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Protein Content and Overrun Value in Coconut Milk-Based Ice Cream with Cashew Milk Combination

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Abstract

The purpose of this study is to determine the protein content and overrun value of ice cream made from a combination of coconut milk and cashew milk. This study is an experimental research with a factorial design and a research design in the form of a Complete Randomized Design (CRD). The CRD consisted of three treatments with two repetitions, using coconut milk and cashew milk in the percentages of 60:40%, 50:50%, and 50:60%. The results obtained were processed by editing, coding, tabulating, and entering data. For data analysis, a statistical test in the form of the One-Way ANOVA Test was used to determine the effect of treatment on each different formula regarding protein content and overrun value.The results showed that there was a significant difference in the use of coconut milk and cashew milk on the protein content, with a value of p=0.000 (<0.005), and the overrun value, with a value of p=0.003 (<0.005). the protein content in all ice cream samples remained below the Indonesian National Standard (SNI) minimum requirement of 2.7%. The highest protein content is ice cream A (60%: 40%) at 1.409%, followed by ice cream B (50%:50%) at 1.284%, and ice cream C (40%:60%) with the lowest protein content at 1.192%. The overrun value met the SNI (Indonesian National Standard) for industrial scale ice cream with ice cream A having an highest overrun value of 73.92%, following ice cream B with an overrun value of 65.295% meets the small industry standard, and ice cream.

Introduction

One of the foods that is very popular among people, especially children worldwide, is ice cream. Ice cream is a refreshing food with a sweet taste and also has nutritional value. The nutritional content of ice cream depends on the ingredients used and is a consideration for some people when choosing food. Ice cream is generally made from cow's milk, which has good nutritional content. Despite its nutritional richness, many people avoid cow's milk because their bodies cannot tolerate the lactose in milk, a condition called lactose intolerance. The prevalence of lactose intolerance in adults and children over 6 years of age is estimated at 80-100% in Asia, 70-95% in Africa, 15-80% in America, and 19-37% in Europe (Malik & Panuganti, 2023). As a country located in Asia, Indonesia is included in the 80-100% who experience lactose intolerance and requires treatment related to these problems (Hasibuan, 2024).

As an alternative to cow's milk, ice cream can be made using plant-based ingredients that do not contain lactose, such as coconut milk (Alfadila et al., 2020). As an Indonesian, you are likely familiar with ice cream made from coconut milk, which is often called "es dung dung" or "es puter". Ice cream made from coconut milk has a distinctive taste and aroma (Choo et al., 2010). In addition to its unique flavor profile, coconut milk has a nutritional content that is comparable to cow's milk as a substitute in ice cream production. In 100 grams of coconut milk

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mixed with water, there is a fat content of 10 grams, compared to pure cow's milk, which only has a fat content of 3.5 grams. The fat content in coconut milk in the process of making ice cream is needed to form a texture, because ice cream in general requires the fat in milk to be able to create a soft texture (Subagio, 2011). This is a consideration in the selection of the use of coconut milk as an alternative to cow's milk in the ice cream making process (Tulashie et al., 2022; Taspinar et al., 2023; Antunes et al., 2022).

The ice cream making process requires natural emulsion stabilizers in ingredients that have protein solids. Protein as a natural emulsifier can prevent the separation of two different liquids (Octaliandra et al., 2023; Kim et al., 2020). The protein content of an ice cream also has an influence on the flavor (Suwita et al., 2021). Coconut milk does not have enough protein content to replace ice cream made from cow's milk. In 100 grams of liquid coconut milk has a protein content of 2 grams while cow's milk is 3.2 grams. Plant foods with high protein content are well-known in legume foods, one of which is cashews. The process of making ice cream in this study uses cashews in the form of dairy products that have a fairly high protein content, which is 1.31% per 100 grams (Smith et al., 2022). Cashew milk has a higher protein content of 5.0% than tiger nut milk and soy bean chocolate drink with a value of 3.5% and 3.37% (Tamuno et al., 2019). Cashew milk is produced by processing cashews into a paste form through baking and peeling the nuts, then adding water and filtering the mixture. This milk alternative has become widely available to the public and can be easily found in supermarkets or through online retail platforms. The protein content in ice cream influences its taste and plays a crucial role in binding water by forming foam during the stirring process, thus increasing the volume or overrun value of the ice cream (Suwita et al., 2021; Roy et al., 2022; Atik et al., 2021).

Overrun is a quality parameter in ice cream that is quite important in the formation of structure. Overrun is an increase in volume calculated before and after the freezing process (Nusa et al., 2019; Voronin et al., 2021). The overrun value is influenced by several factors, one of which is that the basic ingredients used have fat and protein levels (Goff & Hartel, 2013). Coconut milk and cashew milk have fat and protein content so it is expected to have an influence on the overrun value. Overrun has an influence on the formation of texture in ice cream (Choirunnisa, 2022). The higher the overrun value, the softer the texture of the ice cream (Fikri et al., 2022). In addition, overrun is also affected by viscosity. If the ice cream mixture is thicker, the overrun value will decrease. This is because water bound in a molecule can cause the air to not be able to escape completely and is cannot expand fully during the churning process (Sarika et al., 2020). In this study, liquid base ingredients were used, namely coconut milk and cashew milk, which likely resulted in a less viscous mixture and potentially higher overrun value. The viscosity level of ice cream also affects the formation of air pockets during the mixing process, which is a fundamental principle in ice cream production (Liu et al., 2023). During the formation of these air pockets, volume expansion occurs, making the ice cream lighter, less dense, and softer in texture (Padaga M & Sawitri, 2005; Choirunnisa etal., 2022).

Methods

This research adopts an experimental design utilizing a factorial approach within a completely randomized design framework. The study investigates the impact of varying compositions of coconut milk and cashew milk on the production of ice cream, using three treatments with three replications. Each treatment alters the ratio of coconut milk to cashew milk in the ice cream mixture. Specifically, the treatments consist of 60% coconut milk and 40% cashew milk (A1), 50% coconut milk and 50% cashew milk (A2), and 40% coconut milk and 60% cashew milk (A3). These treatments are repeated three times, allowing for a detailed comparison of the

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impact of each formulation on the ice cream's protein content and overrun value, both of which are critical quality metrics.

Table 1. Experimental Design

Treatment	Replication 1	Replication 2	Replication 3
A1 (60% coconut milk, 40% cashew milk)	Protein, Overrun	Protein, Overrun	Protein, Overrun
A2 (50% coconut milk, 50% cashew milk)	Protein, Overrun	Protein, Overrun	Protein, Overrun
A3 (40% coconut milk, 60% cashew milk)	Protein, Overrun	Protein, Overrun	Protein, Overrun

The research was carried out at two different laboratories to ensure proper testing and analysis. The ice cream production was conducted in the Food Science Laboratory at the Faculty of Health Sciences, Muhammadiyah University of Surakarta. Protein content analysis took place at the Chem-Mix Pratama Laboratory in Bantul, while overrun value testing was conducted at the same Muhammadiyah University laboratory where production occurred. The experiment was executed on June 5, 2024.

The independent variable in this study is the varying ratios of coconut milk and cashew milk used in the ice cream mixture. The dependent variables include the protein content and overrun value of the ice cream, both of which are measured after the production process. Control variables, such as the composition of the mixture, size, and freezing time, were carefully regulated to ensure consistency across all treatments.

Coconut milk in this study refers to the liquid extracted from grated coconut flesh, commonly used in culinary applications, including ice cream production. Cashew milk is a plant-based dairy alternative, selected for its creamy texture and ability to blend with coconut milk. The ice cream is a semi-solid product stored at 4°C or below, composed of sweeteners, fats, stabilizers, and additional ingredients that are homogenized to achieve the final texture. Protein content is a key quality indicator, as it stabilizes the fat emulsion, contributes to texture, and influences the overrun value. Protein analysis is conducted using the Kjeldahl method, and values are expressed as percentages. Overrun is defined as the incorporation of air into the ice cream mixture, calculated as the difference between the mixture's volume and the final ice cream's volume, also expressed as a percentage.

The production of ice cream in this study required several essential materials, including coconut milk, cashew milk, granulated sugar, ovalet, carboxymethyl cellulose (CMC), and vanilla. The equipment used consisted of an ice cream maker, freezer, stove, and mixer. For protein content analysis, Kjeldahl flasks, a thermometer, and a fume hood were utilized, while overrun measurements were conducted using an analytical balance and beaker glass.

The ice cream production process began by mixing the primary ingredients coconut milk, granulated sugar, CMC, and vanilla until the mixture reached a homogeneous consistency. The cashew milk was then added based on the specified treatment ratios. The mixture was heated to a temperature of 75°C for 25 seconds, ensuring constant stirring to maintain uniformity. Following this, the mixture was processed using an ice cream machine, and ovalet was incorporated using a mixer for two minutes. The ice cream was then packaged and stored in a freezer at temperatures below -16°C.

Protein content was determined using the Kjeldahl method, which involves three main stages: destruction, distillation, and titration. In the destruction stage, approximately 2 g of the ice

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cream sample was weighed and mixed with K2SO4, CuSO4, and concentrated H2SO4 in a Kjeldahl flask. The mixture was heated until the solution turned clear green, indicating the completion of digestion. In the distillation stage, the solution was neutralized with NaOH, and the ammonia released was collected in hydrochloric acid. Finally, during the titration stage, the distillate was titrated with NaOH to determine the nitrogen content, which was then multiplied by the conversion factor of 6.25 to obtain the protein percentage.

Overrun, an indicator of air incorporation in ice cream, was calculated by weighing the mixture before and after freezing. A 100 ml sample of the ice cream mixture was placed in a beaker glass and weighed. After freezing, the same volume of ice cream was weighed again. The overrun percentage was calculated using the following formula:

$$\%\ Overrun\ = \frac{\text{Weight of dough}-\text{weight of ice cream}}{\text{weight of ice cream}} x100\%$$

Data processing involved several stages, beginning with editing the collected data on protein content and overrun values. The data were then coded based on the differences in ingredient composition, tabulated to create a comprehensive master table, and entered into a computer program for statistical analysis. A One-Way ANOVA test was used to determine whether there were significant differences between the treatments regarding the ice cream's protein content and overrun value. If the data were not normally distributed or homogeneous, a Kruskal-Wallis test was employed as a non-parametric alternative.

Results and Discussion

The treatment in this study was with a difference in the composition of the percentage of coconut milk and cashew milk, respectively 60%:40%, 50%:50%, and 40%:60%. The nutritional analysis carried out was protein levels and overrun values.

Normality Test

Table 1. Overrun Normality

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Overrun	.225	6	.200*	.904	6	.400

In this undertaking, normality test will be used through Kolmogorov-Smirnov and Shapiro-Wilk and the following results have emerged; The test suggests that the overrun data is normally distributed. Thus, the p-value that corresponds to Shapiro-wilk test is equal to zero. 400(p > 0. 05) Hence, it can be pointed out that lack of normality assumption is not valid in this analysis. This enables the (subsequent) analysis, for example, of the One-Way ANOVA test, that can only start when it has been ascertained that the data conforms to the normality standards.

Table 2. Normalitas Protein

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Protein	.124	18	.200*	.942	18	.311

Likewise with the overrun data, the protein content data also conform to the normality test based on the Shapiro-Wilk value of 0. When patients with psychotic disorder were included in the analysis, the mean time to treatment initiation was significantly lower, F = 311; p > 0. 05.

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This implies that the protein content data are normally distributed; as such, it can be analyzed by parametric tests such as analysis of variance (ANOVA).

Table 3. As much protein

No	Code	Protein (%)		
		Test 1	**Test 2**	**Test 3**
1	A1	1,4015	1,4339	1,4590
2	A2	1,4124	1,3553	1,3923
3	B1	1,3190	1,2640	1,2914
4	B2	1,2554	1,2650	1,3101
5	C1	1,1623	1,2072	1,1995
6	C2	1,1721	1,1782	1,2341

Slightly fluctuation of the protein content can also be observed in the data presented in table 3 depending on the specific treatments. For example, the ice cream which contained coconut milk and cashew milk in the proportion of 60:40 as documented in A1 had the highest protein level with the mean values ranging near 1. 409%. The protein content was slightly lower in the composite sample of ice cream with a 50:50 ratio (A2) of approximately 1%. 284%, while the low protein was detected in the ice cream which had a proportion of 40:60 (A3) being 1. 192%. Altogether these results indicate that the trend as the proportion of cashew milk increases, there is a decrease in protein content. Every one of them is lower than the Indonesian National Standard on ice cream, SNI demands at least 2. 7% protein.

Table 4. Overrun Value

Treatment		**Test** 1	**Test** 2
A	**Dough Weight**	**100 gr**	**100 gr**
	Ice cream weight	57 gr	58 gr
	% overrun	**75,43859649**	**72,4137931**
B	Dough Weight	100 gr	100 gr
	Ice cream weight	60 gr	61 gr
	% overrun	**66,66666667**	**63,93442623**
C	Dough Weight	100 gr	100 gr
	Ice cream weight	67 gr	69 gr
	% overrun	**49,25373134**	**44,92753623**

Table 4 also displays the overrun data and based on these findings, ice cream that was incorporated with 60% coconut milk and 40% sweetened condensed milk (A1) had the highest overrun and mean of 73. 92% which exceed the standard SNI for Industrial scale Ice cream of not less than 70- 80%. The 50:50 ratio of the A2 formulation yielded a relatively low overrun value of 65. of which 29% of this falls within the small scale industry players which ranges from 50 to 70%. The flavour with least quantity of coconut milk (A3 40:60) had an overrun of 47. 08%, which is only the requirement of household industry 35-50%).

Protein content

The data obtained for the content of total protein through testing utilized the Khjeldahl method described above. To check the normality of the test data, Shapiro-Wilk normality test was conducted, and the value obtained was 0. It suggests that the distribution of data was normal in

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the given context and proceeded to testing using One Way Anova at p>0. 05 = 311. As evident from the protein test, the results have been presented in table 5.

Table 5. Protein Content of Coconut Milk and Cashew Milk Ice Cream

Percentage of Coconut ilk and cCashew Milk	How much protein (%)	Value sig (p)
A (60: 40)	1.409 ± 0.035^{a}	0.000
B (50: 50)	1.284 ± 0.026^{b}	
C (40: 60)	1.192 ± 0.026^{c}	

Following the analysis of the One Way Anova test, a p value of 0 was obtained in this study. 000 ($p \leq 0.005$) was obtained, thus indicating rejection of H0 and clear differences in treatments A, B and C on protein content in coconut milk ice cream with a blend of cashew milk. Moreover, in order to assess which group is prevailing, a Duncan test was conducted. The Duncan test results identified that the levels of protein A were higher significantly than the levels of B and C Protein levels B were also higher significantly from the A and C Protein levels C, however, were higher significantly from the overrun values of A and B The description on the protein level of the coconut milk ice cream with the addition of cashew milk is depicted in the figure 1.

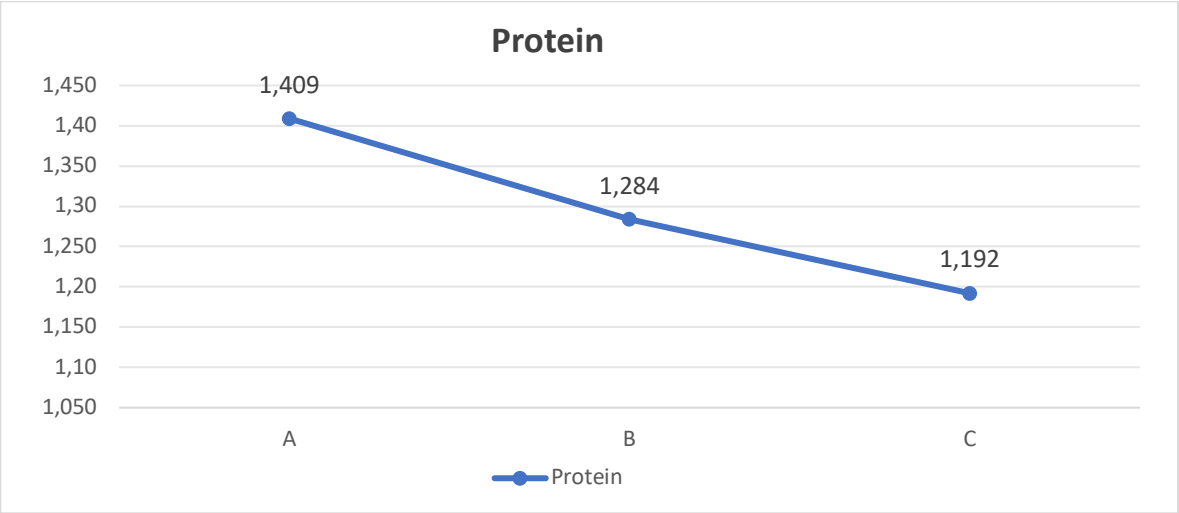

Figure 1. Ice Cream Protein Content Test Results Graph

Based on Figure 1, it shows that the highest protein content in treatment A with a percentage of coconut milk and cashew milk of 60%:40 percent with an average value of one percent. undefined While the lowest protein content of ice cream was treatment C with a percentage of coconut milk and cashew milk of 40%: higher than 60% with an average of 1. undefined The protein content in all treatments was still below the SNI (Indonesian National Standard) which has been established a minimum of 2. undefined Low protein content in the three ice cream treatments may also be attributed to the raw materials with low protein. The protein content provided by the raw material used in the preparation of coconut milk and cashew milk is 2 gms/100 ml and 0. 58 g per 100 ml. This study is in line with Rincon et al. (2020) where the higher the percentage of coconut milk, the higher the protein content because the combination of ingredients has a lower protein value. The addition of cashew milk would enhance the protein value of the coconut milk ice cream as assumed by the firm. The protein content in the original and processed food ingredients will certainly not be the same because the ingredients

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used have gone through a cooking process (Sun-Waterhouse et al., 2014). This is in agreement with the study done by Olatidoye et al. (2020) which indicated that the protein content of raw and roasted cashew nuts reduced from 24% to 10%. 37% to 22. 44%. In this study, making of ice cream meant that there was cooking which altered the proteins.

Another factor attributed to texture of ice cream is proteins where it acts as natural emulsifier responsible for the formation of foam that stabilises fat and air emulsions as the product freezes (Kim et al., 2020; Kinsella & Morr, 1984). The highest percentage of proteins was reported in the formulation containing 60% coconut milk and 40% cashew milk, 1.409% which is way below the SNI minimum requirement for protein of 2%. 7%. Coconut milk, from which the protein was extracted, only contains about one to two grams of protein per 100ml while cashew milk only have about 0.48µg of protein per 100ml (Hasibuan 2024; Smith 2022).

This activity where the protein content decreases as the proportion of cashew milk increases is affirming of other literatures that plant-based milks contain less protein than their dairy. In addition, the heat treatment that occurs in ice cream manufacturing causes a loss of protein and its content is thereby decreased (Liu et al., 2018). However, cashews contain protein content more than coconut, however it is not adequate to meet the protein standard of dairy based ice cream (Tamuno & Monday, 2019; Suwita et al., 2021).

Overrun value

Like any other quality food product, an ice cream can be judged from the degree of overrun it contains or in the standard of SNI. Overrun is where ice cream get big or it is the ability of ice cream to expand and this is due to additional air getting incorporated into the mixture during it production (Goff & Hartel, 2013). There is overrun value for every kind of ice cream treatment. So, before proceeding, one needs to run a test in order to analyze the differences in each treatment A, B, and C, which were conducted with 2 repetitions using the One Way Anova. However when conducting the One Way Anova test there is a requirement that the data used should be normally distributed. The data from the overrun value measurement were tested for Shapiro-Wilk normality with a p value of 0.400 ($p>0.05$), meaning the data is normally distributed.

Table 6. Overrun value on Coconut Milk Ice Cream and Cashew Nut Milk

Percentage of Coconut Milk and Cashew Milk	Overrun until (%)	Value sig (p)
A (60: 40)	73.92 ± 2.13^{a}	0.003
B (50: 50)	65.29 ± 1.93^{b}	
C (40: 60)	47.08 ± 3.06^{c}	

According to the ONe Way Anova test P value is 0. Accordingly, significance level $p \leq 0.005$ and EING was compared to CG (n = 15) of 7. 90±2:10 > 7. The finding of the study showed that there was a significant difference in treatments A, B, and C on overrun value of coconut milk ice cream with a blend of cashew milk. In addition, in order to identify the group, Duncan´s test was used. Based on the Duncan test, protein content of A was significantly different from protein content of B and C, while protein content of B was significantly different from A and C, and protein content of C was significantly different from the overrun of A, B The difference of protein content in coconut milk ice cream with addition of cashew milk.

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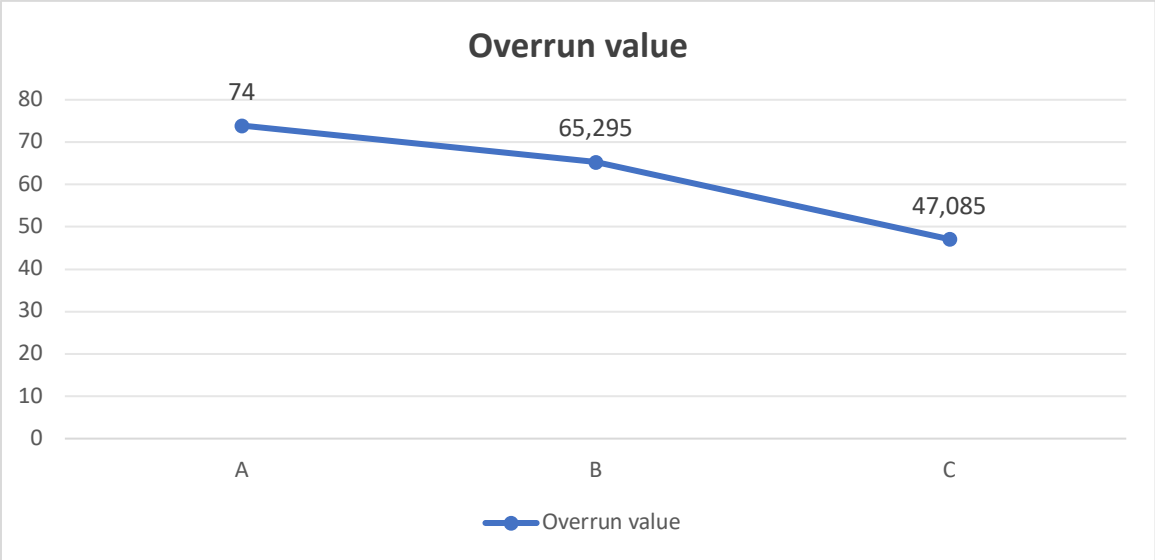

Figure 2. Ice Cream Protein Content Test Results Graph

According to the Figure 2, it can be mentioned that there is an effect on the percentage of coconut milk and cashew milk usage when used separately, if there is more coconut milk used for the preparation of ice cream, then the ice cream has more overrun value. The highest overrun value is 128 percent in treatment A which consist of 60percent coconut milk and 40percent cashew milk. Comparing the overrun of the different treatments the least one is in the treatment C with 40% of coconut milk and 60% of cashew milk. The overweight value in all treatments has satisfy SNI (Standard National Indonesia), ranged from house hold scale SNI to industrially SNI. Indeed, there is ice cream that has industrial scale SNI value namely in ice cream with treatment A with SNI value of between 70% – 80% with overrun value of 73. 92%. In ice cream with treatment B with an overrun value of 65. 295% it is able to meet small industry standard which range from 50-70%. While in treatment C the overrun value is its value according to the household scale with SNI at 35-50% the overrun value is 47. 085%. A note about the raw materials used in this study; the raw materials used for the preparation of the liquid raw materials contained high water content. This is in concordance with the findings by Amhary et all in their study above. 2020 where the amount of water in the texture of the ice cream is higher leading to more trapped air thus having a high overrun.

Overrun is a very important factor in ice cream and it plays an important role in determining texture and mouthfeel of final product. It expresses the quantity of air that is entrapped during the process of freezing and the higher overrun suggests to frozen food with less density and softer texture (Goff & Hartel, 2013). In this study, the overrun of samples had close relationship with the proportion of coconut to cashew milk with the 60% coconut and 40% cashew provided the highest overrun of approximately 73. 92%. This formulation filled the industrial SNI standard of overrun which ranges of 70-80% (BSN, 2018).

Despite this, overly high overrun in coconut-rich preparation may be due to the higher fat content in coconut milk which favors the development of stable air cells in the frozen dessert (Sert et al., 2021). Coconut milk contains fat that contributes to the formation of the desired smooth texture hence argue that fat is a key factor in overrun and therefore the texture of ice cream (Rolon et al., 2017). The overrun was also observed to decrease with increasing concentrations of cashew milk with possible reasons being, lower fat and protein

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concentrations of cashew milk to trap and retain air (Aslam et al., 2022; Nyarko-Mensah, 2018).

The Problems of Plant-Based Ice Cream Production

Some of such hurdles include how to achieve the right protein content and overrun in plant-based ice creams (Tan et al., 2023; Shi et al., 2023). These findings are in line with the existing plant based ice cream literature which indicates that although coconut and cashew milk, although can fit the needs of lactose intolerant clientele, they lack the protein as well as functional equivalence of dairy ice cream (Anand & Awasti, 2020; Lefranc-Millot & Teichman-Dubois, 2018).

Another study suggested the addition of other protein sources including pea protein or soy protein isolates to increase the protein of plant based ice creams (Ma et al., 2022; Sá et al., 2020). For example, pea protein has been found to enhance nutritional value and textural properties in ice cream so that it solves the problem of protein shortage identified in formulations, such as those examined in this study (Narala et al., 2022). Likewise, the soy protein isolate have been used to improve the emulsification capacity of the plant based system to get better overrun values and creaminess (Singh et al., 2008).

Research implications and suggestions for new product development

Consequently, the results of this study portray that there is a dilemma of how to produce plant-based ice creams that can meet consumer preferences while at the same time being healthy. While, overrun values can be obtained for coconut and cashew milk-based ice creams, their major demerit is the low protein content. The authors recommend that studies in the future focus on the ability of incorporating other plant protein sources or even sophisticated food processing methods like high pressure homogenization or enzyme treatment to enhance the protein characteristics and digestibility with regard to such formulations (Serna-Hernandez et al., 2021; Sridhar et al., 2022).

Moreover, the effect of stabilizers and emulsifiers on overrun and texture aspects need to be further researched. Polysaccharides or fat substitutes can be employed as revealed in the aforementioned studies to determine the right balance of overrun and creaminess in plant based ice creams (Verni et al., 2022; Cruz et al., 2022). This work adds to the existing literature on plant-based ice cream but more work is needed to optimise the ingredients used in the making of these products to provide nutrients and texture that is close to that of dairy ice creams.

Conclusion

This work's analysis of coconut and cashew milk as the leading plant-based options for ice cream presents significant opportunities and unique issues. This study also verifies the ability of those plant-based milks to attain overrun values that correspond to SNI, pointing to their possibility to mimic one of the conventional dairy ice cream traits. However, the failure of the formulations to achieve the SNI index of protein content shows that there is one major drawback of using coconut and cashew milk especially due the low protein content and poor protein functional characteristics compared to the dairy proteins. This limitation underscores a broader issue within the realm of plant-based food innovation: a key problem that remains with gelatinization of food grains is the issue of attaining nutritional equivalence with dairy products. It is also clear from the analysis that more elements of protein, for instance, pea or soy protein isolates, ought to be added to plant-based ice creams. Furthermore, the extension of the newer technologies in the computation of food processing, such as the high pressure and enzymes, is a great opportunity in enhancing functionality and bioavailability of protein in such

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formulations. These presented strategies could close the gap between the regulatory bodies providing enhanced nutritional value of dairy products and the structural deficiencies of plant-based milks. Additionally, aromas of such overrun values replicated using coconut and cashew milk show that, with optimization, these ingredients could form the basis of plant-based ice creams that can meet the consumers' quality perception. But to get balanced desirable overrun with at the same time, having a good creamy structure of the product, one has to optimize the amount of fat and perhaps even use some hi-tech emulsifiers or fat substitutes. The relationship between fat content, protein functionality and the overrun is complex and the future research will require a detailed understanding of the above mentioned factors in order to optimize the plant based ice creams formulation. The findings of this study cannot be confined to ice cream industry alone as there are wider messages for the food manufacturing industries. Specifically, given a constant increase in the number of people being loyal to plant-based, lactose-free and environmental-friendly products, the skill of producing plant-based ice creams that perfectly meet the regulations and consumer's preferences will be paramount to market dominance. The study also emphasizes the need to integrate innovation into food science especially in the production of plant sourced foods that mimic dairy products in terms of nutrient profile as well as mouthfeel.

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