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Characteristics Of Moromi Sweet Sauce And The Study Of Its Activity On Protein, Sugar And Viscosity Levels

Ida Ningrumsari
Fakultas pertanian,Teknologi Pangan Universitas Ma'soem, jln Cipacing No 22, Sumedang 45363 Indonesia

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ABSTRACT
The aim of this research was to determine the effect of moromi fermentation on soluble protein content, sugar content and viscosity, with varying salt treatments for 28 days. as well as organoleptic tests. The research design used a completely randomized design (CRD) consisting of 4 treatments and 6 replications. The treatment included fermenting black soybeans by A sojae (Koji) then soaking them in 1000 ml of water with the addition of 0%, 10%, 20% and 30% salt for 28 days (moromi). The parameters analyzed are protein content, sugar content and viscosity and organoleptic tests include color, aroma and taste. The research results showed that the highest protein content was found in the K1 treatment at 1.522%, the sugar content in K1 was 41.227% and the viscosity in K3 was 33.603%. Meanwhile, in terms of organoleptic color, aroma and taste, the panelists liked the product.

Corresponding Author:
Ida Ningrumsari
Fakultas pertanian,Teknologi Pangan Universitas Ma'soem, jln Cipacing No 22, Sumedang 45363 Indonesia
idaningrumsari123@gmail.com

INTRODUCTION

As the food industry develops, especially fermented flavoring products, the presence of sweet soy sauce is increasingly widespread. Moromi as the basic ingredient for sweet soy sauce is the result of salt fermentation of soybeans using the mold Aspergillus sp. For more than 2 months. Moromi extract in making soy sauce contains peptides or vegetable proteins that have accumulated with fatty acids and sugars as a result of the activity of the mold Aspergillus sp which gives the soy sauce a delicious taste, but is also specific with high nutritional content. Moromi extract contains complete nutrients with amino acids. The fermentation process in making soy sauce from soybeans goes through 2 stages, namely solid fermentation using a fungus called koji and liquid fermentation using acid bacteria called moromi. The success of moromi fermentation greatly determines the quality of the soy sauce produced. The principle of making soy sauce by fermentation is the process of enzymatic hydrolysis of protein and other compounds from soybeans by microbial activity. Moromi is a follow-up fermentation after solid fermentation (Aspiyanto & Susilowati 2018).

Things that are closely related to moromi are table salt (NaCl) solution and lactic acid bacteria. This salt is one of the most important types of auxiliary ingredients in food preservation. The various functions of salt, apart from being a preservative, are also to remove the amount of water available for the growth of microorganisms. Morphologically,

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lactic acid bacteria consist of 2 families, namely the rod-shaped Lactobacillacea family and the round-shaped streptococcoceae family. The characteristics of lactic acid bacteria are that they are able to grow in high levels of salt and sugar, grow at pH 3.8-8.0 and are able to ferment monosaccharides and disaccharides. Factors that influence the moromi fermentation stage are temperature, nutrition, pH and oxygen. Each type of microbe has an optimum temperature for growth. Microbes need nutrients for life and growth which include carbon sources, nitrogen sources, energy sources and growth factors (minerals and vitamins). These nutrients are used to form energy and make up cell components. Medium pH is an important factor that influences microbial activity and the death of microorganisms. In general, the process of making moromi is spontaneous. In the spontaneous fermentation process, many types of microbes grow and are difficult to control (Aspiyanto & Susilowati 2018).

Fermented food can improve nutritional value. In the moromi fermentation process, the principle is proteolysis. Protein/amino acid degradation not only affects nutritional value but also affects taste and flavor characteristics due to the formation of aromatic compounds (Yanfang & Wenyi 2009). The main stages that influence the flavor of soy sauce are during the heating process of the raw material (soybeans), koji fermentation, moromi fermentation including aging and pasteurization (Nunomura & Sasaki, 1993). Soy sauce is a fermented black soybean extract with added sugar, salt and spices which functions to improve the taste of a dish (Cahyadi, 2006). The characteristics of soy sauce are that it is brown, thick and contains high protein (Septiani et al, 2004). Basically, the process of making soy sauce is carried out twice, namely koji fermentation and moromi fermentation. At the koji fermentation stage, mold is added which lasts for 2-3 days (Setiawati and Budi, 2006). Moromi fermentation is fermentation between koji and a salt solution, this process lasts for 1-2 months (Pratiwi et al, 2012).

The yeast used is instant dry yeast to form koji. Then proceed with moromi fermentation using a 20-30% salt solution. Moromi fermentation usually takes 14-28 days, then the moromi is added with sugar, spices and thickened (Meutia, Y.R., 2015). The length of moromi fermentation is one of the quality determinants in making sweet soy sauce, this is related to the breakdown of peptide compounds into amino acids and ammonia which are related to the formation of aroma and taste in soy sauce (Pratiwi R.F., et al, 2012). During koji fermentation and moromi fermentation, enzyme activity occurs which results from microbial activity. A oryzae mold becomes dominant in koji fermentation which produces protease enzymes. As much as 65-69% of protein is converted into dissolved form in the fermentation process (Sopandi T. and Wardah, 2014).

METHOD

The research was carried out at the Ma'soem University Microbiology Laboratory while the nutritional analysis was carried out at the Bakti Asih Analyst College Laboratory in Bandung.

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Research Tools and Materials

The research materials consisted of Malika type black soybeans obtained from an online shop, salt, A sojae, brown sugar, lemongrass, bay leaves. Research Tools Research tools consist of a basin for fermentation, a steamer for steaming black soybeans, a glass jar for soaking fermented black soybeans, a gas stove.

Research design

The research design used a non-factorial Completely Randomized Design (CRD) with one treatment factor, namely type of soy sauce (K) with levels K0 = Koji + 0% salt, K1 = Koji + 10% salt, K2 = Koji + 20% and K3 = Koji + 30% salt each soaked in 1000 ml of water for 28 days. The research data were collected and then analyzed using Analysis of Variance (Anava) and if there were significant differences between treatments, it was continued with the Duncant multiple test.

Research procedures consist of:

1. Preparation . This preparation consists of sorting, washing and soaking the nuts.
2. Koji Fermentation. Koji fermentation is the process of fermenting steamed beans using the microorganism Aspergillus sojae (2%/w) in a fermentation process for 3-5 days. (Hidayat dkk, 2008).
3. Moromi fermentation. Moromi fermentation is a follow-up fermentation after koji fermentation using a salt solution with varying concentrations of 0%, 10%, 20% and 30% aimed at inactivating microorganisms from the koji fermentation process and growing microorganisms that will create the taste of soy sauce. This fermentation was carried out for 4 weeks (Hidayat et al, 2008).
4. Cooking. Cooking is the final process in making soy sauce after koji fermentation and moromi fermentation. During the cooking process, 600 grams of brown sugar and spices are added to create the taste and aroma of the soy sauce (Hidayat et al, 2008).

Nutritional Analysis

The test parameters consist of protein content using the Kjeldahl method (AOAC, 1990). Viscosity using a Rion Viscotester Vt-04 viscometer (Susanto and Yuwono, 2001) and total sugar using the Anthrone method (Apriyantono dkk, 1989).

RESULTS AND DISCUSSION

As Much Protein

The main component contained in nuts is protein, so protein has a major role during the soy sauce fermentation process. Proteins are composed of heterogeneous polymers of amino acid molecules. Legume protein is a globular protein. Globule proteins have side chains on the outside that are hydrophilic and polar while side chains on the inside are hydrophobic and nonpolar are on the inside. (Purwoko dkk,2007). The research results are presented in Table 1.

Table 1. Effect of salt in moromi soy sauce for 28 days on protein content

Treatment	K0 (0%)	K1 (10%)	K2 (20%)	K3 (30%)
Average (%)	0,505 (b)	1,522 (c)	1,487 (c)	0,192 (a)

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Note: Average numbers followed by different letters are significantly different at the 5% significance level according to Duncan's multiple range test.

Based on the results of the research in Table 1, it shows that the highest protein content is found in K1 at 1.522%, followed by K2 = 1.487%, K0 = 0.505 and the smallest at K3 = 0.192. K1 and K2 do not show significant differences, but K0 and K3 show very significant differences. High levels of salt during soaking can denature proteins, this is due to the difference in concentration which causes diffusion. Excessive salt concentration can cause an imbalance in the material, causing salting out and the protein not being easily dissolved. This is in line with the research results of Kastaman et al 2009, explaining that an increase in salt concentration results in a decrease in the driving force for the rate of water diffusion from the material to the salt solution. This occurs until equilibrium is reached, namely water diffusion will decrease so that diffusion no longer occurs. The addition of salt to preservation affects food protein. Adding excessive salt can cause the protein to denature. Proteins in food experience denaturation due to changes in secondary and tertiary structures due to interactions with salt (Novia et al, 2011:72). Denatured protein reduces its solubility, as a result the protein will separate as a precipitate. Protein denaturation which is influenced by salt concentration has an effect on protein levels (Winarno, 2008). The protein content based on SNI 3543: 1999 is 2.5%, while the best research results are 1.522%, this is due to the fact that the nuts have been stored for a long time, resulting in a decrease in nutritional quality. Soy sauce in Indonesia is not a nutritional supplement but rather an addition of color to food.

Sugar level

Total sugar content is the overall content in a food ingredient which consists of reducing sugars and non-reducing sugars, the types of total sugar are from the monosaccharide, disaccharide, oligosaccharide and polysaccharide groups. The research results are presented in Table 2.

Table 2. Effect of salt in moromi soy sauce for 28 days on sugar content

Treatment	K0 (0%)	K1 (10%)	K2 (20%)	K3 (30%)
Average (%)	41,712 (b)	41,227 (b)	33,77 (a)	33,603 (a)

Note: Average numbers followed by different letters are significantly different at the 5% significance level according to Duncan's multiple range test.

Based on the research results in Table 2, it shows that the highest sugar content is in K0 at 41.712%, followed by K1 = 41.227%, K2 = 33.77% and the lowest is K3 = 33.603%. As salt is added, the total sugar content decreases, this is caused by several factors such as denaturation of enzymes in the salt solution, utilization of sugar by microorganisms or the Maillard reaction (Yanfang et al, 2009). During salt fermentation, processes occur breakdown of carbohydrates in soybeans by the amylase enzyme (Gao et al, 2011). In general, the sugars measured in moromi come from soybean raw materials, including the monosaccharides glucose, fructose and galactose, disaccharides and trisaccharides such as sucrose, maltose and raffinose (Röling et al, 1994). Sugar is an important component in

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moromi because it acts as a carbon source for microorganisms in the formation of aroma compounds (Hoang et al, 2016).

Viscosity

According to Nugraheni (2008), based on his classification, soy sauce is included in liquids with non-Newtonian flow. In other words, the viscosity changes with changes in the friction force between the liquid surface and the wall. The research results are presented in Table 3.

Table 2. Effect of salt in moromi soy sauce for 28 days on viscosity

Treatment	K0 (0%)	K1 (10%)	K2 (20%)	K3 (30%)
Average (%)	41,712 (b)	41,227 (b)	33,771 (a)	33,603 (a)

Note: Average numbers followed by different letters are significantly different at the 5% significance level according to Duncan's multiple range test.

Based on Table 3, it shows that treatments K0 and K1 do not show any real differences as well as K2 and K3. However, if you look at the highest viscosity value, K0 is 41.72%, followed by K1 = 41.227%, K2 = 33.771% and the lowest is K3 = 33.603%. This low viscosity is caused by the high sugar content in moromi contained in the substrate consisting of sucrose, maltose and raffinose (Röling et al, 1994) so that the soy sauce becomes thick. According to Nugraheni (2008), the factors that greatly influence the variation in final viscosity of soy sauce are the processing process, namely the level of heat used when cooking the soy sauce, stirring, and the length of the cooking process.

Organoleptic

Organoleptic testing or sensory testing is a method of testing using human senses as the main tool for measuring product acceptability. Organoleptic testing has an important role in implementing quality. The research results are presented in Table 4.

Table 4. Organoleptic test of the best soy sauce from research results

Best Treatment	Flavor	Color	Aroma
Best Ketchup	4,80	4,15	4,30

Information: 1. Don't like it at all, 2. Do not like, 3. Neutral, 4. Like, 5. Love it

Color

The hedonic scale shows a value with a numerical scale of 4.15. This means the level of liking (4) to very liking (5). Based on statistical analysis, it turned out that the treatments were not significantly different (P > 0.05). This means that each panelist has almost the same level of preference for the color of black soy sauce. The results of the research ranged from just like it to really like it.

Flavor

The hedonic scale shows a value with a numerical scale of 4.80. This means the level of likes (4) to very likes (5). Based on statistical analysis, it turned out that the treatments were not significantly different (P > 0.05). This means that each panelist has almost the same level of liking for the taste of black soy sauce as a result of the research, namely between just like it and really like it. The taste of soy sauce can be influenced by the

composition of sugar and volatile compounds from the sugar used (Apriyanto and Wiratma, 1997). The longer the moromi ferments, the more delicious the taste will be. There are two types of enzymes that play a role in producing soy sauce flavor in mold fermentation, namely the protease enzyme which gives a meaty (savory) flavor and the enzymes α amylase, amyloglucosidase and maltase which play a role in the sweet taste. (Badriah, 2007).

Aroma

The hedonic scale shows a value with a numerical scale of 4.30. This means the level of likes (4) to very likes (5). Based on statistical analysis, it turned out that the treatments were not significantly different ($P > 0.05$). This means that each panelist has almost the same level of preference for the aroma of black soy sauce. The results of the research ranged from just like it to really like it. At the fermentation stage, aroma and flavor will be formed by a mixture of several flavor-forming compounds formed during the fermentation process (Wulandari, 2008). The aroma of soy sauce is influenced by alcohol compounds and aromatic compounds produced by yeast during moromi fermentation. Apart from that, the addition of salt in the moromi fermentation process causes the resulting soy sauce to have a good taste and aroma (Purwoko, 2007). The longer the fermentation process takes, the better the resulting aroma will be.

CONCLUSION

Based on the research that has been carried out, conclusions can be drawn, including: The best protein content from the research results was K1, which was 1.522%, the best sugar content in K1 soy sauce was 41.227%. The panelists liked the sweet taste of soy sauce, while for thickness they preferred K3 soy sauce = 33.603%.

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