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THE EFFECT OF RAW ALMOND AND TEMPEH FILTRATES PROPORTION ON SENSORY QUALITY AND ACCEPTANCE THE PROTEIN-MULTIVITAMIN SUPPLEMENT FOR THE ELDERLY

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ABSTRACT

Elderly is an age where the function and structure of the body changes, as a result there is a decrease in the effectiveness of the use of nutrients so that it can cause typical nutritional problems. To avoid this problem, in addition to adjusting the diet in sufficient quantities, the consumption of supplements is also needed to support the nutrition of the elderly. This study aims to 1) determine the effect of the proportion of raw almond and tempeh filtrates on the sensory quality of the protein-multivitamin drink supplement; 2) know the best formula of the supplement; and 3) know the data received by the panelists on the supplement. The method used in this research is descriptive qualitative using data collection techniques of organoleptic test with a Likert scale. The used components of organoleptic instruments includes color, aroma, viscosity, taste, and acceptance. Data were analyzed using multiple ANOVA and then tested using Duncan. The panelists involved in this study were 100 people consisting of semi-trained and untrained panelists. The results showed 1) the proportion of raw almond and tempeh filtrates had an effect on color, thickness, and taste, but had no effect on aroma and preference; 2) the chosen formula is F3 with a ratio of 3: 1; and 3) The respect acceptances at α 0.05 of F1, F2 and F3 are 2.18; 2.25; and 2.55. This study indicated that the use of raw almond and tempeh filtrates has the potential to be accepted by the public as a protein-multivitamin drink supplement.

KEYWORD: *raw almond filtrate; tempeh filtrate; sensory quality; supplement; protein-multivitamin drink.*

INTRODUCTION

The health level of the elderly can be used as a measure of the level of public health in general. The more the population of the elderly group, it can be said that the level of public health is getting better (Mursito, 2004). SUSENAS data for 2019 showed the number of the elderly people in Indonesia is 24.64 million people or 9.6% of the total population of Indonesia (BPS, 2019). According to Law No. 13 of 1998, elderly is someone who has reached the age of 60 years and over. Various physical and psychological changes that occur in the elderly greatly affect the health and ability of the body's metabolism. These changes are generally in decline from previous conditions, for example the ability of the body's immunity. With increasing age, the immune system will decline. This is influenced by nutrient deficiency. Therefore, the combination of age and malnutrition can cause the elderly to be very susceptible to disease. Antibiotics are often ineffective against infection in people with immune system problems. As a consequence, infectious diseases are the main causes of death in the elderly.

Adequacy of nutrients in the elderly is lower than in adults. This is adjusted to the physiological changes that occur with age. Increasing age makes changes in the ratio of food consumption. The percentage of macronutrient needs is 20% -25% protein, 20% fat, and 55%-60% carbohydrates. The fatty acids that are consumed should have high unsaturated fatty acid content. Apart from that, the most deficient nutrients in the elderly are vitamins B6, B12, folate, vitamin D and calcium. Because of these changes, the elderly need to take supplements as additional nutritional intake that can increase endurance and body health.

Supplements that are widely offered to the elderly are generally supplements related to memory, endurance, staying young, preventing disease and prolonging life. Consuming foods that are functional with high antioxidant content derived from fruits and vegetables. The consumption of multivitamin supplements generally increases with age (Dickinson and MacKay, 2014). This is of course supported by the increasing growth of the elderly population in Indonesia. One of the non-pharmacological actions that can be developed to maintain and improve health is to take a multivitamin supplement made from almond and tempeh filtrate and then add fruit and vegetable extracts as a source of vitamins.

The use of almond filtrate containing high total vegetable fat, and the high oleic and linoleic acids in almonds play a very good role in the body. One of which is to suppress cholesterol so that it is good for the heart and increases the rate of blood flow. Almonds have high in

nutrients, per 100 grams of total fat (vegetable) of 49.9 g, 12.2 g of dietary fiber, 4.7 mg of B vitamins (B1, B2, B3, B6), 25.63 mg of vitamin E, and high Ca, K, and P of 269, 481, and 733 mg, respectively (USDA, 2016). Almond milk/filtrate can be used as an alternative to cow's milk for people with lactose intolerance considering the prevalence of lactose intolerance in Indonesia. Almond filtrate has several drawbacks, namely almond raw material containing high phytic acid and very little water-soluble protein that is around 0.42 g per 100 g (USDA, 2016). According to SNI No. 01-3830-1995, milk from vegetable commodities must have at least 2% protein and at least 1% in the form of drinks. In order to increase protein content, it is necessary to add protein from outside or from other commodities. One of the ingredients that can be substituted in almond filtrate is tempeh which has better nutritional value and quality than soybeans.

The amino acid content in tempeh is 24 times higher than soy milk. The fermentation process can increase levels of vitamin B2 (Riboferum), vitamin Bb (pyridoxine), folic, pantothenic and nicotinic acids. Meanwhile, the level of vitamin B1 decreases due to mold growth and the formation of vitamin B12 by bacteria that is not present in other vegetable products. The fermentation process in tempeh will activate the phytase enzyme which can break down phytic acid (which binds several minerals) into phosphorus and isotol. With the breakdown of phytic acid, certain minerals such as iron, calcium, magnesium and zinc become more available for the body to use. This enzyme also plays a role in increasing the absorption of iron minerals in the blood (Astuty *et al.*, 2000; Astuty, 1994). Khorunisa (2013) obtained data that tempeh filtrate can reduce blood pressure in the elderly. For a while, Yuniwati (2012) concluded that there is an effect of giving tempeh milk on the Hb levels of pregnant women in trimester II and III, namely increased Hb levels. This study aims to 1) determine the effect of the proportion of raw almond and tempeh filtrate on the sensory quality of the protein-multivitamin drink supplement from the study; 2) know-the best formula of the supplements; and 3) know the data received by the panelists on the supplements.

METHOD

The research was conducted in August-September 2020 at the UPT Chemical Laboratory Unesa on Jl. Ketintang Campus Unesa Surabaya. The method used in this study consisted of two stages, namely the manufacture of raw almond filtrate, tempeh filtrate and root beet extraction, Moringa leaves, and broccoli, and the second stage was determining the proportion of raw almond and tempe filtrates. The design used was experimental with a

completely randomized design of two factors, namely raw almond filtrate (75%; 50%; and 25%) and tempeh filtrate (75%; 50%; and 25%), which resulted in three formulations, namely the proportion of raw almond filtrate and tempeh filtrate: F1 (75:25); F2 (50:50); and F3 (25:75). The responses analyzed were sensory properties in the form of color, aroma, viscosity, taste and acceptance using the hedonic test with a Likert scale (1-4). The panelists used were 100 people consisting of semi-trained and untrained panelists. Data were collected at the Food Management Laboratory, Unesa Surabaya. Data were analyzed using multiple ANOVA and then tested using Duncan.

Product Preparation Process

1) Raw Almond Filtrate Making

The product preparation begins with the raw almond and tempeh filtrates. The almonds are sliced and soaked in boiled water for 8 hours which functions in addition to making the texture a little soft, making it easier for the crushing process, increasing digestibility and absorption of nutrients by the body. After soaking, the soaking water is removed and the almonds are drained until the water does not drip. To make raw almond filtrate, a slow juicer was used and then add water with a ratio of 1 : 3. The resulting filtrate is then filtered again using a drying cloth whose function to produce filtrate without sediment, then packed and stored in a refrigerator.

2) Tempeh Filtrate

The tempeh used is obtained from the Pagesangan market, Surabaya. Before making the tempeh filtrate, the tempeh was cut into cubes and then steamed for 15 mins. Steaming serves to stop fermentation in tempeh. Furthermore, the steamed tempeh is crushed using a slow juicer and using a water ratio of 1: 3. The resulting filtrate is then filtered again using a drying cloth whose function is to produce filtrate without sediment, then packed and stored in a refrigerator.

3) Vegetable Extraction

The vegetables used were beetroot, broccoli and Moringa leaves which were obtained from the market in Surabaya. Each vegetable was washed and aerated to reduce its water content and mashed so that it became a sample powder. Furthermore, each sample powder of 100 g was macerated with 250 mL of distilled aqua for 4 h and filtered with a vacuum pump so that the macerate and yield filtrate was produced. The macerate is evaporated with a rotatory

vacuum evaporator at a temperature of 50 ^{o}C with a pressure adjusted for the water solvent to produce a thick extract.

4) Supplement Making

The preparation of health drink supplements is done by determining the dosage of vegetable extracts, namely beetroot root as a source of B vitamins, especially folate; broccoli as a source of vitamin C; and Moringa leaves as a source of vitamin A. The extract dosage is calculated based on the needs of vitamins A, B, and C for the elderly, which is maximized by adding 1 g of each vegetable extract in 100 mL of the beverage supplement. Furthermore, each formula used vegetable extracts with the same dosage and dose but mixed in different proportions of raw almond filtrate and tempeh filtrate, namely F1 (75% raw almond filtrate: 25% tempeh filtrate); F2 (50% raw almond filtrate: 50% tempeh filtrate); and F3 (25% raw almond filtrate: 75% tempeh filtrate).

Statistical analysis

The obtained data were analyzed using multiple ANOVA with the help of the SPSS and continued with DMRT if there was a significant difference ($\alpha = 0.05$) and LSD if there was a significant difference ($\alpha = 0.05$) but there was no effect.

RESULTS AND DISCUSSION

Almonds (*Prunus dulcis*) have the potential to be developed into functional food products in the form of almond milk. Almond milk is very beneficial for vegetarians and people with lactose allergies. The calorie content of almond milk is 50% lower than cow's milk according to Kristin Kirkpatrick, a dietitian and health nutrition service manager at the Cleveland Clinic's Wellness Institute, so it is very appropriate for almonds to be developed into new products, namely vegetable milk (Nareswara, 2016).

The process of making almond milk begins with soaking almonds in water for 8 h at a ratio of 2: 1 (Laux, 2006) which aims to increase digestibility and absorption of nutrients. In addition, soaking can also affect the texture and taste of almonds (Cassady *et al.*, 2009; Miquel-Kergoat *et al.*, 2015). Almonds contain anti-nutrient compounds that can interfere with the digestion and absorption of certain nutrients, such as calcium, iron, zinc and magnesium (Schlemmer *et al.*, 2009; Mattila *et al.*, 2018). Meanwhile, it was known that soaking almonds can significantly reduce the anti-nutrient levels in almonds, such as tannins and phytic acid (Nakitto *et al.*, 2015; Gupta *et al.*, 2013). Tannins are known as natural

antioxidants, but recent research has shown that tannins are linked to a decrease in the efficiency of nutrient absorption by the body. Tannins can also bind to protein and make it difficult to digest (Chung *et al.*, 1998). Almonds also contain phytic acid which has an inhibitory effect on digestive enzymes such as lipase, pepsin, and amylase. Phytic acid can bind to essential mineral ions to form insoluble salts and inhibit absorption by the body (Zhou *et al.*, 1995; Bohn *et al.*, 2008). Tannins and phytic acid can dissolve in water, so the soaking process can help reduce the levels of tannins and phytic acid in almonds (Chen *et al.*, 2006). The immersed almonds are mashed with the addition of 1: 3 ratio of water and the filtrate is filtered into almond milk. It was reported that the refining process of almonds allows more nutrients to be released and absorbed by the body, especially fat (Lee and Mithchell, 2018).

Apart from almonds, vegetable milk can also be sourced from tempeh or known as tempeh milk. Tempeh is a product resulted from the fermentation process of soybeans which makes many of the nutrients in soybeans change to be more water-soluble and easy to digest. Nearly half of the soy protein content during fermentation is broken down into smaller, water-soluble products such as peptides and amino acids (Astuti, 1994). As a results, the nutritional value and Protein Efficiency Ratio (PER) of tempeh is higher than soybeans without fermentation (Susilowati and Aspiyanto, 2004). The process of making tempeh milk begins with steaming the tempeh for 15 mins with the aim of stopping the fermentation process of the tempeh so that the resulted tempeh milk does not undergo further fermentation. In addition, the steaming process functions to eliminate the bitter taste and unpleasant smell of tempeh. This is because the glycoside in soybean seeds and the lipoxidase that break down soybean fat produce compounds that cause unpleasant odors. This "off flavor" compound can be removed by heat (Eny, 1997). The result of steaming tempeh is mashed with a 1: 3 ratio of water sprinkling and the mixture is filtered into tempeh milk.

This protein-multivitamin drink as a health supplement for the elderly is made from the main ingredients of almond milk and tempeh milk with different proportions, namely the code F1 (75:25); F2 (50:50); and F3 (25:75). The addition of moringa leaf extract, beets, broccoli and dates as additional ingredients to increase the nutritional value and antioxidant ability of the supplement drink. Beets also contain betasianin which is a purplish red pigment and used as a natural dye in the manufacture of food products (Mastuti and Harold, 2010). Dates are chosen as a sweetener in beverage supplements because the sugar content in dates is not a type of sucrose but a high amount of fructose and glucose. Fructose has a low glycemic index

compared to glucose and sucrose so it doesn't cause blood sugar levels to rise drastically and is safe for consumption by the elderly, most of whom have problems with blood sugar levels (Alkaabi *et al.*, 2011).

Effect of Proportion of Raw Almond and Tempeh Filtrates

1. Color

Table 1: Two Way Anova Test Results Toward Product Color.

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	33.020	2	16.510	29.435	.000
Within Groups	169.951	303	.561		
Total	202.971	305			

As seen at Table 1, it is found that the F_{count} value is 29.435 with a significance of 0.000 ≤ α value, namely 0.05. This value shows that the proportion of raw almond and tempeh filtrates has a significant effect on the color of the product. The filtrate produced from raw almonds soaked in water is milky white. The soaking process changes the color of raw almonds from bone white to milky white. This is influenced by water diffusion in almonds during the immersion process which affects cell wall compounds, namely polysaccharides consisting of hemicellulose, pectin, lignin and cellulose (Dewi *et al.*, 2014). Tempeh filtrate is obtained from tempeh that has been steamed in cream color, while tempeh generally has a white appearance. The white color is caused by the presence of fungal mycelia that grows on the surface of the soybean seeds (Kasmidjo, 1990). The steaming process in tempeh makes the mushrooms inactive so that it changes the color of the tempeh. The manufacture of this supplement is based on the proportion of white raw almond filtrate and creamy tempeh filtrate. It can be said that a large proportion of tempeh filtrate will produce a creamier color. The color produced in F1 is milky white, F2 produces a liquid that is slightly white in color, and F3 has a broken white color which is influenced by the use of tempeh filtrate.

2. Odor

Table 2: Two Way Anova Test Results Toward Product Odor.

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2.020	2	1.010	1.320	.269
Within Groups	231.863	303	.765		
Total	233.882	305			

Raw almonds have a slightly unpleasant aroma, as well as raw soybeans. Langu has the distinctive smell and taste of soybeans and other raw beans, and is not liked by consumers. However, the unpleasant aroma of soybeans is stronger than almonds. The cause of the unpleasant aroma is a compound containing a volatile carbonyl group, such as *n*-hexanal. This compound is formed as a result of the oxidation of unsaturated fatty acids found in soybean seeds (especially linoleic acid) due to the activity of the lipoxygenase. This enzyme is active when soybean seeds are broken in the process of peeling the skin and grinding due to contact with air (oxygen), especially if the extraction is carried out with cold water. Lipoxygenase (L) which consists of L1, L2 and L3 are genetically found in soybean seeds and L2 is reported to be dominant in the formation of *n*-hexanal, a volatile compound that causes an unpleasant aroma (Ginting, 2010). In order to reduce the unpleasant aroma, the tempeh is steamed first. The expected aroma of the research product is not unpleasant odor. In Table 2, it was found that the F_{count} value was 1.320 with a significance of 0.269 ≥ α value, namely 0.05. This value shows that the proportion of raw almond and tempeh filtrates has no effect on the aroma of the product. Based on deeper research regarding the sensory quality of the product from the organoleptic test, it was shown that the aroma of each formula was not too different, most of the panelists answered that it was unpleasant. The unpleasant aroma of soy in tempeh is reduced by the steaming technique.

3. Viscosity Level

Table 3: Two Way Anova Test Results Toward Product Viscosity Level.

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	12.046	2	6.023	8.719	.000
Within Groups	209.314	303	.691		
Total	221.359	305			

In table 3, it seemed that the F_{count} value is 8.719 with a significance of 0.000 ≤ α value, namely 0.05. This value shows that the proportion of raw almond and tempeh filtrates influences on the viscosity level of the product. Making raw almond and tempeh filtrates using a ratio of almond or tempeh and water is 1: 3 each. Almonds and soybeans contain starch, it's just that the starch content in almonds is less than soybeans. So that the almond filtrate is thinner than the tempe filtrate. Starch is a component that plays a large enough role in viscosity, because this component is viscous (large viscosity) (Marsono, 2002). According to Winarno (1997) starch greatly affects viscosity because starch can undergo gelatinization

due to certain treatments, especially heat treatment. This is what causes the more the proportion of tempeh filtrate, the thicker the resulting liquid will be. This is supported by measuring the viscosity of beverage supplements with code F1 (75:25); F2 (50:50); and F3 (25:75) showing that the viscosity values are 0.00789 Pa.s, 0.00868 Pa.s and 0.00939 Pa.s, respectively.

4. Taste

Table 4: Two Way Anova Test Results Toward Product Taste.

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2.791	2	1.395	2.519	.082
Within Groups	167.824	303	.554		
Total	170.614	305			

Food or beverage products can be accepted by consumers because of the taste of the product, which is influenced by the nature of the main raw material, additional raw materials or the making process. The main raw material for this supplement is raw almond and tempeh filtrates. Almonds as a snack that are classified as nuts with their fat content, have a delicious taste when roasted, grilled or fried, but taste bland if eaten without being processed first. The same thing also applies to tempeh which has a savory taste due to the high protein and fat content in soybeans which are then hydrolyzed into simpler compounds during the fermentation process (Dewi *et al.*, 2014). Tempeh filtrate has a weakness, namely a bitter taste caused by soybean compounds that have a bitter taste, such as maltol and palmitic, stearic, oleic, linoneic and linolenic acids which are also still found in tempeh (Kasmidjo, 1990). Humans have a sensitive sense of taste which is more sensitive to the presence of bitter tastes than other tastes (Suryani *et al.*, 2010). Therefore, proper processing techniques are needed to reduce these weaknesses by steaming tempeh before filtering it with water. In addition, to increase the taste in the manufacture of this product, sukari type dates are used to provide a natural sweet taste. However, the fat content in nuts can provide a savory taste. As shown in Table 4, it was found that the F_{count} value was 2.519 with a significance of $0.082 \geq \alpha$ value, namely 0.05. This value shows that the proportion of raw almond and tempeh filtrates has no effect on the taste of the product. The dates used are 30% by weight of the liquid, so with the use of the same amount of dates in each formula, the mixtures of raw almonds and tempeh filtrates have no effect on the taste of the product.

5. Levels of Pleasure

Table 5: Two Way Anova Test Results Toward Product.

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	8.020	2	4.010	3.502	.031
Within Groups	346.951	303	1.145		
Total	354.971	305			

As presented in Table 5, the F_{count} value was 3.502 with a significance of 0.031 ≤ α value, namely 0.05. This value shows that the proportion of raw almond and tempeh filtrates has an influence on the level of product preference. Likes are influenced by the visual appearance, taste and aroma of the product.

The Best Formula

After the sensory properties of the product were analyzed based on the organoleptic test, the next step was to determine the best formula according to the desired criteria using the Duncan Multiple Range Test (DMRT) at the 5% (0.05) significance level.

Table 6: Duncan's Test Results.

MS	N	Colour	Odor	Viscosity	Taste	Levels of pleasure
Almond 25 : Tempe 75	102	2.93^{a}	2.89^{a}	2.68^{a}	2.60^{a}	2.18^{a}
Almond 50 : Tempe 50	102	3.36^{b}	2.96^{a}	3.06^{b}	2.63^{a}	2.25^{a}
Almond 75 : Tempe 25	102	$3,74^{c}$	3.09^{a}	3.13^{b}	2.81^{a}	2.55^{b}

Based on Table 6, it can be seen that the best value is F3 with the ratio of raw almond and tempeh filtrate is 75:25 or 3: 1. F3 has the best sensory properties in terms of color, aroma, thickness, taste, and people's preferences. The resulting color is a slightly pink cream which is influenced by the color of the beet root, does not have an unpleasant aroma, has a less thick texture, a sweet and slightly savory taste, and a higher preference level of 2.55.

Product Acceptability

In calculating the mean results of F1; F2; and F3 are 2.63; 2.60; and 2.81 with a panelist assessment covering taste, aroma, color and texture. From this value, the highest score is F3, namely 2.81. It can be concluded that the product most acceptable to the panelists based on this value is F3, namely the ratio of raw almond and tempeh filtrates is 1: 3.

CONCLUSIONS

The results showed 1) the proportion of raw almond and tempeh filtrates had an effect on the color, thickness, and taste of the supplements, but did not affect the aroma and preferences of the respondents; 2) the selected formula that meets the criteria is F3 with a ratio of 3: 1 or 75% tempe filtrate and 25% almond filtrate, namely 2.55; and 3) the acceptability of products in a row F1; F2; and F3 2.63; 2.60; and 2.81 at α 0.05. It means that the product that can be accepted by the community is F3.

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REFERENCES

1. Cassady, Bridget A, James H Hollis, Angie D Fulford, Robert V Considine, and Richard D Mattes. 2009. Mastication of Almonds: Effects of Lipid Bioaccessibility, Appetite, and Hormone Response. *American Journal of Clinical Nutrition*, 89(1): 794–800.
2. Aisha M. Nakitto, Aisha M., John H. Muyonga, and Dorothy Nakimbugwe. 2015. Effects of Combined Traditional Processing Methods on the Nutritional Quality of Beans. *Food Science & Nutrition*, 3(3): 233–241.
3. Astuti, M. 1994. *Iron Biovailability of Traditional Indonesia Soybean Tempe*. Japan: Tokyo University of Agriculture.
4. Bohn, Lisbeth, Meyer Anne S, and Rasmussen Søren K. 2008. Phytate: Impact on Environment and Human Nutrition. A Challenge for Molecular Breeding. *Journal of Zhejiang University Science*, *B* 9(3): 165–91.
5. Chen, Chung-Yen, Karen Lapsley, and Jeffrey Blumberg. 2006. A Nutrition and Health Perspective on Almonds. *Journal of the Science of Food and Agriculture*, 86(14): 2245–50.
6. Chung, King-Thom, Tit Yee Wong, Cheng-I Wei, Yao-Wen Huang, and Yuan Lin. 1998. "Tannins and Human Health: A Review. *Critical Reviews in Food Science and Nutrition*, 38(6): 421–64.

7. Darajat, D P, W H Susanto, and I Purwantiningrum. 2014. Pengaruh Umur Fermentasi Tempe Dan Proporsi Dekstrin Terhadap Kualitas Susu Tempe Bubuk. *Jurnal Pangan dan Agroindustri*, 2(1): 47–53.
8. Dewi, Intan Wahyu Ristisa, Chorul Anam, and Esti Widowati. 2014. Karakteristik Sensoris, Nilai Gizi, Dan Aktivitas Antioksidan Tempe Kacang Gude (*Cajanus canan*) dan Tempe Kacang Tunggak (V*igna unguculata*) Dengan Berbagai Variasi Waktu Fermentasi. *Biofarmasi*, 12(2): 73–82.
9. Gupta, Raj Kishor, Shivraj Singh Gangoliya, and Nand Kumar Singh. 2013. Reduction of Phytic Acid and Enhancement of Bioavailable Micronutrients in Food Grains." *J. Food Sci. Technol.*, 52(2): 676– 684.
10. Kasmidjo, RB. 1990. *Tempe Mikrobiologi Dan Biokimia Pengolahan Serta Pemanfaatannya*. Yogyakarta: PAU Pangan dan Gizi: Universitas Gadjah Mada.
11. Loux, Renée. 2006. *The Balanced Plate: The Essential Elements of Whole Foods and Good Health*. Rodale.
12. Mastuti, C Yizhong, and C Harold. 2010. Identifikasi Pigmen Betasianin Pada Beberapa Jenis Inflorescence Celosia. *Jurnal Biologi UGM*, 66(6): 664-672.
13. Mattila, Pirjo H., Juha-Matti Pihlava, Jarkko Hellström, Markus Nurmi, Merja Eurola, Sari Mäkinen, Taina Jalava, and Anne Pihlanto. 2018. Contents of Phytochemicals and Antinutritional Factors in Commercial Protein-Rich Plant Products. *Food Quality and Safety*, 2(1): 213–19.
14. Miquel-Kergoat, Sophie, Veronique Azais-Braesco, Britt Burton-Freeman, and Marion M. Hetherington. 2015. Effects of Chewing on Appetite, Food Intake and Gut Hormones: A Systematic Review and Meta-Analysis. *Physiology & Behavior*, 151(1): 88–96.
15. Permanasari, Eny. 1997. *Pengaruh Pengukusan Pada Tempe Dan Pengulangan Ekstraksi Terhadap Sifat Fisik Dan Kimia Susu Tempe*. Surabaya: Universitas katolik Widya Mandala.
16. Schlemmer, Ulrich, Wenche Frølich, Rafel M. Prieto, and Felix Grases. 2009. Phytate in Foods and Significance for Humans: Food Sources, Intake, Processing, Bioavailability, Protective Role and Analysis. *Mol. Nutr. Food Res.*, 53(1): 330–75.
17. Suryani, Isti, Agus Santoso, and M. Juffrie. 2010. Penambahan Agar-Agar dan Pengaruhnya Terhadap Kestabilan dan Daya Terima Susu Tempe Pada Mahasiswa Politeknik Kesehatan Jurusan Gizi Yogyakarta. *Jurnal Gizi Klinik Indonesia*, 7(2): 85–91.

18. Susilowati, A, and Aspiyanto. 2004. *Alternatif Pati Jagung Termodifikasi Sebagai Pengental Dan Penstabil Serta Pengaruhnya Terhadap Kualitas Susu Tempe Secara Hidrolis Enzimatik*. Jakarta: Lembaga Ilmu Pengetahuan Indonesia.
19. Zhou, Jin R, and John W Erdman Jr. 1995. Phytic Acid in Health and Disease. *Critical Reviews in Food Science & Nutrition*, 35(6): 495–508.