



# FORMULATION AND STANDARDIZATION OF SYNBIOTIC ICE CREAM WITH INCORPORATION OF OKRA GEL (*Abelmoschus esculentus*) AS A PREBIOTIC AND YOGURT (*Lactobacillus*, *Streptococcus thermophilus*) AS A PROBIOTIC FOR THE MANAGEMENT OF ANXIETY.

WAJIHA S, PAVITHRA ALGARSAMY, DR.P.S.PRATHIBHA  
PG SCHOLAR, LECTURER, PROGRAMME HEAD  
DEPARTMENT OF FOOD SCIENCE NUTRITION AND DIETETICS  
DR.M.G.R. EDUCATIONAL AND RESEARCH INSTITUTE, CHENNAI, INDIA

## ABSTRACT

Anxiety is a common condition characterized by the symptom of worry and apprehension. The study aimed to focus on the development of a Synbiotic ice cream which is incorporated with okra and yogurt as prebiotic and probiotic respectively, A functional food product that not only promised a nutritional density but also showed palatability and consumer appeal. The formulation of the ice cream involves several factors like extraction of gel, blending, freezing, the selection of the suitable ingredients and the processing factors were carefully selected to improve the survival of the beneficial bacteria and to enhance the prebiotic effects of the okra pectin. The sensory evaluation tests were conducted to assess the acceptability of the product. The feedbacks on the consumer preferences on the different sensory characteristics were collected. The resultant synbiotic ice cream serves as a palatable option for functional foods.

**KEYWORDS:** Synbiotic, Ice cream, Yogurt, Okra, Functional food

## 1. INTRODUCTION

Synbiotic foods have become the new trend in the development of the food products. The term "Synbiotic" symbolizes the presence of both the probiotic microorganisms and prebiotics oligosaccharides and pectin. The goal of the Synbiotic food is to improve the survival of health-promoting bacteria in order to maintain the gut micro flora and to promote the metabolism of the intestinal tract. Indeed it is thought that Synbiotic is better for the human health than probiotic and prebiotic individually. (Bandyopadhyay and Mandal 2014, Silvia *et al.*, 2020). Ice cream is a frozen dairy product with good flavor and consistency. However, ice cream has comparatively high fat and cholesterol content, which is considered unhealthy choice of food for the individual (Salem *et al.*, 2005, Abid *et al.*, 2021). These factors have influenced consumer preferences for healthy functional foods such as, Synbiotic ice cream that contains both probiotics and prebiotics (Pinto *et al.*, 2012, Abid *et al.*, 2021). In this study Synbiotic ice cream is formulated for the management of anxiety with both probiotic and the prebiotic ingredients.

Anxiety is an emotional condition characterized by emotions of worry, apprehension, and impending calamity; nevertheless, it is not as disabling as anxiety disorders (Olthuis *et al.*, 2016, Zhao ziran *et al.*, 2023). It is a common psychological symptom which is often associated with stress and depression, which are severe psychological conditions. Individuals suffer from the anxiety symptoms need to utilize the functional foods which will suppress the symptoms.

Okra (*Abelmoschus esculentus*) is an important vegetable crop that grows widely in warm temperature, tropical, and subtropical countries (Wu *et al.*, 2020, D'Urso *et al.*, 2020, Jingru *et al.*, 2022). It is a naturally occurring plant-derived medicine (Petropoulos *et al.*, 2018, Jingru *et al.*, 2022) that has adverse therapeutic effects and health benefit and it is consumed as a fresh, nutrient-dense vegetable. Okra also contains a wealth of useful elements, including lipids, minerals, carbohydrates, dietary fibre, pectin, vitamins, and amino acids (Yasin *et al.*, 2020). Okra gel was extracted from the okra pods and is a type of pectin which will play a crucial role as a prebiotic in the food product. The study derived that okra has a pectic polysaccharides namely okra pectin (Yeung *et al.*,

2021), its effects on the growth of beneficial bacteria, where okra is characterized as a prebiotic and enhances the growth of *Lactobacillus*. Okra builds cognitive strength and is helpful in suppressing the stress effects which will play a vital role in the individual's health.

Yogurt is a dairy product which is made by the process of fermentation and possesses the bacterial species *Streptococcus thermophilus* and *Lactobacillus delbrueckii subsp. bulgaricus*. It enhances the healthy gut microbiota in the humans and it is prepared by milk which is obtained from different varieties of livestock like goat milk, camel milk, sheep milk and cow milk (Mohammed *et al.*, 2021). The microorganisms in the yogurt enhances the intestinal metabolism, like improves digestion, absorbs the nutrient content efficiently, it also improves the overall health by promoting immune system, improve cognitive health, prevents the occurrence of degenerative disease like IBD. Microorganisms found in the intestines that are involved in several physiological functions and metabolism (Wagner-Skacel *et al.*, 2020, Jingru *et al.*, 2022). The brain and gut are intricately connected, and this bidirectional communication between the central nervous system and the intestinal nervous system is known as the "brain-gut axis," in which the gut microbiota plays a crucial role. (H. Person and L. Keefer 2021, Jingru *et al.*, 2022). Growing recognition of the function of intestinal flora in the brain-gut axis has followed developments in clinical care. (M. Sun *et al.*, 2020, Y. He *et al.*, 2019, Jingru *et al.*, 2022). Over 100 trillion microorganisms are known to exist in the human gut, with *Bacteroidetes*, a common bacterial form that occurs in the intestine (Y. Sun *et al.*, 2021, Jingru *et al.*, 2022). notably, there is an evidence that Alzheimer's disease may be influenced by the "brain-gut axis" (M. Sun *et al.*, 2020).

Stevia (*Stevia rebaudiana* Bertoni) is a perennial shrub and is a member of the Compositae family. Although it is originated in South America, it is currently grown in Asia, Europe, and North America (Lemus-Mondaca, Vega-Galvez, Zura-Bravo, & Ah-Hen, 2012, Jamil *et al.*, 2020). Although there are currently more than 200 species of stevia in the world, only *Stevia rebaudiana* has a sweet flavour (Shivanna, Naika, Khanum, & Kaul, 2013, Jamil *et al.*, 2020). The presence of steviol glycosides, which have 100–300 times the sweetness of sucrose, gives stevia the sweet taste (Lemus-Mondaca, Vega-Gálvez, Zura-Bravo, & Ah-Hen, 2012, Jamil *et al.*, 2020).

In this work, okra, yogurt, stevia and cocoa powder are utilized in the development of the Synbiotic ice cream which will promote and improve the gut brain axis and contribute by suppressing the symptoms of anxiety.

## 2. MATERIALS AND METHODS

### 2.1 MATERIALS

#### 2.1.1 Raw Materials

Raw materials such as okra, yogurt, cream, sugar, milk, cocoa powder, stevia were purchased from the local market in Chennai.

### 2.2 METHODOLOGY

#### 2.2.1 Standardization of ice cream

The okra pods were chopped and transferred in a container with water. The mixture was boiled and strained; the okra gel was allowed to cool at room temperature. The milk cream (150ml) was taken in a container and blended until a thick creamy texture was achieved. Condensed Milk was prepared by boiling the milk in a separate container, adding sugar and stirring continuously in a medium flame till the mixture became thick. Mixture was kept in a room temperature to let it cool. The condensed milk (75ml) was added to the cream and blended thoroughly, the yogurt (90ml) and okra gel (90ml) were added gradually and mixed with stevia (2g) and cocoa powder (30g). The ice cream mixture was transferred in mould and kept in a freezing temperature upto -19°C for 6 to 7 hours. Then the ice cream mixture was transferred to the mixer grinder and ground till it became creamy and finally the ice cream mixture was again stored in freezer for 3 to 4 hours.

Table 1. formulation of the ice cream

Ingredients	Sample g/ml
Okra gel	90ml
Yogurt	90ml
Cream	150ml
Milk and sugar (Condensed Milk)	75ml
Cocoa powder	30g
Stevia	2g

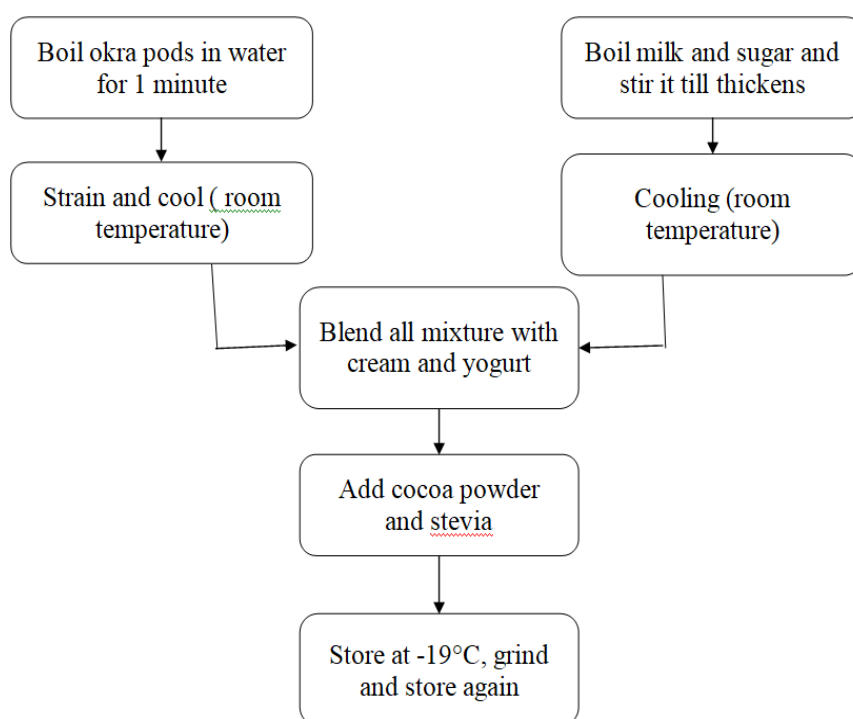


Figure 1. process flow sheet for the preparation of ice cream

### 2.2.2. Sensory Analysis

Sensory analysis of the prepared Synbiotic ice cream was done using 9 point hedonic scale rating, (Kittisak *et al.*, 2022) and the participants were given the sample of ice cream and a sensory card.

### 2.2.3. Statistical Analysis

Statistical analysis was done in a descriptive method using mean and standard deviation in excel sheet (Kittisak *et al.*, 2022) .

### 3. RESULTS AND DISCUSSION

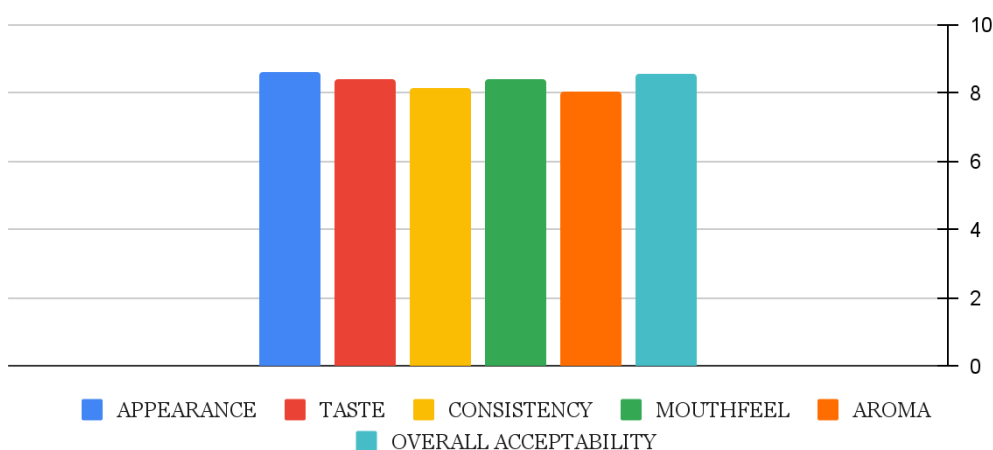
#### 3.1 Organoleptic Characteristics of the Synbiotic ice cream

The data on the organoleptic characteristics of the product is derived via appearance, taste, consistency, mouth feel, aroma and overall acceptability of the Synbiotic ice cream. Table 2 illustrates the mean and the standard deviation values of the sensory characteristics of the ice cream. The statistical ratings of the appearance is the highest up to 8.6, due to the added flavor(chocolate powder) which gave a brown appearance like a commercial ice cream, Due to the stevia's additional flavour and enhanced taste, the ice cream's taste and flavour rating increased to 8.4. The consistency rating was somewhat lower up to 8.14 because of the formation of ice crystals in the product, the texture of the ice cream was flaky due to the ice cream had a less creamy consistency prior to freezing. The ice cream had a higher rating for the mouth feel up to 8.38, because of the addition of okra gel and yogurt, where the okra and the yogurt gave a mouth feel of a creamy consistency despite its flaky texture. The aroma of the product had a lowest rating up to 8.04 because the ice cream lacked an aroma, where the okra and the yogurt did not possess any specific aroma. The overall acceptability of the product rating is 8.54 as it shows that the product is accepted by the major participants during the sensory evaluation. The appearance, flavour, consistency, mouth feel, aroma and overall acceptability of the Synbiotic ice cream results in the desired organoleptic ratings.

**Table 2. organoleptic characteristics of the synbiotic ice cream**

	APPEARANCE	TASTE	CONSISTENCY	MOUTHFEEL	AROMA	OVERALL ACCEPTABILITY
MEAN	8.6	8.42	8.14	8.4	8.04	8.54
SYNBIOTIC ICE CREAM SAMPLE	8.6±0.57	8.42±0.69	8.1±1.0	8.4±0.85	8.04±1.13	8.54±0.61

#### Synbiotic Ice Cream



**Figure 2. score card of synbiotic ice cream**

### 4. CONCLUSION

The formulation and standardization of the Synbiotic ice cream represents an important contribution in the development of the functional food which possess several health benefits like enhancing intestinal metabolism and cognitive health. The evaluation of the 9 point hedonic scale rating has derived that the ice cream is a palatable functional food which represent a promising approach for the management of anxiety. It has been concluded that the combination of okra and yogurt in a palatable food matrix like ice cream can offer a convenient and desirable means of delivering beneficial microorganisms to the gut. This study had paved a way for more valuable research improvement in the domain of Synbiotic functional foods with diverse therapeutic benefits.

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