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The Effect of Tempeh Substitution and Carrot (*Daucus carota* L.*)* Addition on The Acceptance and Nutrition of *Lempuk* Nugget (*Gobiopterus sp.)* as A Snack for PEM Patient

Danish Rafi Surenda[1], Asrul Bahar[1]*
1) Department of Nutrition, Universitas Negeri Surabaya, Surabaya, 60231, Indonesia
**) Corresponding Author: danish.18051@mhs.unesa.ac.id*

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***Abstract*— This study aims to: (1) determine the effect of the substitution of Tempeh and the addition of Carrots on the acceptability of Nugget *Lempuk* as a snack for PEM patients, (2) identify the nutritional content of the best formulation of soft fish nugget from the hedonic test results. This study is an experimental study using a RAL research design with 6 treatments. The treatments involved factor T as a substitute for tempeh with 3 proportions, namely 25%, 35%, and 45%. In addition, factor W was the addition of carrots with 2 proportions, namely 75% and 100%. The panelists in this study were expert panelists and untrained panelists. The data collection technique in this study employed the hedonic test. Organoleptic data were statistically analyzed using a non-parametric test, namely the Kruskal-Wallis test, and continued with the Mann-Whitney test with a confidence interval <0.05. The results of statistical analysis showed that the T1W2 nugget with 25% tempeh substitution and 100% carrot addition was the best treatment based on the results of De Garmo test with a productivity value of 0.946. The analysis of nutritional content was carried out at the Laboratory of the Surabaya Industrial Standardization and Research Institute. This analysis of protein content using the Kjeldahl test marked a value of 10.60%, and another analysis of calories employing the Bomb Calorimeter test marked a value of 395.80 Kcal/100g. UV-vis spectrophotometry test on Vitamin A marked a value of 135.65 mg/100g. Finally, the Gravimetry test on fibre identified a value of 4.16%.**

Keywords — Nugget, Lempuk Fish, Tempeh, Carrot, PEU

I. INTRODUCTION

Nutritional problems are known to be prevalent in every country. Nutritional problems in Indonesia are very diverse, such as lack of protein energy malnutrition (PEM), obesity, disorders due to iodine deficiency (IDA), lack of vitamin A (KVA), and anemia [1].

PEM is a nutritional problem caused by limited energy and protein intake in meeting daily needs, lower than the recommended Nutritional Adequacy Ratio (RDA). The most obvious feature of PEM is suboptimal growth [2]. Toddlers who have mild or moderate PEM tend to appear thin and their weight generally falls within the unhealthy weight range. Children are categorized to suffer from PEM if their weight is less than 80% of the WHO-NCHS standard of body mass index-for-age (BMI-for-age). Mild PEM falls in the BMI range of 70% to 79.9% and moderate PEM falls in BMI ranging from 60% to 69.9%, according to WHO-NCHS Standard [1].

According to [3], PEM is the lack of nutrition caused by the insufficient consumption of food containing energy and protein which is characterized by certain health problems. In addition to protein insufficiency, individuals suffering from PEM also experience vitamin A deficiency due to limited distribution, absorption, and conversion of vitamin A, which can lead to an increased risk of infectious diseases and worsened PEM conditions, especially among toddlers [4]. Enzymes in the body cannot digest fiber, and feces become larger due to bacteria, causing the rectum to defecate. Furthermore, issues associated with enzymes can lead to diarrhea or other digestive problems [5]. Nugget is a well-known fast food preparation in such products as burgers, sausages, hot dogs, pizzas, and corned beef. The nuggets often found in the market are chicken nuggets, meat nuggets, and fish nuggets. However, chicken nugget is the most popular [6].

Tempeh is a fermented food native to Indonesia that is high in protein, especially animal protein, such as chicken, beef, eggs, and burgers [7] Many health benefits of consuming tempeh have been reported, including improving digestive system, increasing intestinal growth, while reducing the incidence of diarrhea, antioxidant properties, and the risk of chronic degenerative diseases [8][33]. The protein content in tempeh can increase the protein content of *lempuk* nugget for every 100 g of tempeh contains 19 g of protein [9]. Tempeh also provides Vitamin A and fiber to *lempuk* nugget. The content of vitamin A in tempeh is 1 RE, while the fiber content is 1.4 g per 100 g material [9]

[10] explains that carrots (*Daucus carota* L) are yellowish-orange vegetables with a hard wood-like texture. [10] also explains that carrots are a type of tuber, taproot, and short stem. Carrots tend to be sweet and crunchy when consumed directly. The addition of carrots to *lempuk* nugget serves to increase its taste and fiber content. Carrots have attractive color, distinctive aroma, and sweet taste so they can cover the shortcomings of

lempuk fish which tend to give dark color and fishy aroma during the process of making nuggets. According to [11], carrots contain a high amount of β-carotene (9600 µg), significantly more substantial than other vegetables, such as melon (3575 µg) and broccoli (1449 µg). The fiber content in carrots is fairly high, at 4 g per 100 g material, so it can maintain healthy digestion [12].

Lempuk nugget with tempeh substitution and the addition of carrots is an innovation to overcome PEM. The substitution of tempeh and the addition of carrots can increase the quality of protein, vitamin A, fiber, and the acceptability of *lempuk* nuggets. In response to this issue, the present study aims at identifying the best proportion of tempeh and carrots in *lempuk* nuggets as one measure to address PEM. The results of this study are expected to optimize *lempuk* nuggets as one ingredient in processed products to overcome the problem of Protein Energy Malnutrition (PEM).

II. MATERIALS AND METHODS

A. Materials

The materials used in this study were fresh *lempuk* fish obtained from Grati lake of Pasuruan regency in Indonesia, tempeh, carrots, eggs, wheat flour, tapioca flour, and breadcrumbs. Additional ingredients included shallots, garlic, onions, scallions, pepper, salt, broth powder, and ice cubes.

B. Equipment

The equipment used in the production of *lempuk* nuggets involved a blender, basin (diameter 28 cm), digital scale, spoon, mortar, baking dish (16 x 16 cm), gas compost (Rinnai, 70 x 38 x 15 cm), pan (diameter 24 cm).), knife, bowl (8.5 cm diameter), and refrigerator (LG^{TM})

C. Research Design

This study used a completely randomized design (CRD) with 2 factors: the substitution of tempeh (25%, 35%, and 45%), and the addition of carrots (75% and 100%). Details of the tempeh substitution and the addition of carrots are presented in Table I.

The data obtained were processed using Kruskal Wallis and Mann Whitney with a confidence interval set at $p<0.05$ to determine the significant effect of each treatment. This study used the De Garmo test to determine the best treatment.

TABLE I. RESEARCH DESIGN

Tempeh Substitution	**Carrot Addition**	
	75%	**100%**
25%	T1W1	T1W2
35%	T2W1	T2W2
45%	T3W1	T3W2

Description:
T1W1 = 25% tempeh substitution and 75% carrot addition
T1W2 = 25% tempeh substitution and 100% carrot addition
T2W1 = 35% tempeh substitution and 75% carrot addition
T2W2 = 35% tempeh substitution and 100% carrot addition
T3W1 = 45% tempeh substitution and 75% carrot addition
T3W2 = 45% tempeh substitution and 100% carrot addition

D. Procedure

The production of lempuk nugget

First, the ingredients need to be prepared in a specific amount. These include 250 g of *lempuk* fish, tempeh (25%, 35%, 45%), carrots (75% and 100%), 50 g garlic, 30 g shallots, onions, 35 g onions, 50 g scallions, 5 g pepper, 10 g salt, 5 g broth powder, and 50 g eggs. These ingredients are then ground using a chopper by adding approximately 20 g ice cube to ascertain that the dough temperature is below 15° C. The dough is stirred with 75 g flour and 25 g tapioca flour to reach a homogeneous mixture. The homogeneous dough is put into the prepared pan to be steamed. The steaming process takes approximately 30 minutes at a temperature between 66°C and 82° C. After steaming, the dough needs to rest for 10 minutes for the cooling process before the cutting and breading process. The dough will then be cut with a thickness of 6 mm in a size of 3 x 1 cm. The breading process is done by preparing flour, breadcrumbs, and eggs. The pieces of dough are coated with flour and egg before being coated with breadcrumbs. The dough that has passed the breading process is stored in the refrigerator at a temperature of -18° C for at least 1 hour. The frying process requires a temperature of 185° C for approximately 2 minutes.

E. Analysis Method

The panelist's level of preference for *lempuk* nuggets was obtained through organoleptic tests. The organoleptic test was a preference test (hedonic) on aroma, color, taste, and texture using a 5-option scale: (1), dislike extremely (2), dislike slightly, (3) neither like nor dislike (4), like slightly, and (5) like extremely. Data processing using the Kruskal-Wallis test. If a significant difference is identified, the Mann-Whitney test will be performed. The best formula is determined using De Garmo test. The analysis for the best nugget formula will be followed by a series of chemical tests. These involved which include protein content using the Kjeldahl method, calorie content using the Bomb Calorimeter test, vitamin A levels using UV-vis Spectrophotometry test, and fiber content using Gravimetric test. Nutrient fulfillment is calculated by referring to recommended dietary allowance (RDA) [13]. This research has been approved by the Health Research Ethics Commission at the Faculty of Dentistry, Airlangga University, with ethics reference number 594/HRECC.FODM/XI/2021.

III. RESULT AND DISCUSSION

A. *Lempuk* Nugget Receptivity

Aroma

The results of the research on the panelists on the preference level for the aroma of *lempuk* nuggets are presented in Table II.

TABLE II. MEAN OF PREFERENCE LEVEL OF LEMPUK NUGGET AROMA

Treatment	N	Mean
25%:75%	50	142.74
35%:75%	50	141.28
45%:75%	50	145.33
25%:100%	50	171.04
35%:100%	50	132.04
45%:100%	50	170.57
Total	300	

Table II shows panelists' preference level for the aroma of *lempuk* nugget. The analysis results of *lempuk* nugget color document a range mean from 132.04 to 171.04 (like slightly to like). The highest mean for aroma was found in the 25%:100% formula, marked at 171.04, while the lowest mean was found in the 35%:100% formula.

Kruskal-Wallis test identified no significant difference (p=0.075) in each of the tested formulas according to the characteristics of nugget aroma. Thus, the hypothesis which stated that the substitution of tempeh and the addition of carrots affected the aroma of *lempuk* nugget was rejected, therefore nullifying the need for further test.

Research conducted by [14] demonstrates that the aroma of fish nuggets is influenced by not only the amount of fish meat or the treatment given but also the spices and seasonings added.

Garlic, shallots, and onions which are used in making nuggets influence nugget aroma. These onions contain a substance called Allicin which gives a pungent aroma [15].

Color

The results of the color test based on panelist preference are shown in Table III below.

TABLE III. MEAN OF LEMPUK NUGGET COLOR

Treatment	N	Mean
25%:75%	50	122.54
35%:75%	50	133.81
45%:75%	50	154.18
25%:100%	50	160.81
35%:100%	50	167.22
45%:100%	50	164.44
Total	300	

Table III shows the distribution of panelists' preferences on the color characteristics of *lempuk* nuggets. The analysis results mark the mean ranging from 122.54 to 167.22 (like slightly to like). The highest mean was found in the 35%:100% treatment marked at 167.22, while the lowest one was found in the 25%:75% treatment at 122.54.

Kruskal-Wallis test found a significant difference (p=0.030) in each of the tested treatments according to *lempuk* nugget color, so further analysis was carried out using the Mann-Whitney test. Further test results showed that there were differences in the level of preference between 25%:75% and 35%:75% (p=0.024), 25%:75% and 45%:75% (p=0.045), 25%:75% and 35%:100% (p=0.007), 25%:75% and 45%:100% (p=0.015), and 25%:75% and 35%:100% (p=0.037). From these results, the color change was influenced by the amount of added carrots to the nugget, while tempeh substitution did not affect the color.

The orange color in carrots is β-carotene. β-carotene is a pigment that gives an orange color to vegetables or fruit and is one of the natural dyes [16]. While tempeh has a white color that comes from the mycelia of molds, the color does not affect the nuggets.

The above findings are in line with research conducted by [17] which states that the proportion of adding carrots to nuggets can affect nugget color because the yellowish color found in carrots is dependent on β-carotene. Meanwhile, [18] points out that the carotenoid addition of carrots to chicken nuggets increases the brightness, yellowness, and redness of related products.

Taste

The results of the taste test based on panelist preference are presented in Table IV below.

TABLE IV. MEAN OF LEMPUK NUGGET TASTE

Treatment	N	Mean
25%:75%	50	122.45
35%:75%	50	156.16
45%:75%	50	129.96
25%:100%	50	177.60
35%:100%	50	156.16
45%:100%	50	160.67
Total	300	

Table IV shows the mean taste test score based on the panelists' judgment. The analysis results reported a mean range from 122.45 to 177.60 (somewhat like to like). The highest mean was found in the 25%:100% formula with a value of 177.60, while the lowest mean for taste was found in the 25:75% formula with a value of 122.45.

Based on statistical tests using the Kruskal-Wallis test, a significant difference (p=0.008) in each of the tested formulas was identified according to the taste characteristics of soft nuggets, so a follow-up analysis was performed using the Mann-Whitney test. Further test results showed that there were differences between the following treatments: 25%:75% and 35%:75% (p=0.023), 25%:75% and 25%:100% (p=0.001), 25%:75% and 35%:100% (p=0.023), 25%:75% and 45%:100% (p=0.025), and 45%:75% and 25%:100% (p=0.008). These results acknowledge the effect of adding carrot and tempeh substitution to *lempuk* nuggets.

Carrots tend to be sweet [6] while tempeh is rather plain. Thus, the addition of carrots and tempeh substitutions affected *lempuk* nugget taste.

This finding is in line with research conducted by [17] reporting that higher addition of carrots to nuggets can add to the impression of a sweet carrot taste and reduce the taste of tuna in nuggets. Meanwhile, the research by [6] stated that the dominant proportion of tempeh can affect the taste and aroma of nuggets since these two ingredients have a strong taste.

In addition to the substitution of tempeh and the addition of carrots, salt, shallots, garlic, pepper, and flavorings also play a role in varying the taste of nuggets. This helps to diversify the resultant taste of nuggets [14].

Texture

The results of the texture test based on panelist preference are presented in Table V below.

TABLE V. MEAN OF LEMPUK NUGGET TEXTURE

Treatment	N	Mean
25%:75%	50	136.96
35%:75%	50	147.96
45%:75%	50	124.78
25%:100%	50	176.22
35%:100%	50	158.04
45%:100%	50	159.04
Total	300	

Table V shows the distribution of panelists' preference for texture characteristics of *lempuk* nugget. The analysis results documented on mean range from 124.78 to 176.22 (slightly like to like). The highest mean for texture was found in the 25%:100% formula marked at 175.22, while the lowest one was found in the 45%:75% formula identified at 124.78.

Kruskal-Wallis test identified a significant difference (p=0.030) in each of the tested formulas in terms of texture characteristics. As such, a Mann-Whitney test was performed for further analysis, the results of which confirmed a significant difference between the following treatments: 25%:75% and 25%:100% (p=0.020), 45%:75% and 25%:100% (p=0.002), 45%:75% and 35%:100% (p=0.040), and 45%:75% and 45%:100% (p=0.040). The substitution of tempeh and the addition of carrot to *lempuk* nuggets have been proven influential to the resulting texture in each formulation.

The texture of carrot tubers tends to be crunchy, not too soft, and hard [6]. The hardened texture is caused by the lack of water content in the product [6], while tempeh has a dense and soft texture [19]. The addition of 2% natural carrot fiber in nuggets improves water retention [20]. The addition of carrots and tempeh substitution can improve the texture of fish-based nuggets.

These findings resonate with [17] who argue that the proportion of carrots affects water content, thus making the nugget texture soft. Meanwhile, the research by [6] states that the high composition of tempeh makes the nuggets a bit chewy and sticky, so the proportion of tempeh in the nuggets affects the elasticity attribute.

In addition to carrots and tempeh, the composition of wheat flour and tapioca flour also affects the nugget elasticity. Wheat flour contains protein in the form of gluten, which functions in determining the elasticity of foods made from wheat. The gluten content determines the elasticity and texture of nuggets so that their use is adjusted to the type and specifications of the dough to be made [21]. According to [22], the proportion of wheat flour affects the occurrence of cracks in the dough in that a higher proportion of wheat flour results in a more homogeneous dough. Meanwhile, [23] contend that the use of tapioca flour can improve the texture of chicken nuggets because this type of starchy flour has large starch granules, which slows down the gelatinization process and affects the texture of chicken nuggets produced.

B. The Best Product Determination

The best product was determined based on the highest Productivity Value (PV). The present study employed De Garmo test to identify the best product, the results of which can be seen in Table VI.

TABLE VI. DE GARMO TEST

Treatment	Productivity Value
25%:75%	0,163
35%:75%	0,297
45%:75%	0,219
25%:100%	0,946
35%:100%	0,595
45%:100%	0,752

Based on the De Garmo test, the best formulation is found in the 25%:100% ratio with a PV of 0.946, while the worst formulation is found in the 25%:75% ratio with a PV of 0.163. The treatment 25%:100% is a *lempuk* nugget formulation with 25% tempeh substitution and 100% carrot addition. This is the formulation with the highest mean of preference level, namely aroma (171.04), taste (177.60), and texture (176.22). Furthermore, the ratio of 25%:100% is characterized by a slightly dark color, dense and chewy texture, and a mild taste. The best nugget formulation recipe can be seen in Table VI.

TABLE VII. SELECTED FORMULA SOFT NUGGETS RECIPE (T2W1 TREATMENT)

Ingredients	25%:100% Formula
Lempuk fish (g)	93.75
Carrot (g)	125
Tempeh (g)	31.25
Leek (g)	50
Onion (g)	35
Garlic (g)	50
Shallot (g)	30
Flour (g)	75
Tapioca flour (g)	25
Bread crumb (g)	100
Salt (g)	10
Pepper (g)	5
Broth powder (g)	5
Eggs (g)	50

C. The Nutritional Content of *Lempuk* Nugget

Nutritional Content

Chemical tests on the best *lempuk* nugget products were carried out to determine the content of protein, calories, vitamin A, and fiber in it. The test results were compared with the nutritional content of nuggets based on [24] to determine the feasibility of the modified nugget product. The comparison of the test results of the nutritional content test results can be seen in Table VIII.

TABLE VIII. NUTRITIONAL CONTENT OF BEST LEMPUK NUGGET WITH TEMPEH SUBSTITUTION AND CARROT ADDITION PER 100G INGREDIENTS

Nutritional Content	SNI Standard (2014)	25%:100% Formula
Protein (g)	9	10.6
Calories (g)	-	395.8
Vitamin A (g)	-	135.65
Fiber (g)	-	4.16

Protein Content

Addressing PEM requires a high intake of protein in an easily digestible form. Proteins function as building blocks and repair damaged tissues. Snacks contribute as much as 10% of nutritional needs in a day [25]. *Lempuk* nuggets contain 10.6 g protein per 100 g ingredients. One serving of soft nuggets (90 grams) would approximately contain 9.54 g of protein. The following is a table of protein requirements based on [26] in comparison to the protein content of soft fish nuggets per 90 g.

TABLE IX. FULFILLMENT OF PROTEIN NEEDS FOR THE PROTEIN CONTENT OF LEMPUK NUGGET

Age	10% needs based on RDA (grams)	Intake (%)	Portion of Meeting Needs
1-3 years	2	477	0.20
4-6 years	2.5	381.6	0.26
7-9 years	4	238.5	0.41

Based on [26], the protein requirements for children aged 1-3 years, 4-5 years, and 7-9 years are 2 g, 2.5 g, and 4 g, respectively. One portion of the best modified *lempuk* nugget (90 g) can meet 477% of the daily protein needs of children aged 1-3 years, 381.6% of the daily protein needs of children aged 4-6, and 238.5% of the daily protein needs of children aged 7 -9 years. The fulfillment of daily protein needs requires around 0.20 servings of the best modified *lempuk* nugget for children aged 1-3 years, 0.26 servings for children 4-6 years old, and 0.41 servings for children aged 7-9 years old. The average protein requirement of Indonesian people is 57 g/day, and 1 portion of the best tender nugget (90 g) can meet 16.73% of the average protein requirement among Indonesians. By implication, it takes 5.97 servings per day to meet the average dietary requirement [26].

The amount of protein in the best modified nugget was influenced by tempeh and *lempuk* fish. The ingredient contributing the most protein content is tempeh. Tempeh contains 20.8 g protein [27]. Although it is included in vegetable protein, the protein content in tempeh has good digestibility, and the amino acid chain is almost similar to that in animal protein [28]. The second-largest protein contributor to modified nuggets is *lempuk* fish. One-hundred grams of *lempuk* fish contains 11.2 grams of animal protein with a complex amino acid component.

According to [24], a quality modified nugget needs to contain a minimum of 9 g protein, while the protein content of the best modified *lempuk* nugget is higher than that of standard nugget, which is 10.6 grams. It can be concluded that the modified *lempuk* nugget has fulfilled the protein quality requirements.

Calorie Content

Snacks contribute as much as 10% of nutritional needs in a day [25]. The calorie content of the best-modified nuggets is 395.80 Kcal per 100 g material. One serving (90 g) offers the calorie content of *lempuk* nugget at 356.22 kcal. The following is a table showing calorie needs based on the 2019 RDA compared to the calorie content of *lempuk* nugget per 90 g.

TABLE X. FULFILLMENT OF CALORIE NEEDS FOR THE PROTEIN CONTENT OF LEMPUK NUGGET

Age	10% Needs based on RDA (kcal)	Intake (%)	Portion of Meeting Needs
1-3 years	135	263.8	0.37
4-6 years	140	254.4	0.39
7-9 years	165	215.8	0.46

Lempuk nuggets consumed once a day will meet the calorie needs of 16.9%, and the average energy requirement for the Indonesian people is 2100 Kcal/day [26]. Children aged 7-9 have an average energy requirement of 165 Kcal/day, so the consumption of 1 serving of *lempuk* nugget a day will meet the energy needs of 215.8% [26]. Energy need for children aged 4-6 years is 140Kcal/day and that for children aged 1-3 years is 135 Kcal/day. As such, one portion of *lempuk* nugget as a snack can meet 263.8% of the needs of children aged 1-3 years and 254.4% of protein needs for children aged 4-6 years [26]. Fulfillment of calories for PEM is certainly the main solution to overcome this problem.

Vitamin A Content

Snacks contribute 10% of nutritional needs in a day [25]. The content of vitamin A in the best nugget is 135.65 mg or 135.65 RE per 100 grams of material, whereas one serving of *lempuk* nugget (90 grams) provides 122.1 RE. The following is a table of required amount of vitamin A based on [26] compared to the Vitamin A content of *lempuk* nugget per 90 g.

TABLE XI. FULFILLMENT OF VITAMIN A CONTENT OF LEMPUK NUGGET

Age	10% Needs based on RDA (RE)	Intake (%)	Portion of Meeting Needs
1-3 years	40	305.2	0.32
4-6 years	45	271.3	0.36
7-9 years	50	244.2	0.40

According to [26], the need for vitamin A in children aged 1-3 years is 40 RE, those aged 4-6 years requires 45 RE, and those aged 7-9 years need 50 RE. Thus, 1 serving of *lempuk* nugget can meet the required vitamin A by 305.2% for children aged 1-3 years, 271.3% for children aged 4-6 years, and 244.2% for children aged 7-9 years. To meet the needs of vitamin A, 0.32 serving of *lempuk* nuggets are needed per day for children aged 1-3 years, 0.36 serving of *lempuk* nuggets per day for children aged 4-6 years, and 0.40 servings of *lempuk* nuggets per day for children aged 7- 9 years.

Vitamin A plays an important role in ensuring and improving human health, especially in the body's immune function whose mechanism is not yet known [29]. Thus, a lack

of vitamin A will have an impact on the growth and development of children. The content of vitamin A in the best formulation of nuggets is influenced by the composition of carrots. Carrots contain β-carotene which can be synthesized into vitamin A. When the body requires a huge intake of vitamin A intake [30]. Carrots contain 3.78 mcg of β-carotene [27].

Lack of vitamin A intake in childhood usually occurs in children who suffer from Protein Energy Malnutrition (PEM) or poor nutrition as a result of poor nutrient intake, including micronutrients in this case vitamin A [31]. Children who suffer from vitamin A deficiency are very susceptible to infection. Acute respiratory tract, measles, chickenpox, diarrhea, and other infections due to decreased child immunity are common infections in children who are deficient in vitamin A. Thus, the link between PEM and vitamin A intake is very important to consider in fulfilling Vitamin A intake in children.

Fiber Content

Snacks contribute as much as 10% of nutritional needs in a day [25]. The fiber content in the best nugget is 4.16 g per 100 g material. One serving of *lempuk* nugget (90 g) contains 3.6 g fiber. The following table show how these needs vary [26] compared to the fiber content of *lempuk* nugget per 90 g.

TABLE XII. FULFILLMENT OF FIBER NEEDS FOR THE PROTEIN CONTENT OF LEMPUK NUGGET

Age	10% Needs based on RDA (grams)	Intake (%)	Portion of Meeting Needs
1-3 years	1.9	189.4	0.52
4-6 years	2	180	0.55
7-9 years	2.3	156.5	0.63

According to [26], 1.9 g fibre is required for the need for children aged 1-3 years, while those aged 4-6 years require 2 g. Children aged 7-9 years require 2.3 g fibre. One serving of *lempuk* nugget can meet the fiber needs of 189.4% for children aged 1-3 years, 180% for children aged 4-6 years, and 156.5% for children aged 7-9 years. To meet the fiber needs, 0.52 servings of *lempuk* nuggets are needed per day for children aged 1-3 years, 0.55 servings of *lempuk* nuggets for children aged 4-6 years, and 0.63 servings for children aged 7-9 years.

Fiber is a substance found in plants and cannot be digested or absorbed by the body [5][32]. From this conclusion, it can be seen that fiber serves to facilitate digestion and prevent colon cancer. Good processed foods have good digestibility. The best modified *lempuk* nugget demonstrates a composition of ingredients that can increase the digestibility value of these foods, such as carrots and tempeh. The mold in tempeh produces digestive enzymes so that the nutrients contained in tempeh are easier to digest [32]. Carrots have a fiber content of 1 gram [27].

Fiber is a part of food that is not easily absorbed and its nutritional contribution can be neglected, but dietary fiber has an important function that cannot be replaced by other substances [5][33]. Dietary fiber, which mainly consists of hemicellulose, lignin, and cellulose, is largely indigestible or broken down by bacteria and enzymes in the digestive tract. Thus, it can cause a short transit time for feces, and this short transit time also causes contact between irritating substances and the colorectal mucosa to be shortened. These account for why fibre helps to prevent the occurrence of diseases in the colon and rectum [5]. From its function, fiber can minimize the problem of PEM which is accompanied by digestive problems.

[24] does not include quality standards of calories, vitamin A, and fiber so there is no standard benchmark for some of these nutritional values in modified nuggets.

IV. CONCLUSION

The substitution of tempeh and the addition of carrots affect the acceptability of *lempuk* nuggets as evaluated in terms of color, taste, and texture. However, these ingredients do not affect the aroma of the nuggets. The results of laboratory tests can be seen that the protein, calories, vitamin A, and fiber content in the best modified soft nugget per 100 grams are 10.6 grams, 395.8 kcal, 135.65 mg, and 4.16 grams.

REFERENCES

[1] Supriasa, *Penilaian status gizi*. Jakarta: EGC, 2014.

[2] M. A. Masrizal, "Effects of protein-energy malnutrition on the immune system," *MAKARA Sci. Ser.*, vol. 7, no. 2, pp. 69–73, 2003, doi: 10.7454/mss.v7i2.325.

[3] Departemen Kesehatan RI, *Pedoman tata laksana KEP pada anak di puskesmas dan di rumah tangga edisi revisi*. Jakarta, 1999.

[4] M. J. Bruins *et al.*, "Addressing the risk of inadequate and excessive micronutrient intakes: traditional versus new approaches to setting adequate and safe micronutrient levels in foods," *Food Nutr. Res.*, vol. 59, no. 1, p. 26020, 2015, doi: 10.3402/fnr.v58.26020.

[5] C. M. Kusharto, "Serat makanan dan peranannya bagi kesehatan," *J. Gizi dan Pangan*, vol. 1, no. 2, pp. 45–54, 2006.

[6] A. Wibowo, F. Hamzah, and V. S. Johan, "Pemanfaatan wortel (Daucus carota L) dalam meningkatkan mutu nugget tempe," *J. Sagu*, vol. 13, no. 2, pp. 27–34, 2014.

[7] W. Shurtleff and A. Aoyagi, *The book of tempeh (1st ed.)*. New York: HarperCollins Publishers, 1979.

[8] M. J. R. Nout and J. L. Kiers, "Tempe fermentation, innovation and functionality: update into the third millennium," *J. Appl. Microbiol.*, vol. 98, no. 4, pp. 789–805, 2005.

[9] J. Erhardt, "NutriSurvey for Windows." UI, SEAMEOTROPMED, 2007.

[10] S. U. Margaretha Sitepu, "Pemanfaatan ikan bandeng (chanos chanos forrskal), wortel dan jagung manis pada pembuatan nugget, kandungan gizi dan daya terimanya," Universitas Sumatera Utara, 2018.

[11] T. Suojala and O. Junttila, "University of helsinki department of plant production Section of Horticulture Pre-and postharvest development of carrot yield and quality," vol. 11, no. 2, 2000.

[12] Rusilanti and C. . Kusharto, *Sehat dengan makanan berserat*. Jakarta: Agromedia Pustaka, 2007.

[13] T. M. Nu'man and A. Bahar, "Tingkat kesukaan dan nilai gizi cookies dengan penambahan tepung daun katuk dan tepung daun kelor untuk ibu menyusui," *J. Agroteknologi*, vol. 15, no. 02, pp. 94–105, 2021.

[14] W. Eni, L. Karimuna, and K. T. Isamu, "Pengaruh formulasi tepung kedelai dan tepung tapioka terhadap karakteristik organoleptik dan nilai gizi nugget ikan kakap putih (Lates carcarifer, Bloch)," *J. Sains dan Teknol. Pangan*, vol. 2, no. 3, pp. 615–630, 2017.

[15] S. E. Bae, S. Y. Cho, Y. D. Won, S. H. Lee, and H. J. Park, "Changes in S-allyl cysteine contents and physicochemical properties of black garlic during heat treatment," *Food Sci. Technol.*, vol. 55, pp. 397–402, 2014.

[16] S. S. Trianto, S. Y. Lestyorini, and Margono, "Ekstraksi zat warna alami wortel (Daucus Carota)menggunakan pelarut air," *Ekuilibium*, vol. 13, no. 2, pp. 51–54, 2014, doi: 10.20961/ekuilibrium.v13i2.2160.

[17] R. Lestari and N. Mustika, "Pengaruh penambahan wortel (Daucus carota l) terhadap mutu organoleptik dan kadar serat nugget ikan tongkol (Euthynus aletrates)," *Pros. Semin. Kesehat. Perintis*, vol. 3, no. 1, pp. 46–51, 2020.

[18] S. S. Bhosale, A. K. Biswas, J. Sahoo, M. K. Chatli, D. K. Sharma, and S. S. Sikka, "Quality evaluation of functional chicken nuggets incorporated with ground carrot and mashed sweet potato," *Food Sci. Technol. Int.*, vol. 17, no. 3, pp. 233–239, 2011, doi: 10.1177/1082013210382339.

[19] S. R. Dewi and S. Aziz, "Isolasi Rhizopus oligosporus pada beberapa inokulum tempe di Kabupaten Banyumas," *Molekul*, vol. 6, no. 2, pp. 93–104, 2011.

[20] S. K. Mendiratta, A. T. Shinde, and B. G. Mane, "Effect of added vegetable (carrot, radish and capsicum) as functional ingredients in mutton nuggets," *J. Meat Sci. Technol.*, vol. 1, no. 2, pp. 71–76, 2013, [Online]. Available: www.jakraya.com/journal/jmst.

[21] B. D. Nugraha, "Sifat fisiokimia dan organoleptik nugget ayam dengan jenis tepung yang berbeda," Universitas Semarang, 2019.

[22] S. Dahal, A. Dangal, M. Pradhananga, D. Timsina, and P. Timsina, "The preparation and quality evaluation of biscuit using composite flour by mixing wheat flour, chickpea flour, and Peanut flour," *Int. J. Food, Agric. Nat. Resour.*, vol. 3, no. 1, pp. 14–19, 2022, doi: 10.46676/ij-fanres.v3i1.58.

[23] S. Sakul and S. Komansilan, "Pengaruh penggunaan beberapa jenis filler terhadap palatabilitas chicken nugget ayam petelur afkir," *Zootec*, vol. 38, no. 2, pp. 368–378, 2018.

[24] S. N. I. SNI, *Naget ayam (chicken nugget)*. Jakarta: BSN, 2014.

[25] Y. Kristianto, *Panduan memilih dan belanja makanan sehat*. Yogyakarta: Nailil Printika, 2010.

[26] AKG, *Angka kecukupan gizi 2019*. Jakarta: Kementrian Kesehatan Republik Indonesia, 2019.

[27] Departemen Kesehatan RI, *DKBM (Daftar komposisi bahan makanan)*. Jakarta: Departemen Kesehatan RI, 2017.

[28] E. Suryanto, *Penggunaan protein kedelai pada industri olahan daging*. Yogyakarta: Fakultas Peternakan UGM, 2011.

[29] Azrimaidaliza, "Vitamin A, imunitas dan kaitannya dengan penyakit infeksi," *J. Kesehat. Masy.*, vol. 1, no. 2, pp. 90–96, 2007.

[30] T. Octaviani, A. Guntarti, and H. Susanti, "Penetapan kadar β-karoten pada beberapa jenis cabe (Genus capsicum) dengan metode spektrofotometri tampak," *Pharmaciana*, vol. 4, no. 2, pp. 101–109, 2014.

[31] N. Muliah, A. S. Wardoyo, and T. Mahmudiono, "Hubungan frekuensi penimbangan, penggunaan garam beryodium, dan pemberian vitamin A dengan kejadian underweight pada balita di Provinsi Jawa Timur," *Media Gizi Indones.*, vol. 12, no. 1, pp. 40–46, 2017, doi: 10.20473/mgi.v12i1.40-46.

[32] I. wayan R. Aryanta, "Manfaat tempe untuk kesehatan," *Widya Kesehat.*, vol. 2, no. 1, pp. 44–50, 2020, doi: 10.32795/widyakesehatan.v2i1.609. Corn Wingko Processing Optimization Using Response Surface Methodology. International Journal of Food, Agriculture, and Natural Resources. Vol 1 (2):28-33.

[33] Syarfaini, Sukfitrianty Syahrir, Nildawati, Fatmawaty Mallapiang, Surahmawati, Uswatun Hasanah. 2021. The effect of substituting carrots into tempeh brownies on the intake of protein energy deficiency in Indonesia. *Enfermería Clínica*. Vol 31(5):735-739.