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The Effects of Addition of Sesame (*Sesamum indicum* L.) Filtrate Towards the Quality of Tree Saga Bean (*Adenanthera pavonina* L.) Milk

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Abstract: This research aimed to study the effects of adding sesame filtrate on physico-chemical properties and to determine the level of acceptance of panelists on organoleptic properties of tree saga bean milk. This experiment was arranged in Completely Randomized Design (CRD) with five treatments and three replications. The treatments were: A (Without addition of sesame filtrate), B (Addition 10% sesame filtrate), C (addition 20% sesame filtrate), D (Addition 30% sesame filtrate) and E (Addition 40% sesame filtrate). Analysis of raw materials (tree saga beans) and tree saga beans milk consist of proximate analysis, total solids, ash content, protein content, calcium content, fat content, pH, viscosity, density, total plate count, amino acid content and organoleptic test. The results showed that the addition of sesame filtrate had given significant effects on total solids, ash, calcium content, fat content, pH, viscosity and density. However, there was no significant influence on protein content. The results of organoleptic test had shown that treatments C, D and E were the preferred products by panelists. Product E was the best product based on organoleptic test with average value of total solids (23.78%), ash content (2.92%), calcium content (0.324%), protein content (5.48%), fat content (10.54%), pH 6, 77, viscosity 2.0 dPas, density 1.035 kg/L and score of amino acid 46%.

Key words: Tree saga bean, sesame, organoleptic, quality, milk

INTRODUCTION

Milk contains nutrients in balanced proportions. The main constituents of milk are water, protein, minerals and vitamins. Everyone is very encouraged to drink milk to get the nutrition needed for the body. Food milk can be used in its original form either as a whole or its parts (Adnan, 1984).

According to Nugraha *et al.* (2009), the quality requirement of good milk should have protein content around 3%. The objectives of milk processing are to obtain a wide variety of dairy products, good quality and high nutrition and extend its shelf life.

Bean milk is extracted legumes that are obtained by soaking the beans, followed by grinding and filtering to obtain a liquid that resembles milk. Milk is a dispersion system with continuous water phase and a discontinuous phase proteins, fats and carbohydrates. Bean milk which is widely known by the public is soymilk (Kanetro and Hastuti, 2006). Another type of legumes which are also potentially to be processed into milk is tree saga bean (*Adenanthera pavonina* L.).

The chemical composition of the tree saga beans in every 100 g contains 31.9 g carbohydrate, 30.6 g protein, 25.5 g fat and 8.1 g water. Amino acid content of tree saga beans is low for methionine but is high for lysine (PAGI, 2009).

Tree saga bean (*Adenanthera pavonina* L.) is a legume family of a tree type. Tree saga beans are known to have protein content of 30.6 g lower than soy beans that is 34.9 g. Besides, tree saga beans also contain high calcium that is 1062.0 mg whereas soy beans has calcium of 227.0 mg. The special characteristic of tree saga beans that contain high protein and calcium is because of its hard seed coat that is impermeable to water, making it to have a long shelf life. However, tree saga beans are known to have an unpleasant odor.

Sesame seeds are produced by sesame plants. It contains oil in it seeds and are widely used in various industries of food and cooking oil. According to Haryoto cit Ambarwani and Susilo (2008) Sesame seeds can also be used to eliminate unpleasant odors. Sesame seeds contain 568 calories of energy, 19.30 g proteins, 18.10 g carbohydrates, 1125.0 mg of calcium and 614 mg phosphorus (PAGI, 2009). According to Onsaard (2012) sesame seeds contain 10.10-17.90% carbohydrate, 19.10-26.94% protein, 48.20-56.30% fat, 2.00-5.59% ash, 2.50-3.90% fiber and 4.50-11.00% moisture. The composition of the sesame seed is dependent on genetic and other factors such: environmental, variety, cultivation, climate, stage of ripening, time of harvesting and method used on analytical. The amino acids content in sesame seeds has low value for lysine but high value for methionine.

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Sesame seeds can also be used to eliminate unpleasant odors. According to Fitriya (2012), one of the flavour components that exist in sesame seeds is pyrazine that can be formed from the reaction between cysteine and glucose. Pyrazine is one of the aromatic compounds, because pyrazine is one of the important flavor components in food, especially food product that processed at high temperature such as coffee, cereals, sesame and cocoa (Ho *eta/*, cit Fitriya, 2012). When the two ingredients are mixed, it is expected to improve amino acid composition and can eliminate unpleasant odors in the tree saga beans.

Based on the results of a preliminary study on making of tree saga beans milk without addition of sesame filtrate produced milk that smells unpleasant, besides in making of the milk with addition of sesame filtrate 10, 20 and 30%, the unpleasant smell of tree saga beans milk had been reduced. This study aimed to determine the effect of addition of sesame filtrate on bean milk that produced.

MATERIALS AND METHODS

Place and time: This research was done in Technology and Agricultural Product Process Engineering Laboratory and Agricultural Product Chemistry, Biochemistry and Food Nutritions Laboratory of Agricultural Technology Faculty, Total Quality Control Laboratory, Microbiology Laboratory and Non-ruminants Laboratory of Farms Faculty of Andalas University.

Materials and equipment: Materials needed in this research were tree saga beans that were obtained from Lubuk Basung, West Sumatra, with shiny red in color that indicates its ripeness, sesame obtained from Pasar Raya Padang, with clean white in color. Additional materials used were: 0.5% $NaHCO_3$, sugar, water. The materials used for the analysis of content and nutritional value were 0.1 N $KMnO_4$, H_2SO_4 concentrated, selenium mix, 50% NaOH, 0.02 NHCl, boric acid 2%, 3 drops of indicator MMMB, 3% HCl, KI20%, solvent Hexana, Hulls filter paper, PP indicator, buffer solution, 1% starch and pH paper, distilled water and other chemicals needed.

The equipment that used were a blender, scales, pots, pressure cooker, mixer, filter cloth, as well as the oven, desiccator, scales Kjeldahl flask, volumetric flask, distillation apparatus, flask fat, Soxhlet, condenser, cottonwool, viscometer, stromercup (200 ml), lactometer, filter lead, glass cup, aluminum cup, pH meter, furnace, water bath, for the analysis of tree saga beans milk nutrients.

Research design: The design used for this study was completely randomized design (CRD) with 5 treatments and 3 replications. Data were analyzed using analysis of variance and further test were conducted with Duncan's New Multiple Range Test (DMRT) at the level of 5%.

The treatment is the addition of the filtrate sesame percentage (volume/volume):

A = without the addition of sesame filtrate
B = addition of 10% sesame filtrate
C = addition of 20% sesame filtrate
D = addition of 30% sesame filtrate
E = addition of 40% sesame filtrate

Making sesame filtrate: Sesame seeds were ground in a blender until a puree with sesame and water ratio of 1:1.5 is obtained. It is then filtered using a filter cloth, producing sesame filtrate.

Making tree saga bean milk with the addition of sesame filtrate (based on modified Yuliwardi, 2009): Tree saga beans and its skin were separated. The beans were then sorted in order to obtain good quality saga. One kilogram of tree saga beans was boiled for 10 min at 70°C. Next, they were soaked in cold water for 3 h with the ratio of water and tree saga bean is 3:1, which aims to eliminate antitrypsin in the bean and simplify the process of stripping bean coat. The bean and the bean coat were then separated. After that, saga beans were soaked for 15 min with 50 g $NaHCO_3$ for 1 kg of tree saga beans, soaking process was performed at room temperature with ratio between solution and tree saga bean is 3:1, which were then drained. Tree saga beans were mashed in a blender until it becomes mush ± 2 min with a ratio between the beans with water is 1:1. This ratio is based on previous study. Nugraha *et al* (2009). Tree saga beans porridge was filtered with filter cloth. After the raw saga bean milk was obtained, it is mixed with sesame filtrate and added sugar 5% of the amount of milk. It was then heated at 70°C for 5 min.

Observation: The observations were the proximate analysis of raw saga bean includes moisture, ash (Sudarmadji *et al*, 1997), fat (Sudarmadji *et al*, 1997), protein (Sudarmadji *et al*, 1997) and carbohydrates. Organoleptic test by hedonic method done on taste, aroma and color. Moreover, chemical analysis also done for the three best products based on organoleptic test includes total solid (SNI: 2981-2009), ash content (Sudarmadji *et al*, 1997), calcium (Sudarmadji *et al*, 1997), protein (Sudarmadji *et al*, 1997), fat (Sudarmadji *eta/*, 1997), pH, viscosity (SNI: 2981-2009), density and total plate count (Fardiaz, 1993). For the best product of all, done analysis of amino acids by HPLC (AOAC, 2005).

Analysis of Amino acids by HPLC (AOAC, 2005): The results of amino acid analysis can be enhanced by utilizing pre-column reaction with the amino group of a specific reagent to form a derivative which can absorb UV light or fluorescent. One of the pre-column reagent

that was very popular in the analysis of amino acids was ortoftalaldehido (OPA). OPA reagent reacted with primary amino acids in a base condition containing merkaptoetanol to form a compound that fluorescent, so that detection can be performed with the fluorescence detector.

RESULTS AND DISCUSSION

The results of the analysis of the chemical composition of tree saga bean without skin can be seen in Table 1.

Table 1: Chemical composition of tree saga bean

Component	Level (%)
Water	8.65
Ash	4.1
Protein	31.47
Fat	24.10
Carbohydrate	31.68

Moisture content of raw tree saga bean without skin has a good enough percentage that is 8.65%. This value does not differ much when compared to the study conducted by the PAGI (2009) with moisture content of 8.1 %. The ash content of raw material was 4.1 % which had not much different from the ash content obtained in the study conducted by the PAGI (2009) that was 3.9%.

The protein content was 31.47%, fat content 24.10% and carbohydrate content was 31.68%.

Organoleptic test: The addition of sesame filtrate gave a significant effect on the taste, aroma and color of the milk produced. The taste of bean milk that preferred by panelists was the bean milk with the addition of 40% sesame filtrate. The addition of sesame filtrates gave different response by panelists, as it is known that tree saga beans had an unpleasant flavor. In this case, the sesame seeds can be used as an ingredient to reduce the unpleasant flavor (Ambarwani and Susilo, 2008). So the addition of sesame filtrate in tree saga bean milk would be affected by the flavor of saga bean milk produced. The more addition of sesame filtrate concentration will reduce the unpleasant flavor of the bean milk, so it will be more preferred by the panelists. The results of organoleptic test can be seen in Table 2.

Table 2: Level of acceptance of tree saga bean milk by panelists

Treatment	Taste	Aroma	Color
A	2.45	2.9	3.15
B	2.85	3.1	3.25
C	3.05	3.4	3.4
D	3.7'	3.5'	3.6'
E	3.9'	3.55'	3.95'
KK	22.39%	20.77%	17.95%

1 = strongly dislike 2 = dislike 3 = regular
4 = like 5 = extremely like

The color of tree saga bean milk that is preferred by the panelists was the milk with addition of 40% sesame filtrate. The color of tree saga bean milk that was produced was yellowish white to brightly colored creams. The more the addition of sesame filtrate, milk colored is brighter and more preferred by the panelists. This was caused by the sesame filtrate that had white color. According to Sunanto (2002), sesame seeds had color white or yellowish white. According Rindengan *et al.* (2007), color was important for an appearance including food products.

The overall results of organoleptic test with hedonic method obtained the level of acceptance of panelists for each product can be seen in Table 2. From the results obtained, it can be concluded that the three products C, D, E were most preferred based on the most preferred flavor, aroma and color. These three products followed by chemical analysis.

Chemical analysis of tree saga milk: The results of the analysis of chemical composition of tree saga milk can be seen in Table 3.

Table 3: Average value of total solids, ash content and calcium levels

Treatment	Total solids (%)	Ash (%)	Calcium (%) level
C	21.25'	1.76'	0.184'
D	22.74	2.41"	0.243
E	23.78'	2.92'	0.324'
KK	1.69%	9.89%	9.88%

1 Numbers in the same column followed by the same lowercase letter are not significantly different according to DMRT at 5% significance level.

Numbers in the same column followed by the same lowercase letter are not significantly different according to DNMRT at 5% significance level

The percentages of total solids of bean milk produced were ranged from 21.25 to 23.78%. The highest value was found in treatment E and the lowest value was contained in treatment C. The addition of more sesame filtrate could increase the product's total solids, where it increased the components of carbohydrates, fats and proteins that would increase the percentage of total solids contained in the product.

Ash content of tree saga bean milk ranged from 1.76 to 2.92%. The highest value was contained in treatment E (addition 40% sesame filtrate) and the lowest value was found in treatment C (addition 20% sesame filtrate). The more addition of sesame filtrate increased the ash content of the product.

Improvement of ash levels of tree saga bean milk due to the ash content of each ingredient was quite high. Ash content of tree saga beans was 3.9 g/100 g and sesame seeds was 5.8 g/100 g. The ash content was derived from the mineral and chemical composition of elements that had turned into ash during the ashing process. Ash content determined the amount of minerals contained in the material, usually determined by means of incineration and combustion (Ali and Ayu, 2009).

Calcium levels of tree saga beans milk ranged between 0.184-0.324%. The highest value was contained in

treatment E (addition 40% sesame filtrate) and the lowest value was found in treatment C (addition 20% sesame filtrate). The content of calcium in saga bean milk tends to increase with increasing concentration of the sesame filtrate added. This improvement was due to the calcium content in both materials. Calcium content of tree saga bean was 1062 mg/100 g while the calcium content of sesame was mg/100 g 1125 (PAGI, 2009). Then, with gradual addition of sesame filtrate would affect the calcium content of bean milk that was produced. Calcium had an important role in determining the quality of dairy products since it is a nutrient that is good for the development of teeth and bones (Winarno, 1991).

Table 4 revealed that the protein content of tree saga bean milk produced were in the range between 5.48-6.06%. The highest value of protein found in the treatment C (addition 20% sesame filtrate) and the lowest value contained in treatment E (addition 40% sesame filtrate). The more addition of sesame filtrate resulted in decreased levels of protein in bean milk. This happened because the levels of the protein of tree saga bean and sesame had different content. The sesame seed protein content was lower than tree saga beans. Sesame contains 19.30% protein, while the protein content of tree saga beans is 31.47% (Sunanto, 2002). So, the more addition of sesame lead to lower protein content of the milk produced.

Table 4: Average value of protein content, fat content and pH

Treatment	Protein content(%)	Fat content(%)	pH
C	6.06	8.13'	6.58'
D	5.83	9.58'	6.68'
E	5.48	10.54'	6.77'
KK	7.23%	2.93%	0.28%

Numbers in the same column followed by the same lowercase letter are not significantly different according to DM RT at 5% significance level

Table 5: Average Viscosity and density

Treatment	Viscosity(dPas)	Density (kg/L)
C	1.8'	1.033'
D	1.9'	1.034'
E	2.0'	1.035'
KK	1.76%	0.05%

Numbers in the same column followed by the same lowercase letter are not significantly different according to DM RT at 5% significance level

Table 6: Results of total plate analysis

Treatment	Total colony (CFU/ml)
C	2.0x10'
D	2.0x10'
E	2.1x10'

Fat content of tree saga beans milk ranged between 8.13-10.54%. The highest value of fat contained in treatment E (addition 40% sesame filtrate) and the lowest value were found in treatment C (addition 20% sesame filtrate). Fat content of saga bean milk increased with the increasing of concentration of sesame filtrate addition. The enhancement of fat content was due to the high fat content of sesame seeds compared to fat content of tree saga beans. Sesame fat content was 51.10% while the fat content of the tree saga beans was 25.5%, thus, with the increasing concentration of the addition of sesame filtrate, can affect the fat content in tree saga beans milk.

The pH of tree saga beans milk produced was ranged from 6.58 to 6.77. The highest value found in treatment E (addition 40% sesame filtrate) and the lowest values found in treatment C (addition 20% sesame filtrate). The more addition of sesame filtrate increased the pH of the product. Improvement of pH value of the product caused by the addition of sesame filtrate that had higher pH than tree saga beans. In this study conducted in the sesame filtrate pH was 6.7 where as tree saga beans was 6.5. So with the increasing addition of sesame filtrate resulted in the increased pH value of the bean milk that produced. When compared with a pH of soy milk on milk quality requirements of SNI 01-3830-1995, pH value of tree saga beans milk had been qualified. There are several factors that can affect the pH such as dilution, heat treatment and less precise measurement (Adnan, 1984).

Table 5 shows that the viscosity of tree saga bean milk ranged between 1.8 DPAs-2.0 DPAs. Viscosity value was highest in treatment E (addition 40% sesame filtrate) and lowest value contained in treatment C (addition 20% sesame filtrate). Increase in viscosity value of tree saga milk caused by the increasing concentration of the sesame filtrate addition. The more addition of sesame filtrate resulted in increased total solids of bean milk it also increased its viscosity. According to Adnan (1984), several factors that affect milk viscosity are the concentration and forms of protein and fat, temperature and duration of milk stored. And various observations have shown that homogenization can increase the viscosity. Besides milk viscosity also directly proportional to the total solids.

Density of tree saga bean milk that had produced ranged between 1.033-1.035 kg/L. The highest value contained in treatment E (addition 40% sesame filtrate) and the lowest values found in treatment C (addition 20% sesame filtrate). The addition of sesame filtrate affected the density of the product. This can be seen where the density of tree saga bean milk is proportional to the addition of increasing concentration of the sesame filtrate. Increased density was also affected by the increased in the total solids in the form of components of protein, fat, ash and minerals in the milk that produced. According to Adnan (1984), there are several things that can affect the measurement of the specific weight/density are temperature, composition of the material.

Table 7 reveal that the results of the analysis of amino acids products E (tree saga bean milk with the addition 40% sesame filtrate) was 0.21 g/100 g isoleucine,

Table 7: Results of amino acid analysis, the pattern of the FAO, and the amino acid score

Amino Acid	Tree saga bean milk (mg/g protein)	FAO Pattern' (mg/g protein)	Amino acid score
Isoleucine	38	40	95
Leucine	77	70	110
Lysine	53	55	96
Methionine	16	35	46
Phenylalanine+ tyrosine	40	60	67
Threonine	29	40	73
Valine	44	50	88

leucine 0.42 g/100 g, 0.29 g/100 g lysine, methionine 0, 09 g/100 g, 0.50 g/100 g phenylalanine + tyrosine, threonine 0.16 g/100 g and valine 0,0,24/100 g. From the amino acid scores, the lowest value of the milk was methionine which was 46% which means that only 46% of the total essential amino acid contained in tree saga bean milk protein that can be exploited.

According to Ambarwani and Susilo (2008), the lowest amino acid of sesame was lysine and the highest one was methionine, while the lowest amino acid of tree saga beans was methionine and the highest one was lysine (Soemartono cit Sutandi, 2002). Hence, if tree saga bean milk is added with sesame filtrate, the amino acid content of the milk will be increased. This was assumed because of the complementation between tree saga bean with sesame seeds.

Microbiological analysis of milk saga seed tree: From Table 6, it can be seen that the number of total plate count of product C (addition 20% sesame filtrate) product E (addition 40% sesame filtrate) ranged between $2.0x10^2$ - $2.1x10^2$. Based on SNI 01-3830-1995, quality requirements for soymilk should have maximum limit of total plate count of $2.0x10^2$. In Table 6, it is shown that total plate count of saga bean milk has met the SNI standard. Although the results of product E exceeds 0.1 standards which was considered harmless pathogens or not, it is still in the same dilution rate was 10^2.

Conclusion: The results of organoleptic test using hedonic methods for taste, aroma and color resulted in treatment E (addition 40% sesame filtrate) as the best treatment with the value of 3.9 for flavor, 3.55 for aroma and 3.95 for color. The level of addition of filtrate sesame gave its effects in increasing total solids, ash content, calcium content, fat content, pH, viscosity and density of tree saga bean milk, but no effect on protein content. Tree saga bean milk with addition of 40% sesame filtrate (E) was the best product with the composition as follows; the average value of total solids (23.78%), ash content (2.92%), calcium levels (0.324%), protein content (5.48%), fat content (10.54%), pH 6.77, viscosity 2.0 DPAs and density 1.035 kg/L. The results of amino acid analysis of tree saga bean milk in treatment E (addition 40% sesame filtrate) were isoleucine 40 mg/g protein, 70 mg leucine/g protein, lysine 55 mg/g protein, methionine 35 mg/g protein, phenylalanine+ tyrosine 60 mg/g protein, threonine 40 mg/g protein and valine 50 mg/g protein. Judging from the amino acid score of the tree saga bean milk where it contains methionine content of 46%, it means that only 46% of the total essential amino acid contained in saga bean milk protein can be utilized.

Suggestion: In review, these findings uncovered new areas of research which can be further developed; how to eliminate unpleasant odors more optimally, assessing the utilization of tree saga beans for others variety of processed food products; conduct research on the content of the saga bean coat, determine the shelf life of tree saga bean milk and test of proteins bio-availability of milk that produced and test NPU, NPR, PER of tree saga bean milk.

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