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INNOVATION OF OYSTER MUSHROOM GRIND *DENDENG* WITH BEEF AND CHICKEN SUBTITUTION

Siti Fathonah, Resitya Esi Ramadani
Semarang State University, Department of Family Welfare Education Kampus Sekaran Gd E7 Gunung Pati, Semarang, Indonesia fathonah@mail.unnes.ac.id, resityaesi@yahoo.co.id

ABSTRACT

*Oyster mushrooms have a texture and taste like meat, allowing to be made Dendeng. In order to increase protein content, it needs to be substituted with meat. The purpose of this research is to know the influence of substitution and the type of meat to the sensory quality, preference and the protein content of the oyster mushroom grind Dendeng. The experimental design used is a 2x2 factorial design, meat type factor (beef and chicken) and meat substitution (20 % and 40%). there are Beef 20 %, Beef 40%, Chicken 20 %, and Chicken 40 %. Data were analyzed by using factorial analysis and Duncan's test. The research result shows substitution and meat type, and interaction substitution and meat type affect the sensory qualities of oyster mushroom grind Dendeng on color, flavor, and overall indicator. Oyster mushroom Grind Dendeng with 40% beef and chicken **s**ubstitution and the use of beef in 20% and 40% substitutions gave significant differences in all sensory aspects. Conversely, oyster mushroom grind Dendeng with 20% beef and chicken substitution and the use of chicken meat in 20% and 40% substitution did not make a significant difference in all sensory aspects. Preference score is between 4.2 - 6.7 (maximum score 7), with the highest is on 40% beef substitution (S 40) with criteria of "like extremely". The protein content in each sample is: Beef 20 %: 13.5% and Beef 40%: 17.7%, Chicken 20 %: 8.9%, and Chicken 40 %: 9.7%. Innovation of oyster mushroom grind Dendeng with 40% beef substitution can be used as a high protein source of side dish with protein content of 17.7% and is likeextremely.*

KEYWORDS: *grind dendeng, meat types, chicken meat, beef, oyster mushroom*

1. INTRODUCTION

Mushroom is one of horticultural products that can be developed to improve people's nutritional status, one of them is white oyster mushroom. White oyster mushroom is categorized as food because it is safe and non-toxic so it is consumable. In addition, oyster mushroom is very nutritious which the composition and nutritional are such as protein, thiamin, carbohydrates, fat, dietary fiber, riboflavin, niacin, calcium, vitamins and minerals (Dewi, 2006). The fiber reaches 7.4 - 24.6% making it suitable for dieters (Tjokrokusumo, 2015). Mushroom contains unsaturated fat and lots of fiber which makes it good for digestion (Rini, 2011). King oyster mushroom increases insulin sensitivity and provide anti-hyperglycemic and anti-hyperlipidemic effects in mouse (Kim, et al., 2010). Mushroom products (oak mushrooms and oyster mushrooms) have strong antioxidant capacity in vitro and are useful as functional biomaterials in health-enhancing food products (Kang, et al., 2012). Extracts of oyster mushrooms grown on wheat can prevent acute liver damage, improve damaged lipid profiles, reduce triglycerides and total cholesterol in mouse models (Kim et al., 2012).

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There are many oyster mushroom productions in Indonesia which can meet the needs of mushrooms in the market. According to Biro Pusat Statistik (BPS) data, the last mushroom production in 2016 reached 40.914,3 tons, while for Central Java Province, it was 23.188,9 tons (56.7%), compared with other vegetables in Indonesia such as mustard 9.91 ton or spinach 2.96 ton. Oyster mushroom (*Pleurotus ostreanus*) is an edible fungus with a semicircular hood similar to an oyster shell with a slightly concavecenter.Mushroom is a vegetative food which has a texture and tastes savory, close to the taste of meat. This makes mushroom can be processed into a meal similar to chicken meat (Tjokrokusumo et al, 2015). However, oyster mushrooms belong to a perishable horticulture. Oyster mushroom can only last 3 days, and will be damaged after (Editor Agromedia, 2009). The diversification of mushroom processing and development of processed mushroom technology are very necessary for farmers and mushroom entrepreneurs in increasing the additional value and durability of oyster mushrooms. One form of diversifications of processed white oyster mushroom is a grind white oyster mushroom *Dendeng*.

Dendeng is one of processed meat products that usually uses beef. *Dendeng* is a food product in the form of slab made of fresh beef and/or frozen beef, sliced or ground, added with seasoning and dried by sun or dryers, with or without additional food ingredients and allowable food additives (*BSN*, 2013). The main ingredient of beef *Dendeng* is preserved beef dried by a drying machine or dried under the sun. However, the price of beef is very high compared with the price of chicken and fish meat. Since white oyster mushroom is more economical, then it can be an option used as a main ingredient for *Dendeng* as a substitution for beef and chicken meat. The use of both types of meat is supported by the highest level of consumption. In Indonesia in 2010, consumption of chicken, beef and preserved meat are consecutively at 5.110 kg/capita/year (14 g/capita/day) and 0.417 kg/capita/year (1,1 g/capita/day (Sekretariat Ditjen PKH, 2016). This consumption is much lower than in Australia which the consumption of meat/poultry/fish is 118 g/capita/day for children and 162 g/capita/day for adults, mostly from chickens and cows (Sui, et.al,2017).

Beef is red meat originally from cow which has thick fibrous, bloody red when it is fresh, physically elastic and smelling tasty (Usmiati, 2010). Beef is a source of protein and vitamin B12 which is good for brain, nerves development and blood formation. Chicken or poultry meat is a meat that has high nutritional value. Chicken contains vitamin C and E and contains low levels of fat. Most chicken fat is unsaturated fatty acids (Kurt and Kilincceker, 2011). Characteristic differences between the two types of meat will affect the beef *Dendeng* result.

The purpose of this research are to know 1) the effect of meat type and meat substitution on the quality of white oyster mushroom grind *Dendeng*; 2) the effect of meat type on 20% substitution to the quality of white oyster mushroom grind *Dendeng*. 3) the effect of meat type on 40% substitute on the quality of white oyster mushroom grind *Dendeng*; 4) the effect of 20% and 40% substitution of chicken meat on the quality of white oyster mushroom grind *Dendeng*. 5) the effect of 20% and 40% of substitution of beef meat on the quality of white oyster mushroom grind *Dendeng*. 6) the level of public's likeness for white oyster mushroom grind *Dendeng*; and 7) the protein content of white oyster mushroom grind*Dendeng*.

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2. METHODS

The object in this study is white oyster mushroom grind *Dendeng* which is substituted with chicken and beef meat. The experimental design used was 2 x 2 factorial design (Sudjana, 2005). The independent variable is types of meat (beef and chicken) and meat substitution (20 % and 40 %). The dependent variable includes sensory quality, likeness level and protein content. Control variable includes the type of materials, the amount of materials, tools and the process of *Dendeng* making.

Subjective assessment is a sensory test using a scoring test, with a score of 1 to 7 as the standard procedure (Meilgard, et al, 2007), with 3 repetitions using a slightly trained 20 panelists. For sensory test result, the data obtained is then analyzed using analysis factorial and continued with Duncan test if there is a clear difference (Gazpersz, 1991). Objective assessment is done by conducted protein content assessment using micro kjeldahl test (AOAC, 1995). Subjective assessment is done in the form of likeness/hedonic test using 80 untrained panelists, with a score of 1 - 7 (Meilgard, et al, 2007). The result of the community's likeness test was analyzed using the mean (Kadir,2015).

3. RESULT ANDDISCUSSION

3.1 Sensoric Quality

White oyster mushroom grind *Dendeng* with substitution of beef and chicken meat obtained has characteristics similar to beef *Dendeng*. The result of factorial analysis (Table 1) shows that meat type and meat substitution factors affect all indicators of color, aroma, flavor, sweetness and overall, and only texture aspect on unfavorable type of meat factor is not affected. The interaction of both meat type and meat substitution factors has an influence on color, flavor and overall indicator, and has no effect on indicator of aroma, sweetness and texture. This happens because there are different characteristics between beef and chicken meat.

Table 1. Factorial Analysis Result

Indicator	Significancy Score	Remarks
Color		
Meat Type	0.000	There is effect
Meat Substitution	0.000	There is effect
Meat Type* Meat Substitution	0.005	There is effect
Aroma		
Meat Type	0.000	There is effect
Meat Substitution	0.001	There is effect
Meat Type* Meat Substitution	0.085	There is no effect
Flavor		
Meat Type	0.000	There is effect
Meat Substitution	0.000	There is effect
Meat Type* Meat Substitution	0.000	There is effect
Sweetness		
Meat Type	0.001	There is effect
Meat Substitution	0.008	There is effect
Meat Type* Meat Substitution	0.343	There is no effect
Texture		
Meat Type	0,308	There is no effect
Meat Substitution	0.000	There is effect
Meat Type* Meat Substitution	0.234	There is no effect
Overall		
Meat Type	0.000	There is effect
Meat Substitution	0.000	There is effect
Meat Type* Meat Substitution	0,024	There is effect

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The characteristic difference between beef and chicken meat creates a significant effect on the oyster mushroom grind *Dendeng*. The result of the difference the white oyster mushroom grind *Dendeng* between the substitution of beef and chicken meat is presented in Figure1.

Figure 1. Oyster mushroom grind *Dendeng*, A. Beef 20 %, B. Beef 40 %, C, Chicken 20 %, and Chicken 40 %.

Substitution of beef produces a color that is more brown than black, compared with chicken substitution. The more meat substitution it has, resulted in darker *Dendeng* color. In the table 2 of Duncan test summary table, it can be seen that 20% factor of meat (chicken and beef) is not significantly different in all its aspects. Whereas, on the factor of meat type (chicken and beef), 40% of the results is significantly different in all aspects. The substitution factor of 20% and 40% of chicken meat has significant differences in color, aroma, flavor and sweetness, but not significantly different for the texture aspect. Moreover, in the substitution of 20% and 40% of beef, the results are significantly different in allaspects.

Tabel 2. Duncan Test on Grind *Dendeng* with Meat Type and Meat Substitution Factor

Grind *Dendeng* Products	Brown Colour	*Dendeng* Aroma	Flavour	Sweetness	Texture	Overall
Beef 20 %	$4,9^{a}$	$4,9^{a}$	$4,6^{a}$	$5,1^{a}$	$4,4^{a}$	$5,0^{a}$
Beef 40 %	$5,6^{b}$	$5,4^{b}$	$5,7^{b}$	$5,5^{b}$	$4,9^{b}$	$5,8^{b}$
Chicken 20 %	$4,7^{ac}$	$4,8^{a}$	$4,5^{a}$	$4,9^{a}$	$4,4^{a}$	$4,5^{a}$
Chicken 40 %	$4,9^{a}$	$4,9^{ac}$	$4,6^{ac}$	$5,0^{ac}$	$4,6^{bc}$	$4,8^{bc}$

Remarks: when the superscript letters are same, it means that there is no difference on both products. When superscript letters are different, it means that there is a difference between both products. For the color of white oyster mushroom *Dendeng,* it shows mean range from 4.7 to 5.6. The highest mean value with brownish color criteria is slightly blackish sample Beef 40 % of oyster mushroom grind *Dendeng* with 40% beef substitution. Beef 20 % and Chicken 40 % samples are dark brown, while Chicken 20 % is brown. This happens because the color of chicken and beef meat is different, which the chicken color is pale white (containing a little myoglobin) comparing with the color of red blood beef. Beef contains

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myoglobin pigment as the main pigment found in red meat. The heating and drying process cause heated myoglobin to create darker color and cause the reaction of Maillard browning. The occurring Millard reaction is the carbonyl group of reducing sugar reacts with the amino group of meat protein and the amino acids in a non-enzymatic way, and the reaction creates dark brown color, towards the heat causing the *Dendeng* color to be blackish brown (Winarno, 2004, Kusnandar, 2010, Singla, 2018). In addition, brown color is also influenced by the basic ingredients of *Dendeng* itself which is oyster mushroom. At first, the oyster mushroom was steamed first. In the steaming process, a non-enzymatic browning process also occurs so that the color becomes white brown. In a study by Ashriyyah (2015), it says that the steaming process of oyster mushrooms before it is processed into beef *Dendeng* is to make the oyster mushroom not to smell unpleasant and can simplify the makingprocess.

The results of this study shows that the best aroma of this white oyster mushroom grind*Dendeng* is very real. The aroma is very noticeable which can be observed in samples with 40% of beef substitution. The other three samples produce real scents. The aroma produced from oyster mushroom grind *Dendeng* is not much different from other samples. This is because the ingredients composition in the manufacture are made into the same condition, including brown sugar used. This supports the research of Febrianingsih, et.al (2016) which states that the higher the level of palm sugar added to *Dendeng,* it will weaken the meat aroma. On the contrary, the lower the level of palm sugar, the stronger the meat aroma. Aroma is not only determined by one component, but also by some components that create a distinctive odor. Therefore, the typical *Dendeng* aroma is produced from a combination of meat, sugar, salt and spices. Beef *dendeng* has a delicious aroma (Usmiati, 2010), in which it gives effect to the resulted *Dendeng*. Furthermore, deMan (1997), which states that the aroma of *Dendeng* is the result of the presence of a number of water-soluble ingredients and fat and essential compounds of additional spices. The aroma of *Dendeng* can also be influenced by the material used is coriander, since it has a fragrant smell and can create a delicious impression. The essential oil of coriander has the characteristics of linalool, mild, sweet, warm, and aromatic flavor. In the food industry, coriander is usually used as flavoring agent (Burdock and Carabin, 2009).

The main components of coriander are linalool (64.5%) and (E) - anethole (59.2%) (Cantore et al., 2004). Garlic is used as a spice to add the scent. Garlic contains alicine active substance which is very effective to fight bacteria. In addition, garlic contains *scordinin*, the complex *thioglisidin* compound which is an antioxidant (Palungkun and Budhiarti, 1995). Garlic has an antioxidant activity value of 8.77 ± 1.93mg VCE / 100 g and a total phenol value of 63.51 ± 3.67 mg GAE / 100g (Tangkanakul et al., 2009). Garlic extract can prevent diseases associated with oxidative damage (Ichikawa, et al., 2006). Galangal contains essential oil such as *kamfer*, *galang*, *galangol*, *philandren* and curcumin (Muchtadi and Sugiyono, 1992), and contains compound of flanoid, phenol and terpenoid. Galangal contains *acetoxi cavicol acetate* and *acetoxi eugenol acetate* which has is anti-inflammation and anti-tumor (Buchbauurf et al., 2003).

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The curing process, which is mixing spices with ingredients, creates a typical aroma of beef white oyster mushrooms grind *Dendeng*. In addition, a typical *Dendeng* aroma is also created during the process of grinding and drying, which is because the substances on the *Dendeng* evaporate which resulting in a distinctive aroma. The aroma of the white oyster mushroom grind *Dendeng* is out after the heating process, i.e. drying process with temperature (55^0 C) for ± 8 hours. Soekarto (1985), states that the composing components of the aroma are related to volatile compounds at high temperatures. This supports the statement expressed by Widawati and Susi (2015), that the aroma is related to the volatile components of a material. The more volatile components found in a material, the scent will be sharper.

The spices flavor is very noticeable in samples with beef 40% the other three *Dendeng* produce the same spice flavor that is real. This is because the sample with 40% meat substitution has a savory taste, tasty and balanced seasoning so that the typical taste of grind *Dendeng* is obvious. Protein(17.5 g) and fat (22.0) of beef (Kementerian Kesehatan RI, 2018) is higher than protein (18.0 g) and fat(3.5g) of skinless chicken breast meat (Erabaru .net, 2018).

Components of herbs and spices used in the production of oyster mushroom grind *Dendeng* such as garlic, galangal, cumin, ginger, coriander, salt and sugar give a distinctive flavor mixture for the white oyster mushroom grind *Dendeng*. The addition of salt should be enough, not to excessive or less since it can affect the taste of *Dendeng*. The taste of *Dendeng* is influenced by several factors such as the taste of meat, seasoning, and the drying and frying. As a result of the drying temperature, millard reaction and the taste of sugar and spices occur, so the fat in the meat will melt then increase the palability and can provide various components of taste in the *Dendeng* products (Soeparno, 2005). In addition, the use of herbs and spices in the *Dendeng* production has a real antioxidant activity The research results of *dendeng* produced in West Java and Central Java showed the total *Dendeng* phenolic from producers ranged from 42.47-102.00 mg EAG/100 g DW for raw *Dendeng*, and 36.51-95.49 mg EAG/100 g DW for cooked *Dendeng*. The antioxidant capacity of DPPH ranged from 79.35 to 379.40 mg EVC/100 g DW for raw *Dendeng*, and 94.30559.40 mg EVC/100 g DW for cooked *Dendeng*. The capacity of raw *Dendeng* antioxidants was 87.2%, whereas in cooked *Dendeng* was decreasing to 59.0% (Suryati, et.al, 2012).

Based on the results of this study, the best sweet taste criteria of white oyster mushroom grind *Dendeng* is a sample with beef 40 % substitution with slightly sweet criteria, while the same "slightly sweet" criteria is in the sample with beef 20 % and chicken 40 %, and the sample with another criteria that is " less sweet" is in the sample with chicken 20 %.

The main function of sugar in the curing is to modify the *Dendeng* taste (Soeparno, 2005). This is in line with Bintoro (2005) which states that the addition of sugar aims to improve the taste. In addition, sugar can also be used as a natural food preservative. Brown sugar also contains amino acids and vitamins. The addition of brown sugar aims to modify the flavor, improve the aroma, color, aroma and texture of the product. In addition, brown sugar can also inhibit the growth of microbes and acts as a natural

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preservative. The standard limit of sugar addition to processed meat products is 25% of the amount of meat used. During storage, there is a change of taste of each *Dendeng* treatment. The results of research on the use of brown sugar in various *Dendeng* companies showed around 5 - 40% depends on the desired level of sweetness (Suryati, et.al, 2012), the best beef *Dendeng* has 30% sugar addition (Evanuarini, et.al,2011).

Texture is an important factor in the process of selection and food consumption. The texture of a food material determines the factors that affect the acceptability of the food material (Guerrero, et al., 1999). The ideal texture of white oyster mushroom grind *Dendeng* is hard, this is due to the drying and frying process of *Dendeng*. From this process, the water will decrease causing the texture becomes hard.This is inline with Soeparno (2005) which states that the surface of dried meat will harden because meat loses water content during heating. The texture of a product depends on the amount of integrated miofibrillar protein, the drying rate, the degradation rate of connective tissue in the meat and the intramuscular fat of the meat (Toldra, 2004).

3.2 Level Of Likeness

Based on the results of the community's likeness test conducted, 80 non-trained panelists to give the likes for white oyster mushroom grind *Dendeng*. The highest degree of fondness is in oyster mushroom grind *Dendeng* with 40% beef substitution, with a mean of 6.18 in the like extremely category. It is on the outermost graph for all sensory aspects (Figure 2). This very high level of likeness indicates that the criteria are in accordance with the standard of *Dendeng* criteria, ie normal aroma and normal color (BSN, 2013). The *Dendeng* with 40% beef substitution also has the best/highest sensory quality for all sensoryindicators.

White oyster mushroom grind *Dendeng* with the lowest mean is grind *Dendeng* with 20 % chicken meat substitution with mean of 4,52 and criteria of “like”. Oyster mushroom grind *Dendeng* with 20% beef substitution and 40% chicken substitution have the same criteria that is “very like”. In the research, grind *Dendeng* consists of 60% oyster mushrooms and 40% dumbo catfish substitution is the like extremely (Ashriyyh, (2015). A good quality grind *Dendeng* is a *Dendeng* with the addition of 20% palm sugar which has organoleptic nature favored by panelists (Febrianingsih, et.al, 2016). *Dendeng* which is formerly soaked longer with betel leaves, will have more smell, taste and the level of the *Dendeng* preferences is increasing (Legowo, et.al, 2002).

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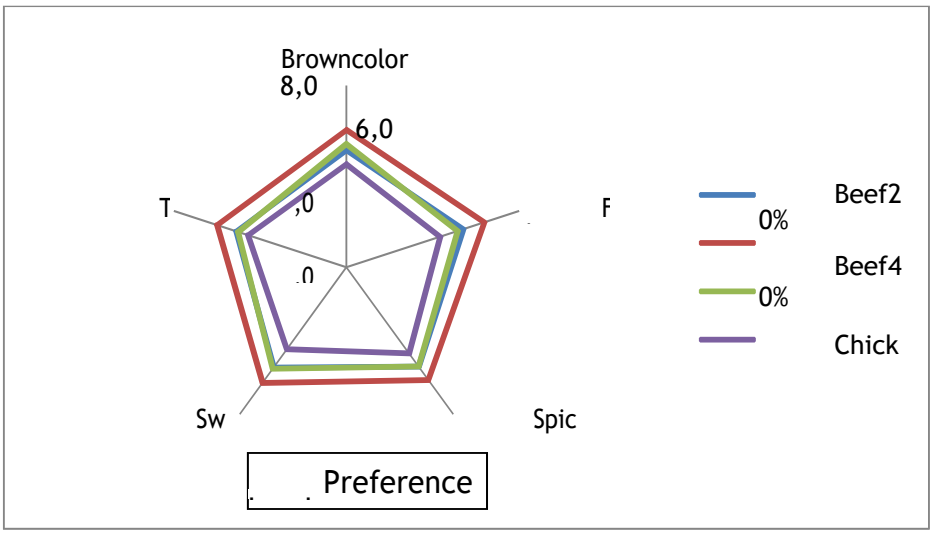

Figure 2. Preference Level of Grind *Dendeng* Oyster Mushroom

3.3 Proteincontent

Based on the analysis result of the protein of white oyster mushroom grind *Dendeng,* the lowest protein level is in the white oyster mushroom grind *Dendeng* with 20% chicken meat substituti on by 8.9% and the high estis in the white oyster mushroom grind *Dendeng* with 40% beef substituti on by 17.7 % (Figure 3). The content is lower than the standard of SNI (Indonesian National Standard) beef *Dendeng* 2908: 2013 which is 18% (BSN, 2013). The Lack of protein content in white oyster mushroom grind *Dendeng* is caused by drying which cause the protein content to be reduced. The long heating at high temperatures can lead to protein become less useful in food, low temperature treatment of protein can increase protein digestibility than the original ingredients (Desrosier , 2008). In the study, catfish *Dendeng* with the addition of 100 grams of tapioca flour produces 17.08 % protein (Saputra, Suparmi, Dahli, 2013). Oyster mushroom grind *Dendeng* with substitution ofdumbo catfish (50% ; 50%) produces the best protein value of 18.79% (Ashriyyah, 2015). The protein of oyster mushroom grind *Dendeng* with the addition of peanut puree is 15.76% (Anggraeni, 2016).

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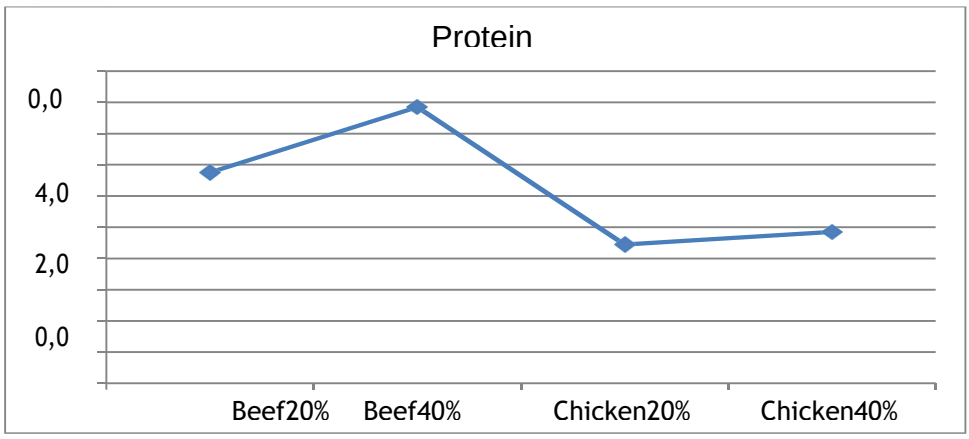

Figure 3. Protein Content of Oyster Mushroom Grind Dendeng

Oyster mushroom grind *Dendeng* with 40% beef substitution can be used source of side dish with high-protein and like extremely. In order for the protein in the grind *Dendeng* to meet the standard of *SNI*, the substitution of meat is more added. More meat substitution will increase the protein content in the white oyster mushroom grind *Dendeng.*

4. CONCLUSION

Based on the results of research and discussion, it can be concluded that:

1) There is influence of substitution and meat type to the quality of white oyster mushroom grind *Dendeng* on the color and flavor indicator, while there is no effect on the aroma, sweetness and textureindicator.
2) There is no effect of chicken and beef meat in the 20% substitution to the quality of white oyster mushroom grind*Dendeng.*
3) There is influence of chicken and beef in the 40% substitution to the quality of white oyster mushroom grind *Dendeng* on color, aroma, flavor, sweetness, and textureindicator.
4) There is no effect of 20% and 40% substitution in chicken meat to the quality of white oyster mushrooms grind *Dendeng,* except for thetexture.
5) There is an effect of 20% and 40% substitution in beef to the quality of white oyster mushroom grind*Dendeng.*
6) White oyster mushroom grind *Dendeng* with 40% beef substitution is likeextremely.
7) The protein content of White oyster mushroom grind *Dendeng* are beef 20 %: 13.5%, beef 40%: 17.7%, chicken 20 %: 8.9%, and chicken 40 %:9.7%.

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