ISSN 3031-0911

Preliminary Test of Edamame Jelly Anti Hypertension: The Analysis Of Acceptability and Nutritional Quality of Edamame Jelly

Yualeny Valensia[1*], Budiyanti Wiboworini[2], Nur Hafidha Hikmayani[3],

[1] Department of Nutrition science, Sebelas Maret University, Surakarta, Indonesia
[2] Department of Nutrition science, Sebelas Maret University, Surakarta, Indonesia
[3]Department of of Medical science, Sebelas Maret University, Surakarta, Indonesia
*Correspondence author : valensia.yv@gmail.com

Abstract

The management of primary hypertension is divided into non-pharmacological and pharmacological therapies. Non-pharmacological therapy can be done by increasing the consumption of nuts. Edamame is a source of protein, amino acids, potassium, calcium, magnesium, and isoflavones. This study used edamame-made jelly with a mixture of carrageenan. This study analyzed the acceptability and content of edamame jelly's potassium, calcium, magnesium, and isoflavones. The research design was experimental by mixing three edamame jelly formulas. The acceptability test was conducted on 30 students, lecturers, and educational staff of the D-IV Clinical Nutrition Study Program, Jember State Polytechnic. The acceptability test includes colour, aroma, taste, firmness, and overall, with five scales. The panellists preferred the formula followed by proximate tests, potassium, calcium, magnesium, isoflavones, and total calories at the Jember State Polytechnic Food Industry Technology Laboratory. The organoleptic test results showed that the most preferred formula was P2 with 25 grams of cooked edamame. The nutritional quality of the selected edamame jelly is 139.5 kcal calories, 9.1 grams protein, 2 grams fat, 21.4 grams carbohydrates, 147 mg potassium, 36 mg calcium, 19.5 mg magnesium, and 8.1 mg isoflavones. There is a need for further research regarding the effect of edamame jelly on reducing blood pressure in sufferers of primary hypertension.

Keywords: Blood Pressure, Edamame, Hypertension, Potassiums

Introduction

Management of primary hypertension is divided into non-pharmacological and pharmacological therapy. One of the non-pharmacological therapies can be done with lifestyle modifications (PDHI 2021). A healthy lifestyle that can be done is to increase the consumption of nuts. Legumes containing bioactive components that benefit patients with primary hypertension are vegetable soybeans or edamame (*Glycine max* (L.) Merril). Edamame is a source of protein, carbohydrates, fibre, amino acids, potassium, calcium, and magnesium. Isoflavones in edamame can also reduce the risk of developing hypertension. Edamame can support the development of functional food ingredients that reduce the prevalence of non-communicable diseases (Fitriyana, 2014).

Consuming edamame for patients with primary hypertension can lower blood pressure because of the potassium, calcium, magnesium, and isoflavones contained in edamame (Rohatin & Prayuda, 2020). Previous research conducted by Sumarni (2020) regarding giving edamame to women of childbearing age (WUS) with hypertension can reduce systolic and diastolic blood pressure. Edamame is provided in the frozen form, consumed directly at a dose of 25 grams/day, accompanied by amlodipine 5 mg/day for 30 days. Another study by Karyadi *et al*. (2022) stated that the freezing treatment of edamame can affect its texture. The panellists' acceptance of the edamame texture (hardness) organoleptic test showed that they did not like frozen edamame because of its hard surface.

Researchers have developed edamame by processing it into jelly as a non-pharmacological therapy for sufferers of primary hypertension. The choice of jelly is because, in previous studies, edamame was given in frozen form with a hard texture. In contrast, jelly is a semi-solid food popular with everyone because of its dense and chewy texture (Prakarsa, 2017). The process of making edamame jelly is by mixing edamame with carrageenan, an ingredient from seaweed that functions as a gel former. Carrageenan has high fibre and potassium content; when consumed, it can help reduce the risk of hypertension (Kusumaningrum & Rahayu, 2018).

Edamame jelly is made in 3 different formulas with different edamame composition ratios. This study aims to analyze the acceptability of 3 edamame jelly formulas and test proximate, fibre, minerals, isoflavones, and total calories in panellists' most preferred formulas.

ISSN 3031-0911

Methods

This research design is experimental with three formulas, namely P1, P2, and P3. The research was conducted at the Nutrition Care Center (NCC) Laboratory of the D-IV Clinical Nutrition Study Program at the Jember State Polytechnic for product manufacture and hedonic testing. In contrast, the proximate, fibre, mineral, isoflavone, and total calorie tests were carried out at the Food Industry Technology Laboratory at the Jember State Polytechnic. This research was carried out from November 2022 to January 2023.

The preparation of the edamame jelly formula refers to previous research with several modifications to the additional ingredients (Afiska *et al*., 2021). The difference between the three formulas lies in the total weight of cooked edamame used, namely P1 30 grams, P2 25 grams, and P3 35 grams. Other ingredients are 16.7 grams of granulated sugar, 2.3 grams of carrageenan, 0.7 grams of vanilla powder, and 450 ml of water, used in the same amount for each formula. Formula P2 is the total weight of ripe edamame, which refers to previous studies (Sumarni, 2020). The three edamame jelly formulas in this study are presented in **Table 1.**

Table 1. Edamame Jelly Formula

Formula	Ripe Edamame (gram)	Sugar (gram)	Carrageenan (gram)	Vanilla Powder (gram)	Water (ml)
P1	30	16.7	2.3	0.7	150
P2	25	16.7	2.3	0.7	150
P3	35	16.7	2.3	0.7	150

In accordance with **Table 1**. making edamame jelly is clean the raw edamame, boil raw edamame for ± 5 minutes. Peel the edamame and weigh according to the weight stated. Blend the edamame with 100 ml of boiled water until smooth and pour into a container. Dissolve carrageenan with 50 ml of boiled water in a separate container and stir thoroughly until there are no lumps, sdd the granulated sugar to the smooth edamame bowl and stir thoroughly. Put the dissolved carrageenan into the edamame container and mix thoroughly. Heat and cook the mixture over low heat while continuing to stir. Add vanilla powder if the mixture explodes and mix well. Remove the dough, pour it into a serving cup, then chill for at least 2 hours. Edamame jelly is ready to serve.

Testing of organoleptic properties aims to determine the response of panellists to the quality properties of organoleptic, including colour, taste, aroma, elasticity, and overall product, using the hedonic method. The organoleptic test was carried out by 30 semi-trained panellists with the following criteria: knowing the sensory properties of the samples to be assessed, not smoking, not hungry or complete, and not sick. Panellists were presented with a selection of each product in a plastic cup and asked to provide an assessment using a hedonic scale and a description of the characteristics of each product on an organoleptic test form with five scales (1: dislike, 2: do not like, 3: neutral, 4: like, and 5: really like). The formula most panellists prefer based on organoleptic testing is continued for nutritional quality testing.

The nutritional quality test of edamame jelly was carried out at the Jember State Polytechnic Food Industry Technology Laboratory in the form of proximate tests, namely water and ash content using the gravimetric method, fat content using the Soxhlet method, protein content using the Kjeldahl method, carbohydrate content using the bay different method by SNI 01- 2891-1992 and SNI 2973:2011. Test potassium, calcium, magnesium, isoflavone, and total calorie levels using the spectrophotometric method by SNI 06-6989.12-2004.

Determination of the best formula is carried out using weighting on the analysis of organoleptic properties, which are then ranked based on the scoring results of the three formulas.

Results and Discussions

Edamame jelly was made in 3 formulas, which the panellists tested. *Edamame jelly* is a processed food made from edamame, carrageenan, granulated sugar, vanilla powder, and water.

ISSN 3031-0911

Table 2. Organoleptic Test

Parameter	Mean±SD*		
	P1	P2	P3
Colour	3,57±0,81	3,60±0,81	3,87±0,81
Aroma	3,33±0,84	3,50±0,86	3,17±0,95
Taste	3,10±0,75	3,70±0,87	3,10±0,92
Elasticity	3,10±0,92	3,73±0,90	3,47±0,90
Overall product	3,30±0,79	3,67±0,84	3,43±0,93

*: ANOVA test

The organoleptic test was determined using the hedonic method with parameters of colour, aroma, taste, elasticity, and overall by 30 semi-trained panellists. *Colour* is the first parameter that can influence the panellists' perception of the product. The most preferred colour parameter is P3, with a hedonic scale 3.87. The colour produced by the P3 formula is light green, while the other two formulas are slightly lighter than P3. The most preferred aroma parameter is P2, with a hedonic scale 3.50. The aroma of the three products is typical of edamame. The results showed that P2 was the most preferred formula regarding taste, with a hedonic scale of 3.70. The delicious taste of edamame is covered by the addition of vanilla powder so that the edamame jelly has a sweet and savoury taste due to the addition of granulated sugar. Formula P2 is a product with the best level of elasticity with a hedonic scale of 3.73. Based on the results of the panellists' assessments, the P2 formula has the highest rating compared to the other two. The correct proportion between the amount of edamame, the jelly powder, and other ingredients resulted in the jelly's elasticity level, which many panellists liked.

The most preferred overall parameter of edamame jelly is P2, with a scale of 3.67. The overall acceptability of the edamame jelly formula is illustrated in **Table 2.** Based on the panellists' overall assessment results, Formula P2 received the highest score compared to the other two. The panellists preferred the P2 formula because the composition of the edamame jelly matched the jelly products on the market that the panellists often consumed. The panellists preferred the P2 formula to the other two formulas regarding aroma, taste, elasticity, and overall, so the formula was continued with analysis of nutritional value, mineral, and isoflavone content at the Jember State Polytechnic Food Industry Technology Laboratory. The test used 100 grams of edamame jelly, while the weight per serving was 150 grams. The results of the analysis can be seen in **Table 3.**

Table 3. Results of analysis of nutritional content of edamame jelly

Parameter	Nutritional Value of Ripe Edamame /100 gr*	Edamame Jelly Test Results /100 gr **	Nutritional Value of Edamame Jelly/serving (150 gr) **
Water content (%)	-	77,58	116,37
Ash Content (%)	-	0,73	10,9
Fat Content (gr)	7,57	1,34	2
Protein Content (gr)	11,5	6,08	9,1
Carbohydrate Content (gr)	8,63	14,28	21,4
Potassium Level (mg)	422	98	147
Calcium Level (mg)	61	24	36
Magnesium Level (mg)	62	13	19,5
Fiber Content (mg)	5	1,06	1,59
Isoflavone levels (mg)	17,92	5,4	8,1
Calorie Content (kcal)	140	93	139,5

Source :
*: USDA (2022)
**: Primary data (2023)

ISSN 3031-0911

Table 3 shows that the nutritional value of ripe edamame is higher than the test results per 100 grams of edamame jelly. The nutritional value of edamame jelly is smaller than cooked edamame because only 25 grams of cooked edamame are used in making the jelly. An increase in the nutritional value of edamame jelly can occur if more ripe edamame is used. Previous research conducted by Maulina et al. (2020) stated that giving edamame 25 grams/day effectively reduced blood pressure in women of childbearing age with hypertension.

The results of the organoleptic quality assessment by 30 semi-trained panellists with overall formula P2 weighing 25 grams of cooked edamame was the most preferred formula. The three colour characteristics of the edamame jelly formula are a light green colour, a distinctive edamame aroma, a tending to sweet taste, and a typical suppleness of jelly products. Moreover, the overall characteristics of the desired product are light green, sweet, and chewy, distinct from jelly with a distinctive edamame aroma.

Colour is the first depiction of a product that can affect the panellist's perception. Colour will appear first and often determines the value of a product (Lestari, 2015). Based on the panellists' perception, the more edamame used, the better the resulting colour, so the panellists liked the formula more. The green colour in edamame jelly comes from chlorophyll pigment. *Chlorophyll* is a pigment that gives green colour to photosynthetic plants, algae, and bacteria (Nur *et al*., 2018). The most preferred colour was formula P3 with an edamame weight of 35 grams on a scale of 3.87, and the least preferred was formula P1 with a scale of 3.57 **(Table 2).**

Another parameter that determines the assessment of a product is aroma. *Aroma* is an odour that can affect panellists before enjoying food products because panellists can smell food before consuming it. The aroma of edamame jelly in all three formulas is typical of edamame. Edamame has a distinctive aroma of nuts, namely the unpleasant smell that comes from the oxidation of the lipoxygenase enzyme by linolenic acid (Adinugraha & Michael, 2019). Making edamame jelly uses vanilla powder to reduce the unpleasant aroma of edamame. The most preferred aroma parameter was formula P2 with a hedonic scale of 3.50 **(Table 2).**

Taste is the main parameter for determining the acceptability of a food product (Adinugraha & Michael, 2019). The formula with the most preferred level of taste parameters is P2, with a hedonic score of 3.70 **(Table 2).** Edamame jelly tastes sweet because granulated sugar is added in the making process. The use of granulated sugar can affect the quality of the jelly; the lower the addition of granulated sugar, the more it can cause the jelly to taste bland and the taste response to be heavier, especially the nutty taste (Merta, 2017).

The elasticity of edamame jelly is an organoleptic parameter assessed from the hedonic test. Formula P2 was the panellists' most preferred edamame jelly product, with a hedonic score of 3.73. The process of making edamame jelly is by mixing edamame with carrageenan, an ingredient from seaweed that functions as a gel former (Kusumaningrum & Rahayu, 2018). The results of the overall panellist assessment of the three edamame jelly formulas, namely, P2, had the highest score of 3.66, and the lowest was the P1 formula, with a hedonic score of 3.30 **(Table 2).**

Edamame jelly is a processed product from edamame, a food ingredient containing vegetable protein. The weight per serving of edamame jelly is 150 grams, made from 25 grams of cooked edamame with several additional ingredients. The protein content per 100 grams of edamame jelly is 6.08% or 9.1 grams/per serving **(Table 2).** The vegetable protein in edamame contains essential amino acids, namely leucine, isoleucine, valine, tryptophan, phenylalanine, threonine, lysine, and histidine. Essential amino acids increase the active transport process from the blood into muscle cells and other tissues. Essential amino acids can also increase protein synthesis in muscle and liver cells by inhibiting protein catabolism using insulin. The effect on the cardiovascular system is to increase peripheral blood flow, increasing cardiac output, which influences a decrease in blood pressure (Kusumastuty *et al*., 2016).

Edamame jelly is rich in potassium content because the manufacturing process uses carrageenan addition. Carrageenan has high fibre and potassium content, which can help reduce the risk of hypertension (Kusumaningrum & Rahayu, 2018). The potassium content per 100 grams of edamame jelly is 98 mg per serving, containing 147 mg (Table 2). Consumption of foods high in potassium can have a diuretic vasodilator effect and maintain a balance of extracellular sodium and potassium concentrations so that it can lower blood pressure in people with hypertension (Yuni, 2016). Potassium intake of 2-5 grams/day can lower blood pressure in hypertensive patients because it helps balance sodium (Kusumastuty *et al*., 2016).

Calcium is the most abundant mineral in the human body, primarily found in bones and teeth and a small part in plasma and extracellular fluids. Calcium can improve blood circulation, flex muscles, maintain body fluid balance, and maintain cell membrane permeability (Kurniawan, 2015). The calcium content of edamame jelly is 36 mg per serving **(Table 2).** Adequate calcium intake keeps the calcium balance in the blood maintained. Blood calcium levels are essential because calcium can help flex blood vessel muscles. Plaque or deposits that stick to blood vessels will quickly come off, and blood pressure will become more stable (Rohatin & Prayuda, 2020).

ISSN 3031-0911

Edamame jelly contains 19.5 mg of magnesium per serving **(Table 2).** Hypertension sufferers are advised to consume foods that are sources of magnesium because magnesium can maintain heart health by maintaining heart rhythm and controlling blood pressure to remain normal so that blood circulation remains smooth. Magnesium plays a role in controlling blood pressure and heart muscle contraction. Increasing the magnesium concentration in the blood can make the heart muscle work optimally and decrease blood pressure (Nurmayanti & Kaswari, 2020).

Edamame contains isoflavones that are thought to show antihypertensive activity by increasing NO, reducing angiotensin, and inhibiting the formation of free radical reactions (Maulina *et al.*, 2020). The isoflavone level in edamame jelly is 8.1 mg per serving **(Table 2).** The soy protein consumption of 25 grams per day, equivalent to an isoflavone intake of 37-62 mg, is stated to have met 83% of the recommended daily isoflavone requirements (Yulifianti *et al.*, 2018). Isoflavones work as antihypertensive agents by inhibiting the change of angiotensin I to angiotensin II, thereby inhibiting the release of aldosterone by ACE. Aldosterone impacts the kidneys to retain sodium and water; more water is excreted, and blood pressure will decrease if aldosterone production is inhibited (Maulina *et al.*, 2020).

Conclusions

The hedonic score results show that the most preferred formula is P2 with a cooked edamame weight of 25 grams. The characteristics of the P2 formula are a light green color and sweet, chewy jelly with a distinctive edamame aroma. The nutritional value of the selected edamame jelly is calories 139.5 kcal, protein 9.1 grams, fat 2 grams, carbohydrates 21.4 grams, potassium 147 mg, calcium 36 mg, magnesium 19.5 mg, and isoflavones 8.1 mg. The recommended suggestion is that there is a need for further research regarding the effect of giving edamame jelly on reducing blood pressure in sufferers of primary hypertension

Acknowledgments

Thank you to the Directorate General of Health Workers of the Ministry of Health of the Republic of Indonesia, the Kupang Ministry of Health Polytechnic, and the Jember State Polytechnic for facilitating this research activity.

References

Adinugraha, Andreas Tanuel, and Stefanus H. Michael. 2019. "Analisa Pengaruh Kualitas Makanan Dan Persepsi Harga Terhadap Kepuasan Konsumen D'Cost Surabaya." *Journal of Chemical Information and Modeling* 53(9):1689–99.

Afiska, Widya, Manuntun Rotua, and Yunaini Nabila. 2021. "Uji Daya Terima Puding Kacang Merah Sebagai Alternatif Makanan Selingan Untuk Remaja Putri Anemia." *Jurnal Gizi Dan Kesehatan (JGK)* 1(1):9–16.

Dewi, Ni Wayan Ratna. 2019. "Susu Edamame Jelly Kelor Sebagai Alternatif Minuman Untuk Perbaikan Gizi Anak." 3(2):49–53.

Fitriyana, Nurul Isnaini. 2014. "Pengembangan Pangan Fungsional Antikolesterol Dari Kedelai Edamame (Glycine Max (L) Merril)." (L):1–19.

Karyadi, Joko Nugroho Wahyu, Inas Kamila, Arifin Dwi Saputro, and Dwi Ayuni. 2022. "The Effect of Blanching on the Quality of Freeze-Dried Edamame." *International Journal on Advanced Science, Engineering and Information Technology* 12(2):819–25. doi: 10.18517/ijaseit.12.2.13358.

Kurniawan, Fajar Bakti. 2015. *Buku Teknologi Laboratorium Medik_ Buku Kimia Klinik Praktikum Analis Kesehatan*. Penerbit Buku Kedokteran EGC.

Kusumaningrum, I., and N. S. Rahayu. 2018. "Formulasi Snack Bar Tinggi Kalium Dan Tinggi Serat Berbahan Dasar Rumput Laut, Pisang Kepok, Dan Mocaf Sebagai Snack Alternatif Bagi Penderita Hipertensi." *Argipa* 3(2):102–10.

Kusumastuty, Inggita, Desty Widyani, and Endang Sri Wahyuni. 2016. "Asupan Protein Dan Kalium Berhubungan Dengan Penurunan Tekanan Darah Pasien Hipertensi Rawat Jalan." *Indonesian Journal of Human Nutrition* 3(1):19–28.

Lestari, Sri. (2015). "Uji Organoleptik Mie Basah Berbahan Dasar Tepung Talas Beneng (Xantoshoma Undipes) Untuk Meningkatkan Nilai Tambah Bahan Pangan Lokal Banten." 1(Badrudin 1994):941–46. doi: 10.13057/psnmbi/m010451.

Maulina, Ica, Rifkiyatul Islami, Lanny Sunarjo, Sri Achadi Nugraheni, Midwifery Student, Postgraduate Program, Politeknik Kesehatan, Kemenkes Semarang, and Universitas Diponegoro Semarang. 2020. "Effectiveness of

ISSN 3031-0911

Giving Edamame Supplementation (Glycine Max l . Merrill) on Improvement Blood Pressure in Women of Childbearing Age with Hypertension." 12–16.

Maulina Putri, Binti, and Yasinta Nofia. 2020. "Minuman Berbahan Dasar Kedelai Sebagai Antihipertensi." *Nutrire Diaita* 12(1):29–35.

Merta, Cindy Rahayu. 2017. "Pengaruh Kadar Gula Terhadap Kualitas Permen Jeli Belimbing Wuluh." *Jurnal Elektronik Universitas Negeri Padang* (September):1–14.

Nur, Rizaludin, Hanifah Nuryani Lioe, Nurheni Sri Palupi, and Budi Nurtama. 2018. "Optimasi Formula Sari Edamame Dengan Proses Pasteurisasi Berdasarkan Karakteristik Kimia Dan Sensori Formula Optimization of Pasteurized Edamame Milk Based on Chemical and Sensory Characteristics." *Jurnal Mutu Pangan* 5(2):88–99.

Nurmayanti, Hafidah, and Sutomo Rum tegufile:///D:/garuda1761230. Pdf. Kaswari. 2020. "Efektivitas Pemberian Konseling Tentang Diet Dash Terhadap Asupan Kalium, Kalsium, Natrium Magnesium, Aktivitas Fisik, Dan Tekanan Darah Pasien Hipertensi." *Jurnal Nutriture* 1(1):63–75.

PDHI. (2021). "Perhimpunan Dokter Hipertensi Indonesia." *I-Hefcard.Com* 118.

Prakarsa, Arief Wiyarta. 2017. "Pengaruh Perbedaan Tepung Labu Kuning Dalam Produk Jelly Ditinjau Dari Karakteristik Fisikokimiawi Dan Sensori the Effect of Different Pumpkin Flour in Jelly Product Based on Physicochemical Characteristic and Sensory."

Rohatin, Atin, and Cahyani Wira Prayuda. 2020. "Hubungan Asupan Natrium, Kalium Dengan Hipertensi Pada Lansia Di Poliklinik Penyakit Dalam." *Jurnal Fakultas Ilmu Kesehatan* 1(1):10–14.

Sumarni;, Ica Maulina Rifkiyatul Islami; Lanny Sunarjo; Sri Achadi Nugraheni; Sri. 2020. "Efektifitas Pemberian Suplementasi Edamame (Glycine Max L. Merril) Terhadap Perbaikan Tekanan Darah Dan Profil Lipid (Kolesterol Total, Ldl, Hdl, Trigliserida)(Studi Pada Wanita Usia Subur Dengan Hipertensi Di Puskesmas Mlonggo Kabupaten Jepara)."

USDA. (2022). "FoodData Central." *Agricultural Research Service*. Retrieved January 18, 2023 (https://fdc.nal.usda.gov/fdc-app.html#/food-details/2342911/nutrients).

Yulifianti, Rahmi, Siti Muzaiyanah, and Joko Susilo Utomo. 2018. "Kedelai Sebagai Bahan Pangan Kaya Isoflavon." *Buletin Palawija* 16(2):84. doi: 10.21082/bulpa.v16n2.2018.p84-93.

Yuni, S. 2016. "Pengaruh Konsumsi Minuman Fungsional Terhadap Tekanan Darah Dan Konsentrasi Elektrolit Urin Perempuan Dewasa Prahipertensi." *Disertasi S3 Program Studi Ilmu Gizi Manusia IPB*.