The effect of soybean varieties and flavors on tempeh milk powder

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Abstract. One of the soybean products that people like was tempeh. Tempeh could not be stored for a long time and smells unpleasant, so it was less preferred by children, so tempeh milk powder was made with the aim to determine the effect of varieties and flavour on the quality of tempeh milk powder. The research method used was a completely randomized design factorial pattern with 3 replications. The first factors were the six soybean varieties (Anjasmor, Grobogan, Agromulyo, Burangrang, Kepak Hijau and import variety), the second factor was various flavourings, 4 levels (cocoa paste, strawberry paste, cocoa powder and vanilla paste). This activity is held from January until December 2015. Soybeans were harvested in Soppeng and Jeneponto Districts, South Sulawesi and then taken to the Post-Harvest Laboratory Assessment Institutes for Agricultural Technology (AIAT) of South Sulawesi for processing soybean to became of tempeh milk powder. The results showed that there was significant interaction between soybean varieties and flavor added of the yield, moisture, ash, protein, carbohydrate and organoleptic test (colour, aroma, texture and taste of tempeh milk powder. The best milk powder of tempeh was treatment interaction of Grobogan variety and strawberry flavouring with a yield of 86.31%, moisture 10.10%, ash 0.58%, protein 3.01%, fat 0.0% and carbohydrates 86.31%.

1. Introduction
Increased knowledge about diseases that are developing nowadays makes people look for foods that contain high protein and low cholesterol level. One of them is soybeans which is a source of vegetable food for most people in Indonesia.

Tempeh is a local food widely consumed by Indonesian 14.15 people. A survey in 2012 stated that the Indonesian people consumed more than 6 kg of tempeh per year on average. Although Indonesian people are fond of tempeh, the raw tempeh is limited in preparation and shelf life. Conventionally, the tempeh is fried and boiled only. Its shelf life is also very short, just 48 h, which restricts the utilization of tempeh [1]. It is fortunate since the tempeh is a good source of vitamin B complexes, folic acid, protein, iron and zinc which are important for red blood cell formation [2]. Therefore, to increase the availability of tempeh for a longer period, a method is needed to increase the shelf life of tempeh and one of the examples is by extracting the tempeh. By making the extract, the nutritional value of tempeh can be maintained consuming iron-fortified tempeh could also reduce the risk of diarrhoea, the side effect of iron consumption [3]. Thus, making new food formulations based on tempeh can be an alternative to treat and overcome anaemia. Tempeh has a low shelf life and is easily damaged. Tempeh can be stored fresh at room temperature for only two days while low temperature storage lasts one week [4].
One way to extend the shelf life of tempeh is to process it into tempeh milk powder. Tempe milk powder is not only intended for children, but also for adults. This functional drink made from tempeh juice has many health benefits, from treating diarrhoea to lowering cholesterol [5]. Symbiotic tempeh extract with iron fortification has the potential to be a functional food to treat patients with anaemia in the future [6]. Tempeh is one of the fermented foods made from soybeans. The fermentation process that occurs reduces the content of macromolecules into simpler compositions, such as proteins that will be degraded to amino acids and also peptides which have smaller molecular weights [7].

Tempeh powder milk still has an unpleasant taste that makes people not interested in drinking it. So we need a flavour that can reduce the unpleasant feeling. The flavour is the quality of something that affects the taste and aroma that is usually added to food or drinks, so that it creates a delicious and delicious taste and aroma.

So far, processed tempeh products are still very limited, so research on processing tempeh, to diversify processing such as drinks is needed to further enrich the form of processed tempeh [8]. Some studies have been carried out to process tempeh into a drink. Tempeh use as a sports drink that is useful for recovering muscle damage [9]. According to [10] pure tempeh cider drinks have a neutral preference value, that is, a favourite score of 3 from a scale of 5 which means that tempeh cider tempeh drinks need to be improved in quality to be preferred by consumers. Several studies report the processing of tempeh into ice cream by adding saffron-coloured rice [11]. Besides making yoghurt from tempeh juice and adding durian fruit extracts that can improve the taste of yoghurt [12]. From these studies, it can be seen that tempeh could be processed into various types of products both tempeh juice drinks, yoghurt, and ice cream with the addition of various kinds of flavour to improve flavour and increase consumer acceptance. The flavour is a food additive that can give, add, or emphasize the colour, taste and aroma of fruit on the product.

Therefore this study aims to determine the effect of varieties and flavour on the quality of tempeh milk powder. Information about the use of flavours in tempeh milk powder products is expected to be a material recommendation for producers or related stakeholders to develop better methods of the production of tempeh milk powder.

2. Materials and methods

2.1. Materials and tools

This activity was carried out from January to December 2015. Soybean was harvested in Soppeng and Jeneponto Regencies, South Sulawesi and then taken to the Post-Harvest Laboratory of South Sulawesi Assessment Institute for Agricultural Technology, for processing of tempeh and to be continued of tempeh milk powder.

The ingredients used in this study were tempeh from several soybean varieties (Anjasmoro, Grobogan, Agromulyo, Burangrang, Gepak hijau and Import variety), tempeh yeast (*Rhizopus mould*), water, *carboxymethylcellulose* (CMC) 0.25%, sugar, cocoa paste, cocoa powder, strawberry paste and vanilla paste, and plastic packaging. Materials for chemical analysis include Potassium Oxalate, Phenolphthalein indicator 1%, formaldehyde 40%, NaOH, HCL 0.1 N, NaOH 30%, H2SO4 0.1 N, boric acid, petroleum ether, methyl red, aquadest, buffer pH 4 and pH 7.

The tools used in the study include blender, boiling pan, filter cloth, wood stirrers, gas stoves, analytical scales (accuracy 0.1 mg), vacuum freeze dryers and centrifuges, tools used in the analysis are 100 ml volume flask, buret, Petri dish, beaker glass, Erlenmeyer, measuring glass (IWAKI Pyrex), centrifuge tubes, analytical scales (accuracy 0.1 mg), pH meters, viscometer, soxhlet, desiccator, distillation and glass ware.
2.2. Research Implementation

2.2.1. Making tempeh. Soybeans with different varieties (Anjasmoro, Grobogan, Agromulyo, Burangrang, Kepak hijau and imported variety) are sorted and weighed 1 kg each and washed and soaked for 24 hours. The soybeans squeezed so that the peel skin is loose and washed clean. Soybeans were put into a pan and given enough water. Soybeans boil for about 30 minutes. During the boiled soybeans would appear white foam. After boiling for 30 minutes, remove the remaining water in the pan. Then, put the remaining pan containing soybeans on the stove again. Stir it up, did not burn it. This process was carried out to dry the soybeans. Did not take too long - because the beans burn easily. Soybeans were poured into containers that make it easy for soybeans to cool. After cool, spread the yeast as much as 2 grams and added CMC then stir well. Soybeans were put in plastic to a thickness of approximately 2-3 cm and fermented for 36 hours [13].

2.2.2. The procedure of Tempeh Milk Powder. Tempeh is blended with water (1 tempeh : 3 water) then squeezed and extracted and heated to a temperature of 80°C[14]. Then flavourings were added according to treatment (cocoa paste, cocoa powder, strawberry paste and vanilla paste) and sugar. Tempeh milk is dried with freeze drying to be used as milk powder. For drying method, lyophilization (Freeze Drying) is the least possible time and the product has similar characters as which use spores that were fresh prepared than the other methods [15].

The research method used was a completely randomized factorial design pattern with 3 replications. The first factor was six-level soybean varieties (Anjasmoro, Grobogan, Agromulyo, Burangrang, Kepak hijau and imported variety), the second factor was various flavours, 4 levels (cocoa paste, cocoa powder, strawberry paste and vanilla paste). Each treatment was repeated 3 times so that 72 times the experimental unit was obtained.

The chocolate paste is made from cocoa beans, manually peeled to separate the seeds (cotyledons) and the skin. Furthermore, the seeds are roasted at 120°C for 12 minutes. The pieces of roasted seeds are then crushed with a blender and then crushed with a caster for 15 minutes [16]. The cocoa paste is packaged and stored at 5°C [17]. Cocoa powder was made from cocoa bean cake/pulp which has been separated from cocoa butter. This meal is dried and finely ground to form brown flour [18]. Vanilla and strawberries were made from fruit extracted from each fresh fruit.

Observations made were yield (rendemen), chemical analysis (moisture, ash, protein, carbohydrate and fat). The sensory test was conducted by 20 panellists with 5 hedonic scale scoring scales using 5 numerical scales, from score 1 (very dislike) to score 5 (very like).

The collected data are tabulated, analyzed with ANOVA analysis of analysis (Analysis of variance) and if the real F test is forwarded to the DMRT multiple tests (Duncan Multiple Range Test) [19].

3. Results and Discussion

3.1. The yield of Tempeh Milk Powder

In Table 1 it could be seen that the treatment of flavour and variety has a significant effect and there was an interaction between the flavour and variety of the yield of tempeh milk powder, where the highest yield was the Imported variety of tempeh milk powder with powdered chocolate flavour (46.89%). Import variety that is currently used by the tempeh industry has big grains, so that the yield is large. Besides cocoa powder is a solid made from cocoa cake or pulp that has a weight or mass, so it has the highest yield and markedly different from other treatments. Soybean imported from the United States is GMO (genetically modified organism) are genetically modified soybeans that were currently widely used by tempeh artisans in Indonesia, because the price is much cheaper than Indonesian local soybeans [20].
Table 1. Yield analysis of tempeh milk powder from some soybean varieties and types of flavour

| Variety                  | Treatment                   | Yield (%) |
|--------------------------|-----------------------------|-----------|
| Argomulyo                |                             | 37.85 d   |
| Burangrang               |                             | 37.55 e   |
| Grobogan                 |                             | 36.63 f   |
| Gepak hijau              |                             | 40.07 a   |
| Anjasmoro                |                             | 38.19 c   |
| Import                   |                             | 38.43 b   |
| **Flavour**              |                             |           |
| Cocoa paste              |                             | 31.02 d   |
| Cocoa powder             |                             | 44.41 a   |
| Vanilla powder           |                             | 35.54 c   |
| Strawberry paste         |                             | 42.12 b   |
| **Interaction of variety and flavour** |                     |           |
| Argomulyo + cocoa paste  |                             | 28.68 t   |
| Argomulyo + cocoa powder |                             | 44.13 d   |
| Argomulyo + vanilla pasta|                             | 35.31 o   |
| Argomulyo + Strawberry paste|                        | 43.29 f   |
| Burangrang + cocoa Paste |                             | 28.53 u   |
| Burangrang + cocoa powder|                             | 44.06 e   |
| Burangrang + Vanilla paste|                           | 35.68 n   |
| Burangrang + Strawberry paste|                        | 41.92 i   |
| Grobogan + cocoa Paste   |                             | 28.70 t   |
| Grobogan + cocoa powder  |                             | 42.73 g   |
| Grobogan + Vanilla paste |                             | 34.83 p   |
| Grobogan + Strawberry paste|                        | 40.25 j   |
| Gepak hijau + cocoa Paste|                             | 39.69 k   |
| Gepakhijau + cocoa powder|                             | 44.05 e   |
| Gepakhijau + Vanilla     |                             | 33.86 q   |
| Gepak hijau + Strawberry paste|                        | 42.69 g   |
| Anjasmoro + cocoa Paste  |                             | 29.81 s   |
| Anjasmoro + cocoa powder |                             | 44.62 b   |
| Anjasmoro + Vanilla powder|                           | 35.87 m   |
| Anjasmoro + Strawberry powder|                        | 42.46 h   |
| Import + cocoa Paste     |                             | 30.70 r   |
| Import + cocoa powder    |                             | 46.89 a   |
| Import + Vanilla powder  |                             | 37.70 l   |
| Import + Strawberry powder|                         | 44.44 c   |

Note: the average number in a column followed by the same letter is not significantly different according to the Duncan test at the 5% level.

This was not in accordance with the results of Indonesian Agency for Agricultural Research and Development [21] which reported that tempeh produced from four superior varieties of soybeans (Anjasmoro, Burangrang, Bromo, and Argomulyo) had the same quality as tempeh from Imported soybeans, even higher protein than imported variety. The same thing was reported by [22], where tempeh from Galunggung, Anjasmoro and Bromo varieties each had better yield, protein and preference level than tempeh from imported soybeans. It may be that the imported soybeans are non-GMO (Genetically Modified Organism) or soybeans that have not been genetically modified yet.
3.2. Proximate Characteristics of Tempeh Milk Powder

The results of the proximate analysis of tempeh milk powder could be seen in Table 2. The proximate analysis includes moisture, ash, protein, fat and carbohydrate.

| Variety       | Treatment             | Moisture (%) | Ash (%) | Protein (%) | Fat (%) | Carbohydrate (%) |
|---------------|-----------------------|--------------|---------|-------------|---------|-------------------|
| Argomulyo     |                       | 11.39 b      | 0.57 d  | 4.32 a      | 0.90 a  | 82.81 e           |
| Burangrang    |                       | 7.80 e       | 0.59 cd | 3.62 e      | 0.24 d  | 87.75 a           |
| Grobogan      |                       | 9.77 d       | 0.57 d  | 3.23 f      | 0.26 d  | 86.18 b           |
| Gepak hijau   |                       | 12.61 a      | 0.63 b  | 3.97 c      | 0.66 b  | 82.14 f           |
| Anjasmoro     |                       | 10.46 c      | 0.61 bc | 4.28 b      | 0.66 b  | 84.00 c           |
| Import        |                       | 11.38 b      | 0.96 a  | 3.78 d      | 0.53 c  | 83.30 d           |

| Flavor        | Treatment             | Moisture (%) | Ash (%) | Protein (%) | Fat (%) | Carbohydrate (%) |
|---------------|-----------------------|--------------|---------|-------------|---------|-------------------|
| Cocoa Paste   |                       | 11.00 a      | 0.59 c  | 3.96 b      | 0.28 c  | 84.15 c           |
| Cocoa powder  |                       | 9.42 c       | 0.93 a  | 4.03 a      | 0.56 b  | 85.04 a           |
| Vanilla       |                       | 10.94 ab     | 0.41 d  | 3.70 d      | 0.68 a  | 84.24 b           |
| Strawberry    |                       | 10.91 b      | 0.68 b  | 3.76 c      | 0.65 a  | 84.01 d           |

| Interaction of variety and flavour | Treatment             | Moisture (%) | Ash (%) | Protein (%) | Fat (%) | Carbohydrate (%) |
|-----------------------------------|-----------------------|--------------|---------|-------------|---------|-------------------|
| Argomulyo + cocoa paste           |                       | 13.93 c      | 0.54 ij | 4.97 a      | 0.36 i  | 80.20 u           |
| Burangrang + cocoa powder         |                       | 8.53 j       | 0.88 e  | 4.71 b      | 0.78 b  | 85.10 j           |
| Grobogan + vanilla paste          |                       | 11.23 g      | 0.26 m  | 4.05 g      | 0.00 k  | 84.46 k           |
| Argomulyo + strawberry paste      |                       | 11.74 f      | 0.57 ijk| 3.62 j      | 2.60 a  | 81.47 t           |
| Burangrang + cocoa paste          |                       | 8.63 j       | 0.59 ij | 3.90 h      | 0.15 ij | 86.73 g           |
| Burangrang + cocoapowder          |                       | 6.66 m       | 0.96 cd | 3.56 k      | 0.64 cd | 88.18 c           |
| Grobogan + strawberry paste       |                       | 7.87 l       | 0.52 k  | 3.66 j      | 0.13 j  | 87.82 e           |
| Grobogan + cocoa powder           |                       | 9.21 i       | 0.38 l  | 3.34 l      | 0.17 ij | 86.90 f           |
| Grobogan + vanilla powder         |                       | 11.83 f      | 0.92 d  | 3.64 j      | 0.46 fg | 83.15 p           |
| Grobogan + vanilla paste          |                       | 7.93 lk      | 0.41 l  | 2.91 o      | 0.41 gh | 88.34 a           |
| Grobogan + strawberry paste       |                       | 10.10 h      | 0.58 ij | 3.01 n      | 0.00 k  | 86.31 h           |
| Gepak hijau + cocoa Paste         |                       | 11.90 ef     | 0.62 hi | 3.34 l      | 0.00 k  | 84.14 l           |
| Gepakhijau + cocoa powder         |                       | 14.27 b      | 0.63 hi | 4.87 a      | 0.00 k  | 80.23 u           |
| Gepakhijau + vanilla powder       |                       | 11.74 f      | 0.57 ijk| 3.62 j      | 2.60 a  | 81.47 t           |
| Gepak hijau + strawberry paste    |                       | 12.52 d      | 0.70 fg | 4.04 g      | 0.02 k  | 82.72 r           |
| Anjasmoro + cocoa Paste           |                       | 10.20 h      | 0.65 gh | 4.48 c      | 0.60 cde| 84.07 m           |
| Anjasmoro + cocoa powder          |                       | 8.53 j       | 0.98 c  | 4.15 e      | 0.82 b  | 85.53 i           |
| Anjasmoro + Vanilla powder        |                       | 11.25 g      | 0.26 m  | 4.17 e      | 0.43 g  | 83.89 n           |
| Anjasmoro + Strawberry powder     |                       | 11.87 ef     | 0.54 jk | 4.31 d      | 0.79 b  | 82.49 s           |
| Import + cocoa Paste              |                       | 12.01e       | 0.73 f  | 3.83 i      | 0.53 ef | 82.90 q           |
| Import + cocoa powder             |                       | 6.74 m       | 1.25 a  | 3.27 m      | 0.68 c  | 88.06 d           |
| Import + Vanilla powder           |                       | 15.63 a      | 0.70 fg | 4.10 f      | 0.57 de | 79.00 v           |
| Import + Strawberry powder        |                       | 11.35 g      | 1.16 b  | 3.91 h      | 0.33 h  | 83.25 o           |

Note: the average number in a column followed by the same letter is not significantly different according to the Duncan test at the 5% level.

Soybean varieties significantly affected the moisture of tempeh milk powder produced, wherein tempeh milk powder of Burangrang variety which had the lowest moisture (7.8%) and the highest...
moisture was the Gepak Hijau variety (12.60%). This difference occurs due to the difference in water penetration into the seed matrix and the difference in seed development in each variety. The flavour treatment also significantly affected the moisture of tempeh milk powder where the highest moisture in the treatment of cocoa paste flavouring (11.0%) and the lowest moisture in the treatment of cocoa powder flavouring (9.42%) and significantly different from other treatments.

The moisture content of Tempeh powder ranges from 6.66-15.63%. There was a significant interaction between varieties and flavour of tempeh milk powder, where the highest moisture was in the treatment of tempeh milk powder from imported soybean variety with vanilla flavour (15.63%). While the lowest moisture was the treatment of Burangrang varieties with the flavour of cocoa powder (6.66%) and from Import variety with the flavour of cocoa powder (6.74%). Relatively small water content will make the product have a long shelf life and can inhibit damage by microorganisms. Low moisture in the material would achieve optimum stability so that chemical reactions that damage materials such as browning, hydrolysis and fat oxidation could be reduced.

According to [23] that the formula of tempeh milk powder with a moisture content of 4-8% can be durable because the level of low moisture content in food products can increase the shelf life of food products. While according to [24], the highest levels of imported soybean water compared to five other superior varieties. Differences in moisture can be caused by differences in the process of handling, drying, storing and distributing soybeans by suppliers. When referring to SNI 01-3922-1995, the water content of imported varieties of tempeh does not meet the standard of more than 13% [25]. High water levels cause susceptibility to microbial activity. In an effort to extend the shelf life, carried out drying up to certain water content limits. Drying at low temperatures aims to minimize the degradation of milk powder produced.

Ash was an inorganic material obtained from residues or residual combustion of organic material. The mineral content of a material can be seen from the ash of the material. Tempeh milk ash was very low, ranging from 0.26 - 1.25%, based National Standart fixed by SNI maximum ash 1.5%. The lowest ash in the treatment of Anjasmoro and Argomulyo varieties of tempeh milk powder each had vanilla flavour (0.26%) and the highest ash in the treatment of tempeh milk powder from Import variety with the flavour of cocoa powder (1.25%). According to [25] the higher the value of ash content, the more inorganic ingredients in the product.

Protein levels from the study ranged from 2.91 - 4.97%. The highest protein of the tempeh milk powder in the treatment was from Argomulyo variety with cocoa paste flavour (4.97%) and the lowest as the treatment of Grobogan variety with vanilla flavour (2.91%). This is consistent with the statement of [26] that large, yellow-coloured soybean varieties such as Argomulyo, Bromo, Burangrang, Panderman, Anjasmoro, and Grobogan have higher protein content compared to imported soybeans and Wilis varieties which have long been cultivated by farmers; although based on the results of statistical analysis, the protein content of Burangrang and Dena 1 varieties is not different from imported soybeans.

Tempeh craftsmen respond positively for the introduction of superior varieties the soybeans provided Argomulyo, Anjasmoro and Burangrang because of weight and volume the temps are not significantly different from import soybeans. The quality of tempeh is made from soy superior varieties are proven to be better than tempeh which uses imported soybeans. The higher levels of soy protein shows is a higher quality of soybeans [27]

Soybean fat contains sufficient essential fatty acids, namely linoleic acid (Omega 6) and Linolenic (Omega 3) [28]. The fat content of tempeh milk powder in the study results ranged from 0.00 - 2.6%. The lowest fat content in the treatment was from Argomulyo variety with vanilla paste flavoured, Gepak Hijau with cocoa paste and cocoa powder flavoured and Grobogan variety with strawberry-flavoured (0.00%). While the highest fat content in the treatment of Argomulyo variety of strawberry flavoured tempeh milk powder (2.6%). From the Indonesian National Standardization Agency [29] Argomulyo strawberry flavoured milk powder is categorized as low-fat milk powder (1.5-26%) and other treatments include nonfat milk powder (<1.5%).
Carbohydrates that are calculated are a combination of simple sugars, starch, oligosaccharides and fibre. The carbohydrate content of tempeh milk powder in the study results ranged from 80.20 - 88.34%. The highest carbohydrate content in the interaction treatment of Grobogan variety with vanilla paste flavoured (88.34%) and the lowest of the treatment from Argomulyo variety with cocoa paste flavoured (80.20%). According to [28] the high percentage of the carbohydrate content in tempeh flour formula causes the percentage of protein and fat content to decrease.

3.3. Organoleptic Characteristics

Organoleptic characteristics include colour, aroma, solubility and taste (Table 3). Table 3 was known that significant interaction between variety and flavour of colour, aroma, solubility and taste on tempeh milk powder.

Table 3. Organoleptic test results of tempeh milk powder from several varieties of soybean and flavour

| Variety       | Treatment          | Colour | Aroma | Solubility | Taste |
|---------------|--------------------|--------|-------|------------|-------|
| Argomulyo     | 3.09 c             | 2.84 c | 2.97 e | 3.09 d     |
| Burangrang    | 3.91 b             | 3.47 a | 3.55 a | 3.44 b     |
| Grobogan      | 3.82 c             | 3.43 a | 3.15 d | 3.49 ab    |
| Gepak hijau   | 3.16 d             | 2.75 c | 2.87 f | 3.06 d     |
| Anjasmoro     | 3.78 c             | 3.03 b | 3.46 b | 3.21 c     |
| Import        | 4.16 a             | 3.13 b | 3.23 c | 3.54 a     |

| Flavour       | Treatment          | Colour | Aroma | Solubility | Taste |
|---------------|--------------------|--------|-------|------------|-------|
| Cocoa paste   | 3.51 c             | 2.81 c | 3.17 b | 3.17 c     |
| Cocoa powder  | 3.77 a             | 3.09 b | 3.15 b | 3.18 c     |
| Vanilla paste | 3.65 b             | 3.18 b | 3.28 a | 3.28 b     |
| Strawberry    | 3.68 b             | 3.36 a | 3.23 a | 3.59 a     |

| Interaction of variety and flavour |
|-----------------------------------|
| Argomulyo + cocoa paste           | 3.25 e | 2.00 g | 3.00 h | 3.00 h     |
| Argomulyo + cocoa powder          | 3.25 e | 3.33 c | 3.00 h | 3.33 e     |
| Argomulyo + vanilla paste         | 2.6 h  | 3.00 de| 2.75 i | 3.00 h     |
| Argomulyo + Strawberry paste      | 3.25 e | 3.10 cde| 3.07 gh| 3.03 gh    |
| Burangrang + cocoa paste          | 4.10 b | 3.75 b | 3.5 c  | 3.50 d     |
| Burangrang + cocoa powder         | 4.10 b | 3.67 b | 3 fgh  | 3.10 gh    |
| Burangrang + vanilla paste        | 3.67 c | 3.33 c | 4.10 a | 3.67 c     |
| Burangrang + Strawberry paste     | 3.75 c | 3.10 de| 3.5 c  | 3.50 d     |
| Gepak Hijau + cocoa paste         | 3.10 f | 2.75 ef| 3.5 c  | 3.07 gh    |
| Gepak Hijau + cocoa powder        | 3.33 e | 2.67 f | 3 fgh  | 3.17 fg    |
| Gepak Hijau + Vanilla paste       | 3.10 f | 2.50 f | 4.10 a | 2.75 i     |
| Gepak Hijau + Strawberry paste    | 3.10 f | 3.10 dc| 3.5 c  | 3.25 ef    |
| Grobogan + cocoa paste            | 2.75 g | 2.50 f | 2.75 i | 2.75 i     |
| Grobogan + cocoa powder           | 3.75 c | 3.10 cd| 3.33 d | 3.33 e     |
| Grobogan + Vanilla paste          | 4.67 a | 4.10 a | 3.25 de| 3.5 d      |
| Grobogan + Strawberry paste       | 4.10 b | 4.10 a | 3.25 def| 4.38 a     |
| Import + cocoa paste              | 3.75 c | 2.75 ef| 3.75 b | 3.6 cd     |
| Import + cocoa powder             | 4.67 a | 2.63 f | 2.67 i | 2.83 i     |
| Import + vanilla paste            | 4.13 b | 3.10 dc| 3.25 def| 3.50 d     |
| Import + Strawberry paste         | 4.10 b | 4.10 a | 3.25 def| 4.25 b     |

Caption 1: very dislike; 2: don't like it; 3: rather like; 4: like; 5: really like it
Colour is one of the factors that determine the quality of milk Tempe powder. The colour of tempeh milk powder which the panellists preferred was the treatment of cocoa powder flavoured with import variety and significantly differences with others (score 4.67). Whereas the least preferred colour was the treatment of Argomulyo variety with vanilla flavouring (score 2.6). The presence of cocoa powder in foods leads to greater postprandial insulin secretion than alternate flavourings. Specific insulinogenic amino acids or greater cephalic phase insulin release may explain the findings [30]. Cocoa powder is a complex substance containing several biologically active compounds, including caffeine, theobromine, serotonin, phenylethylamine and cannabinoid-like fatty acids [31] and [32].

The most preferred aroma of tempeh milk powder by panellists was the treatment of vanilla and strawberry flavours with Grobogan variety (score 4.00) and the least preferred aroma in the treatment of Argomulyo variety with flavoured cocoa paste (score 2.00). Vanillin is probably the most widely used flavouring agent for sweet foods such as biscuits, desserts, ice cream etc. It has been argued, however, that vanillin is used not only as a flavouring ingredient but also to mask undesirable off flavours developed during storage by-products susceptible to oxidative degradation. Vanillin not only adds its pleasant flavour note, but also acts as an antioxidant in complex foods containing polyunsaturated fatty acids. It is shown that the keeping quality of precooked dried cereal flakes was considerably increased by the addition of 0.01–0.5% (on a dry matter basis) of vanillin [33]. Whereas flavour vanillin all of the varieties range 2.50 (dislike) – 4.1 (like). it was not similar as [34] reported that the addition of vanilla to tempeh milk by 0.25% (v / v) and 0.5% (v / v) has an aroma value respectively 2.35 (dislike) and 3.5 (between ordinary and like).

The aroma was a sensation received by the nasal cavity against fragrant odours and could also be used as food deodorizers, while the flavor is the overall sensation received by the body when ingested, mainly in the form of taste and aroma. Plain milk is most consumed the liquid product, but when this milk is converted to flavoured milk that will be more acceptable by the peoples of all age groups. Flavoured milk is the second-largest widely consumed the liquid dairy product after plain milk. Adding flavour and colour to milk increases its palatability value. Some natural as well as artificial flavours, are used in the preparation of flavoured milk. Flavoured milks are also prepared by adding various types of herbs to provide therapeutic value to the flavoured milk. Several vitamins and minerals are also added in flavoured milk to enrich with health providing components. Fruit-based flavoured milk is prepared by adding fruit pulps or fruit juices to add the variety to the flavoured milks [35].

The level of panellists's preference for solubility is Tempeh milk powder which dissolves easily in water, the more easily dissolves the higher the panellist preference level. The highest level of solubility in the treatment of tempeh powder vanilla flavoured with Burangrang variety (score 4.00) and the lowest in the treatment of tempeh milk powder import variety with cocoa powder flavoured (score 2.67). Cocoa powder naturally has poor solubility (wettability) cause contained cacao butter which was hydrophobic [36]. Cocoa powder with a fat content of 5.9% requires the wetting time of more than 1 hour at a temperature of 20°C [37]. The addition of special sugars that have large particle size help the process of rehydration of cocoa powder [38]. [39] recommended that solubility of 10% cocoa powder was preferred by consumers must add 40% instant milk powder, 40% caster sugar, 0.3% salt and up to 100% maltodextrin.

Table 3 showed that the most preferred tempeh milk powder was tempeh milk powder from Grobogan and Import varieties with strawberry flavoured. This was consistent with the results of the socialization in farmer groups at the soybean production centre who like tempeh milk with strawberry flavoured. Grobogan soybean is a local soybean that is widely grown in the Grobogan area of Central Java [40]. The addition of strawberry flavouring to give the characteristics of milk. Sugar added to the product is useful for giving sweetness to milk and fat which will form the texture of milk so as to give the impression of cream. This treatment was chosen because the yield is quite high, water content and ash content are low, protein and carbohydrate are high and are most preferred by panellists because of their highly preferred aroma and taste.
Water with strawberry aroma, sucrose and citric acid had the best combination of aroma and taste. It had the strongest perceived flavour. This study suggests that the combination of aroma and taste induced greater satiation and short-term satiety than the independent aroma or taste and water, potentially via increasing the perceived flavour intensity or by enhancing the perceived flavour quality and complexity as a result of aroma-taste cross-modal perception [41].

4. Conclusion

- There was significant interaction between soybean varieties and flavours to the yield, moisture, ash, protein, carbohydrate and organoleptic of tempeh milk powder
- The best tempeh milk powder was treatment combination of Grobogan variety and strawberry paste flavouring with yield 86.31%, moisture 10.10%, ash 0.58%, protein 3.01%, fat 0.0%, carbohydrate 86.31% with like of aroma (score 4.1) and taste (score 4.38).

References

[1] Shurtleff, W. and A. Aoyagi, 2011. History of Tempeh and Tempeh Products (1815-2011): Extensively Annotated Bibliography and Sourcebook. Soyinfo Center, Lafayette, Louisiana, ISBN: 9781928914396, Pages: 990.

[2] Babu, P.D., R. Bhakayaraj and R. Vidhyalakshmi, 2009. A low cost nutritious food Tempeh: A review. World J. Dairy Food Sci., 4: 22-27.

[3] Kiers, J.L., J.C. Meijer, M.J.R. Nout, F.M. Rombouts, M.J.A. Nabuurs and J. van der Meulen, 2003. Effect of fermented soya beans on diarrhoea and feed efficiency in weaned piglets. J. Applied Microbiol., 95: 545-552.

[4] Widowati, S., Yuniar, M.E. Christina dan R. Holinesti. 2004. Analisis Kerusakan Produk Tempe Kedelai. Lap MK Pengawetan Pangan. Program Studi Ilmu Pangan, Sekolah Pascasarjana, IPB.

[5] Anonim. 2013. Susu Tempe. http://lordbroken.wordpress.com/2011/10/01/susu-tempe/. Diakses tanggal 22 juli 2013.

[6] Helmyati, S., L. A. Lestari, O. R. Mayasari, M. Wigati, E. S. Rahayu and M. Juffrie. 2018. Synbiotic Fermented Milk with Tempeh Extract and Iron Fortification: Effect on Antibacterial Activity and Total Enterobacteriaceae. Am. J. Food Technol., 13 (1): 32-41, 2018

[7] Handoyo, T., & Morita, N. (2006). Structural and Functional Properties of Fermented Soybean (Tempeh) by Using Rhizopus Oligosporus. International J. of Food Properties, 9 (2), 347-355.

[8] Nurhidajah. 2010. Aktivitas Antibakteri Minuman Fungsional Sari Tempe Kedelai Hitam dengan Penambahan Ekstrak Jahe. J. Pangan dan Gizi, 1 (02)

[9] Jauhari, M., Sulaeman, A., Riyadi, H., Ekayanti. I. 2014. Pengembangan Formula Minuman Olahraga Berbasis Tempe Untuk Pemulihan Kerusakan Otot. J. Agritech, 34 (3).

[10] Kusmanto dan Hidyati, M. H. (2011). Total Bakteri dan Sifat Organoleptik Minuman sari Tempe dengan Variasi Waktu penyimpanan. J. pangan dan Gizi, 2 (03).

[11] Hendrianto, E. & Rukmi, W. D. 2015. Pengaruh Penambahan Beras Kencur Pada Es Krim Sari Tempe Terhadap Kualitas Fisik dan Kimia. Pangan dan Agroindustri, 3(02), 353-361.

[12] Yuliani, H., Jeki, D. S. D., dan Rasmia, D. A. 2013. Pengaruh Penambahan Ekstrak Buah Durian (Durio Ziberthinus Murr.) Terhadap Daya Terima Yogurt Tempe. J. Biologi Tropis, 13 (02).

[13] Titi P. H. dan M. Saihullah. 2013. Pembuatan susu tempe kajian pengaruh lama fermentasi tempe dan penggunaan Carboxymethyl cellulose (CMC). J. Teknologi Pangan 5 (1) : 1-15

[14] Darajat, D.P., W.H. Susanto and I.Purwantiningrum. 2014. Pengaruh umur fermentasi tempe dan proporsi dekstrin terhadap kualitas susu tempe bubuk (influence of fermentation time and proportion of dextrin to the quality of milk tempeh powder). J. Pangan dan Agroindustri. 2 (1): 47-53.
[15] Chutrtong, J. and T. Bussabun. 2014. Preparation of Tempeh Spore Powder by Freeze Drying. International J. of Bioengineering and Life Sciences 8 (1) : 40 – 43.

[16] Misnawi and Ariza. 2011. Use of gas chromatography – alfactometry ini combination with solid phase micro extraction for cocoa liquor aroma analysis. J Int Food Res 18 : 129 – 135.

[17] Kusumaningrum, I., C.H. Wijaya, F. Kusnandar, Misnawi and Ariza BTS. 2014. Aroma and flavor sensory profiles of superior cocoa liquors from different regions in Indonesia. J. Teknologi dan Industri Pangan 25 (1) : 106 – 114.

[18] Hadi, A. and Siratunnisak, N. 2016. Effect of addition cocoa powder to physical, chemical and organoleptic of bran drink products. J. Action. Aceh Nutrition 1 (2) : 121 – 129.

[19] SAS (Statistical Analysis System). 1999. SAS User’s Guide : Statistics SAS Institute, Cary, NC.

[20] Mursyid, M. Astawan, D. Muchtadi, T. Wresdiyati, S. Widowati, S.H. Bintari, dan M. Suwarno. 2014. Evaluasi Nilai Gizi Protein Tepung Tempe yang Terbuat dari Varietas Kedelai Impor dan Lokal. PANGAN, Vol. 23 No. 1 Maret 2014 : 33 – 42.

[21] Balitbangtan. 2008. Mutu kedelai lokal lebih baik dari kedelai impor. Siaran Pers, 12 Februari 2008:1-4.

[22] Hidayah, N., R.S. Adiandri, dan M. Astuti. 2012. Evaluasi sifat fisikokimiawi dan organoleptik tempe dari berbagai varietas kedelai. Widiyariser 15 (2):357-364.

[23] Bastian F, Ishak E, Tawali A.B, dan Bilang M. 2013. Daya Terima Dan Kandungan Zat Gizi Formula Tepung Tempe Dengan Penambahan Semi Refined Carrageenan (Src) Dan Bubuk Kakao. J. Aplikasi Teknologi Pangan 2 (1).

[24] Astawan, M., T. Wresdiyati, S. Widowati, A.H. Bintari, dan N. Ichsani. 2013. Karakteristik Fisikokimia dan Fungsional Tempe yang Dihasilkan dari Berbagai Varietas Kedelai. J.Pangan 22 (3):241-252.

[25] BSN. 1995. Standar Nasional Indonesia untuk Kedelai. SNI 01-3922-1995. Badan Standarisasi Nasional, Jakarta. 7 hal.

[26] Ginting, E., S.S. Antarlina, dan S. Widowati. 2009. Varietas unggul kedelai untuk bahan baku industri pangan. J. Litbang Pertanian 28 (3):79-87.

[27] Elisabeth D.A.A, E. Ginting and R. Yulifianti. 2017. Respon Pengrajin Tempe Terhadap Introduksi Varietas Unggul Kedelai untuk Produksi Tempe, J. Pengkajian Dan Pengembangan Teknologi Pertanian, 20 (3) : 183-196.

[28] Ratmaningsih, Ginting E, Muchlidh dan Harnowo, D. 2017. Sifat Fisikokimia Dan Kandungan Serat Pangan Galur-Galur Harapan Kedelai. J. Penelitian Pascapanen Pertanian 14 (1):35-45.

[29] Badan Standarisasi Nasional Indonesia. 1999. SNI 01-2970-1999: Susu Bubuk. Balai Besar Industri Kimia Departemen Perindustrian dan Perdagangan, Jakarta.

[30] Miller, J.B., S. H.A. Holt, V. de Jong and P. Petocz. 2003. Cocoa Powder Increases Postprandial Insulinemia in Lean Young Adults. J. Nutr. 133 : 3149 – 3152.

[31] Burri J., M. Graf , P. Lambelet and J.Löliger. 1989. Vanillin: More than a flavouring agent — a potent antioxidant. J. of the science of food and agriculture 48 (1) : 49-56.

[32] Bruinsma, K. & Taren, D. 1999. Chocolate: food or drug? J. Am. Diet. Assoc. 99: 1249–1256.

[33] Bruni J., M. Graf , P. Lambelet and J.Löliger. 1989. Vanillin: More than a flavouring agent—a potent antioxidant. J. of the science of food and agriculture 48 (1) : 49-56.

[34] Abdullah, K. and D.W. Asriati. 2016. Characteristics of Tempeh Drink with Vanilla Flavour. J. of Agro-based Industry 33 (No.1) 07 2016: 1-8

[35] Tiwari P.K., and S. Asgar. 2017. Diversification in flavoured milk: A review. Int J Clin and Biomed Res. 3 (2):15-20

[36] Visotto FZ, Jorge LC., Makita GT., Rodrigues ML., Menegal FC. 2010. Influence of the process parameters and sugar granulometry on cocoa beverage powder steam agglomeration. J. Food Eng 97 : 283-291.

[37] Fitzpatrick JJ., Salmon J., Ji J., Miao S. 2017. Characterization of the wetting behavior of poor wetting food powders and the influence of temperature and film formation. KONA Powder
Part J 34 : 282 -289.

[38] Abdelazis IB, Sahli A., Bornaz A. Scher S., Galani C. 2014. Dinamic method to characterize rehydration of powdered cocoa beverage. Influence of sugar nature quantity and size. Powdered Technol. 264 : 184-189

[39] Hartono Y., Sugiyono and N. Wulandari. 2018. Formulation and improvement of solubility properties of chocolate beverage powder. J. Technol and Industri Pangan. 29 (2) : 185 -194

[40] Mursyid, M. Astawan, D. Muchtadi, T.Wresdiyati, S. Widowati, S.H. Bintari. dan M. Suwanto. 2014. Evaluasi Nilai Gizi Protein Tepung Tempe yang Terbuat dari Varietas Kedelai Impor dan Lokal. J. Pangan, 23 (1): 33 – 42

[41] Yin W., L. Hewson, R. Linforth, M. Taylor and I. D. Fisk. 2017. Effects of aroma and taste, independently or in combination, on appetite sensation and subsequent food intake. Appetite 114 : 265-274