nadu, India.
[2]Assistant Professor, Department of Biochemistry, Vels Institute of Science and Technology and Advanced Studies (Deemed-to-be University), Chennai, Tamil Nadu, India.
[3]Third B.Sc Biochemistry, Department of Biochemistry, Vels Institute of Science and Technology and Advanced Studies (Deemed-to-be University), Chennai, Tamil Nadu, India.

Received: 21 Apr 2025 Revised: 18 May 2025 Accepted: 17 Jun 2025

***Address for Correspondence**
Shobana.C
Associate Professor, Department of Biochemistry,
Vels Institute of Science and Technology and Advanced Studies
(Deemed-to-be University), Chennai, Tamil Nadu, India.
E.Mail: shobana.sls@vistas.ac.in

ABSTRACT

The goal of the research was to create flavoured milk by blending cotton seed milk with strawberry. Made from unfermented milk, flavoured milk is a ready-to-drink food item. Cotton seed milk is a premium product that hasn't lost its appeal as a culinary item. Cotton seed milk is a protein and lipid-rich extract made from cotton seeds. It can be provided to the world's protein-energy starved people because it is high in protein. Along with improving blood circulation and digestion, it also aids in the removal of bad cholesterol, blood pressure maintenance, healing, and cancer prevention. The strawberry, or Fragaria x ananassa, is an important fruit crop and a member of the Rosaceae family. Another frequent name for it is Garden Strawberry. It is a well-liked fruit that is grown extensively in temperate regions of the world, including Europe, the US, and India. Strawberry pulp and cotton seed milk were used to make the flavoured milk in the following concentrations: 90:10 (T1), 80:20 (T2), and 70:30 (T3). The 9-point hedonic scale was used for the sensory evaluation. Treatments T1, T2, and T3 yielded flavour-infused cotton seed milk with overall acceptance scores of 7.33, 7.68, and 8.67, respectively. The most widely accepted was then used for microbiological, physico-chemical, and nutritional investigation.

Keywords: Cotton seed milk, protein energy malnutrition, strawberry, flavoured milk, sensory analysis, nutrient analysis.

INTRODUCTION

The Malvaceae family, which includes the marshmallow family, includes cotton seed (Gossypium). Many nations grow cotton seed in both temperate and tropical regions. The high protein content of cotton seeds can help satisfy the needs of the growing global population while also enhancing nutritional status. The World Health Organization (WHO) defines malnutrition as excesses, imbalances, or shortages in an individual's energy and/or nutrient consumption. Cotton seed can prevent malnutrition in billions of people because it is high in protein. (J. Amudha, 2018). The majority of cotton seed milk is consumed in southern India, where it is customarily served as a welcome beverage in many homes (K. Jeshi, 2018). It is commonly referred to as Paruthi Paal, where Paal means milk and Paruthi signifies cotton seed. Cotton seed milk is a highly rich source of protein, vital fatty acids, and carbohydrates, making it a "triple-nutrient." Cotton seeds, which are high in lipids and proteins, are used to make milk. Cotton seeds contain gossypol, a poisonous terpenoid molecule with negligible nutritional benefit. To make it suitable for human use, this needs to be eliminated. This compound can be eliminated by air separation, liquid treatment, or chemical means. Cotton seed milk can be made from the gossypol-removed seeds. It is an excellent substitute for cow's milk. Those who are lactose intolerant can therefore use cotton seed milk instead of cow's milk. It aids in the removal of bad cholesterol, enhances blood flow and digestion, lowers body temperature, and supports healthy pancreatic, bone marrow, and neurological system function (Amudha, J., 2018; Manoj Kumar, 2019).

Flavoured milk is a ready-to-drink beverage produced from unfermented milk combined with coffee, fruit juice, sweeteners, fragrance agents, and other additives. It is necessary to boil, pasteurize, or sterilize the flavoring milk. Coffee, chocolate, strawberry, vanilla, and banana are the most commonly utilized flavors. Kamble, S. (2019). One of the major fruit crops is the strawberry (Fragaria × ananassa), which is a member of the Rosaceae family (Singh R. et al., 2017). In temperate regions of the world, such as the United States, Canada, Mexico, Europe, and Asia, including China, Japan, Korea, and India, it is widely grown. States like Maharashtra, Himachal Pradesh, Jammu & Kashmir, and Punjab are where it is primarily farmed in India (NHB, 2020). Vitamin C, folate, potassium, fiber, and a variety of antioxidants, including flavonoids, anthocyanins, and ellagic acid, are all abundant in it (Giampieri F. et al., 2012).

The many health benefits of strawberries are well documented. Because of their high vitamin C concentration, they are quite good at increasing immunity. Strawberries contain antioxidants that have cardioprotective, anti-inflammatory, and anti-cancer effects (Hannum SM, 2004). They lessen the risk of heart disease, improve lipid profiles, and lower blood pressure. The high fiber content promotes healthy gut function, eases digestion, and avoids constipation. Strawberries are an effective way to lower the incidence of prostate, breast, and colon cancer because of their anthocyanins and ellagic acid, which are known to suppress the formation of cancer cells (Seeram NP et al., 2006). Because of their flavonoid content, strawberries also enhance brain function and guard against age-related memory decline (Devore EE et al., 2012). Strawberries are also beneficial for cosmetics and skincare. Their high levels of antioxidants and vitamin C aid in skin renewal, wrinkle reduction, and UV protection. Strawberry extracts applied topically aid in anti-aging, oil management, and skin whitening (Panchal S et al., 2021).

Because of its high folate content, which promotes fetal growth and guards against neural tube abnormalities, strawberries are good for you during pregnancy. Because of their vitamin and mineral profile, they also aid in lowering pregnancy-related problems such iron-deficiency anemia, tiredness, and nausea. Strawberries enhance the taste, texture, and sensory acceptance of food products. In order to increase the nutritional and economic value of jams, yogurts, smoothies, desserts, and baked goods, strawberry pulp is frequently utilized. An attempt was made to prepare flavoured milk from cotton seed milk where varying proportions of strawberry pulp was added to it and jaggery syrup was added to the cotton seed milk and further studied for the sensory evaluation, nutrient analysis, Physico-chemical properties and microbial analysis.

MATERIALS AND METHODS

The study's cotton seed was purchased from the local Tambaram market. After soaking in water for 12 hours, the cotton seeds were drained. A pressure cooker was used to autoclave the damp cotton seeds for 20 minutes. A stainless-steel strainer (1680 microns) was used to remove the milk after it had been ground in a food processor. The strawberry needed to make the flavored cotton seed milk was purchased at the local Tambaram market in Chennai. Strawberry-flavored cotton seed milk was made using the following ratios of pureed strawberry pulp and cotton seed milk (J. Amudha, 2018).

First, the strawberry fruit was completely cleaned with water in order to prepare the strawberry pulp (puree). With a knife, the strawberry fruit was cut into slices. To turn it into a pulp, it was twisted into the food processor.

Preparation of Strawberry Flavored Cotton Seed Milk

With a few modest adjustments, strawberry-flavored cotton seed milk was made using the method described by S. T. Pakalwad (2010). After being heated at 70°C, the cotton seed milk was quickly cooled. Various amounts of strawberry pulp were added, and six grams of jaggery syrup were added for sweetness. Figure 1 shows the flowchart for making strawberry-flavored cotton seed milk. Twenty-five untrained panelists used S. T. Pakalwad's nine-point hedonic scale to evaluate the strawberry-flavored cotton seed milk. Color, flavor, texture, appearance, taste, and general acceptability were all evaluated. The most widely used treatment was chosen for additional examination. The method described by AOAC (2000) was used to determine energy, the micro-kjeldhal method described by AOAC (1996) was used to determine protein, the soxhlet method described by AOAC (2000) was used to determine fat, and the AOAC (2000) method was used to determine carbohydrates, dietary fiber, calcium, and iron. AOAC for physico-chemical properties (2000).

RESULTSANDDISCUSSION

Sensory Evaluation of Strawberry Flavoured Cotton Seed Milk

Table 1 displays the results of a sensory evaluation of the strawberry-flavoured cotton seed milk made with varying ratios of strawberry pulp and cotton seed milk. Scores for each parameter are reported. The colour, flavour, texture, appearance, taste, and general acceptability of the flavour-infused cotton seed milk were all found to improve with the addition of strawberry pulp.

Nutrient Analysis

According to Vandana Verma, the nutrient content of strawberry milk shake using cow's milk were nergy (67Kcals), protein (3.2gm), carbohydrate (4.4gm), fat (4.1gm), calcium (120mg) and Iron (0.2mg) respectively. In this study, the nutrient content obtained were energy (172.3Kcals), protein(29.63gm), fat(0.874gm), carbohydrate (17.81gm), dietary fiber (6.148gm), calcium (0.86mg) and iron (7.48mg) respectively. From the above result, it was concluded that the flavored milk was rich in energy, protein, carbohydrate and iron.

Physico-Chemical Properties

From the above table it is observed that the viscosity, acidity, pH, total soluble solids and moisture was 142.3 cps, 1.3%, 6.65, 78.4% w/w and 88.24% respectively.

Viscosity

Kalpeshdilprao (2012) created flavored milk by mixing safflower and buffalo milk. The average viscosity when safflower milk was added in proportions of 0, 10, 20, and 30 was 6.18, 6.67, 6.80, and 8.80 percent, respectively. The viscosity of the flavoring milk increased as the amount of safflower milk in the blend increased. The viscosity

content of the papaya whey beverage grew as the proportion increased, according to Aher's 2007 preparation. The papaya whey beverage's viscosity rose from 7.91 to 8.51 cp. The viscosity of cotton seed milk ranges from 2.8 to 3.4 cP, per Amudha J. (2018). Since 30 percent was the most often acceptable percentage, adding more strawberry pulp also made the flavor-infused cotton seed milk more viscous.

Acidity

Kalpeshdilprao (2012) created flavored milk by mixing safflower and buffalo milk. The average acidity of the safflower milk added in the proportions of 0, 10, 20, and 30 was 0.140, 0.152, 0.173, and 0.180 percent, respectively. They came to the conclusion that when the amount of safflower milk in the blend rose, the flavoring milk's acidity also increased. In order to create flavored milk, Bala Sahib Son Walker et al. (2017) added jackfruit pulp in amounts of 2.5, 5, 7.5, and 10. The range of the acidity was 0.153 to 0.163%. They came to the conclusion that the rise in acidity might be between 0 and 400 viscosities. Viscosity 81 as a result of the original jackfruit pulp's strong acidity. They came to the conclusion that the acidity content rose as the amount of jackfruit pulp increased. Cotton seed milk's acidity concentration varied between 0.17% and 0.19%, per Amudha J. (2018). Thus, the addition of fruit pulp raised the flavoring cotton seed milk's overall acidity. Since 30% was the most often recognized percentage, adding more strawberry pulp raised the acidity content.

pH

A flavored soy milk whey beverage was created by Upadhyay et al. (2011). He came to the conclusion that the pH of the flavored whey soy milk beverage decreased as the amount of soy milk grew. Kalpesh Dilprao (2012) created flavored milk by mixing safflower and buffalo milk. The proportions of safflower milk added are 0, 10, 20, and 30. In those order, the average pH was 6.43, 6.19, 5.91, and 5.78. They came to the conclusion that when the blend's safflower milk content rose, the flavor-infused milk's pH dropped. Cotton seed milk has a pH of 6.5 to 7.1, according to Amudha J. (2018). when a result, the pH of strawberry-flavored cotton seed milk dropped when more fruit pulp was added. The addition of strawberry pulp lowered the overall pH level because 30% was the most widely approved percentage.

Total Soluble Solids

In order to create flavored milk, Balasaheb Sonwalker et al. (2017) added jackfruit pulp in amounts of 2.5, 5, 7.5, and 10. The range of the total soluble solids was 18.21 to 19.53. They came to the conclusion that the amount of total solids content rose as the amount of jackfruit pulp increased. Because jackfruit pulp contains a higher percentage of total soluble solids (23.57%) than skim milk (9.53%). Cotton seed milk's total soluble solids ranged from 11.8% to 13%, per Amudha J. (2018). Thus, the addition of fruit pulp raised the flavoring cotton seed milk's total soluble solids. The total soluble content increased as the amount of strawberry pulp increased since 30% was the most widely approved proportion.

Moisture

Kalpeshdilprao (2012) created flavored milk by mixing safflower and buffalo milk. The flavoring milk had a moisture content of 81.13 to 83.18 percent. The moisture level of the flavoured milk rose as the percentage of safflower milk in the mix grew, and the same was true as the percentage of strawberrry pulp increased. Kalchare made the sago lassi in 2002. He stated that the sago lassi's moisture content rose from 76.82 to 84.70 percent. The blend's moisture content rose as the amount of safflower milk increased. Thus, the flavoring milk's moisture content rose as the amount of strawberry pulp grew.

The strawberry-flavored cotton seed milk had a total bacterial count of 0.52×10^2, 2.1×10^2, and 1.7×10^2 for yeast and mold, respectively. It is recommended that the total plate count for milk not exceed 50×10^3/ml. The Indian Food Safety and Standards Authority, 2015. The prepared product's microbiological content fell within the acceptable range.

CONCLUSION

It has been determined that strawberry-flavored cotton seed milk is high in protein and energy and can be administered to people who are lactose intolerant or malnourished. Cotton seed milk can be used as a substitute for strawberry milkshakes made with cow's milk because it has more protein and energy. Since lactose intolerance is on the rise and children's milk consumption is declining, flavor-infused milk was developed to appeal to them. It was discovered that adding fruit pulp to flavor-infused cotton seed milk enhanced its quality. The study found that adding 30% strawberry milk to cotton seed milk produced better-tasting, higher-quality milk. Therefore, cotton seed milk can be used in future research to formulate other by products.

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Table 1. Strawberry-flavored cotton seed milk ratios

T1	10% strawberry pulp + 90% cotton seed milk
T2	20% strawberry pulp + 80% cotton seed milk
T3	30% strawberry pulp + 70% cottonseed milk

Table 2. Sensory Evaluation of Strawberry Flavoured Cotton Seed Milk

Nutrient	Strawberry Flavoured Cotton Seed Milk
ENERGY(Kcals)	172.3
PROTEIN(gms)	29.63
FAT(gms)	0.874
CARBOHYDRATE(gms)	17.81
DIETARYFIBER(gms)	6.148
CALCIUM(mg/gm)	0.86
IRON(mg/gm)	7.48

Table 3. Nutritive value of strawberry flavoured cotton seed milk

	T1	T2	T3
Colour	7.54±0.73	7.71±0.55	8.52±0.63
Flavour	7.36±0.74	7.59±0.62	8.71±0.55
Texture	7.33±0.52	7.64±0.58	8.54±0.46
Appearance	7.37±0.65	7.65±0.42	8.58±0.48
Taste	7.31±0.88	7.68±0.77	8.78±0.71
Overall acceptability	7.33±0.75	7.68±0.54	8.67±0.52

Table 4. Physico Chemical Properties of Strawberry Flavoured Cotton Seed Milk

Treatment	Viscosity	Acidity	Ph	Total Soluble Solids	Moisture
T3	142.3cps	1.3%	6.65	78.4% w/w	88.24%

Table 5. Microbial Analysis of Strawberry Flavoured Cotton Seed Milk

Treatment	Yeast count	Mould count	Total bacterial count
T3	1.7×10^2	2.1×10^2	0.52×10^2