International Journal on
Advanced Science
Engineering
Information Technology

Vol.3 (2013) No. 4
ISSN: 2088-5334

Substitution of Soybean Meal and Cornmeal to Moisture, pH, Bacterial Colony Forming and Shelf Life of Rejected Duck Meatballs

Novia D.[#], I. Juliyarsi[*], S. Melia[*], W.A. Vermalida[#]
[#] *Animal Husbandry Fakulty, Andalas University,Limau Manis, Padang, West Sumatera, Indonesian*
E-mail: deni_novia@yahoo.co.id;indri.juliyarsi@yahoo.co.id

***Abstract*— This study aimed to determine the effect of substitution of soybean meal with cornmeal to moisture, pH, bacterial colony forming and the shelf life of rejected duck meatballs. This research material using duck meat Coast (Indian Runner) salvage as much as 4000 grams were obtained from the Livestock Anduring Padang and soybean meal with Mungbean trademarks and cornmeal with cornstarch trademarks respectively of 600 grams were obtained at Raya Padang market. The research method used was experimental method with the random design, which consists of 5 treatments and 4 groups as replication. The treatment given in this study is the substitution of soybean meal and maize by A (100%: 0%), B (75%: 25%), C (50%: 50%), D (25%: 75%) and E (0%: 100%). Variables measured were moisture, pH, bacterial colony forming and the shelf life of rejected duck meatballs. The results of this study indicate that substitution of soybean meal and cornmeal significant effect on moisture, pH, bacterial colony forming and shelf life. Substitution of soybean meal and cornmeal by 100%: 0% is the best to produce the rejected duck meatballs with 69.20% moisture, pH 6.44, bacterial colony forming 7.85 x 105 CFU / g, and the shelf life of 22.12 hours..**

***Keywords*— Soybean Meal; Cornmeal; Moisture; Bacterial Colony Forming; Shelf Life.**

I. INTRODUCTION

Poultry meat has enough good nutritional value compared to red meat, which have a shorter fiber so tough and easy to digest, contain essential amino acids needed by the body, has no saturated fatty acids and lower cholesterol more, has a distinctive aroma, also contain vitamin B1. Poultry meat was often eaten duck meat chicken while not favored by the public. According to the Department of Animal Husbandry (2008), the majority of duck populations in West Sumatra Padang Pariaman of the region, namely 168 057 tail, District 50 City 157 188 122 646 Solok tail and tail. Duck produce eggs that contain high nutritional value, rich in protein, fat, and easy to digest.

Duck meat color slightly darker than chicken, although the same nutritional content, even content of vitamin B in the duck meat is higher than the chicken. Duck meat efficacious for patients with rheumatoid arthritis and brittle bones, so it is good to eat. Duck that were no longer productive (rejected), has low economic value because generally if the duck has reached the spawning grounds for the rejects ducks not too enthused by the community. This was caused by the meat tough and smelled fishy so unpopular, to increase the economic value of duck meat salvage it was necessary to diversify so that the duck meat rejected initially disliked being liked by the people. It also aims to diversify the forage products especially duck meat, a lot of products that can be produced from the processing of duck meat rejected them nuggets, sausage, jerky, shredded and meatballs.

The meatballs are foods that were round meat obtained from cattle that have been mashed and mixed with flour and other additives to produce a product that better. Meatballs are animal products with high water content or meatball products including wet so easily covered with microorganisms. The main ingredient in making meatballs is the meat, either beef, chicken, shrimp, fish and ducks. In making the meatballs, add the flour to form a binder or filler. In general, flour is often used tapioca flour. In addition to tapioca starch can also be used soybean meal and corn flour. Soybean meal can improve the quality of food, but it soybean contain lecithin as an emulsifier and natural substances that isoflavones may reduce the risk of heart disease by helping to lower blood cholesterol levels, helps reduce osteoporosis, and reduce the risk of breast cancer. According Koswara (2006), soy foods such as tofu, soy milk, soy flour and soy isoflavones intact uterus have ranged from 130-380 mg/100 g.

Corn flour can also be added in making the meatballs, the excess of cornmeal was resilient store, and easily mixed with other materials. From the research Rakhmadi, Novia, and Rena (2010), the use of corn flour, has a high protein and has a hydrophilic nature so the more added to the dough balls the higher the water holding capacity. This had led to the hydrophilic nature of the protein molecule that binds to a protein that binds to the water, the more it will decrease the moisture content of rejected duck meatballs. Therefore, diminishing the growth of microorganisms that will reduce decay due inhibited bacterial activity and will affect the shelf life of the rejected duck meatballs. Cornmeal including the gluten-free are made from starch and have a smooth texture.

This study aimed to determine the effect of soy flour substitution level with cornstarch to moisture, pH, bacterial colony forming and the shelf life of rejected duck meatballs.

II. MATERIAN AND METHOD

An easy way to comply with the conference paper formatting requirements is to use this document as a template and simply type your text into it.

A. Materials Research

In this study, the raw materials used were of Pesisir duck meat (Indian Runner) that have been rejected as many as 4000 g derived from duck farms in the area Anduring. The materials used in this study was a trademark of soy flour Mungbean and corn starch trademarks Maizena with each 15% (600 g) of the weight of the meat. Other materials are 20% ice (800 g) of weight of meat, salt 2.5% (100 g), garlic that has been crushed 3% (120 g) and pepper with Pepper trademark Lada Lampung Cap Kumbang 1% (40 g) of weight of meat. Where all of these materials obtained from Pasar Raya Padang.

The chemicals used for this analysis is the PCA (Plate Count Agar), HCl, distilled water, alcohol and ether peptone. While the equipment used is analytic scales, meat processor, stainless steel knife, spoon stainlees steel, quebec colony counter, electric oven, autoclave, petridish, test tubes, beakers, erlenmeyer, stir sticks, hockey sticks, pH meter, aluminum foil, stove, mortar and pestle.

B. Research Methods

The method used in this study is an experimental method using a randomized block design, which consists of 5 treatments with 4 replications, in which the group as a test. The treatment given in this study is the substitution of soybean meal and maize by A (100%: 0%), B (75%: 25%), C (50%: 50%), D (25%: 75%) and E (0%: 100%).

The mathematical model of this design according to Steel and Torrie (1995) are:

$$Yij = \mu + \alpha i + \beta j + \sum ij \qquad (1)$$

where: Yij: Observations from experimental units treated to i, to j. μ: general median. αi: Effect of treatment to i
βj: The effect group to j ∑ij: Influence of the rest of the experimental units treated to i and j group. i: Treatment (A, B, C and D) j: Many groups (1,2,3,4 and 5)

According to Steel and Torrie (1995) if significantly different between treatments (P <0.05) and differed significantly (P <0.01) then further tested by Duncan's Multiple Range Test (DMRT).
The variables measured were oven method moisture, pH, bacterial colony forming Standard Plate Count method, and the shelf life by using sensory parameters (aroma, flavor and texture). Performed using the parameters of environmental conditions can accelerate the deterioration process (usable quality) food products. The analysis estimates the last shelf was characterized by the formation of fine threads and changes in taste. Research procedures could be seen in Figure 1.

C. Place of Research

This research had been carried out in the Laboratory of Animal Products Technology Faculty of Animal Husbandry Andalas University.

.

III. RESULTS AND DISCUSSION

TABLE I
MEAN MOISTURE, PH, BACTERIAL COLONY FORMING AND THE SHELF LIFE THE REJECT DUCK MEATBALLS RESEARCH

Treatment	**Moisture (%)**		
	Moisture (%)	**Ph**	**Bacteria Colony Forming (x 10^5 CFU/gram)**
A	69.20^{c}	6.44^{c}	7.85^{d}
B	71.19^{b}	6.48^{bc}	9.90^{c}
C	72.55^{ab}	6.53^{ab}	11.39^{c}
D	73.47^{a}	6.59^{a}	14.00^{b}
E	73.83^{a}	6.60^{a}	22.43^{a}
SE	0.63	0.03	0.62

Note : Mean with different superscript letters indicate effects significantly different (P <0.05). Substitution of soybean meal and maize by A (100%: 0%), B (75%: 25%), C (50%: 50%), D (25%: 75%) and E (0%: 100%)

A. Water Content

The average water content of rejects duck meatballs resulting was measured after saving an hour before decay can be seen in Table 1. The average water content substitution soybean flour and cornstarch reject duck meatballs rate ranged from 69.20% to 73.83%. Water content rejects duck meatballs were highest for treatment E is 0% and 100% soybean flour with corn flour rataan73.83%, while the lowest water content on a treatment that was 100% and 0% soybean meal corn flour with an average 69.20%. Results of analysis of variance showed that the treatment effect was very real to the moisture of rejected duck meatballs. This suggests that the substitution of soybean meal with corn flour affect the moisture of rejected duck meatballs.

Results of Duncan's multiple range test showed that the water content of reject duck meatballs treatment A substitution at 100% with 0% soy flour cornmeal highly significant with reject duck meatballs water content on treatment B, C, D and E. E in the treatment of the substitution 0% to 100% soy flour cornmeal significantly different with treatment A and B but did not differ significantly with treatment D and C. This shows, that the

lower percentage of soy flour substitution lowers the moisture during storage rejects duck meatballs.

Lower water content rejects duck meatballs on a treatment that was 100% soybean flour and corn flour 0% due to higher levels of substitution of soybean flour with corn flour. Water content rejects duck meatballs were obtained, namely 69.20%. The low water levels caused by soy flour contained lecithin which acts as a natural emulsifier. It also had a high water absorption, so that when added to food products that will improve water absorption, water thus obtained was lower. Soy contains 1.5 - 3.0% lecithin which was very useful both in food and non-food industry and have a water absorption (DSA) which is 242.4% higher (Widyaningrum et al., 2005). Added by Pravitasari (2009) Soybean flour was a processed soybean, soybean meal processed in the form aims to reduce water content so as to extend the shelf life.

Soy flour has been a high protein content compared cornmeal. Wherein the soy flour protein content 39.7 g/100 g (Laboratory of Analysis and Calibration Center for Industrial-Bogor, 2010) while the protein content of corn flour that is 9.2 g/100 g (Nutrition Directorate of the Ministry of Health, 2000). According to Wolf and Cowan (1975) in Widaningrum et al. (2005), soy protein has been functional properties such as water and fat binding properties, emulsifying properties and thicken and form a thin layer. This was consistent with the results of Melina (2011), that the highest protein content of the 18:06% 100% 0% soybean meal and corn flour and the lowest protein levels are 10:11% 0% 100% soy flour and corn flour. This suggests that the higher levels of the protein, the higher the water holding capacity so as to reduce water content of reject duck meatballs. In addition to its high protein content, soy flour is also hydrophilic, water-binding good. Functional properties contained in soy flour as a binder was water that can be measured by NSI (Nitrogen Solubility Index) which shows the percentage of total nitrogen were extracted with water (Koswara, 1995). As shown in the study, showed that the higher the percentage of substitution of soybean meal and corn flour that is 100% versus 0%, it produced low water levels on treatment A (69.20%).

Based on research studies, the average water content of reject duck meatballs resulting in treatment A has met quality standards in accordance with SNI 01-3818-1995 meatballs. Wherein water content is ≤ 70% meatballs. This means 100% soy flour substitution with 0% corn flour in the manufacture of reject duck meatballs with content produced water that meets the quality requirements meatballs SNI criteria established by the National Standardization Agency of Indonesia (1995).

B. pH

The average pH of duck meatballs rejects measured 1 hour before decay can be seen in Table 1. Mean pH substitution of soybean flour and corn flour reject duck meatballs rejects ranged from 6.44 to 6.60. pH meatballs the highest ducks were rejects in treatment E is 0% 100% soy flour and corn flour with an average 6.60, while the lowest pH in a treatment that was 100% and 0% soybean meal corn flour with an average 6.44. Results of analysis of variance showed that the treatment gave a significantly different effect on the pH of reject duck meatballs. This suggests that the substitution of soybean meal with corn flour affect the pH of reject duck meatballs.

Results of Duncan's multiple range test showed that the water content of reject duck meatballs treatment A substitution at 100% and 0% soybean flour cornmeal significantly different from the pH of reject duck meatballs on treatment C, D and E, but did not differ significantly with treatment B. E in the treatment of the substitution 0% and 100% soy flour cornmeal significantly different from treatments A, B, but did not differ significantly with treatment C and treatment D. This shows, that the higher the percentage of soy flour substitution would maintain the pH remains low reject duck meatballs during storage.

Lower pH reject duck meatballs on treatment A was 100% soy flour and corn flour 0% due to higher levels of substitution of soybean meal with corn flour. pH obtained reject duck meatballs were due 6.44 soy flour contains lecithin which acts as a natural emulsifier, wherein the lecithin content of 1.5 - 3.0%, which was very useful both in food and non-food industries. According to Tsen et al soya fatty intact, namely soy lecithin on fat-free flour. Dough reject duck meatballs culled it would lower moisture followed by low pH reject duck meatballs.

Besides soybean flour contains high protein than corn flour. Soybean flour protein content was 39.7 g/100g (Laboratory of Analysis and Calibration Center Industry Bogor, 2010), whereas the protein content of corn flour that was 9.2 g/100g (Nutrition Directorate of the Ministry of Health, 2000). Accordance with the opinion Accordance with the opinion Koswara (1995) that this type of flour is higher in protein can increase the water holding capacity due to the nature of the starch itself was easy to draw water. This happens because at the time of cooking the starch molecules will bind to each other through hydrogen bonds with the protein. With the weakening of the hydrogen bonding of water molecules can infiltrate between protein and starch molecules, thus strengthening occurs when cooled hydrogen bonds between starch molecules and water molecules involving hydrogen as the hydrogen bridge. This gives the effect of the depreciation of cooking and a decrease in the pH of reject duck meatballs. Added by Koswara (1995) that soy flour was usually used as a binding agent in food products, where the addition of a binder serves to improve the stability emulsion, reducing cooking shrinkage, improve the characteristics chunks, enhance flavor and reduce formulation costs.

Thus the higher rate of substitution of soybean meal with corn flour then reject duck meatballs pH can be kept low during the process. As evident from the results of this study, which found that the pH range was not much different between the treatment and the increasing substitution of soybean meal with corn flour that was 100%: 0% in treatment A reject duck meatballs pH would result in a low during storage was 6.44.

In fact no different pH reject duck meatballs on treatment C, D and E were soy flour substitution at a rate of 50%, 75%, and 100%, due to the substitution of cornstarch treatment was more dominant, this causes the pH of resulting reject duck meatballs different unreal. Wherein the substitution rate of 50% in the water-binding capacity was

optimal, this contributes to shrinkage and a decrease in the pH of cooking reject duck meatballs. Accordance with the opinion and Djarijah Nurwanto (1997) that the water content of a food was directly proportional to pH. As a result, when the rate of substitution of corn flour were given higher at up to 100%, the ability to maintain pH was not much different from the treatments C and D, so that the pH of reject duck meatballs E on relatively equal treatment and did not differ significantly with pH reject duck meatballs.

The high water content in the treated E is 0% and 100% soy flour cornmeal caused, in the absence of treatment of soy flour substitution. So the lack of cooperation between soy flour with corn flour to bind water and maintain it during the cooking process takes place. As a result, the water content in the reject duck meatballs high, the high water content in the reject duck meatballs would accelerate the growth of microorganisms during storage, and therefore contributes to an increase in pH and a pH of reject duck meatballs too high. The results showed that the pH was directly proportional to the water content, where the decrease of the water content resulting pH would be even lower.

The results Komariah, Ulupi and Hendrarti (2005) dough balls with a pH value of raw material mixture of beef and oyster mushrooms ranges from 6.43 to 6.56. Functional properties of the protein as an emulsifier was needed in making meatballs. Proteins could bind water on the outside of the hydrophilic and binds fat on the inside that is hydrophobic.

C. Bacteria Colony Forming

Mean bacterial colony forming reject duck meatballs results measured 1 hour before it was damaged, it can be seen in Table 1. Total bacterial colonies substitute soy flour with cornstarch reject duck meatballs ranged mean 7.85 x 105 CFU / g until 22.43 x 105 CFU / gram. Bacterial colony forming reject duck meatballs were highest for treatment E is 0% 100% soy flour and corn flour with an average 22:43 x 105 CFU / g, whereas the lowest bacterial colony forming on a treatment that was 100% and 0% soy flour with corn flour mean of 7.85 x 105 CFU / gram. Results of analysis of variance showed that the treatment gives a real effect on bacterial colony forming rejects duck meatballs. This suggests that the substitution of soy flour with cornstarch effect on bacterial colony forming reject duck meatballs.

Results of Duncan's multiple range test showed that bacterial colony forming reject duck meatballs treatment A substitution at 100% with 0% soy flour cornmeal significantly different from the bacterial colony forming reject duck meatballs on treatment B, C, D and E. However, the bacterial colony forming on substitution treatment B was 75% and 25% soy flour cornstarch not differ significantly with treatment C. This shows, that the higher the percentage of soy flour substitution would maintain bacterial colony forming reject duck meatballs remain low during storage.

Lower bacterial colony forming reject duck meatballs on a treatment that was 100% soy flour and corn flour 0% due to higher levels of soy flour substitution of corn starch, bacterial colonies forming obtained was 7.85 x 105 CFU / g. The low total bacterial colony forming reject duck meatballs caused by soy flour contain lecithin as an emulsifier that was natural, but it also has a high water absorption, so that when added to food products will increase the absorption of water, thus the water content obtained would be lower and would result in a low bacterial colonies forming as well. Soy contains 1.5 - 3.0% lecithin which was very useful both in food and non-food industry and have a water absorption (DSA) which is 242.4% higher (Widaningrum et al., 2005). Added by Pravitasari (2009) Soybean meal was a processed soybean, soybean meal processed in the form aims to reduce water content so as to extend the shelf life.

The low water content of reject duck meatballs on treatment A will inhibit the growth of bacteria during storage, because bacteria require adequate water for growth. This will affect the growth of microorganisms during storage, because the water needed for growth microorganisms increasingly limited. As a result, the low water content of microorganisms duck meatballs the growth of bacteria during storage can be pressed, followed by the low number of bacterial colonies resulting.

According Soeparno (1998), all living creatures, including microorganisms need water, because water was available will determine the rate of growth of microorganisms. Soy flour has been a high protein content and thus the more hydrophilic the percentage of the addition of reject duck meatballs in dough the higher the water holding capacity and can maintain it during the processing progresses and further reduces the availability of water needed for the growth of microorganisms, so the growth of bacteria which causes decay is inhibited. As evident from the results of a study on the treatment of bacterial colonies forming produced reject duck meatballs were low as a result of the addition of flour significantly affected by water content and pH.

Not in fact totally different bacterial colonies forming reject duck meatballs treatment B and C on the substitution of soy flour with corn flour at the rate of 75% and 50%, due to the substitution level of soybean flour ability to bind water and maintain it throughout the process had a maximum. So that the water content of reject duck meatballs resulting relatively similar or different was not significant (P> 0.05), between treatments B and C, consequently a different bacterial colony forming. Substitution of soybean meal and corn flour to (100%: 0%) in treatment A produced water levels are the lowest 69.20%, the lowest pH and 6.44% bacterial colonies forming reject duck meatballs lowest 7.85 x 105 CFU / gram.

D. Shelf Life

The average shelf life of reject duck meatballs the results of the study can be seen in Table 1. The shelf life of soy flour substitution with cornmeal reject duck meatballs with an mean range from 16.75 hours until 22.12 hours. The shelf life of reject duck meatballs were highest treatment A was 100% and 0% soybean meal corn flour with an average 22.12 hours, and the lowest shelf life in treatment E is 0% and 100% soy flour cornmeal with average 16.75. Results of analysis of variance showed that the treatment gave a real effect on the shelf life of reject duck meatballs. This suggests that the substitution of soybean meal with corn flour affect the shelf life of reject duck meatballs.

Results of multiple range test Duncan's showed that the shelf life of reject duck meatballs on treatment A substitution 100% soybean meal and 0% cornstarch significantly different with the shelf life of reject duck meatballs on treatment B (75%), C (50%), D (25 %) and E (100%). This show, that the lower percentage of soy flour substitution would reduce the shelf life of reject duck meatballs during storage.

Most long shelf life reject duck meatballs on a treatment that was 100% soy flour and corn flour 0% due to higher levels of substitution of soybean meal with corn flour. Over the length of the shelf life of reject duck meatballs on treatment A, caused by soybean flour had a high protein content and also hydrophilic, which was able to bind water so as to reduce water content and can extend the shelf life. It was also caused by soy flour contains lecithin which acts as a natural emulsifier. It also had a high water absorption, so that when added to food products would increase the absorption of water, thus the water content obtained will be low. Soy contains 1.5 - 3.0% lecithin very BERGINA in both food and non-food industry and have a water absorption (DSA) was as high as 242.2 (Widaningrum et al., 2005).

Accordance with the opinion Pravitasari (2009) that soy flour was one of processed soybean, soybean meal processed in the form aims to reduce water content so as to extend the shelf life. This will affect the growth of microorganisms during storage, because the water needed for growth microorganism increasingly limited. As a result, the low water content of reject duck meatballs the growth of bacteria during storage can be reduced, followed by more long shelf life of reject duck meatballs.

The results Yeni (2010), the longest shelf life in the addition of corn starch, tapioca and corn at the level of 30%, where the shelf life of corn starch for 12.67 hours, during the 12:33 hour tapioca starch and corn flour for 11.67 hours. Thus it can be seen that the substitution of soybean meal and corn would increase the shelf life of reject duck meatballs. Where in the longest shelf life of the research was on treatment A during the 22.12 hour. Besides soy flour has been a protein content that was hydrophilic so that more percentage of the dough reject duck meatballs added ducks will be then the higher the water holding capacity, followed by decreasing levels of water so that the protein content obtained would be higher and certainly extend the shelf life.

With the low water content of duck meatballs rejects the growth of bacteria can be inhibited, this will affect the duration of the shelf life of reject duck meatballs. Accordance with the opinion of Buckle et al (2007) that all the microorganisms in the growth and development requires water. In other words, inhibition of bacterial growth during processing and during storage, the shelf life of reject duck meatballs longer be defended. If the parameters were linked between each other then the shelf life of reject duck meatballs associated with water content, pH and bacterial colonies forming in this study. Wherein the low water content and pH of reject duck meatballs followed by curbing the growth of microorganisms, thereby reducing the total bacterial colony forming reject duck meatballs that will extend the shelf life of reject duck meatballs. The results showed that, 100% soy flour substitution with 0% corn flour that was in treatment A produces the lowest water content (69.20%) and lowest pH (6:44) and the lowest bacterial colonies forming as well (7.85 x 105 CFU / g) so that would increase the shelf life of reject duck meatballs longer the 22.12 hour.

IV. CONCLUSIONS

Results of this study concluded that the substitution of soybean meal and corn flour significantly affected the water content, pH, bacterial colony forming and shelf life. Substitution of soybean meal and corn as much as 100%: 0% was the best to produce the reject duck meatballs with 69.20% water content, pH 6.44, bacterial colony forming 7.85 x 105 CFU / g and 22.12 hour shelf life.

REFERENCES

[1] Analysis and Calibration Laboratory Center for Agro-Bogor. 2010. Nutritional Value of Soybean Meal Mungbean. Analysis and Calibration Laboratory Center for Agro-Bogor. Bogor.

[2] Buckle, K.A., R.A. Edward., G.H. Fleet and M, Wootton. , 2009. Food Science. Translation: H. Purnomo. First Printing. University of Indonesia, Jakarta.

[3] Department of Animal Husbandry of West Sumatra Province. , 2008. Poultry Population by County / City and Poultry type. Central Bureau of Statistics of West Sumatra.

[4] Nutrition Directorate of the Ministry of Health. In 2000. Nutritional content of food substances. Department of Health RI.

[5] Komariah, Surajudin and Purnomo, D. , 2005. Assorted Processed Beef, Healthy, Nutritious and Delicious. Cet-1. Agro Media Library. Jakarta.

[6] Koswara, S. , 1995. Soybean Processing Technology Makes Food grade. Pustaka Sinar Harapan, Jakarta.

[7] Koswara, S. 2006. Isoflavones, Multi Compound Benefit In soybean. http://www.ebookpangan.com/ARTIKEL/ISOFLAVON, 20ZAT% 20MULTI%% 20% BENEFITS 20DALAM% 20KEDELAI.pdf. Retrieved July 11, 2010. 08.30 pm.

[8] _____. 2006. Nuts, fiber-rich nutrient source. http://www.Ebook pangan.com. Thursday, 10 June 2010, 14:30 pm.

[9] Melina, D. , 2011. The substitution effect of Soybean Meal with Corn Flour on protein content, fat content and Sensory Properties of salvage Duck Meatballs Appearance. Thesis Faculty of Animal Husbandry, Andalas University. Padang.

[10] Muchtadi, D. , 2009. Principle of Protein Source Food Technology. Alfabeta. Bandung.

[11] National Standardization Agency of Indonesia. , 1995. SNI List of Food and Drug Administration. Balai Drug and Food Control, Jakarta.

[12] Nurwantoro and a U.S. Djarijah. , 1997. Animal and Vegetable Food Microbiology. Canisius. Jakarta.

[13] Pravitasari, R. , 2009. Effect Soaking in Sugar Solution the percentage of oligosaccharides and Sensory Properties Soybean Flour (Glicine max). http://www.google.com. Retrieved June 20, 2010. 19:00 pm.

[14] Rakhmadi, A. D. Novia.dan D. Rena. 2010. Characteristics Salvage Duck Meatballs with substitution type different Number flour. ttp://Ip.unand.ac.id/?pModule=news&pAct=detail&detail=202.Diakses July 10, 2010. 13:00 pm

[15] Soeparno. , 1998. Meat Science and Technology. Gajah Mada University Press, Yogyakarta.

[16] Wibowo, S. , 2003. Making Fish and Meat Meatballs. 6th prints. Self spreader publisher, Jakarta.

[17] Widyaningrum, S. Widowati and S.T. Soekarto. , 2005. Enrichment of Soybean Flour Making the Wet Noodle on Substitution Raw Materials wheat with arrowroot flour. Postharvest Journal 2 (1): 41-48.

[18] Yeni, F. 2010. The effect of Meatballs Against Power save Ducks culled At Different Level. Faculty of Animal Husbandry, Andalas University, Padang