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Study of Tortilla Chips Snack from Corn Flour and Tempeh Formulation for Stunting Prevention

Kajian Camilan Tortilla Chips dari Formulasi Tepung Jagung dan Tempe untuk Pencegahan Stunting

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ABSTRACT

Background: Nutritional problems during pregnancy can affect the health of the mother and fetus. Stunting is a chronic malnutrition that must be addressed immediately. One of the food products that can be given to pregnant women and children under five with high nutritional value, especially protein, and calcium content, is tortilla chips.

Objectives: Analyzing the formula of tempeh with corn flour in tortilla chips to increase protein value and calcium content.

Methods: This study used an experimental study of adding tempeh and corn flour to tortilla chips. A randomized block design with five formulas for adding tempeh F1=0%, F2=10%, F3=20%, F4=30%, and F5=50%, with five replications was done. Observations included organoleptic assessment and laboratory analysis. The data analysis used the parametric type ANOVA test with a value of $\alpha=0.05$ with a follow-up BNT test.

Results: F2 was the best formulation regarding color (3.69) and assessment of sensory parameters (3.71). F3 is the best formulation based on aroma (3.72) and taste (3.72) organoleptic tests. F5 was the highest organoleptic test for texture (4.05), protein, and calcium content. The most preferred addition of tempeh to tortilla chips is the 10% formulation. The ANOVA test showed significant differences in the organoleptic test for color (0.001), texture (0.02), aroma (0.001), taste (0.001), overall sensory parameter assessment (0.001), protein (0.001), and calcium (0.02).

Conclusions: There was a significant difference in the average organoleptic assessment of color (F2=3.69), texture (F3=3.61), aroma (F3=3.72), taste (F3=3.94), and preference rating of various tortilla chip formulations with the best tortilla chip formula on F2.

INTRODUCTION

Indonesia has abundant natural resource wealth, although it faces nutritional and health problems. The low consumption of foods that contain high nutritional value is due to the low purchasing power of the people, resulting in the impact of undernutrition. The government launched the first 1,000 Days of Life Movement (1,000 HPK) to address chronic nutritional problems that often occur in children. This movement is a concept used to improve health during pregnancy to the age of 2 years because this period is the most critical period for children's physical and cognitive development[1]. Nutrition during pregnancy is a public health problem that needs attention. Inadequate nutritional intake during pregnancy will impact the health of the mother and baby. Lack of intake primarily found in meat, poultry, eggs, fish, fruits, green vegetables, and milk and their processed products causes a high prevalence of micronutrients[2].

Stunting is a condition of failure to thrive in children due to malnutrition that occurs over a long time and results in a child being too short for his age, resulting in impaired growth and motoric and mental development in children[3]. Based on the 2018 Basic Health Research of Indonesia (Riskesdas), stunting is 29.9%, and Lampung province is 27.4%, most of which are in rural areas. Although the prevalence of stunting in Lampung is below the national rate, it is still above 20% (the WHO target is less than 20%). The prevalence of stunting is below 20% only in Metro City (19.52%) and Pringsewu Regency (10.55%). According to the epidemiological analysis of Riskesdas data (2018), the highest prevalence of stunting in Lampung province is in Way Kanan Regency (36.07%)[4].

Calcium is a mineral found in hard tissue, bone tissue, and teeth, as much as 99%. Calcium plays a role in muscle contraction and relaxation, blood clotting, transmission of nerve impulses, and regulates hormone secretion. In addition, calcium also plays a role in strengthening bone structure and the body's calcium stores. When calcium in the blood decreases, the body will take reserves from the bones to raise blood calcium levels. Adequate calcium intake will make bones and teeth strong and grow normally. Adequate calcium intake is essential during pregnancy and breastfeeding[5]. The

need for calcium during pregnancy is higher than average. During pregnancy, calcium is needed for the bone health of the mother and fetus. Adequate calcium intake can reduce the incidence of hypertension during pregnancy[2]. Efforts to overcome the problem of stunting include increasing the calcium content in food. Calcium Needs for toddlers between 200-1,000 mg per day[6].

Snack products with high calcium content are still rarely found in society, so an alternative snack is needed high in calcium and protein that people like. Snack products are not a staple food but a secondary type of food. Snacks with various types and shapes, varied flavors, crunchy textures, affordable prices, and attractive packaging have a relatively long shelf life. Thus, snack products have a very good market opportunity[7]. Even though snack food is not a staple food, it is a food that is popular and often consumed by all levels of society, both men, women, children, adolescents, and adults. The percentage of household food spending tends to increase, including snack shopping. Tortilla or corn chips are one of the snacks that many people buy[8].

Tortilla chips are processed food derived from corn through the processing of cooking, grinding, drying, and frying. Tortilla is a type of chip or chips made from corn and is formed into a rectangular flat with a thickness and shape that varies for each country. There is no specific standard for the shape and thickness of the tortilla[8]. Corn can be processed into corn flour. The nutritional content of corn flour is not inferior when compared to wheat. Corn flour contains dietary fiber, iron, and beta-carotene, which can function as functional food[9]. Corn's protein content is lower than the carbohydrate content, so to increase the nutritional content of tortilla products, it is necessary to add other food ingredients, one of which is tempeh. Adding tempeh to tortilla chips is expected to increase the nutritional value and sensory quality that people like and can increase the selling value of the product. The use of tempeh and corn ingredients as raw materials for tortilla chips products with considerations aside from the nutritional value above is also because they are local food ingredients.

Calcium is included in the class of macro minerals needed by the body, with an amount of >100 mg/day. Calcium plays a role in blood clotting and catalyzes various biological reactions in the body and muscle contractions[10]. Adequate calcium and vitamin D intake to meet the body's needs is necessary for maximum bone growth. Increasing calcium and vitamin D intake during pregnancy optimally impacts fetal bone development. During pregnancy, the intake of nutrients that meet the body's needs is significant and can reduce the risk of congenital disabilities. In addition, adequate intake of nutrients can increase the body's defense system for pregnant women from various infectious diseases[11]. Low calcium intake in pregnant women can harm fetal growth, including forming imperfect bones and teeth in the fetus. A lack of calcium intake for pregnant women can cause early osteoporosis, cramps, and toothache. The incidence of hypertension is related to maternal nutritional intake during pregnancy[12].

Tortilla is a processed corn product that is popular in the community. Tortilla usually resemble flat round chips or chips with different thickness sizes. The popularity of tortilla in society shows that products made from corn are liked and accepted by Indonesian people[13]. However, corn has low calcium and iron content. To increase levelsCalcium and iron in processed corn products can be done by substituting foods that contain high calcium and iron, one of which is tempeh[14]. The choice of tempeh as a substitute material in the manufacture of tortilla chips is intended to improve taste, calcium content (155 mg), and iron (4 mg) so that people have alternative snacks that are nutritious and delicious[15].

Based on the study and linkages with the Tanjungkarang Health Polytechnic Development Master Plan 2011-2025[16], in the field of agroindustry, it is necessary to do research that can produce snack products that are high in calcium and are popular with the public. Agroindustry is a local wisdom potential that the Tanjungkarang Health Polytechnic favors, particularly the Lampung Province policy. The development of a snack food commodity that has a high nutritional content can directly touch the joints of the economic life of farmers in various production centers, bearing in mind that corn is one of the leading regional commodities in Lampung Province, so efforts are needed to maximize the development of corn processing into snacks that have added value, as a quality food product.

METHODS

The design of this study was an experimental complete randomized block design treatment of five repetitions by substituting corn flour with tempeh flour in the manufacture of tortilla chips snack products to obtain the most preferred formulation by 30 panelists. The randomized block design is a randomized design that is carried out by grouping experimental units into homogeneous groups and then carrying out random treatments within each group. The organoleptic test observations consisted of color, aroma, texture, taste, and acceptance of sensory parameters as a whole using the hedonic quality method, and analysis of protein content and calcium levels was carried out for protein analysis using the Kjeldahl method, while calcium analysis using the volumetric (complexometric) method. This research has obtained ethically sound statements from the health research ethics committee of the Tanjungkarang Polytechnic of Health, Number.209/KEPK-TJK/VIII/2021, dated 9 August 2021.

The tools used include electric food scales, a blender, a plastic basin, a measuring spoon, a knife, a Teflon pan, a filter, a boiler, a bowl, and a plastic tray. Tempeh and corn flour obtained from the Smep Market in Bandar Lampung are ingredients for making tortilla chips. How to make tortilla chips is tempeh is steamed, then crushed, mixed into the cornflour mixture, and added salt, garlic, and ground pepper. After thoroughly mixed, the mixture is flattened with a thickness of 0.2 cm, then steamed until cooked. Then cut into triangles, then fried. After the finished product, the organoleptic test and laboratory analysis of protein-calcium content were observed.

Statistical analysis using the parametric type ANOVA test value α=0.05 with a follow-up BNT test, both

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Indriyani et al. | Amerta Nutrition Vol. 7 Issue 3 (September 2023). 358-364

360

on the organoleptic test and on the analysis of protein-calcium levels, was conducted in this study.

RESULTS AND DISCUSSION

An organoleptic test relies on the five human senses (eyes, skin, nose, tongue) to measure or determine the acceptability of a food product. Organoleptic tests were carried out to determine the organoleptic value, which consisted of color, aroma, taste and texture, and overall appearance, involving 30 semi-trained panelists. Overall appearance is a combined assessment of color, aroma, taste, and texture by the panelists. Organoleptic values were assigned to tortilla products with tempeh and corn flour formulations with a ratio of 100:0 (F1), 90:10 (F2), 80:20 (F3), 70:30 (F4), 50:50 (F5). Following are the results of color organoleptic tests on various tortilla chip formulations.

Table 1. Organoleptic assessment of tortilla chips for color in Tempeh and corn flour formulas

Formulation of tempeh and corn flour	Means	Std Deviation	95% CI	p-value
F 1 (100:0)	3.33	1.079	3.16-3.51	
F 2 (90:10)	3.69	0.970	3.53-3.84	
F 3 (80:20)	3.52	1.073	3.35-3.69	0.001*
F 4 (70:30)	3.62	0.953	3.47-3.77	
F 5 (50:50)	3.11	1.167	2.92-3.30	

ANOVA test, *) Significant if p-value <0.05

Based on Table 1, F2 is the most preferred product color by the panelists. F2 is a tortilla chips formula that uses corn flour and tempeh flour with a composition of 90:10. This condition is possible because the proportion of the second formula is the suitable color formulation with the comparison between tempeh and corn flour. The less the addition of the proportion of tempeh, the brighter the color (golden yellow). Statistical analysis obtained p=0.001 (<0.05), meaning there is a significant difference in acceptance of tortilla color *chips* on various formulations of corn and tempeh flour[7]. The original white color of tempeh comes from the mycelium threads, which are perfectly strung between the fermented soybeans to give it a white color. Besides, the color of corn flour is also very influential in the color of the tortilla chips, which is golden yellow[17]. The quality of a food product is determined by its color. Food products with attractive colors can increase consumer acceptance, even before assessing taste and nutritional value[18].

Tortilla are a snack food product generally made from corn, also known as corn tortilla chips. Tortilla chips are loved by people, from children to adults. However, the primary consumers of tortilla chips are children and adolescents[19]. Physical parameters, including color, influence consumer acceptance of food products. Consumers will undoubtedly choose tortilla that look attractive, such as bright colors[18]. The original color of the tortilla chips is brownish yellow, whereas in F2, with the addition of 10% tempeh and 90% corn flour, it gives a bright color, namely golden yellow. Besides that, a golden yellow color is formed after processing thin tortilla sheets in oil. Heat at 170°C to produce bright colors. A large amount of tempeh added to the tortilla gave a pale color, so the panelists did not like it. The results of the organoleptic test of tortilla chips on the texture of tortilla products in the addition of tempeh and corn flour formulations can be seen in the Table 2.

Table 2. Organoleptic assessment of tortilla chips for texture in Tempeh and corn flour formulations

Formulation of tempeh and corn flour	Means	Std Deviation	95% CI	p-value
F 1 (0:100)	3.36	0.838	3.22-3.50	
F2 (10:90)	3.60	0.867	3.46-3.74	
F3 (20:80)	3.61	0.925	3.46-3.76	0.020*
F 4 (30:70)	3.35	0.891	3.21-3.50	
F5 (50:50)	4.05	0.974	3.36-3.67	

ANOVA test, *) Significant if p-value <0.05

Based on Table 2, the average fluctuation in texture assessment by panelists in the formula above increased in F2 with the addition of 10% tempeh and F3 with the addition of 20% tempeh. Statistical test results obtained a p-value below the value of α (0.020), meaning that there is a significant difference in the texture rating scale between the five formulas or at least one difference between the formulas that have been prepared.

Table 2 shows that the panelists prefer a crunchy and unbroken texture, namely F5 with the same ratio of tempeh and corn flour, whereas the tortilla chips formula without added tempeh produces a texture that is easily crushed and broken due to the content of

amylose and amylopectin in corn flour. In addition, the water content in the addition of 50% tempeh produces tortilla chips with relatively low water content. Low water content affects the texture or crispiness of a product. The texture is the sensation of pressure observed using the mouth and felt with the fingers, and consistency shows thick, thin, and smooth[20]. The higher the concentration of tempeh, the crunchier the texture will be[18]. Using tempeh and corn flour in the same amount will give a crunchy texture and not break easily in tortilla chip products. This condition is presumably because the higher acidity level makes it easier for water and calcium to penetrate the corn kernels, resulting in a crisper final

product[13]. The results of the organoleptic test of tortilla chips on the aroma of tortilla products in the addition of tempeh and corn flour formulations can be seen in the table below:

Table 3. Organoleptic assessment of tortilla chips for aroma in Tempeh and corn flour formulations

Formulation of tempeh and corn flour	Means	Std Deviation	95% CI	p-value
F 1 (0:100)	3.21	0.756	3.09-3.34	
F2 (10:90)	3.31	0.750	3.19-3.43	
F3 (20:80)	3.72	0.942	3.57-3.87	0.001*
F 4 (30:70)	3.57	0.709	3.45-3.68	
F5 (50:50)	3.61	0.749	3.49-3.73	

ANOVA test, *) Significant if p-value <0.05

Table 3 shows that the mean organoleptic aroma assessment by panelists on tortilla chips varied and increased sharply in F3. The results of the statistical test p-value were less than 0.05, and it could be concluded that there was a significant difference in the average organoleptic aroma of tortilla chips with various formulations. F3 is the formulation that has the highest average aroma value.

Table 3 describes the aroma as something that can be observed with the sense of smell and is considered vital because it can quickly provide information about the acceptance or rejection of a product[7]. Factors affecting aroma are the quality of aroma components, aroma composition, temperature, the viscosity of food, and natural interactions between nutritional components in these foods, such as proteins, fats, and carbohydrates[13]. Aroma determines the delicacy of food, so aroma becomes one of the factors in determining the quality of food products[19]. In the results of tortilla chips, the most preferred formula was F3 with 30% tempeh, and the least preferred formula was F1 with the addition of 0% tempeh. Tempeh has a distinctive aroma of unpleasant-smelling soybeans. In addition, the aroma of tempeh comes from the mold *Rhizopus oligosporus*, which affects its high activity of protease and lipase enzymes but low amylolytic activity, causing tempeh to have a distinctive aroma[21]. The results of the organoleptic test of tortilla chips on the taste of tortilla products in the addition of tempeh and corn flour formulations can be seen in Table 4.

Table 4. Organoleptic assessment of tortilla chips on taste in corn flour and Tempeh formulations

Formulation of tempeh and corn flour	Means	Std Deviation	95% CI	p-value
F 1 (0:100)	3.21	0.756	3.09-3.34	
F2 (10:90)	3.31	0.750	3.19-3.43	
F3 (20:80)	3.72	0.942	3.57-3.87	0.001*
F 4 (30:70)	3.57	0.709	3.45-3.68	
F5 (50:50)	3.61	0.749	3.49-3.73	

ANOVA test, *) Significant if p-value <0.05

Table 4 shows that the panelists' mean organoleptic assessment of the taste of tortilla chips varied in each formulation. The tortilla with the highest score for organoleptic taste is F3. F3 is a formulation of 80% corn flour and 20% tempeh. Statistical test results obtained a p-value of less than 0.05, and it can be concluded that there is a difference in the average taste scale rating when viewed from the average aroma rating. F3 is the formula with the highest average taste value. The flavors tested in this simple difference ranking test were conducted to determine the sequence of samples perceived by the sense of taste buds with very salty, slightly salty, salty, savory, and very tasty.

Table 4 explains that the tortilla taste comes from tempeh amino acids. Arginine amino acid is an amino acid that is usually found in proteins, including tempeh. The panelist's favorite flavor is F3. The most disliked tortilla formulation by the panelists was F1, which used a composition of 80:20 corn flour and tempeh. Taste is one of the essential sensory characteristics in accepting a food product[20]. Taste is a quality parameter detected using the sense of taste. The level of panelists' preference for the taste of tortilla chips is an essential factor to observe after assessing the color, texture, and aroma[13]. The results of the tortilla chips organoleptic test on the overall assessment of tortilla products in the addition of tempeh and corn flour formulations can be seen in Table 5.

Nutrition

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Indriyani et al. | Amerta Nutrition Vol. 7 Issue 3 (September 2023). 358-364

362

Table 5. Overall organoleptic value of tortilla chips on sensory parameters

Formulation of tempeh and corn flour	Means	Std Deviation	95% CI	p-value
F 1 (0:100)	3.10	1.048	2.93-3.27	
F2 (10:90)	3.71	3.432	3.15-3.26	
F3 (20:80)	3.60	0.983	3.44-3.76	0.001*
F 4 (30:70)	3.57	0.806	3.44-3.17	
F5 (50:50)	3.65	0.8091	3.50-3.79	

ANOVA test, *) Significant if p-value <0.05

Based on Table 5, the average overall performance of all formulas tends to increase in proportion to the increase in the use of tempeh in the formulations. The statistical test results for the p-value are less than 0.05, and it can be concluded that there is a significant difference in overall appearance. Meanwhile, F2 is the formulation with the highest score for the overall appearance aspect.

Overall appearance is a product assessment based on all sensory parameters, including color, texture, aroma, and taste, with very like, like, neutral, dislike, and immensely dislike assessment criteria. The results of this assessment can provide an overview of the level of acceptance and level of preference of the panelists for the product. The product formulation with the highest score is the most preferred and most acceptable formulation by the panelists. Based on Table 5, the formulation acceptable to the panelists was F2, with an average panelist score of 3.71 out of a maximum score of 5. Tempeh and corn flour in the tortilla formulation can affect the panelists' preference for tortilla products.

Corn flour material will have higher economic value if it is processed into various kinds of food preparations[22]. Maize commodity in Lampung Province is the 3rd highest in Indonesia and has considerable potential as a source of carbohydrates that can be made into various food products[13]. Testing for protein content using the volumetric (complexometric) method, with a total of 5 (five) repetitions, resulted in average protein content in percent(%) as follows:

Table 6. Protein value (%) of tortilla chips in various formulations

Formulation of tempeh and corn flour	Means	Std Deviation	95% CI	p-value
F 1 (0:100)	6.88	0.58	6.15-7.61	
F2 (10:90)	7.58	0.50	6.94-8.21	
F3 (20:80)	8.35	0.76	7.40-9.30	0.001*
F 4 (30:70)	8.84	0.72	7.94-9.73	
F5 (50:50)	9.24	0.75	8,31-10.17	

ANOVA test, *) Significant if p-value <0.05

Table 6 shows test results on protein content in tortilla products with various tempeh and corn flour formulations. It shows that the protein content in tortilla chips is directly proportional to the increase in the use of tempeh in the tortilla formula. The greater the percentage of tempeh used, the higher the protein content in the tortilla chips. Protein is one of the essential components used as builders and regulators in the body. Corn flour contains 0.26 g of protein in every 100 g, while tempeh contains 51.7 g in every 100 g[23]. Corn has five protein fractions: albumin, globulin, prolamin, glutelin, and non-protein nitrogen[24]. Increasing the protein content in tortilla chip products is done by increasing the concentration of tempeh in the product. Testing calcium levels using the volumetric (complexometric) method, with a total of 5 (five) repetitions, resulted in an average calcium level in mg/100 g as follows:

Table 7. Calcium levels in tortilla chips with the addition of tempeh and corn flour (mg/100 g tortilla)

Formulation of tempeh and corn flour	Means	Std Deviation	95% CI	p-value
F1 (0:100)	124.62	1.62	122.61-126.64	
F2 (10:90)	182.36	10.89	168.83-195.89	
F3 (20:80)	224.99	15.36	205.91-244.07	0.021*
F 4 (30:70)	266.80	15.84	247.13-286.47	
F5 (50:50)	294.69	16.15	274.63-314.74	

ANOVA test, *) Significant if p-value <0.05

Table 7 explains that calcium levels in tortilla products increased along with the addition of tempeh in the tortilla chips formula. This condition is because the calcium content in tempeh is relatively high, namely 111 mg/100 g of tempeh, while corn only contains 30 mg of calcium/100 g of it[21]. Adding tempeh to the tortilla chips

formula increased calcium levels in the tortilla chips. The results of calcium levels in tortilla with the addition of balanced corn flour and tempeh provide optimal calcium levels. The calcium content in tortilla chips is high because there is a process of softening the pericarp, endosperm, and gelatinization of corn starch so that corn can be converted into flour and processed into tortilla chips[24].

CONCLUSIONS

The tortilla product uses tempeh and corn flour formulations on the organoleptic test of overall appearance and color, with the best score on F2 (10:90), while the panelists preferred organoleptic taste and aroma was F3 (20:80). The highest protein and calcium content is found in F5, with the proportion of tempeh and corn flour 50:50. F5 also has the best texture among other formulations. The most preferred addition of tempeh to tortilla chips was on F2 (10%).

REFERENCES

1. Djauhari, T. Gizi dan 1000 Hari Pertama Kehidupan (HPK). *Saintika Medika* **13**, 125 (2017).

2. Purnasari, G., Briawan, D. & Dwiriani, C. M. Asupan Kalsium dan Tingkat Kecukupan Kalsium pada Ibu Hamil di Kabupaten Jember. *Jurnal MKMI* **12**, 261–268 (2016).

3. Mitra, M. Permasalahan Anak Pendek (*Stunting*) dan Intervensi untuk Mencegah Terjadinya *Stunting* (Suatu Kajian Kepustakaan). *Jurnal Kesehatan Komunitas* **2**, 254–261 (2015).

4. Ministry of Health of Indonesia. *Laporan Nasional Riskesdas 2018*. (2018).

5. Edina H. Perbedaan Kadar Kalsium dan Fosfor Gigi Sulung pada Anak dengan DEF-T Rendah dan Tinggi. *E-Prodenta Journal of Dentistry.* **3**, 232–239 (2019).

6. Ministry of Health of Indonesia. *Peraturan Menteri Kesehatan Republik Indonesia Nomor 28 Tahun 2019 Tentang Angka Kecukupan Gizi Yang Dianjurkan Untuk Masyarakat Indonesia*. 5–10 (2019).

7. Agusta, E. N., Amalia, L. & Hutami, R. Formulasi Nori Artifisial Berbahan Baku Bayam. *jurnal Agroindustri* **3**, 19–27 (2017).

8. Rohmayanti1a, T., Novidahlia, N. & Damayanti, I. Karakteristik *Tortilla* Chips dengan Penambahan Tepung Ampas Kecap. *Jurnal Agroindustri* **5**, 113–121 (2019).

9. Jeni Aturut, Montong, M., Manangkot, H. & Lambey, L. Pemanfaatan Tepung Ubi Jalar Orange (*Ipomoea trifida*) Sebagai Pengganti Sebagian Jagung terhadap Persentase Karkas, Lemak Abdomen dan Organ Hati Ayam Kampung Super. *Zootec* **38**, 337–344 (2019).

10. Almatsier, S. *Prinsip Ilmu Gizi Dasar*. (PT Gramedia Pustaka Utama, 2009).

11. Mulya, F. M. & Bahar, H. Hubungan Asupan Suplemen Kalsium pada Ibu Hamil dengan Panjang Bayi Saat Lahir di Wilayah Cengkareng. *Nutrire Diaita* **6**, 81–98 (2014).

12. Nofita, R. & Anjansari, F. R. Korelasi Waktu Pemberian Kalsium, dan Kepatuhan Konsumsi Kalsium dengan Kejadian Resiko Tinggi Pre Eklamsia Ibu Hamil di Wilayah Kerja Puskesmas Ciputat. *Indonesian Journal of Midwifery (IJM)* **1**, 41–48 (2018).

13. Febrianto, A., Basito & Anam, C. Kajian Karakteristik Fisikokimia dan Sensoris *Tortilla* Corn Chips dengan Variasi Larutan Alkali pada Proses Nikstamalisasi Jagung. *Jurnal Teknosains Pangan* **3**, 2302733 (2014).

14. Suhanda, T. Tempe Kedelai sebagai Antihiperglikemik Soy Tempeh as Antihyperglycemic. *Agromed Unila* **2**, 252–256 (2015).

15. Mahmud, M. K. *et al. Tabel Komposisi Pangan Indonesia 2017*. (Kementerian Kesehatan RI., 2018).

16. Tanjungkarang, P. *Rencana Induk Pengembangan (rip) reviu-2*. (2017).

17. Andriyani, Y., Syahrumsah, H. & Marwati. Studi Formulasi Jagung (Zea Mays L.) dan Tempe terhadap Nilai Gizi dan Sifat Mutu Sensoris *Tortilla* Chips. *Jurnal Teknologi Pertanian Universitas Mulawarman* **12**, 64–69 (2017).

18. Rahayu, S. T., Asgar, A., Hidayat, I. M. & Djuariah, D. Quality Evaluation of Some Genotype of Spinach (Amaranthus sp.) Cultivated in West Java. *Berita Biologi 12(2)* **12**, 153–160 (2013).

19. Cahyono, E., Rieuwpassa, F. J. & Sirih, S. Analisis Organoleptik *Tortilla* Rumput Laut Kappaphycus alvarezii. *Jurnal Ilmiah Tindalung* **4**, 61–65 (2018).

20. Setiawan, E. C. *et al.* Kandungan Gizi dan Uji Organoleptik Beras Analog Kedelai Edamame dan Rumput Laut. *Indonesian Journal of Human Nutrition* **7**, 139–152 (2022).

21. Astawan, M., Wresdiyati, T. & Saragih, A. M. Evaluasi Mutu Protein Tepung Tempe dan Tepung Kedelai Rebus pada Tikus Percobaan Evaluation of Protein Nutritional Quality of Tempe and Boiled Soybean Flours by Rats. *Jurnal Mutu Pangan: Indonesian Journal of Food Quality* **2**, 11–17 (2015).

22. Wuryandari, Y., Triana, N. W., Rosida, D. F. & Pawana, G. Pengolahan Tepung Jagung Menjadi Berbagai Olahan Makanan di Kabupaten Bangkalan. *Jurnal Abdimas Bela Negara Vol.2* **2**, 29–43 (2021).

23. Ministry of Health of Indonesia. Data Komposisi Pangan Indonesia. *Kementerian Kesehatan* (2019).

24. Amrih, D. & Syarifah, A. N. Karakteristik Kimiawi Camilan Keripik *Tortilla* dengan Substitusi Sayuran Hijau. *Indonesian Journal of Agricultural and Food Research* **2**, 21–32 (2020).