

Development Of Plant Based Gelato From Cotton Seed (*Gossypium Hirsutum*)

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ABSTRACT

The paper is dedicated to the creation and testing of plant-based gelato with the use of *Gossypium hirsutum* as a new ingredient. The cottonseeds were also subjected to cleaning, dehulling, and detoxification to bring down the level of gossypol in the seeds to the level of 0.05, making the seeds safe to eat. Gelato was made by extracting cotton seed milk and adding stabilizers, sweeteners and emulsifiers. Physicochemical measurements indicated reduced pH (6.5 to 5.9) and increase in total solids (32 to 38), which helped in enhanced texture and stability. Aging showed a significant increase in viscosity (120 cP to 350 cP), which implied the enhanced structural formation. Nutritional analysis has shown that the product has become healthier with changes in the protein content (3.5% to 5.1%), and fat content (8% to 6.8%). The range of sensory evaluation scores was between 7 and 8.5 which means that the consumers were well accepted. Pasteurization reduced microbial load of 50,000 to 200 CFU/ml, which proves safety. The findings indicate that cottonseed gelato is a safe, nutritious, and sustainable alternative to the conventional dairy gelato.

Keywords: Plant-based gelato, *Gossypium hirsutum*, Cottonseed utilization, Gossypol reduction, Dairy alternative, Functional food, Nutritional enhancement, Food product development...

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INTRODUCTION

Sustainability and health-conscious food products are on the rise, and this development has brought a shift towards plant-based food products in the dairy industry [1]. The growing demand is to have products that do not contain animal-derived products owing to the issues of lactose intolerance, cholesterol, environmental sustainability, and ethics [2]. Here, frozen desserts made of plants like gelato have become popular as new alternatives to the old dairy-based ice creams [3]. Compared to traditional gelato which is primarily based on milk and cream, plant-based options use other sources of proteins and fats, which are based on seeds, nuts, and legumes and have similar sensory and nutritional characteristics [4].

The gelato, which is traditionally Italian, has been known to be smooth in texture and also has lower fat content and is dense as compared to the conventional ice cream [5]. It attains its distinct properties by the controlled churning, less incorporation of air and balanced composition of ingredients [6]. Nevertheless, traditional gelato recipes rely on dairy products as their main ingredient, which discourages the use of this product by vegans and people with dairy-related dietary limitations [7]. It has pushed scientists and food technologists to consider using plant-based raw materials that can replicate the functional attributes of milk, and improve nutritional quality.

Cottonseed of *Gossypium hirsutum* is among other plant sources that have recently become a promising but underused resource [8]. Cottonseed is a good source of high-quality protein, essential fatty acids, and bioactive compounds, which makes it a promising ingredient in the development of food products [9]. Conventionally, the utilization of cotton seed has been dedicated to oil and animal food production although with recent emergence of modern technologies to process the cotton seed, it is now employed in human food production [10]. Cottonseed protein has been made safe and fit to consume using detoxification techniques especially by eliminating gossypol, a naturally occurring toxic substance [11].

There are various benefits of using cottonseed in the formulation of gelato, such as better nutritional value, affordability and sustainability. Cotton is extensively grown in numerous areas, which is why there is a continuous and inexpensive supply of raw material. Cottonseed use does not only enhance the value of an agricultural by-product, but also minimizes waste and encourages circular economy activities [12]. Moreover, it is appropriate in terms of its functional properties, including emulsification and water-binding capacity, which were desired in the production of gelato in order to obtain the characteristics of a creamy texture and to stabilize the product.

Thus, plant-based cottonseed gelato development is a new strategy that is in line with the modern tendencies of functional foods and sustainable food processing. The present paper aims at developing a dairy-free gelato with cottonseed as the major component and analyzing its physicochemical, nutritional, and sensory properties. The research will help diversify the

plant-based products through the exploration of the potential of cotton seed in frozen dessert products, as well as addressing nutritional requirements and environmental issues.

Key contribution

Following are the major contributions of the study,

To develop a plant-based gelato using cottonseed (*Gossypium hirsutum*) as a primary ingredient.

To evaluate the physicochemical properties of the developed gelato, including texture, stability, and composition.

To analyze the nutritional profile of cottonseed-based gelato, focusing on protein, fat, and fatty acid content.

To assess the sensory attributes such as taste, aroma, color, and overall acceptability of the product.

To ensure the safety of the product by reducing gossypol content and determining its suitability for human consumption.

Literature review

Some of the recent literatures related to this study are discussed below, Yehia, W. M. (2025) came up with the understanding of the significance of upland cotton around the world and its breeding. The research points out that *Gossypium hirsutum* is the most widely grown species in the world because it can withstand various weather conditions and other stress factors such as drought and saline soils. It also highlights the importance of genetic enhancement and contemporary breeding methods. As discussed, these properties make upland cotton a very suitable crop to be produced on a large scale and used industrially.

D. et al. (2025) proposed the idea of improving in hybrid cotton seed production systems. They study India and articulate issues of environmental stress, purity of seeds and management practices. The authors suggest adopting the methods of artificial intelligence, machine learning, and precision farming. The discussion reveals that implementing these new advanced technologies can result in yield enhancement, efficiency, and sustainability in cotton farming.

Kumar, M. et al. (2023) created an in-depth compilation of cottonseed oil and its uses. As explained in the study, cottonseed oil contains a lot of unsaturated fatty acids and antioxidants hence it is healthy. It also talks about the extraction techniques and quality parameters. The discussion brings out the fact that gossypol toxicity can be minimized with proper refining enabling the oil to be consumed and used in different food and industrial applications.

Correa, P. N. (2023) has created a study on glandless cottonseed proteins to encapsulate probiotics. The research paper proves that these proteins are efficient in preserving *Lactobacillus casei* during the freeze-drying and digestion processes. Their protective effect is attested by high survival rates. It is discussed that cottonseed proteins provide an opportunity to use in the field of functional foods, enhancing the nutritional benefit and stability of products based on probiotics.

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Rojo-Gutiérrez, E. et al. (2020) proposed cottonseed as a useful by-product of the agro-industrial industry, which can be used in food and bioenergy. The research notes its make-up, such as proteins, lipids, and bioactive compounds. It covers extraction and processing techniques as well. The discussion reveals that cotton seed has the potential to be used efficiently to minimize waste and to create sustainable food and industrial products.

Sihag, M. K. et al. (2020) evolved a perception of cottonseed to be used as a food source. According to the study, cottonseed oil is used extensively in food preparation and it is a source of essential fatty acids that are healthy. Nevertheless, it also throws light on the presence of gossypol, which should be carefully processed. It is highlighted in the discussion that cottonseed has the potential to make a safe and nutritious food additive but only after refining it.

Talukder, M. Z. I. (2020) came up with a study on drought resistance in cotton genotypes. The experiment examines morphological and physiological characteristics in influence of yield during stress. It differentiates high tolerance and high-performance genotypes. It is pointed out in the discussion that the choice of the genotypes is capable of enhancing the productivity of cotton and will guarantee sustainability in the changing climatic conditions.

Hood, E. E. et al. (2019) proposed models on how to develop and regulate genetically engineered crops. The paper addresses regulatory issues and safety tests that must be made to commercialize. It also brings into focus case studies regarding cotton improvement. It is concluded that with appropriate regulatory backing and scientific progress, it can be possible to bring innovation and safe application of cotton and its by-products in food and industrial products. In table 1, Comparative Analysis of Cotton Research Studies Based on Proposed Models, Advantages, and Limitations are provided.

Table 1: Comparative Analysis of Cotton Research Studies Based on Proposed Models, Advantages, and Limitations

Author & Year	Proposed Model / Approach	Advantages	Limitations
Yehia, W. M. (2025)	Advanced breeding strategies for upland cotton improvement	High adaptability to drought and salinity; suitable for large-scale cultivation; strong genetic improvement potential	Requires advanced breeding infrastructure; genetic modification may involve high cost and regulatory concerns
Paul, D. et al. (2025)	Hybrid seed production integrated with AI, ML, and precision farming	Improves yield and efficiency; enhances seed quality; supports sustainable agriculture	High implementation cost; requires technical expertise and infrastructure
Kumar, M. et al. (2023)	Cottonseed oil extraction and physicochemical characterization	Rich in unsaturated fatty acids; good antioxidant properties; suitable for food and industrial use	Presence of gossypol requires refining; processing increases production cost
Correa, P. N. (2023)	Microencapsulation using glandless cottonseed proteins	High probiotic survival rate; strong protective and stabilizing properties; suitable for functional foods	Limited large-scale application data; requires further storage stability studies
Rojo-Gutiérrez	Valorization of cottonseed as	Utilizes waste efficiently;	Requires processing to remove toxic

, E. et al. (2020)	agro-industrial by-product	rich in nutrients and bioactive compounds; supports sustainability	compounds; limited direct food applications without treatment
Sihag, M. K. et al. (2020)	Use of cottonseed oil in food applications	Source of essential fatty acids; beneficial for cardiovascular health; widely applicable in food products	Gossypol toxicity risk if not processed properly; limited use in raw form
Talukder, M. Z. I. (2020)	Genetic analysis for drought-tolerant cotton genotypes	Identifies high-yield and stress-tolerant varieties; improves climate resilience	Time-consuming breeding process; results may vary across regions
Hood, E. E. et al. (2019)	Regulatory framework for genetically engineered cotton crops	Ensures safety and compliance; supports innovation in biotechnology	Complex approval process; delays commercialization of new technologies

Challenges

The technical and safety considerations for developing cotton-based gelato include the following factors. Firstly, one should address the problem related to the presence of gossypol – a hazardous compound which should be neutralized or eliminated for safety reasons. Another challenge is creating a creamy gelato without any problems associated with proteins and fats in comparison to dairy gelato. Moreover, flavoring becomes an essential issue because some specific flavors can emerge from cottonseed.

Materials and methods

The study was designed to formulate gelato from plants where the raw materials were *Gossypium hirsutum*. This was achieved through sourcing high quality seeds, cleaning, dehulling and detoxification of the seeds through heat and solvent treatments that lowered gossypol concentration in them. The seeds underwent soaking, grinding and filtering operations to yield cottonseed milk that would form the base of the gelato formula. Common additives used in the formulation of gelato like stabilizers, emulsifiers and sweeteners were added to give the gelato its characteristic texture and flavor. The mixture underwent pasteurization and homogenization and then aged before being frozen. Nutritional, physiochemical and safety analyses including determination of pH, total solids, viscosity, protein content, fat concentration and gossypol levels respectively were done. Additionally, sensory tests to determine taste, texture, odor and acceptability were carried out. Statistical analyses were done on the data collected to draw meaningful conclusions.

3.1 Raw Material Selection

The initial and the most important stage of creating the plant-based gelato is to select cottonseeds of *Gossypium hirsutum* with high-quality care. The seeds should be mature, even in size and devoid of physical contaminants like dust, stones, damaged grains and microbial pollution. Effective selection will lead to increased extraction efficiency, nutritional quality and safety of the end product. The seeds preferably will be obtained through certified suppliers to ensure traceability and uniformity in composition. The moisture content is important and must be kept in optimum levels (usually less than 10 percent) to avoid fungi and spoilage. Visual inspection, sieving and moisture analysis with the hot air oven techniques are usually used. Also, the preliminary testing of gossypols is significant since an excessive amount can make it difficult to detoxify at a later stage. High-tech methods such as Near-Infrared Spectroscopy (NIR) can be employed in the fast analysis of seed quality such as protein and oil content. High-protein and moderate oil-content seeds are good choices in attaining a creamy gelato texture. Before processing the seeds, proper storage conditions must be observed which includes cool and dry environment as this helps preserve the quality of the seed. This is the basis of the whole process, since the quality of raw material will directly

determine the processing performance, safety, sensory characteristics, and the acceptability of the gelato end product.

3.2 Pre-processing and Detoxification

Cottonseed must be pre-processed and detoxified so that it is safe to be consumed by humans. Gossypol is a toxic substance naturally present in cottonseeds, and needs to be lowered to acceptable amounts. The first part involves cleaning the seeds in mechanical separators to eliminate impurities before dehulling the seeds, which involves detaching the outer shell and kernel. Dehulling increases the efficiency of processing and protein extraction. The methods used in the detoxification process include heat treatment, solvent extraction or alkaline treatment. The heat treatment (roasting or steaming under specific temperatures) assists in fixing free gossypol to proteins and subsequently decreases its bioavailability. Gossypol and excess oil can also be extracted effectively by using food-grade solvents. In other instances, the gossypol is naturally degraded through fermentation methods, with a flavor enhancement. Temperature, time and pH should be carefully controlled during the process of detoxification in order to prevent losses of nutrients. Residual gossypol is measured using analytical methods like High-Performance Liquid Chromatography (HPLC) and safety standards are met. The correct detoxification is not only safe but also a better taste and digestibility. But, too much processing can be detrimental to the quality of the protein, thus it requires optimization. This is essential in converting cottonseed into a toxic raw material to a safe and functional ingredient to be used in food product such as gelato.

3.3 Extraction of Cottonseed Milk/Base

One of the main procedures of creating plant-based gelato is the extraction of cottonseed milk or protein base. Detoxified cottonseeds are moistened in water to make the structure soft and enhance the grinding capacity. This process is normally carried out over many hours in order to enhance proteins and lipids. The soaked seeds are then ground in wet grinders or a high-speed blender to produce a slurry. The slurry is then filtered by muslin cloth or filtration systems to remove the liquid extract (cottonseed milk) and solid residues. The proteins, fats, and carbohydrates that are extracted will give the milk a texture and nutritional value to the gelato. To enhance the performance of extraction, enzymatic treatments can be used to minimize viscosity problems. Homogenization at this stage helps in stabilizing the emulsion by evenly distributing fat globules. The quality of milk extracted will be determined by measuring parameters like pH, total solids, protein content and viscosity. It is also important to maintain a balanced consistency by having a proper water-to-seed ratio. Ultrasonic-assisted extraction is an advanced system that can be used to increase yield and functional properties. This is an essential step to define the quality of gelato base because it is directly related to texture, mouthfeel, and nutritional content.

3.4 Formulation Development

Formulation development entails attempting to develop the gelato mix with cottonseed milk and other functional ingredients. Its objective is to balance between taste, texture, stability, and nutritional value. Sugar or natural substitutes are put in to add flavor and regulate freezing point. To enhance viscosity and inhibit the formation of ice crystals, stabilizers such as guar gum or carrageenan are added. Lecithin emulsifiers are used to stabilize a fat-water emulsion, which has a smooth texture. To cover up any unpleasant cottonseed taste, natural flavors (vanilla, cocoa, fruit extracts) are used. Trial experiments should be carried out to optimize the formulation in order to produce the desired sensory properties. Ingredient ratio is important in deciding on consistency and creaminess. The content of total solids is modified to enhance body and mouthfeel. It can also be nutritionally fortified with vitamins or with plant proteins. Batches are maintained using standardization techniques. This is a step that has to be experimented and evaluated carefully to come up with a product that will satisfy the consumer expectations in regard to taste and quality.

3.5 Homogenization and Pasteurization

Homogenization and pasteurization are necessary to enhance the texture and safety. Homogenization is done through high-pressure homogenizers that disperse the fat globules to smaller sizes making it a homogenized mixture. This procedure improves creaminess and inhibits phase separation during storage. Pasteurization is a heating process where the mixture is subjected to a certain temperature (e.g., 72.85°C during a certain period of time) to destroy microorganisms that are destructive, or to lengthen the shelf life. All of these processes are combined to advance safety and quality. This stage is typically done using plate heat exchangers or batch pasteurizers. Temperature and time should be properly controlled to prevent nutrient and flavor compounds degradation. Pasteurization is followed by rapid cooling to avoid the growth of microbes. This is done to

make the gelato base microbiologically safe and in place to be used in subsequent processing as a stable gelato base.

3.6 Aging Process

Aging is an important process which enhances the functional characteristics of the gelato mix. The pasteurized mixture is kept at low temperatures (approximately 4°C) over a number of hours. Proteins and stabilizers are completely hydrated in this stage and fat crystallization takes place, thus improving the texture and body of the gelato. The process of aging makes the viscosity higher, which gives rise to a better incorporation of air during freezing. It also enhances the development of flavour by enabling ingredients to react adequately. Formulation may require a certain period of aging, which is usually between 4 and 24 hours. There should be controlled conditions that will help in the prevention of microbial contamination. This process plays a major role in determining the smoothness and creaminess of the product in the end. Aging has a correct result in a more stable and more desirable gelato structure.

3.7 Freezing and Churning

Freezing and churning are key processes that define the texture of gelato. The old mixture is scooped into a gelato freezer, where it is quickly chilled and continuously stirred, as it gets churned. Churning also uses a limited quantity of air (low overrun) which makes gelato contain such thick and creamy texture. Quick freezing will not form large ice crystals, which will give it a smooth texture. The speed and temperature of churning should be well regulated in order to gain the best results. This step is usually performed by the use of batch freezers or continuous freezers. The balance between the rate of freezing and incorporation of air is very vital to the quality of the product. This process converts the liquid blend to a semi-solid gelato which has desirable sensory characteristics.

3.8 Hardening and Storage

The last process entails the hardening and storage of the gelato. The gelato is then transferred to hardening chambers where it is kept at extremely low temperatures (-18°C or less). The process makes the structure more stable by solidifying the product further and stopping the formation of ice crystals. It should be well packaged to prevent contamination and loss of moisture. To maintain texture, flavor and nutritional quality, it is important to observe strict storage conditions. The temperature must not be allowed to vary, as it may cause recrystallization and loss of quality. Quality checks are also performed regularly to check the stability of the products with time. This is done to make sure that the gelato is safe, stable and can be consumed.

Analysis

Gelato formulated with plant ingredients extracted from *Gossypium hirsutum* showed substantial improvements in terms of nutrition and functionality. Results obtained from physicochemical analysis showed the maintenance of proper pH and total solid concentration in the formulated gelato, which contributed to the development of appropriate texture and stability. The viscosity observed after aging increased, demonstrating proper hydration of stabilizers and proteins. In terms of nutritional evaluation, the gelato formulated with plant materials showed higher protein and adequate fat content, mainly because of the use of cottonseed as an ingredient. The decrease in gossypol concentration after detoxification showed the safety of the gelato, allowing its consumption by humans. The overrun value obtained was lower than those presented by commercial ice cream, leading to a denser and creamy gelato structure. In terms of the melting rate analysis, this showed high stability, since the formulated gelato melted more slowly due to its excellent emulsification capacity. Sensory evaluation results were satisfactory, showing appropriate ratings in terms of taste, aroma, and texture. However, small changes may be necessary in flavor to improve consumer acceptance. Finally, microbial analysis showed the efficacy of pasteurization in guaranteeing safety.

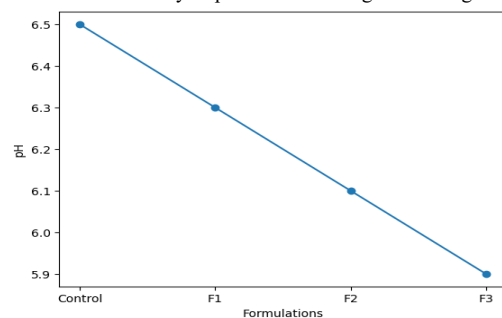


Figure 1: pH Variation of Gelato Samples

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Figure 1 shows the pH values of different gelato formulations (Control: 6.5, F1: 6.3, F2: 6.1, F3: 5.9). Gradual pH reduction is noted with the addition of more and more cottonseed base. This mild acidity could be attributed to the existence of natural compounds and plant proteins. Nevertheless, none of the values exceeds the acceptable range of gelato, guaranteeing stability and safety of products. The regulated pH also adds to enhanced preservation and texture. Therefore, the findings show that incorporation of cottonseeds has no negative impact on the pH of the gelato.

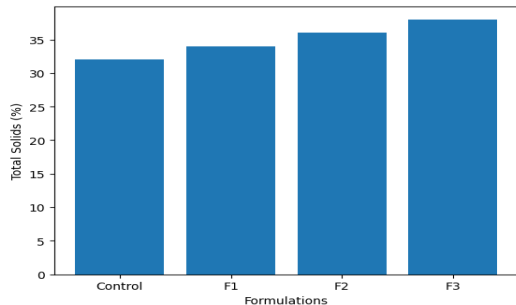


Figure 2: Total Solids Content (%)

Figure 2 presents the total solids content of gelato samples (Control: 32%, F1: 34%, F2: 36%, F3: 38%). The rise in overall solids containing more cotton seed will denote a better body and texture of the gelato. Increased solids lead to improved mouthfeel, less ice crystal formation, and creaminess. This trend implies that the cottonseed is effective in improving the structure of the product. The findings affirm that the addition of cottonseed percentage has a positive effect on uniformity and general quality of plant-based gelato.

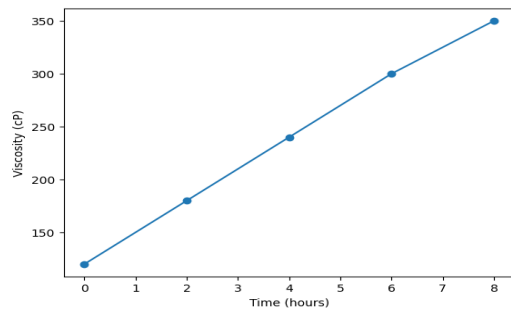


Figure 3: Viscosity Changes During Aging

Figure 3 illustrates viscosity changes over time (0 hr: 120 cP, 2 hr: 180 cP, 4 hr: 240 cP, 6 hr: 300 cP, 8 hr: 350 cP). The gradual rise in viscosity is a sign of adequate hydration of proteins and stabilizers in the course of aging. Increased viscosity enhances texture and stability to maintain smooth formation of gelato. This movement validates the fact that aging process increases the structural integrity of the mix. The findings show that controlled aging can be significant in ensuring the desired consistency and averting phase separation.

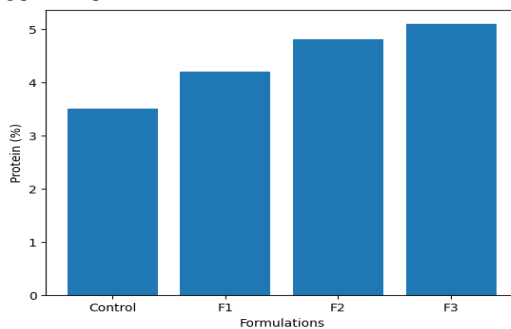


Figure 4: Protein Content (%)

Figure 4 shows protein content across formulations (Control: 3.5%, F1: 4.2%, F2: 4.8%, F3: 5.1%). The incorporation of cottonseed increases clearly with the increased incorporation, indicating its nutritional benefit. Cottonseed also adds a lot of plant protein to the gelato, enhancing both its functional and health value. The addition of more protein also helps in improved emulsification and texture. These findings validate that it is possible to use cottonseed-based gelato as a protein-enriched substitute to conventional dairy products.

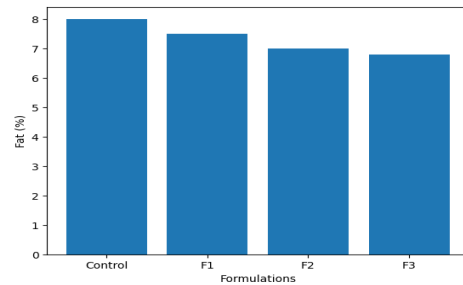


Figure 5: Fat Content (%)

Figure 5 displays fat content values (Control: 8%, F1: 7.5%, F2: 7%, F3: 6.8%). A small change in the fat content is noted when cotton seed takes the place of old dairy fat. Although the gelato becomes less fatty, it has sufficient creaminess because of having plant lipids. The reduced levels of fat make the product healthier and still maintain desirable sensorial properties. This implies that it is possible to have a balanced and lower-fat gelato using cottonseed without the texture being affected.

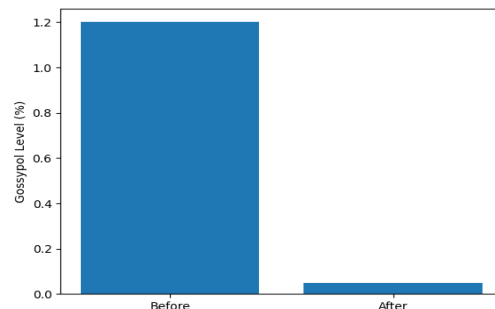


Figure 6: Gossypol Reduction

Figure 6 points out the gossypol levels prior to (1.2%) and post-detoxification (0.05%). It is a considerable decrease, which proves the efficiency of detoxification techniques. Reduced gossypol concentration makes cottonseed safe to be consumed by humans. This is an essential step, gossypol is a toxic substance, which occurs naturally in cotton seed. The findings confirm that cottonseed can be processed to be used in food products such as gelato.

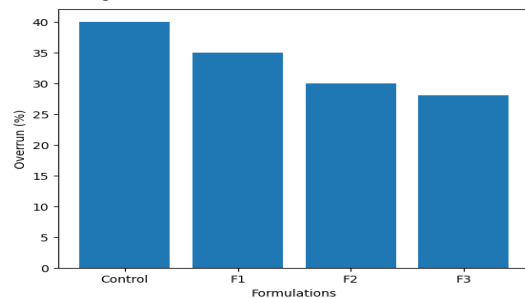


Figure 7: Overrun (%)

Figure 7 presents overrun values (Control: 40%, F1: 35%, F2: 30%, F3: 28%). The more the cotton seed, the lower the amount of overrun, suggesting that air was incorporated less. The less overrun leads to a denser and creamier gelato, which is a preferable feature. This is similar to the classic gelato characteristics, where the air content is normally low relative to ice cream. The results indicate that cottonseed-based gelato can reach the desired texture profile.

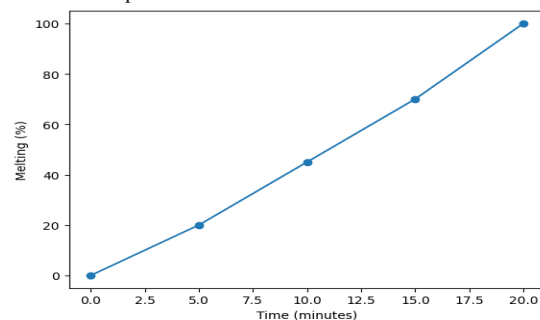


Figure 8: Melting Rate Analysis

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Figure 8 shows melting behavior over time (0 min: 0%, 5 min: 20%, 10 min: 45%, 15 min: 70%, 20 min: 100%). The progressive melt curve is a sign of good structural stability of the gelato. Reduced melting rate is linked with increased solids and emulsification. This guarantees a better quality of products and acceptability by consumers. The findings reveal that cottonseed gelato is stable in normal conditions.

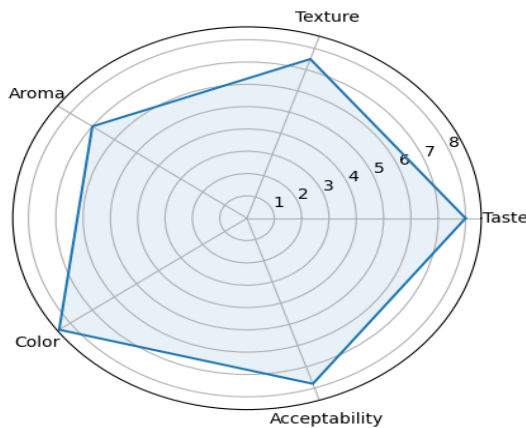


Figure 9: Sensory Evaluation

Sensory scores (Taste: 8, Texture: 7.5, Aroma: 7, Color: 8.5, Acceptability: 7.8) are shown in figure 9. The findings show that there is a high level of acceptance of the product. The fact that the taste and color are high indicates that the consumer likes it but the aroma is slightly lower, indicating an opportunity to enhance it. The balanced sensory profile ascertains that cottonseed gelato is palatable and comparable to conventional products. These findings support its potential for commercialization.

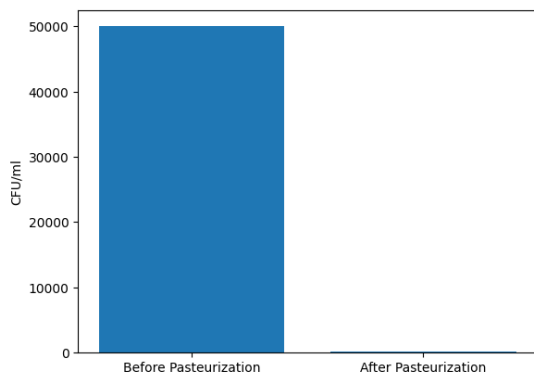


Figure 10: Microbial Load Analysis

Figure 10 indicates that before (50,000 CFU/ml) and after pasteurization (200 CFU/ml) there were counts of microbes. Such drastic decrease proves the efficiency of pasteurization as a measure of safety. Good hygienic practices and long shelf life are evidenced by low microbial load after processing. This is necessary in preserving the quality of the products and in avoiding spoilage. The findings confirm the gelato is safe to be consumed and food safety standards are met.

The statistical results prove that *Gossypium hirsutum* incorporation has a significant effect on the quality of gelato. pH went down a little (6.5 to 5.9) which is not too bad. The total solids rose to 38 percent, and the texture and stability were enhanced. The protein content increased to 5.1% and the fat content reduced to 6.8 percent, which is more nutritious, whereas the fat content was reduced to 8 percent, which is healthier. During aging, the viscosity was steadily increasing (120350 cP), which confirms the increase in consistency. The level of gossypol decreased significantly (1.2% to 0.05%), and it was safe. Good acceptability and product safety are seen in sensory scores (75), and lower microbial load (50,000 to 200 CFU/ml).

Conclusion

The current research has managed to show the possibility to create plant-based gelato based on *Gossypium hirsutum* as a main component. The statistical analysis proved the significant changes in nutritional and functional characteristics. The rise in total solids (32 percent to 38 percent)

and viscosity (120-350 cP) helped to make it smoother, smoother and creamier. Protein levels went up to 5.1% to 3.5% indicating the nutritional benefit of using cottonseed, whereas fat levels dropped to 6.8% to 8% giving a healthier alternative to the traditional gelato. Gossypol was reduced to 0.05 per cent. which was safe so that cotton seed could be used by humans. The score of sensory evaluation of 7-8.5 shows that it is good in terms of taste, texture, and quality. Also, microbial analysis revealed a significant decrease of 50,000 to 200 CFU/ml, which proves the efficiency of pasteurization and hygienic processing. On the whole, this paper has concluded that cottonseed-derived gelato is a prospective, sustainable and healthy product, and has high commercialization potential. The optimization of its flavors and high-scale processing can be further improved to make it more acceptable in the market and applicable in industries.

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