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Hedonic test and nutritional analysis of instant cream soup from sweet corn and mackerel fish for the elderly

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ABSTRAK

Latar Belakang: *Secara global rata-rata harapan hidup telah meningkat pesat dalam beberapa tahun terakhir, namun angka ini tidak diiringi dengan angka harapan hidup sehat. Berbagai masalah terkait dengan penuaan seperti kesulitan mengunyah, dan menelan makanan dapat mengurangi kemampuan lansia untuk memenuhi kebutuhan gizinya, untuk itu dibutuhkan modifikasi tekstur dari makanan lansia sehingga memudahkan mereka dalam mengonsumsinya*
Tujuan: *Penelitian ini bertujuan untuk mengembangkan formula yang tepat, menganalisis nilai organoleptik, dan kandungan zat gizi sup krim jagung manis dan ikan kembung untuk lansia.*
Metode: *Penelitian ini merupakan experimental di laboratorium dengan Rancangan Acak Lengkap (RAL) faktor tunggal yaitu kombinasi jagung dan ikan kembung dalam 3 taraf berbeda. Formula terdiri atas F1 (6% ikan), F2 (8% ikan), dan F3 (10% ikan). Data uji hedonik diperoleh dengan menggunakan kuesioner dan data zat gizi dengan pengamatan di laboratorium. Data penelitian diolah dengan menggunakan uji statistik one-way annova dan paired t test.*
Hasil: *Tidak terdapat perbedaan yang signifikan untuk seluruh atribut pada uji hedonik dan protein sup krim segar, sehingga formula 3 dipilih sebagai formula terbaik dengan kandungan protein yang lebih banyak dibandingkan formula lainnya. Kandungan gizi sup krim instan yaitu protein 39,98%, lemak 16,13% karbohidrat 34,36%, air 4,80%, abu 4,74%, dan total serat 5,96%.*
Kesimpulan: *Sup krim ini dapat dikembangkan sebagai makanan selingan lansia, sup krim ini disukai oleh panelis dan memiliki kandungan gizi yang baik bagi lansia.*

KATA KUNCI*: sup krim; ikan kembung; jagung manis; isolat protein kedelai; lansia*

ABSTRACT

Background: *From a global perspective, the average life expectancy has risen rapidly in recent years but has not been followed by healthy life expectancy. Several aging-related issues, such as difficulties in chewing and swallowing, can hinder elderly people's ability to meet their nutritional needs. Therefore, modifying food texture to facilitate easier consumption for this age group is essential.*

Objectives: *This study aims to develop an optimal formula and evaluate the organoleptic and nutritional content of sweet corn and mackerel cream soup for elderly people.*

Methods: *This research was a laboratory experiment employing a Completely Randomised Design (CRD) with a single factor, namely the combination of maize and mackerel at three different levels: F1 (6% fish), F2 (8% fish), and F3 (10% fish). The hedonic test data was obtained through a questionnaire, while nutritional data were gathered through laboratory observation. Then, data were analyzed by one-way ANOVA and paired t-tests.*

Results: *The fresh cream soup's hedonic test and protein content demonstrated no significant differences found between the formulas. Therefore, Formula 3 was the optimal choice, as it exhibited a higher protein content than the other formulas. The nutritional composition of the instant cream soup is as follows: protein (39.98%), fat (16.13%), carbohydrate (34.36%), water (4.80%), ash (4.74%), and total fiber (5.96%)..*

Conclusions: *This cream soup has been developed as a snack meal for the elderly. The panelists liked its taste, and it has a good nutritional profile.*

KEYWORD*:* *cream soup; mackerel fish; sweet corn; isolat soy protein; elderly*

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INTRODUCTION

Since 2021, Indonesia has entered an aging population structure, with 1 out of 10 people being an elderly person. This situation could lead to a second demographic bonus, where a significant portion of the elders remain productive and contribute to the country's economy. On the other hand, if the elders are unproductive and become a part of the vulnerable population, they become constraints for development (1). In 2021, the number of elderly individuals (aged 65 and above) in Indonesia reached 23,900,000 (10.82% of the total population), with the average life expectancy for this age group being 71.57 years (2). In comparison, the global average life expectancy in 2016 was 72 years, yet this figure was not aligned with the average healthy life expectancy of 63.3 years worldwide (3).

The age of elderly people is a significant factor influencing the complexity of physiological deterioration. As an elderly individual grows older, their body organ's function becomes intricate, leading to suboptimal body organ performance and a decline in both physical and cognitive abilities (4). With advancing age, their ability to swallow food becomes progressively more difficult, affecting the health and well-being of the elders (5). The health issues mentioned above will inevitably lead to a substantial increase in economic and social burdens (6).

A healthy diet is important for elders because it will help them stay fit and active. In addition, preventing malnutrition in the elders is also crucial, as malnutrition leads to various health problems (7). Several factors, as previously outlined, can hinder the ability of the elders to meet their nutritional requirements. Given the fundamental role of food in maintaining health and well-being, it is essential to modify the texture of the elderly's food diet to ensure their wellness.

Currently, only a few food products designed for the elders are available in the market, necessitating further development and adjustment to meet the nutritional requirements of this demographic. An adjusted design of food products

specifically made for elderly people can help fulfill their nutritional needs in a balanced manner while at the same time reducing the effects of malnutrition (8). In addition to appropriate textures, elders require a suitable menu structure that considers nutritional adequacy and nutrient consistency. Cream soup plays a significant role in elderly dietary management, offering a practical and nutritionally dense option where it can provide a substantial portion of the recommended daily allowance for various nutrients, including protein, vitamins, and minerals (9). The consumption of thick liquids, such as cream soups, is more suitable for this population since elders experience changes in chewing ability, taste preferences, nutritional needs, and the body's ability to absorb food (10). Instant cream soup provides an appealing food preparation solution for the elders, with the potential to incorporate functional ingredients tailored to meet the specific nutritional needs of this demographic. Adopting this approach may benefit the elders by supporting the prevention and improvement of their health conditions. Additionally, the drying method can be used to preserve the quality and stability of the food during storage (11). Cream soup can serve as an innovative-nutritionally balanced snack meal since the ingredients can be combined with sources of carbohydrates and protein. In this article, the product development utilizes sweet corn (Zea mays L. saccharata) as a carbohydrate source incorporated with mackerel fish (Rastrelliger sp) as a protein source to meet the protein needs of elderly people.

Maize has become a viable option due to its high production capacity, with Indonesia's maize production estimated at 14.4 million tons per year (12). Sweet corn is known to lose its sweetness within 48 hours of harvest. Thus, it requires processing to preserve its flavor. Apart from being a source of complex carbohydrates, sweet corn is a relatively rich source of carotenoids and tocopherols, the phytochemical with antioxidant properties that protect cells against oxidative stress and the emergence of degenerative diseases (13). While carotenoids in corn, including lutein and zeaxanthin, also possess potent antioxidant properties (14).

Mackerel is a nutrient-rich food with an economical price value (15). However, fish is one commodity that is highly susceptible to quality deterioration due to its highly perishable nature and its vulnerability to decay (16). The food processing to be instant soup cream is a way to protect the fish's nutrient content from degrading, and mackerel fish is chosen for its savory and delicious taste due to its rich protein and omega-3 contents. This study aims to develop the optimal formula for an instant cream soup of sweet corn and mackerel, with the addition of soy protein isolate, as a snack for elderly people. The aim is to create a high-nutritional food product with a delicious taste and simple preparation time.

MATERIALS AND METHODS

The experimental design employed in this study was a Completely Randomized Design (CRD) utilizing a single factor: the combination of maize and mackerel fish in three distinct levels. The corn source was taken from local farmers around the campus of IPB Dramaga and was of the sweet variety characterized by large and round kernels with bright color and soft texture. Furthermore, the corn must have a smooth external layer exhibiting no notable defects or damage. The mackerel fish source was obtained from Dramaga market and supermarket with characteristics of fresh fish as visible from clear eyes, fresh scent, no loose scales, tight fish skin with a bright color, and chewy meat texture (not mushy).

The research was carried out from January 2023 to March 2024, starting with manufacturing cream soup products at the Food Processing and Experimental Laboratory, Department of Public Nutrition, FEMA IPB, and drying the product at the SEAFAST center IPB. The organoleptic data collection (hedonic test and hedonic quality test) was held at the Organoleptic Laboratory, Department of Public Nutrition, FEMA IPB, and was conducted by 30 semi-trained panelists, all of whom were IPB University students. The requirements panelists were in healthy condition, did not have olfactory disorders, were not color blind, did not have psychological disorders, and had already received material or conducted organoleptic tests in prior time. The recruitment process involves completing a form filled with questions about personal data and the criteria required for panelists, such as asking whether the

applicant has previously participated in material testing or organoleptic testing. If the applicants answer "no," they will be disqualified immediately from the panelist pool. Conversely, those who indicate prior involvement in such activities will move on to the next stage of the selection process. Following this screening, the prospective panelists will be given a detailed explanation of the ingredients used to prepare the cream soup to identify individuals who may have an allergy to it. Once the prospective panelists have filled out the form, the researcher will review the submissions and select the most suitable candidates to become panelists. Meanwhile, The nutritional analyses (including moisture and ash content analysis by Gravimetric method, fat content by Soxhlet method, carbohydrates content (based on differences), and total fiber analysis by Enzymatic method) were conducted at the Laboratory of Chemistry and Food Analysis FEMA IPB.

The research was conducted through several stages, including the following: (1) formulation; (2) organoleptic analysis; (3) preparation of fresh and instant cream soup from the selected recipe; and (4) performance of various analyses, including proximate nutrient analysis and total fiber analysis. The formula and recipe standards in this study were calculated based on the snacks' contribution to the 2019 Recommended Daily Allowance (RDA) for elderly people (10%) and adjusted to the Indonesian National Standard (SNI) for instant cream soup (SNI 1-4967-1999). The estimation of the nutrient content, namely protein, fat, carbohydrates, and fiber, of each fresh cream soup formula was calculated using the Nutrisurvey application. The cream soup formula was prepared with three levels of fish addition (6%, 8%, and 10%) with the proportion of fish based on the optimization formula to obtain the maximum weight of mackerel that is acceptable for the consumers. The data about the cream soup formulas is presented in **Table 1**. The instant cream soup is prepared by using a drum dryer as an ideal apparatus to process the majority of heat-sensitive ingredients since it can ignite at a very high temperature within a second. The heating temperature set up was 130ºC with a drum speed of 31.68 seconds per rotation. The result was solid flakes or solid sheets of cream soup, which were then smoothened or mashed with a food processor and sieved by Mesh 14 equipment. Finally, the product was stored at room temperature (25ºC) in aluminum foil and zip lock packaging at room temperature (25ºC).

Figure 1. Sweet corn and mackerel instant cream soup with soy protein isolate addition

The hedonic test was conducted by presenting one sample at a time (F1, F2, and F3) using an aluminium foil cup and coded with three different random numbers. The samples were then rated by semi-trained panelists to express their preference level using a nine-point scale (ranging from "very strong dislike to "very strong like") to assess the attributes of texture, color, aroma, taste, mouthfeel, and aftertaste in each sample by marking a vertical line (straight) on the line provided. The completion of the hedonic test resulted in one selected formula, which later will undergo the drying and proximate nutrient analyses. Meanwhile, the gravimetric method is used to analyze the water content and ash, where its principle is based on weight measurement, which involves forming isolation and measuring the weight of the precipitate formation (18). Protein analysis was conducted using the micro Kjeldahl method, based on the principle of determining protein through the oxidation of carbonaceous materials and the conversion of nitrogen to ammonia (19). In this study, fat content was analyzed using the Soxhlet method, which involves extracting fat with a non-polar solvent (20) and carbohydrate content was determined by using a by-difference method based on calculating

Table 1. Sweet corn and mackerel instant cream soup formula with added isolate soy protein

Material	Unit	Comparison of sweet corn and mackerel		
		F1 (94:6)	F2 (92:8)	F3 (90:10)
Sweet corn	%	32.3	31.6	30.9
Mackerel fish	%	2.1	2.7	3.4
Isolate soy protein	%	5.5	5.5	5.5
Margarine	%	1.7	1.7	1.7
Wheat flour	%	1.7	1.7	1.7
Cooking cream	%	5.2	5.2	5.2

water, ash, fat, and protein content, whereas the total fiber analysis was carried out using the enzymatic method (21).

The data from this study were analyzed using two distinct statistical tests. The first statistic test was the one-way ANOVA, which was used to analyze the hedonic test and the protein data statistically. This analysis aimed to ascertain the effect of the sweet corn and mackerel ratio on the liking of the fresh cream soup as perceived by the panelists. The second statistical test was the paired sample t-test, employed to analyze the moisture, ash, protein, fat, carbohydrate, and total dietary fiber content in the selected formulas.

RESULTS AND DISCUSSIONS

Characteristics of Respondents

A hedonic test was conducted to determine the panelists' overall liking of the product and identify the optimal formula for the cream soup product. The sensory analysis was conducted on 30 semi-trained panelists at the Organoleptic Laboratory Department of Public Nutrition of IPB. The hedonic test comprised seven attributes: color, aroma, viscosity, taste, mouthfeel, aftertaste, and overall product. The results of the hedonic test for sweet corn and mackerel cream soup are presented in **Table 2**.

Table 1. Characteristics of Children (N=167)

F	hedonic test attributes						
	Colour	Aroma	Viscosity	Flavour	Mouthfeel	Aftertaste	Overall
1	6.56 ± 1.37[a]	6.68 ± 1.58[a]	6.73 ± 1.33[a]	6.44 ± 1.45[a]	6.35 ± 1.67[a]	5.83 ± 1.57[a]	6.80 ± 1.62[a]
2	6.85 ± 1.40[a]	6.33 ± 1.46[a]	6.56 ± 1.59[a]	6.21 ± 1.56[a]	6.25 ± 1.65[a]	5.93 ± 1.58[a]	6.74 ± 1.35[a]
3	6.18 ± 1.57[a]	6.09 ± 1.54[a]	6.37 ± 1.55[a]	6.28 ± 1.76[a]	5.95 ± 1.82[a]	5.99 ± 1.68[a]	6.60 ± 1.55[a]

Notes: F= Formula, F1 = 94% sweet corn and 6% mackerel fish, F2 = 92% sweet corn and 8% mackerel fish, F3 = 90% sweet corn and 10% mackerel fish, $p<0.05$ (significant), Sensory score using mean±standard deviation data, and values with the same superscript in one column indicate non-significant difference results.

One of the organoleptic characteristics of food products is color. Color is one of the determinants of whether a product is acceptable or not because the first impression is color visibility. If the product is less attractive or not acceptable, or different in color from its usual color, then consumers will be reluctant to taste or consume the food product. Moreover, consumers will only be interested in the product if it has a very good texture and taste (22). Based on Table 2, the color attributes of the three formulas were at a value of 6.18 to 6.85 (ranging from preferences of Somewhat like to Like), and the analysis results showed an insignificant difference where the color attribute from all cream soup formulas was acceptable to the panelists.

Table 2 presents the aroma profile of the three formulas, which exhibits a mean value of 6.09 to 6.68 (ranging from preferences of Somewhat like to Like), indicating the observed differences are not statistically significant. The term "aroma" is used to describe the olfactory sensations perceived through the sense of smell (the nose). The function of aroma is essential in food products since it is often the first sensory experience customers have of the given food. If

the aroma of a product is perceived as bland or pungent, it can influence consumer interest to be less in liking the product or reluctant to consume it (23).

Viscosity is defined as the food texture that a panel of judges assesses through taste. The result of a combination of several physical properties, including shape, size, and other elements that can be perceived by touch and taste (eye and mouth area), is referred to as texture (24). The viscosity of all cream soups was found to be within the range of 6.37 to 6.73, as seen in Table 2. The analysis results of the three formulas indicated insignificant differences, and the viscosity attribute in all cream soups was acceptable to the panelists.

Taste is another determinant factor for the liking preferences of panelists for the product. The consumer acceptance of the product depends on the food taste, where it will be obtained after the food enters the mouth (25). Based on Table 2, the panelists scored 6.21 to 6.44 (in preference of Somewhat like) on the three cream soup formulas; furthermore, the analysis showed insignificant differences between formulas, and the taste attributes of the cream soup were liked by the panelists.

Mouthfeel refers to the tactile sensation of food experienced in the mouth, which can stimulate sensory nerves on the tongue and taste buds. The panelists assigned a score of 5.95 to 6.35 (in preference of Somewhat similar) to the mouthfeel attribute, indicating a non-significant difference found between the three formulas. Overall, the panelists provided a favorable rating for the mouthfeel attribute.

Meanwhile, aftertaste is defined as food taste intensity that is perceived after it enters the throat (27); this attribute is commonly employed during organoleptic testing. The aftertaste of this product came from mackerel fish as the source of protein in the product where the three formulas exhibited less significant difference, and the aftertaste attribute is acceptable or has satisfactory taste according to the panelist with a value ranging between 5.83 and 5.99, indicating “Slight liking” preference.

The overall products are a result of the equilibrium state between various hedonic attributes evaluated in terms of their respective flavor profiles. As illustrated in Table 2, panelists assigned a score of 6.60 to 6.80 (preference of Like), indicating insignificant differences were found, and the product was well received in general. This study is consistent with findings from previous research, which was conducted by the addition of mackerel fish to biscuit products. Substitution of mackerel in biscuits at levels ranging from 0 % to 10 % has no significant impact on the overall acceptability of the product (28).

Table 3 presents data on the protein content of the cream soup, showing no significant differences among the three formulas. However, studies on elderly people in Indonesia reveal a concerning trend, with protein intake often being inadequate. Malnutrition prevalence ranges from 3.2% to 61%, with notable deficiencies in protein, calcium, and vitamin D intake (29). Factors such as disease history, energy intake, and protein intake have a significant correlation with elderly nutritional status (30). Therefore, the third formula was selected based on its higher protein content than the other two formulas. The results of the protein analysis of the fresh cream soup are presented in tabular form in **Table 3** below.

Table 3. Protein Content of Fresh Cream Soup

Formula	Protein (%)
1	6.63 ± 0.07[a]
2	6.69 ± 0.004[a]
3	7.03 ± 0.31[a]
p-value	0,214

Notes: F1 = 94% sweet corn and 6% mackerel fish, F2 = 92% sweet corn and 8% mackerel fish, F3 = 90% sweet corn and 10% mackerel fish, protein content using mean±standard deviation data, and values with the same superscript in one column indicate non-significant difference results.

The analyzed nutritional content was the parameters of proximate analysis (moisture, ash, protein, fat, and carbohydrate) and fiber analysis (soluble fiber, insoluble fiber, and total fiber). A

detailed explanation of the analysis result is presented in the following table (**Table 4**). Protein is beneficial in alleviating health issues associated with aging, including the loss of muscle mass and strength, dyslipidemia, bone mineral loss, and type 2 diabetes. Its role in enhancing muscle protein synthesis, promoting satiety (stomach fullness), optimizing growth factors, inhibiting inflammation, and regulating critical metabolic pathways makes protein valuable for disease prevention. Adequate intake of high-quality protein, alongside a healthy lifestyle, can contribute to a healthy aging process, help maintain muscle mass, and improve the recovery phase from illness. The protein content of this cream soup is derived from fish and soy protein isolate, which is utilized as an ingredient in the product. As illustrated in Table 4, instant cream soup exhibits a higher protein content (41.65% wb) than fresh cream soup (8.37% wb) due to water content differences between both products, where an increase in water content resulted in a corresponding rise of the protein content (32).

Table 4. Nutrition content of fresh and instant cream soup

Parameter	Fresh cream soup		Instant cream soup	
	wb	db	wb	db
Protein (%)	8.37 ± 0.13	46.84 ± 0.93	41.65 ±0.10	42.75 ± 1.25
Fat (%)	3.82 ± 0.07	21.38 ± 0.50	15.97 ± 0.54	16.94 ± 0.30
Carbohydrate (%)	4.78 ± 0.27	26.72 ± 1.41	32.66 ± 0.01	34.31 ± 0.07
Moisture (%)	82.13 ± 0.09	-	4.80 ± 0.16	-
Ash (%)	0.91 ± 0.01	5.07 ± 0.02	4.77 ± 0.05	5.01 ± 0.06
Total Fibre (%)	1.25 ± 0.01	6.97 ± 0.07	5.97 ± 0.01	6.27 ± 0.03

The dry basis column in **Table 4** indicates higher protein content exhibited from the fresh cream soup. This decline is attributable to protein denaturation from elevated temperature during the product drying process. The process of protein denaturation refers to a change or modification in the protein structure where the underlying cause was the heating process that reduces protein solubility and, as a consequence, also reduces the protein content from the food ingredients (33). The protein content of the product (instant cream soup) met the SNI standard, which requires a minimum of 10 % protein within the product, and this standard can be achieved by a contribution of protein source ingredient (in this study was mackerel fish), which has a protein content of 21-22% (34). Additionally, the protein isolate used in this study contains 92% protein.

Table 4 showed the fat content in the instant cream soup was 15.97 %. Thus, it fulfills the SNI criteria for instant cream soup products, where the requirement standard states that it must contain a minimum of 5 % fat. One of the most significant differences in food properties is present because of the fat content, which is an essential factor that must be considered in any food properties analysis. The occurring differences may become unfavorable, such as progressing rancidity. The fat content inside the cream soup was influenced by many additions of fat-rich ingredients such as cooking cream and margarine. Fresh cream soup has a lower fat content, as mentioned to be 3.825 (wb) when compared to instant cream soup (15.97 lb of fat). The high level of the fat content of the instant cream soup can be related to the drying process, which is held at an elevated temperature and results in water content reduction and an increase in the fat content of the product (35). From the dry basis fat analysis, it indicates less fat content inside the instant cream soup when compared to the fresh cream soup. Fat content reduction is attributed to the heating process during the drying process, which damages the fat content or alters its components. In line with this finding, the previous research also reported similar results where the drying corn process can reduce specific nutritional values, including fat content (36). Fat plays a significant role in forming food flavor, with various degradation processes contributing to this phenomenon (37). During the heating or drying process, the reduction in fat content is due to the oxidation of unsaturated fatty acids, leading to hydroperoxide formation. This formation breaks into volatile compounds, including aldehydes, ketones, alcohols, hydrocarbons, and acids (38).

The macronutrients, including carbohydrates, fat, and protein elements, are vital for optimum bodily function. Deficiencies of these nutrients can have a bad impact on physical and cognitive health (39). This study employs a by-difference method where the carbohydrate content is calculated by subtracting other nutrients from the total (40). This approach is affected by water, ash, protein, and ash proportions (41). As a consequence, increases in other nutrient contents will decrease the calculated carbohydrate content. Table 4 illustrates that the carbohydrate content in the fresh cream soup was found to be 26.72 % (db) when compared to the instant cream soup, as mentioned to be 34.31% (db). Thus, it can be concluded that the heating process will increase the bioavailability of the nutrients in food products, including carbohydrate nutrients (42).

The instant cream soup is experiencing a drying process in a drum dryer, enabling a visual comparison of the wet weight between the fresh and instant cream soups. The result of the water content inside the instant cream soup already met the SNI requirement, with a maximum value of 8 %. The stability of a product during storage is frequently linked to its water content. High water content provides a supportive environment for the multiplication of bacteria, molds, and yeasts, leading to alteration in the food product. As a result, food products with reduced water content into a specific limit will become dry and durable (43). Ash content is the total of non-organic components or minerals within the food ingredients (44). Ash content is considered to be representative of the residual minerals produced when the sample study underwent a combustion/heating process (45). The ash content is a significant difference between both products. As illustrated in **Table 4**, the ash content for instant cream soup was found to be 5.01 %(db), and the ash content for fresh cream soup was found to be 5.07% (db). A further study employing pumpkin cream soup with tempeh yielded the same result: the ash content of fresh cream soup was higher than the ash content of the instant cream soup (46). A drum dryer to produce instant cream soup resulted in a lower ash content, where it can be observed that the rising temperature from the heating process results in a more significant dissolution of minerals in the water. Furthermore, it was approved that the longer the heating/combustion time, the lower the water-soluble mineral concentration, and as a consequence, the ash content of the food ingredients (47) would be reduced. However, fresh cream soup contains a greater quantity of total fiber than instant cream soup. The following table presents the soluble and insoluble fiber content inside the cream soup product.

Table 5. Cream soup fiber analysis results

Type of fibre	Fresh cream soup	Instant cream soup
Insoluble fibre (%)	6.10 ± 0.050	4,92 ± 0.035
Soluble fibre (%)	0.87 ± 0.120	1,36 ± 0.007
Total fibre (%)	6.97 ± 0.070	6.27 ± 0.028

Dietary fiber benefits for elderly people include alleviating relief and prevention of symptoms associated with constipation and promoting the reduction of cholesterol, blood pressure, and systemic inflammation levels. It is crucial to consume sufficient fiber to ensure optimum cardiovascular health. Apart from it, dietary fiber able to control blood sugar level and reducing risk of developing diabetes (48).

Terms of soluble and insoluble dietary fibers are often used to describe types of fibers present in food ingredients where soluble dietary fibers have shown a higher reduction in developing risk of cardiovascular disease to a greater extent than insoluble dietary fibers (49). Insoluble dietary fibers can be fermented in the colon and become an essential process for maintaining colon health as they affect the composition of gut microbiota, which regulates the immune system (50).

The fiber content of this product is derived from sweet corn, which is the primary ingredient in this study. Sweet corn kernels contain a significant amount of dietary fiber, with insoluble fiber being the predominant type (51). The total fiber content was found to be lower in instant cream soups compared to fresh cream soups. This is attributed to the significant impact that thermal processes can have on the dietary fiber content of foods.

Additionally, heating has been observed to alter the proportion of soluble and insoluble fiber (52).

CONCLUSIONS AND RECOMMENDATIONS

The results of the hedonic test and the protein content of all formulas were found statistically to have no significant difference from one another. Therefore, formula three, which exhibited the highest protein content, was selected for processing into instant cream soup. The instant cream soup has been found to comply with the minimum and maximum limits for fat, protein, and water content outlined in the SNI requirements for instant cream soup. Although some nutrients have been reduced, the protein content remains unchanged, while the carbohydrate content has increased. This instant cream soup remains an appropriate snack meal for elderly people, as they can prepare it with minimal effort by themselves or other family members.

The product of sweet corn and mackerel cream soup combined with soy protein isolate has the potential to be developed as a supplementary food product to meet the nutritional requirements of the elders. Nevertheless, further analysis is required to observe the product's shelf life and chemical composition. Another further analysis will be a great aid for investigating any alternative processing technique in handling mackerel fish, such as the fish smoked process, to reduce the fishy odor of the cream soup product.

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