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Sensory acceptance and physicochemical profiles of Pempek Made with Narrow-barred Spanish Mackerel Fish Enriched with Broccoli and Red Cabbage

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Abstract: Food modification by adding vegetables to popular local foods such as pempek is expected to help overcome low vegetable consumption. This study aimed to develop pempek products made from narrow-barred spanish mackerel (*Scomberomorus commerson)* with the addition of broccoli *(Brassica oleracea var. Italica)* and red cabbage *(Brassica oleraceavar. Capitata forma rubra)*. It was an experimental study with a completely randomized design (CRD). There were 4 formulas for each type of pempek, F0 (0% vegetables), F1 (20% vegetables), F2 (40% vegetables), and F3 (60% vegetables). Based on the assessment of 25 semi-trained panelists using a Visual analog scale instrument on color, aroma, texture, taste, and aroma, both broccoli and red cabbage affected and increased significantly (p <0.05) almost all sensory acceptance parameters, except for the aroma parameter of broccoli pempek (P> 0.05). Through the texture analyzer instrument, the selected formula of vegetable pempek with the highest sensory acceptance (broccoli pempek F3 and red cabbage pempek F3) together with control pempek was declared to have a chewy texture. Based on Hunter's color notation, it was revealed that the control pempek was brownish-white, the broccoli pempek was greenish-brown, and the red cabbage pempek was purple. Then, the addition of vegetables at the level of 60% affected the chemical properties of both vegetable pempek, in the parameters of water, ash, protein, carbohydrates, and dietary fiber, at $\alpha = 0.05$. The three types of pempek did not show any difference in fat level due to the very low-fat content. Thus, vegetable pempek can be used as an alternative food to improve vegetable consumption.

1. Introduction

Pempek is a staple food typical of the city of Palembang, South Sumatra, Indonesia. Pempek is a traditional food product classified as fish gel, such as otak-otak or kamaboko in Japan. This food is made from the essential ingredients of meat, tapioca flour, salt, and water [1]. A study in Jakarta, Indonesia, shows that 90% of respondents usually eat pempek as a snack, between the main daily meals or side dishes for specific events [2].

Pempek can be a food source of animal protein because the main ingredient in making pempek is fish. In addition, the high carbohydrate content in tapioca flour as a mixture of pempek also makes pempek a good source of carbohydrates. The addition of vegetables as a source of dietary fiber into pempek is expected to improve the nutritional quality of pempek and help increase dietary fiber intake.

The amount of food fiber consumed per day by the people of Indonesia is very low, namely an average of 9.9 - 10.7 g/day from the recommended 30 g/day [3]. Lack of consumption of vegetables is caused by the taste of vegetables which tend not to be savory, a taste favored by the general public. Broccoli and red cabbage are types of vegetables that are not preferred because of their unpleasant aroma and bitter taste. However, their nutritional content is highly recommended for health.

Broccoli and red cabbage are types of vegetables that are very easy to find in Indonesia and can be grown in all seasons. Both vegetables can withstand storage at a temperature of 10 °C for 2-6 weeks

[4]. It ensures the availability of these vegetables as additional ingredients of food, including pempek. Apart from the availability and shelf life of vegetables, various nutrients in these vegetables are also expected to increase the nutritional content of pempek. This study aimed to develop pempek, a protein food source with narrow-barred spanish mackerel fish (*Scomberomorus commerson)* enriched with broccoli (*Brassica oleracea var. Italica*) and red cabbage (*Brassica oleraceavar. Capitata forma rubra*).

2. Methods

2.1. Design and Materials

It was an experimental study with a completely randomized design (CRD). The main ingredients used in this study were narrow-barred spanish mackerel fish (*Scomberomorus commerson)*, broccoli (*Brassica oleracea var. Italica*), and red cabbage (*Brassica oleraceavar. Capitata forma rubra*).

2.2. Product Preparation

2.2.1. Vegetable preparation. The broccoli should be fresh, non-wilted, and bright green color. Broccoli was sorted, soaked in 1% saltwater, washed, and then drained. Soaking broccoli in saltwater aimed to kill the worms and insects in broccoli. Besides, saltwater can reduce the bitter taste of broccoli [5]. At the same time, the chosen red cabbage should be fresh, not wilted, leaves intact, not rotten, and purplish-red color. The red cabbaged was sorted and cleaned. After, both broccoli and red cabbage were separately blanched with hot water (temperature 82-84 ºC) for 3-5 minutes for enzyme inactivation that can cause damage to plant tissue. Then blend broccoli and red cabbage to obtained the pastes.

2.2.2. Making narrow-barred spanish mackerel fish pempek with the addition of vegetables. The concentrations of vegetables (broccoli and red cabbage) added at this stage were F0 = 0%, F1 = 20%, F2 = 40%, and F3 = 60%. The concentration of vegetables added to the pempek mixture was based on the weight of the fish meat. The formula for pempek with the addition of vegetables was presented in Table 1.

Table 1. Product Formulations.

Formulation	Ground Fish Meat (g)	Vegetables (g)	Tapioca Flour (g)	Cold Water (g)	Salt (g)
F0	45	0	30	15	3
F1	45	9	30	15	3
F2	45	18	30	15	3
F3	45	27	30	15	3

The process of making pempek was initialized by mixing the grounded narrow-barred spanish mackerel fish meat with cold water and salt until well blended and forms a paste. Then, added the vegetables according to the formulation in Table 1 and mixing well. The tapioca was added and mixed well and become the dough. The dough was shaped to be a small cylinder about 10 cm long with about 3 cm. Boiled the shaped dough in a pot of boiling water for 30 minutes, then drained.

2.3. Sensory Acceptance Analysis

Panelists carried out organoleptic analysis with the hedonic test. Twenty-five trained panelists assessed the parameters of color, aroma, texture, taste, and overall preference. The assessment was carried out using a visual analog scale with a value range of 0 to 10 [6]. The sensory assessment was carried out on pempek products ready for consumption, fried but without cuko, a special spicy sauce of pempek.

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In the sensory analysis, the selected products were determined for each type of vegetable. Then, the selected product with the highest acceptance values was further analyzed physico-chemically.

2.4. Physical Analysis

2.4.1. Texture. Texture measurements were carried out using a texture analyzer to analyze textures [7]. This tool worked by using the Texture ProLite program. The principle of texture analysis was to apply pressure to the sample using probes of various types. This tool would record the test result data and then converted it into a texture profile curve.

2.4.2. Color. In this study, the analysis of color parameters was carried out using the Hunter color notation method [8]. A color type was described systematically and objectively with a color notation system, letter and or number notation (symbol). In the Hunter or tristimulus color notation system, color measurements were carried out objectively using a photoelectric colorimeter called a Hunter colorimeter.
The Hunter color notation system was characterized by three parameters, namely L, a, and b. Each with a value range of 0 to ± 100. The L notation denoted the brightness (lightness) parameter with a value of 0 which means black, and 100 means white. Notation represented the red-green, +a (positive) from 0 to +100 for red, and -a (negative) from 0 to -80 for green. Meanwhile, notation b represented the blue-yellow, +b (positive) from 0 to +70 for blue, and -b (negative) from 0 to -70 for yellow. Measuring the color of food products using the Hunter notation system using a colorimeter could directly record L, a, and b.

2.5. Chemical Analysis

2.5.1. Water content. Water content analysis was performed using the oven method [9]. Principally, it evaporated the free water (H_2O) molecules present in the sample.
Ash content

Ash content analysis was carried out using the oven method [9]. The principle was the combustion or ignition of organic materials, broken down into water (H_2O) and carbon dioxide (CO_2), and inorganic did not burn. Remain inorganic substances were measured as ash.

2.5.2. Fat content. Fat content analysis was performed using the soxhlet method [9]. In principle, the fat contained in the sample was extracted using a non-polar fat solvent.

2.5.3. Protein content. Protein content analysis was performed using the Kjeldahl method [9]. The principle was the oxidation of carbonaceous materials and the conversion of nitrogen to ammonia by sulfuric acid. Ammonia reacted with excess acid to form ammonium sulfate. The ammonium sulfate formed was decomposed, and the solution alkaline with NaOH. The evaporated ammonia would bind with boric acid. The amount of nitrogen contained in the solution was determined by titration using a standard acid solution.

2.5.4. Carbohydrate content. The determination of carbohydrate content uses by difference [10].

2.5.5. Fiber. Dietary fiber was analyzed using enzymatic methods [11]. In this study, the termamyl enzyme was used as an analog of the digestive enzyme for food followed by the enzyme pancreatin digestion.

2.6. Data Analysis

A one-way ANOVA test was conducted to determine the effect of vegetable concentration on the products' level of acceptance and chemical properties.

3. Results and Discussion

3.1. Sensory Acceptance

Pempek without the addition of vegetables (0% vegetables) were stated as control/standard pempek (F0). In comparison, pempek with the addition of 20%, 40%, and 60% vegetables were grouped as vegetable pempek (broccoli and red cabbage) F1, F2, and F3. The results of the organoleptic analysis of pempek products are presented in Table 2.

Based on Table 2, the addition of vegetables (broccoli and red cabbage) significantly affected and increased (p <0.05) almost all sensory acceptance parameters of pempek products, except for the pempek broccoli aroma. In broccoli pempek, the aroma produced was not significantly different (P> 0.05) from the standard pempek made without vegetables.

Table 2. Sensory acceptance of the product.

Parameters	Formulations*				Sig. **
	F0	F1	F2	F3	
Broccoli Pempek					
Color	5.18 ± 1.85^{a}	5.94 ± 1.87^{ab}	6.62 ± 1.73^{b}	6.77 ± 1.41^{b}	0.01
Aroma	5.16 ± 1.66	5.73 ± 1.85	6.14 ± 1.90	6.38 ± 1.94	0.11
Texture	4.89 ± 1.98^{a}	6.03 ± 2.16^{b}	6.74 ± 1.87^{b}	6.80 ± 1.41^{b}	0.00
Taste	5.31 ± 1.84^{a}	6.86 ± 1.89^{b}	6.74 ± 1.77^{b}	5.99 ± 1.49^{ab}	0.01
Overall	5.30 ± 1.76^{a}	6.69 ± 1.86^{b}	6.67 ± 1.56^{b}	6.22 ± 1.62^{ab}	0.01
Red Cabbage Pempek					
Color	6.56 ± 1.76^{a}	5.39 ± 2.11^{b}	5.28 ± 2.13^{b}	5.01 ± 2.22^{b}	0.04
Aroma	5.29 ± 1.74^{a}	5.76 ± 2.14^{ab}	5.54 ± 1.97^{a}	6.72 ± 1.42^{b}	0.04
Texture	5.42 ± 1.75^{a}	6.23 ± 1.85^{ab}	6.25 ± 1.73^{ab}	7.03 ± 1.63^{b}	0.01
Taste	5.37 ± 1.92^{a}	5.91 ± 1.87^{ab}	5.92 ± 1.66^{ab}	6.85 ± 1.35^{b}	0.03
Overall	5.40 ± 1.55^{a}	6.40 ± 1.72^{ab}	6.10 ± 1.71^{ab}	6.50 ± 1.49^{b}	0.04

Note: *mean ± SD, ** significant at the level of 5%

3.1.1. Broccoli pempek. The addition of broccoli increased the preference for pempek. Broccoli contains chlorophyll or commonly referred to as a green leafy substance. The chlorophyll content makes broccoli green, especially in the flower area, which then affects the color of the pempek.

In this product, the distinctive aroma of fish decreased, and broccoli's aroma increased as the concentration of broccoli was added. However, the increase in the aroma of broccoli did not significantly affect the panelists' preference. Broccoli, which is a cruciferous plant, contains sulfur molecules (glucosinolates), which, when broken, will cause a distinctive (unpleasant) smell [12]. However, the broccoli used in this study was blanched before added to the pempek mixture, so the aroma of the broccoli pempek product was not unpleasant. Morales-Blances et.al. (2002) state that the vegetable blanching will inactivate the peroxidase enzyme, which causes unwanted aromas [13].

The addition of broccoli could increase the elasticity of the broccoli pempek product. The increase in chewiness in the broccoli pempek product was due to the high water content in the broccoli. As a result, the water content of the broccoli pempek product would increase along with the improvement of broccoli. The higher the water content, the softer the product.

Broccoli contains a glucosinolate group that causes a slightly bitter taste [14] However, the bitter taste can be minimized by blanching the broccoli before adding the broccoli to the pempek mixture. In addition to reducing unpleasant odors, Morales-Blances et.al. (2002) also state that the blanching process in vegetables can also eliminate unwanted bitter tastes [13].

3.1.2. Red cabbage pempek. The addition of red cabbage to pempek affected the panelists' preference based on color parameters. Red cabbage has anthocyanin pigment [15], responsible for the resulting red color of the pempek.

Also, the preference value of red cabbage pempek based on aroma parameter was increased. Like broccoli, as a cruciferous plant, red cabbage contains sulfur compounds in the form of glucosinolates. It will cause a distinctive (unpleasant) smell and aroma [12]. However, in this study, red cabbage was blanched before added to minimalize the distinctive aroma. Morales-Blances et.al. (2002) stated that the vegetable blanching process might inactivate the peroxidase enzyme, which causes unwanted aromas. It was thought to be the cause of the increase in the preference value of the aroma parameters of the red cabbage pempek product.

The addition of red cabbage increased the elasticity, and the preference for the panelists also increased. The increase in chewiness was thought to be due to the high water content in red cabbage. It resulted in the water content of the red cabbage pempek product was increasing along with the increase in the concentration of the addition of red cabbage. The higher the moisture content, the higher the tenderness of the product. Thus, the pempek product with the addition of red cabbage tended to be chewier than the pempek without red cabbage.

The addition of red cabbage to pempek resulted in a more savory pempek, so the panelists' preference increased. Red cabbage contains a glucosinolate group which causes a slightly bitter taste [14]. Morales-Blances et.al. (2002) also state that the blanching process in vegetables can also eliminate unwanted bitter tastes. Thus the savory taste of pempek was not covered by the bitter taste of red cabbage [13].

The best formula of vegetable pempek products with the highest sensory acceptance value was the F3 broccoli pempek (60% broccoli) and the F3 red cabbage pempek p(60% red cabbage). The two best formulas were then observed further for their physicochemical properties.

3.2. Physical Properties

Physical analysis was including texture and color analysis. The pempek products analyzed were the standard formula pempek (control), the F3 broccoli pempek, and the F3 red cabbage pempek. The results of the physical analysis are presented in Table 3.

Table 3. Physical Properties of Pempek.

Parameters	Control (Formula F0)	Broccoli Pempek (Formula F3)	Red Cabbage Pempek (Formula F3)
Texture	Chewy	Chewy	Chewy
Color	Brownish white	Greenish brown	Purple

3.2.1. Texture. Through the texture analyzer, the selected formula of vegetable pempek (broccoli pempek F3 and red cabbage pempek F3) together with the control pempek were declared to have a chewy texture. The addition of vegetables with high water content can reduce the water holding capacity of tapioca flour. Thus, the resulting vegetable pempek became softer due to an increase in the moisture content of the food product.

3.2.2. Color. Based on Hunter's color notation, the control pempek was a brownish-white color. The broccoli pempek was a greenish-brown color. The red cabbage pempek was a purple color. The color of products influenced by the original color of the vegetables added. The vegetable pempek product analyzed was a pempek product with a high enough vegetable concentration. Thus, the color of the vegetable pempek produced would greatly reflect the original color of the vegetables added.

Physical analysis conducted on the broccoli pempek product shows that the broccoli pempek product has a greenish-brown color. Chlorophyll is easily degraded due to exposure to heat, light, oxidizing agents, and environmental pH conditions [16]. One of the degradation reactions of chlorophyll pigments is the peofitination reaction which causes chlorophyll to lose Mg^{2+} ions. In this study, broccoli was exposed to heat twice, the blanching and the boiling processes. Exposure to heat causes an oxidation reaction to the chlorophyll color to become brown [17].

Red cabbage contains at least thirty-six of the 300 kinds of anthocyanins that play a role in various red and blue colors in plants [18]. This pigment molecule is stored in the cells of red cabbage leaves. The processing of the product influenced the decrease in the purple color produced in the red cabbage pempek product. When exposed to heat during the cooking process, cells containing anthocyanins open up, causing the color pigments to dissolve into the surrounding fluid [19,20]. The red cabbage underwent a blanching process causes the color to dissolve in the cooking water. Thus, the color of the red cabbage pempek is not as bright as the color of fresh red cabbage.

3.3. Chemical Properties

The nutritional analysis included proximate analysis (water, ash, fat, protein, and carbohydrates) [21] and dietary fiber content. The pempek products analyzed were the standard formula/control pempek and the selected vegetable pempek with the highest level of preference (broccoli pempek F3 and red cabbage pempek F3). The results of the nutritional analysis of vegetable pempek products are presented in Table 4.

The addition of vegetables at the level of 60% affected the chemical properties of pempek, both in the parameters of water, ash, protein, carbohydrates, and food fiber, at $\alpha = 0.05$. Whereas in the fat parameter, the three types of pempek did not differ due to the low content of the product fat content.

Table 4. Chemical Properties of Vegetable Pempek Products.

Parameters	Products*			Sig.**
	Control (Formula F0)	Broccoli Pempek (Formula F3)	Red Cabbage Pempek (Formula F3)	
Water (%)	62.17 ± 1.20^{a}	67.62 ± 0.19^{b}	63.8 ± 0.03^{a}	0.00
Ash (%)	2.38 ± 0.05^{c}	1.57 ± 0.01^{a}	1.54 ± 0.03^{a}	0.00
Fat (%)	< 0.02	< 0.02	< 0.02	-
Protein (%)	8.44 ± 0.11^{d}	7.21 ± 0.00^{b}	6.96 ± 0.04^{a}	0.00
Carbohydrate (%)	26.98 ± 1.27^{b}	23.58 ± 0.18^{a}	26.64 ± 0.04^{b}	0.02
Fibre (%)	0.90 ± 0.01^{a}	2.03 ± 0.04^{b}	2.63 ± 0.03^{d}	0.00

Note: *mean ± SD, ** significant at the level of 5%

The increase in water content in vegetable pempek, when compared to control pempek, was influenced by the high water content in the vegetables. The average water content in broccoli and red cabbage is 88 - 92%. The highest water content is found in broccoli, which is 92% so that broccoli pempek has the highest water content when compared to other pempek products. It is in line with Afriani et.al. (2015), which showed increased water content in snakehead fish pempek added with broccoli.

The addition of vegetables to the pempek reduced the ash content of the pempek vegetable. The raw material for pempek in this study was narrow-barred spanish mackerel fish. Although vegetables contain several minerals, the amount is smaller compared to the mineral content in fish. So, the amount of ash in this study is being lower in the vegetable pempek than pempek without vegetables. In addition, vegetable pempek had a higher water content than control pempek. The ash content will generally be lower if the water content in a product is high.

Fish is included in the group of low-fat animal protein sources. In this study, the fish part used was only the meat. So the resulting pempek product contained very low fat. Meanwhile, the fish that contain the most fat is the skin and stomach, which were not used as raw material for making pempek in this study.

The protein content in vegetable pempek was lower than the control pempek. The addition of vegetables at the level of 60% could reduce the protein content of vegetable pempek products, both in broccoli pempek and red cabbage pempek.

Pempek contains a high carbohydrate content because it is made from tapioca starch as raw material. The addition of vegetables to pempek made the tapioca starch concentration smaller, the carbohydrate content decreased in vegetable pempeks.

The addition of vegetables to narrow-barred spanish mackerel fish pempek can increase the level of dietary fiber in pempek products. Adequacy of dietary fiber for adults ranges from 20 - 35 g/day. In average consumption, control pempek with a dietary fiber content of 0.90 ± 0.01% met the daily dietary fiber needs of 2.8 - 4.5%. Broccoli pempek with a 2.03 ± 0.04% food fiber content fulfilled the daily dietary fiber needs of 5.8 - 10.2%. Pempek red cabbage with a 2.63 ± 0.03% food fiber content met the daily dietary fiber needs of 7.5 - 13.2%. Overall, consumption of vegetable pempek was able to meet the needs of food fiber by 2.8 - 13.2% in each portion. A food ingredient or food product can be dedicated as a good source of nutrients if it contains 10-19% of the daily nutritional needs in 1 serving [22]. Thus, the vegetable pempek produced in this study was declared as a dietary fiber food source.

4. Conclusion

Pempek's innovation made from narrow-barred spanish mackerel (*Scomberomorus commerson)* with the addition of broccoli *(Brassica oleracea var*. *Italica)* and red cabbage *(Brassica oleraceavar. Capitata forma rubra)* can be an alternative in increasing vegetable consumption for the community.

References

[1] Afriani Y, Lestari S and Herpandi H 2015 Karakteristik Fisiko-Kimia Dan Sensori Pempek Ikan Gabus (Channa Striata) Dengan Penambahan Brokoli (Brassica Oleracea) Sebagai Pangan Fungsiona *Fishtech* **4** 95–103

[2] Ekaprana A Y 2015 *Perencanaan Model Bisnis Restoran Pempek All You Can Eat "Queen Pempek."* (Universitas Bina Nusantara Jakarta)

[3] Santoso I A 2011 Serat pangan (dietary fiber) dan manfaatnya bagi kesehatan *Magistra* **23** 35

[4] Samad M Y 2006 Pengaruh penanganan pasca panen terhadap mutu komoditas hortikultura *J. Sains dan Teknol. Indones.* **8**

[5] Nasthasia A C 2014 Perancangan Buku Panduan Kreasi Sajian Sayur yang Menarik untuk Anak-Anak *J. DKV Adiwarna* **1** 12

[6] Sugiura T, Uchida S and Namiki N 2012 Taste-masking effect of physical and organoleptic methods on peppermint-scented orally disintegrating tablet of famotidine based on suspension spray-coating method *Chem. Pharm. Bull.* **60** 315–9

[7] Suchy J, Lukow O M and Ingelin M E 2000 Dough microextensibility method using a 2- g mixograph and a texture analyzer *Cereal Chem.* **77** 39–43

[8] İncedayi B, Tamer C E, Sinir G Ö, Suna S and Çopur Ö U 2016 Impact of different drying parameters on color, β-carotene, antioxidant activity and minerals of apricot (Prunus armeniacaL.) *Food Sci. Technol.* **36** 171–8

[9] AOAC 2012 *Official methods of analysis* (Arlington (VA): Association of Official Analytical Chemists Washington, DC)

[10] Winarno F G 2008 *Kimia Pangan dan Gizi Jakarta* (Jakarta: PT Gramedia Pustaka)

[11] de Almeida Costa G E, da Silva Queiroz-Monici K, Reis S M P M and de Oliveira A C 2006 Chemical composition, dietary fibre and resistant starch contents of raw and cooked pea, common bean, chickpea and lentil legumes *Food Chem.* **94** 327–30

[12] Bernuzzi F 2021 What are cruciferous vegetables and why are they so special_ - Quadram Institute

[13] Morales- Blancas E F, Chandia V E and Cisneros- Zevallos L 2002 Thermal inactivation kinetics of peroxidase and lipoxygenase from broccoli, green asparagus and carrots *J. Food Sci.* **67** 146–54

[14] Fatharanni M O and Anggraini D I 2017 Efektivitas brokoli (Brassica oleracea var. Italica) dalam menurunkan kadar kolesterol total pada penderita obesitas *J. Major.* **6** 64–70

[15] Chandrasekhar J, Madhusudhan M C and Raghavarao K 2012 Extraction of anthocyanins from red cabbage and purification using adsorption *Food Bioprod. Process.* **90** 615–23

[16] Arifin T, Ali A and Hamzah F Pembuatan Mi Instan dari Tepung Jagung Lokal Riau dengan Penambahan Brokoli (Brassica Oleracea L.,)

[17] Murcia M A, López- Ayerra B, Martínez- Tomé M and García- Carmona F 2000 Effect of industrial processing on chlorophyll content of broccoli *J. Sci. Food Agric.* **80** 1447–51

[18] Wiczkowski W, Szawara-Nowak D and Topolska J 2013 Red cabbage anthocyanins: Profile, isolation, identification, and antioxidant activity *Food Res. Int.* **51** 303–9

[19] Jiang T, Mao Y, Sui L, Yang N, Li S, Zhu Z, Wang C, Yin S, He J and He Y 2019 Degradation of anthocyanins and polymeric color formation during heat treatment of purple sweet potato extract at different pH *Food Chem.* **274** 460–70

[20] Wu H-Y, Yang K-M and Chiang P-Y 2018 Roselle anthocyanins: Antioxidant properties and stability to heat and pH *Molecules* **23** 1357

[21] Sofiana M S J, Aritonang A B, Safitri I, Helena S and Nurdiansyah S I 2020 Proximate, Phytochemicals, Total Phenolic Content and Antioxidant Activity of Ethanolic Extract of Eucheuma spinosum Seaweed *Syst. Rev. Pharm.* **11** 228–32

[22] McGuire M and Beerman K A 2012 *Nutritional sciences: from fundamentals to food* (Cengage Learning)

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