

DEVELOPMENT OF SPIRULINA MILKSHAKE FOR THE NUTRITIONAL IMPROVEMENT OF HEALTH

Abstract

To study the preparation method and sensory evaluation of spirulina incorporated milkshake, we selected a three treatments namely T₁, T₂ and T₃ were prepared. Spirulina milkshake was prepared by using Banana, cardamom, toned milk, vanilla powder and spirulina powder. The milkshake was prepared and evaluated for its sensory characteristics. Spirulina powder was incorporated at various levels of 0.5, 1.0 and 1.5 percent. 0.5 percent was a highly acceptable level, 0.5 percentage was incorporated for further experiments. Among the treatments, Spirulina - cardamom incorporated milkshake have attracted the judges and other treatments like spirulina - banana incorporated milkshake and spirulina incorporated milkshake have been evaluated.

Keywords: Spirulina, Milkshake, Banana, cardamom, Toned milk.

Introduction

India is the largest producer of milk in the world and its production has rallied from 55 Million tones in 1991-92 to 230 million tones in 2022-23 [1]. Now a variety of milk-based beverages are being introduced into the market and their reach among the consumers have increased in the recent years. Milkshake is one of the beverages that has attracted most consumers due to its unique taste, made by blending milk with other ingredients. Milkshake can be customized according to the preference of an individual by blending with other ingredients like nuts, fruits, chocolate syrup, ice creams, biscuits along with milk. All these ingredients make a thick, sweet, cold mixture called milkshake which is on trend among the consumers [5].

Spirulina was first discovered by Spanish Scientist Hernando Cortez and Conquistadors in 1519. Cortez observed that Spirulina was eaten at the tables of the Aztecs during his visit in Lake Texcoco in the Valley of Mexico. Pierre Dangeard discovered the health benefits of Spirulina who observed that flamingos were surviving by consuming blue-green algae. Botanist Jean Leonard supported the findings of Dangeard and people soon started to commercialize spirulina to reap its benefits [8]. It is an edible biomass of cyanobacteria, blue green algae for both humans and animals. The awareness and consumption rate of spirulina is widening due to its astonishing nutritional profile and medicinal properties. Spirulina contains 55-70% protein, 15-25% polysaccharides, 5-6% total lipids, 6-13% nucleic acids and 2.2- 4.8% minerals per 100 g. It also contains various minerals like calcium, potassium, magnesium, manganese, iron, nickel, chromium, copper, sodium, zinc, selenium, and other essential fatty acids. Spirulina has

antimicrobial, anti-inflammatory and anti-oxidative properties. This makes spirulina a functional food to combat malnutrition and health related problems [2].

Spirulina is rich in antioxidants, especially lycopene. Strong antioxidant lycopene fights free radicals. Eating foods rich in lycopene reduces the risk of heart disease, stroke, and some types of cancer, diabetes, and premature aging [10]. Spirulina is fast emerging as a complete answer to the varied demands due to its imposing nutrient composition which can be used for therapeutic uses. The United Nations in a world food conference declared that Spirulina as the best food for future, and it is gaining popularity nowadays [7]. Spirulina is considered as a 'superfood' [11]. Spirulina is the richest source of proteins. Spirulina is abundant in plant protein, which makes up 60% to 70% of its weight [9].

Banana is one of the earliest crops cultivated by man and remains a staple food crop for millions of people in the tropical world. Bananas are monocotyledonous plants, belonging to the genus *Musa* of the family *Musaceae* in the order *Scitamineae* [13]. Bananas are edible fruits which are consumed daily for their benefits as they contain major sources of potassium and calcium. It helps to enhance the heart health, manages blood pressure and enhances the personal mood of an individual [6]. Cardamom is an aromatic spice that is used in day-to-day activities for enhancing the flavor and taste of the food. It contains high levels of antioxidants and vitamin C, niacin, magnesium and potassium [4]. The main use of sugar in food products is for sweet taste but they have other important roles such as preservative, texture modifier. Vanilla is a flavoring ingredient used in baking, tea, ice cream, flavored juice and other food products for making product more delicious and tastier. Dietary fibre is a key ingredient widely used nowadays while developing nutritionally designed foods due to its significance in health promotion and technological impact [12]. Despite having high calorie content primarily from carbohydrates and dietary fiber, bananas are poor in protein and fat. Vitamins C, A, B1, B2, and B6, as well as minerals, such as magnesium, phosphorus, calcium, and iron could be also found in bananas. Banana consumption could be associated with a reduction in the risk of gastrointestinal diseases, regulation of carbohydrate metabolism, and weight control [14, 15].

Material and Methods –

The required raw materials like milk, sugar, cardamom, Banana were procured from a retail shop and other products like vanilla powder, xanthan, spirulina were procured through online.

T1 - Spirulina incorporated milkshake

T2 - Spirulina – banana incorporated milkshake

T3 - Spirulina – cardamom incorporated milkshake

Initially spirulina incorporated milkshake was prepared by incorporating spirulina at 0.5 %, 1 %, 1.5% and 2 %. On screening, 0.5% was most accepted by the judges hence for further studies 0.5% was used to prepare other treatments.

Procedure

Toned milk was heated and cooled suddenly for pasteurization of milk, banana were cut into small pieces and small quantity of cardamom were grinded into fine powder to make incorporation easier. Other ingredients like sugar, vanilla powder, Xanthan and spirulina which have constant measure were taken separately. And according to the type of milkshake; ingredients were added separately and homogenized by using the mixer.

Chart 1 :Experimental procedure

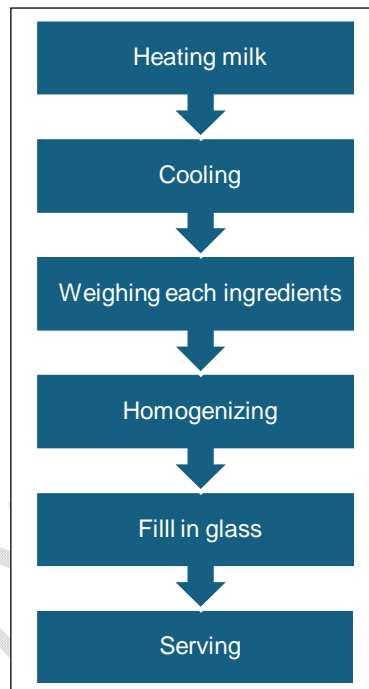


Fig 1 : Color, texture, mouthfeel, flavor, taste consistency



Then, the treatments were given to judges for evaluating color, texture, mouthfeel, flavor, taste, consistency and overall acceptance of the products by using 9 points hedonic scale.

Result and Discussion

Table :1.Sensory Evaluation of Spirulina incorporated milkshake

Treatments	Color&Appearance	Flavour	Taste	Texture	Overall Acceptability
T ₁	7.2±.83	6.6±.54	6.2±.44	6.4±.54	6.6±.47
T ₂	7.4±.54	7.2±.83	7.2±.83	7.4±.54	7.3±.64
T ₃	7.4±.54	7.4±.54	8.4±.54	8.2±.44	7.8±.54
T ₁	Spirulina milkshake				
T ₂	Spirulina – Banana incorporated milkshake				
T ₃	Spirulina – Cardamom incorporated milkshake				

Colour, and appearance one of the important visual attributes, has been used to judge the overall quality of foods for a long time. If the colour is unattractive, a potential consumer may not be impressed by the other major attributes. The first impression is usually visual and the major part of our willingness to accept a food depends on the appearance. The scores for the colour and appearance T₃ has more acceptance than T₂&T₁. Texture constitutes a physical property of food stuff apprehended by the eyes, the skin and muscle senses located in the mouth. Flavour is the mingled but unitary experience of sensation produced by a material taken in the mouth perceived principally by the senses of basic smell and by the other cutaneous sensations in the mouth. Cardamom incorporated milkshake was highly acceptable compare to

other treatments. Taste is the major attribute, which determines the acceptability of food material. It is not only a sensory response to soluble materials but also tactile sensation of the mouth.

Spirulina incorporated milkshakes colour & appearance, flavour, texture, taste and overall acceptability T_3 has more acceptance than T_2 & T_1 . Cardamom has imparted the flavor and taste to spirulina incorporated milkshake and has completely masked the original odor of spirulina. Whereas, the other two treatments had spirulina odor dominance. Spirulina platensis revealed to be a good stable ingredient when the desired colour is green [16]. The banana and pineapple spirulina smoothie were similar to this study [17]. The spirulina cookies proved to be acceptable smell, color, appearance, texture and taste [18].

Conclusion

Spirulina milkshake standardized the potential of this microalgae in creating a nutritious and sustainable beverage. With its high protein content, rich vitamin and mineral profile, and antioxidant properties, Spirulina has proven to be an excellent addition to a milkshake. Spirulina can be effectively blended with banana and cardamom to create a delicious and refreshing drink that appeals to a wide range of consumers. Moreover, Spirulina's ability to thrive in diverse environments and its low water and land requirements make it an attractive solution for sustainable food production. As the world continues to face challenges related to food security, environmental degradation, and human health, innovative products like Spirulina milkshakes can play a vital role in addressing these issues.

Acknowledgements

We thank Kumaraguru Institute of Agriculture, Erode, Tamil Nadu for provision of required place and financial support for successful conduction of this research.

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