DEVELOPMENT OF MILLET BASED NON-DAIRY CREAMER USING SORGHUM MILK POWDER & COCONUT FAT POWDER

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ABSTRACT

This study explores the development of a non-dairy creamer powder using sorghum milk powder,coconut fat powder, silicon-dioxide, poly-dextrose and lecithin as key ingredients. The research aims to create a plant based alternative to traditional dairy creamers that caters lactose-intolerance. The developed non-dairy creamer is formulated with plant based milk (Sorghum).Non-dairy creamer formulated using a combination sorghum milk powder & coconut fat powder as a primary ingredients.The non-dairy creamer is subjected from phsyicochemical analysis moisture, ash, fat, protein. Sensory evaluation is conducted it access the appearance, aroma, taste, mouth feel, creaminess, colour with hot beverages. The results highlight the feasibility of using sorghum and coconut derivatives to produce sustainable, nutritious, and functional non-dairy creamers, contributing to the growing demand for vegan and allergen-free food products. All samples had moisture(0.83g), ash(4.14g), with fat ranging from 32.08g to 44.8g, carbohydrates from 31.6g to 40.72g, protein from 6.6g to 12.16g, and cholesterol from
19.4mg to 42.6mg. Sensory evaluation showed that Sample S4 achieved the highest overall acceptability among the millet-based variants, followed by Sample S3, both closely matching the control sample in texture and creaminess.These results indicate millet-based creamers are promising alternatives to conventional dairy creamers.

Keywords: *Sorghum milk powder, Creaminess, Coconut Fat powder, Non-dairy Creamer and Plant-based*

INTRODUCTION

The global food landscape is experiencing a profound transformation, with plant-based alternatives to traditional dairy products emerging as a significant trend in response to evolving consumer preferences and needs. This shift is driven by multiple converging factors, including increasing rates of lactose intolerance, growing adoption of vegan and plant-based diets, environmental sustainability concerns, and health-conscious consumer behaviors. Within this context, non-dairy creamers represent a rapidly expanding market segment, offering consumers alternatives to conventional dairy creamers that align with these evolving preferences while maintaining the sensory experience traditionally associated with dairy products.

Non-dairy creamers, first introduced in the 1950s, have undergone significant evolution from their early formulations, which primarily relied on hydrogenated oils and artificial ingredients.Over the years, modern consumers have shifted their preferences toward products that offer cleaner labels, better nutritional value and environmentally sustainable options. This growing demand has opened up opportunities for innovation using novel plant-based ingredients (A. Romulo, 2023). Among these, millet's- particularly sorghum represent an underutilized yet highly promising category of grains that align perfectly with these contemporary expectations.

Sorghum (Sorghum bi-color), often referred as " the camel of crops" due to its remarkable drought resistance, possesses exceptional nutritional and functional properties that make it an ideal candidate for developing value-added food products such as non-profile, containing approximately 10-12% protein, 3-4% fat and 70-75% carbohydrates (USDA & IFCT NIN-ICMR 2017). It is also rich in dietary fiber, Vitamins and Minerals such as iron, zinc, phosphorus and B-complex Vitamins. Moreover, sorghum contains a diverse range of bioactive compounds, including phenolic acids, flavonoids, and condensed tannins, which contribute to its high antioxidant capacity (Dykes and Rooney, 2006).

REVIEW OF LITERATURE

Ferdows *et.al*.., (2025) investigated the Rheological, tribological and sensory characteristics of low-fat non-dairy coffee creamers, focusing on improving their overall sensory quality. The study explored the use of cress seed gum (CSG), a natural and locally sourced thickener and fat replace as a means to enhance these attributes. Creamer samples with varying fat content (0%, 10%, 20% and 30% reduction) were analyzed using Rheological, tribological and sensory evaluation methods. The results demonstrated
That incorporating CSG allowed for up to 30% fat reduction while maintaining desirable sensory properties, highlighting its potential to produce a healthier coffee creamer suitable for consumer use.

Dominic Rovai *et.al*.., (2025) investigated how the method of serving coffee creamer and the variety of coffee influence consumer preferences. The study was conducted in two phases to evaluate whether the way creamers are served or the type of coffee used affects the acceptance of four different creamers. Their findings indicated that the serving method had minimal impact on sensory results and actionable insights, although it might slightly influence the visual appearance of the creamer in coffee.

Chatchawan Chotimarkorn *et.al*.., (2024) formulated a non-dairy creamer by modifying the fatty acid composition to increase the levels of omega-3 and omega-6 fatty acids. The raw ingredients were obtained from the Republic of the Philippines, and the product's quality was monitored for 90 days. Throughout the storage period, the peroxide value remained low(0.22meq/kg fat), well under the FDA's acceptable threshold of 10meq/kg fat, showing only minor associated with normal lipid oxidation over time.

Panigrahi *et.al*.., (2024) developed and standardized a millet-based probiotic beverage, assessing its physicochemical properties and microbial stability. The study found that the probiotic beverage exhibited a balanced flavor, acidity and microbial stability, suggesting that fermented millet beverages could serve as a nutritious and functional base for non-dairy creamers, with added health benefits due to probiotics.

Adly *et.al*.., (2023) examined the impact of partially replacing fat with non-dairy creamer (NDC) at levels of 10%, 15% and 20% in cake formulations. Their results showed that fat substitution with NDC improved the cake's quality characteristics while producing a low-fat product that maintained good physio-chemical and sensory properties.

Bo Yang *et.al*.., (2023) investigated the use of coconut oil-based diacylglycerol (CO- DAG) as an alternative fat source for non-dairy creamers. The study demonstrated that CO-DAG enhanced thermal stability, improved whiteness and provided desirable emulsification properties. Moreover, the absence of tarns fats makes it a healthier option compared to conventional dairy-based fat emulsions. These findings suggest that coconut oil derivatives could serve as an, effective and health-conscious fat source for plant- based creamers.

Geethambika *et.al*.., (2023) investigated how moisture content affects the physical and flow properties of milk-millet powders, which are commonly used in the preparation of instant beverages and dry non-dairy creamers. Their findings demonstrated that reducing moisture content significantly improved powder flow-ability, solubility and re-hydration characteristics. These improvements not only facilitate easier handling and processing but also enhance the functional quality of the powders when reconstituted into beverages. This

study highlights the importance of controlling moisture content in milk- millet powders to ensure consistent performance, better solubility and higher consumer acceptability in powdered non-dairy creamers and instant drink applications.

MATERIAL & METHODOLOGY

1.1 PROCURMENT OF RAW MATERIALS:

In this study, the utilized materials are sorghum milk powder, coconut fat powder, poly- dextrose, silicon-dioxide and lecithin which are made into a acceptable formulations of Millet based non-dairy creamer.

1.2 CRITERIA FOR SELECTION OF MATERIALS:

For preparing the millet-based non-dairy creamer, all the raw materials were obtained from Aarkay Food Products Ltd. To ensure good quality and reliability, the main ingredients-sorghum milk powder, coconut fat powder, poly-dextrose, silicon-dioxide and lecithin were provided by this supplier, which is well-known for offering safe and standardized food ingredients. Choosing these materials from a trusted source helped maintain consistency in the product, enhance its functionality and ensure overall quality of the final formulation.

Sorghum Milk Powder: For the basic ingredient, sorghum milk powder, the primary focus should be on its nutritional profile-particularly its protein and fiber content-as well as its solubility and flavor neutrality. A high-quality, spray-dried sorghum milk powder should disperse easily in liquids and impart minimal off-flavors, ensuring a smooth mouthfeel and pleasant taste in the creamer.

Coconut fat powder: Coconut fat powder is selected to provide the characteristic creaminess, mouthfeel and opacity expected in creamers. The ideal coconut fat powder should have a high fat content (typically 50-65%) and a significant proportion of medium-chain triglycerides (MCTs), which not only contribute to a rich texture but also offer potential health benefits. The powder must be stable in water, preventing separation or “oiling off” when added to hot beverages, and should be compatible with spray-drying Processes to ensure a free-flowing, non-clumping final product.

Poly-dextrose: It serves as a fiber source, bulking agent and sugar substitute. The chosen poly-dextrose should have a high soluble fiber content and a low glycemic index, making it suitable for health-conscious and diabetic consumers. It is important that the poly-dextrose is neutral in taste, so as not to interfere with the overall flavor profile of the creamer and that its inclusion does not digestive discomfort when consumed within recommended limits.

Silicon dioxide: It is incorporated as an anti-caking agent to maintain the powder’s flow- ability and prevent clumping during storage and handling. Only food-grade, amorphous silicon-dioxide should be used, as it is safe and effective at controlling moisture without interacting with other ingredients or affecting the products sensory qualities.

Lecithin: It acts as an emulsifier, ensuring the even dispersion of fat within the creamer and preventing separation in beverages. The lecithin should be derived from a reliable source and possess an appropriate hydrophilic-lipophilic balance (HLB) for oil-in-water emulsions. This helps achieve a stable, homogeneous product with a smooth texture and prevents visuals defects like feathering when the creamer is added to hot drinks.

Overall, the selection of these ingredients should also take into account their synergistic interactions, processing compatibility and compliance with food safety and labeling regulations such as those set by FSSAI. By carefully evaluating each ingredient based on these criteria, the resulting non-dairy creamer can deliver optimal sensory, nutritional and functional properties that meet both consumer expectations and regulatory standards.

1.3 METHOD FOR PREPARATION OF NON-DAIRY CREAMER:

The non-dairy creamer was developed using a dry blending technique involving sorghum milk powder, coconut fat powder, poly-dextrose, silicon-dioxide and lecithin. Prior to formulation, all ingredients were visually inspected and subjected to basic quality checks to ensure their integrity, cleanliness and suitability for use. Each ingredient was individually weighed according to the proportions specified in the formulations. Sorghum milk powder served as the primary base, offering a plant-based, lactose-free alternative with nutritional benefits. Coconut fat powder was used to provide the desired creamy texture and flavor profile. Poly-dextrose functioned as a bulking agent and contributed to the mouthfeel and soluble fiber content of the product. Silicon -dioxide was included to prevent clumping and ensure a smooth, free-flowing consistency.

3.3 METHOD FOR PREPARATION OF NON-DAIRY CREAMER:

Receiving of Materials

(Sorghum milk powder, Coconut fat powder, Polydextrose, Silicon -dioxide and Lecithin)

Inspection of ingredients

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↓

Weighing the ingredients for 50g

↓

Mixing

(Addition of sorghum milk powder + addition of coconut fat powder)

↓

Addition of Anti-caking agent

↓

Addition of Emulsifier

↓

Quality Check

↓

Packaging

Fig:3.1 Process flow sheet for non-dairy creamer

4. RESULTS AND DISCUSSION

This chapter deals with the results and discussions from sensory evaluation for all six trails with different formulations.

4.1 SENSORY EVALUATION FOR THE DEVELOPED PRODUCT

4.1.1 Appearance

4.1.2 Aroma

4.1.3 Taste

4.1.4 Mouthfeel

4.1.5 Creaminess

4.1.6 Solubility

4.1.7 Aftertaste

4.1.8 Overall Acceptability

4.2 SENSORY EVALUATION FOR THE DEVELOPED MILLET BASED NON- DAIRY CREAMER

Sensory evaluation score of different Non-dairy Creamer samples S_0, S_1, S_2, S_3, S_4, S_5, and S_6 developed by using of Sorghum milk powder, Coconut fat powder, Polydextrose, silicon- dioxide and Lecithin in table 4.1

Table 4.1 Sensory evaluation for the developed Non-Dairy Creamer

Variant	Control Sample-(S0)	Sample - S1	Sample - S2	Sample - S3	Sample - S4	Sample - S5	Sample - S6
Appearance	8.21±0.23	6.56±0.20	7.48±0.18	8.19±0.12	8.47±0.10	6.55±0.15	6.20±0.20
Aroma	7.85±0.30	7.50±0.21	7.48±0.23	8.47±0.19	7.77±0.06	7.23±0.19	7.20±0.14
Taste	8.49±0.28	7.60±0.20	7.21±0.06	8.74±0.23	7.54±0.35	6.02±0.09	6.10±0.23
Texture/ Mouthfeel	8.74±0.14	.13±0.10	7.04±0.13	8.52±0.31	8.04±0.09	6.61±0.12	6.13±0.26
Creaminess	9.09±0.18	9.14±0.05	8.53±0.14	9.11±0.22	7.06±0.12	6.05±0.22	6.11±0.15

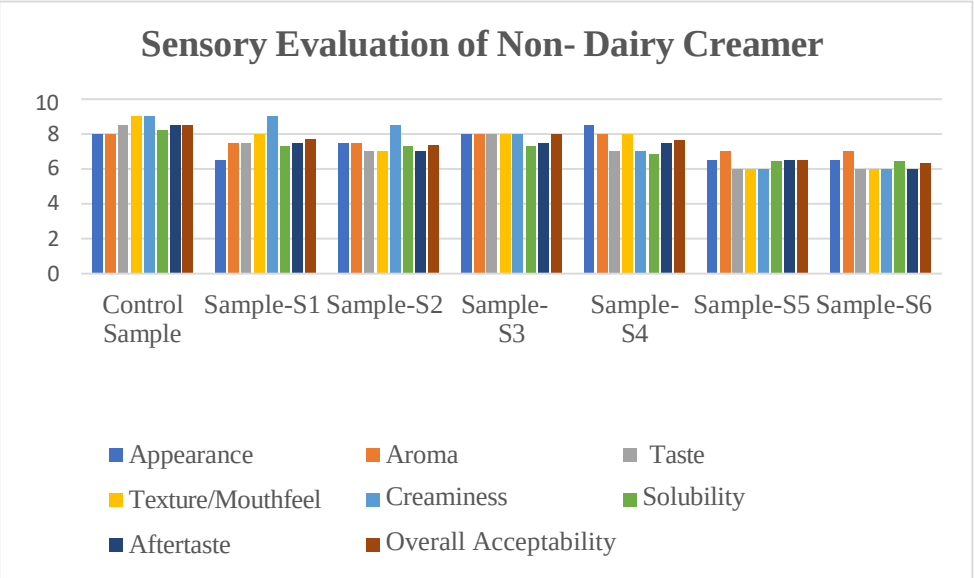

Fig:4.1 Graph for sensory evaluation of Non-Dairy Creamer

The standardized procedure for optimization of non-dairy creamer was employed and organoleptically evaluated. The developed non-dairy creamer choose through an organoleptic test using a 9-point hedonic scale for sensory properties.The evaluation of different millet based non-dairy creamer formulations made from sorghum milk powder, coconut fat powder, silicon dioxide, poly-dextrose and lecithin. while the control sample generally set the standard for desirable qualities, some of the non-dairy creamer formulations, especially S3, were rated highly by the panelists and came closest to the control in terms of overall acceptability. These samples were noted for their appealing appearance, pleasant aroma, and a creamy texture that closely resembled the control. S4 also performed well and was considered acceptable, though slightly less favored than S3. These results suggest that with the right combination and proportion of plant-based ingredients, it is possible to develop non-dairy creamers that closely mimic the sensory experience of traditional dairy-based creamers.

Fig:4.2 Millet based Non-Dairy Creamer

Fig:4.3 Samples of Millet based Non-Dairy Creamer

The fig 4.2 samples of millet based Non-Dairy Creamer which had been undertaken several formulations to get desired product. The fig 4.3 final samples of non-dairy creamer after mixing of formulated Millet based non-dairy creamer to the 10ml of warm water, the non- dairy creamer was taken 0.6g and the coffee powder was taken 0.1g. addition of sugar is optional, because poly-dextrose little bit replace of sugar. The sample s_3 is accepted one because formulation of sorghum milk powder and coconut fat powder are with same amount and moreover sample s_1 is also similar to s_3 due to lesser amount of sorghum milk powder and higher amount of coconut fat powder which resembles mouthfeel/texture, creaminess. In sample s_2 addition of sorghum milk powder are increased and fat powder are decreased, so due to that appearance is enhanced but the taste is similar to s_1 but the creaminess is decreased small amount. The sample s_5 and s_6 addition of sorghum milk powder is increased and coconut fat powder was decreased so the taste, texture and creaminess also decreased. So, finally after adding formulated non- dairy creamer the color was similar to the traditional non-dairy creamer, the sensory action described the non-dairy creamer was reached what we excepted.

4.3 PROXIMATE ANALYSIS OF MILLET BASED NON-DAIRY CREAMER

4.3.1 SAMPLE-S1 OF MILLET BASED NON-DAIRY CREAMER:

Table:4.2 Proximate Analysis for Sample-S1 of Non-dairy creamer

	Moisture	Ash	Total Fat	Total carbohydrates	Protein	Cholesterol
Sample-S1	1.33g	4.11g	44.8g	31.6g	6.6g	19.4mg

The millet-based non-dairy creamer (Sample S1) formulated in this project offers a balanced nutritional composition suitable for plant-based applications. The product is completely dry, with 1.33% moisture and ash 4.11% , which supports good shelf stability. The high fat content (44.8g) from coconut fat powder provides a creamy mouthfeel while carbohydrates (31.6g) from sorghum milk powder and poly-dextrose contribute to energy and texture. Protein (6.6g) adds nutritional value, making the creamer a viable plant-based alternative. The cholesterol content is 19.4mg per 100g, which is relatively low compared to traditional dairy creamers. Overall, this formulation is lactose-free and vegan-friendly, making it suitable for consumers seeking dairy alternatives in beverages and food products.

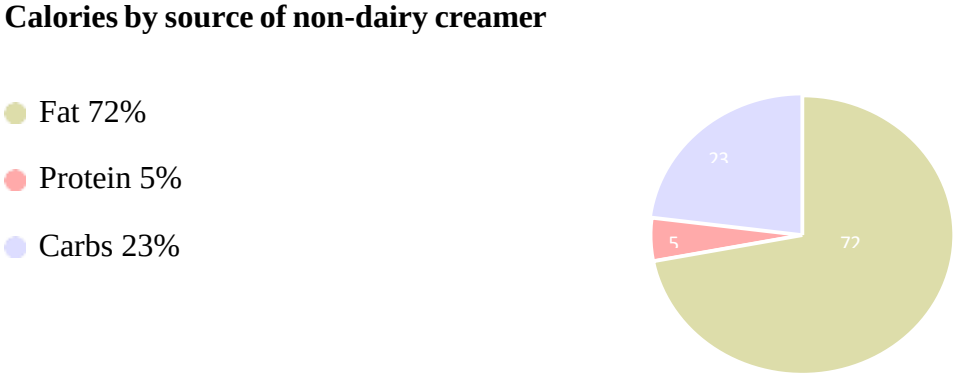

Fig 4.4 S1 Calories by source of non-dairy creamer

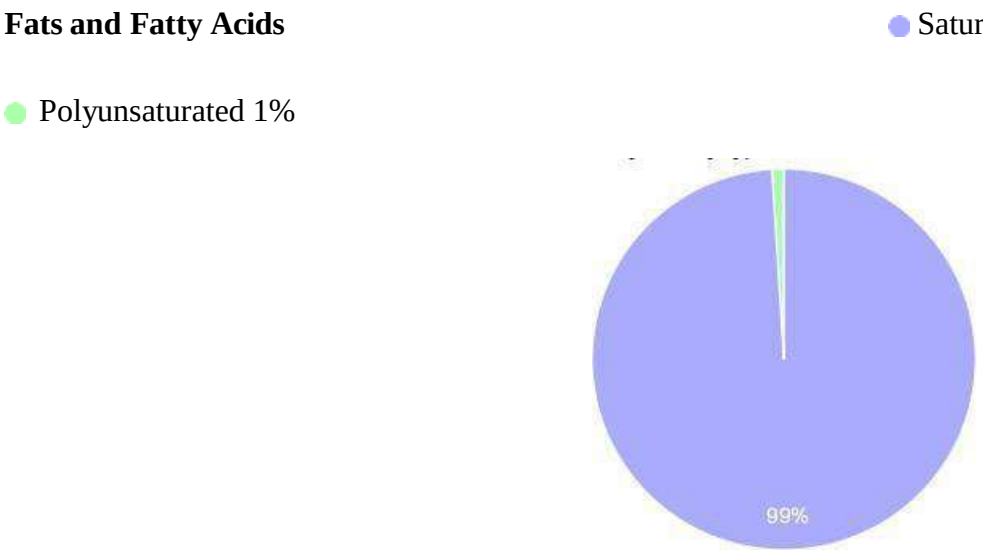

Fig 4.5 Fats and fatty acids of S1

4.3.2 SAMPLE-S2 OF MILLET BASED NON-DAIRY CREAMER:

Table:4.3 Proximate Analysis for Sample-S2 of Non-dairy creamer

	Moisture	Ash	Total Fat	Total carbohydrates	Protein	Cholesterol
Sample-S2	1.35g	4.15g	42.68g	33.12g	7.56g	23.28mg

Sample S2 of the millet-based non-dairy creamer shows a dry and stable composition, with moisture 1.35%and ash 4.15%. The total fat content is 42.68g, mainly from coconut fat powder, which helps provide a creamy texture. Carbohydrates are present at 33.12g, contributed by sorghum milk powder and poly-dextrose, enhancing the product's energy value and mouthfeel. The protein content is 7.56g, slightly higher than Sample S1, adding more nutritional value and aligning with the high-quality protein profile of millets. Cholesterol is present at 23.28mg per 100g, which remains lower than many traditional dairy creamers. Overall, this formulation is suitable for consumers seeking plant- based, lactose-free alternatives, and leverages the nutritional benefits of millets such as fiber, protein, and essential micro-nutrients.

4.4 BRANDING REQUIREMENTS:

While comparing the Millet based non-dairy creamer to other commercial non-dairy creamers which are in market, it emphasizes unique ingredients and health benefits.

- It is a zero added sugar product contrast to commercial non-dairy creamers.

- Vegan & Gluten-free
- Dairy-free

5.SUMMARY & CONCLUSION

From the results obtained, the research work entitled "Development of Millet based Non- Dairy Creamer using Sorghum milk & Coconut fat powder" is summarized as follows

This project was undertaken to develop a plant-based, non-dairy creamer using sorghum milk powder, coconut fat powder, lecithin, poly-dextrose and silicon-dioxide with the goal of providing a nutritious and allergen-friendly alternative to traditional dairy creamers. The formulation process involved selecting and combining these ingredients to optimize both nutritional value and sensory appeal, targeting consumers with lactose intolerance, milk allergies or those following vegan diets.

A total of six non-dairy creamer formulations (S1-S6) were developed using sorghum milk powder, coconut fat powder, lecithin, poly-dextrose and silicon dioxide and were compared against a control sample for sensory quality. The samples were evaluated for appearance, aroma, taste, texture/mouthfeel, creaminess, solubility, aftertaste and overall acceptability. The control sample consistently scored the highest across all attributes setting a standard for comparison. Among the developed variants, S_3 exhibited the most balanced sensory profile, closely matching the control in appearance, aroma, taste and texture/mouthfeel and achieving the highest overall acceptability among the samples. S_1 and S_4 also demonstrated favorable results, especially in creaminess and aftertaste. S_2 showed moderate performance, while S_5 and S_6 received comparatively lower ratings, particularly in taste, creaminess and aftertaste. The proximate analysis of the optimized sample S_3 revealed a nutritional profile of 8.94g protein, 39.5g fat, 35.4g carbohydrates,
4.14g ash, 0.83g moisture and 29.1mg cholesterol indicating its suitability as a nutritious, plant-based creamer.

CONCLUSION

The millet based non-dairy creamer was optimized by the base ingredients are sorghum milk powder, coconut fat powder, silicon-dioxide, poly-dextrose and lecithin all these are blended effectively into non-dairy creamer. The sensory evaluation indicates that the optimized non-dairy creamer formulations (S3) can closely replicate the sensory experience of a traditional control creamer,while also providing balanced nutrition and being free from major allergens. The results highlight the importance of ingredient selection and ratio in achieving desirable taste, texture and overall acceptability in plant-based creamers.

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