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The Effect of Fenugreek Paste on Physical Quality and Organoleptic Quality Meatballs Made From Chicken Meat

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Abstract. Meatballs is a processed meat product and one of Indonesia's favourite culinary delights. This study aims to determine the effect of fenugreek paste on the physical and organoleptic quality of meatballs made from chicken meat. The researchwas conducted in June-July 2023 at the Research and Technology Laboratory, Faculty of Agriculture, and Animal Production Laboratory, Faculty of Agriculture, University of No Sumatra. The design used in this study was RAL (Completely Randomised Design) with 4 treatments, namely P0 = 0%, P1 = 5%, P2 = 10%, P315%, and 5 replications. The parameters in this study were physical quality tests, namely meatball pH and cooking loss, and organoleptic tests of color, aroma, taste, and tenderness. The results showed that 5%, 10%, 15% fenugreek paste had a very significant effect (P<0.01) on physical quality and organoleptic quality. The higher the percentage of fenugreek paste used in meatballs, the higher the physical and organoleptic quality of meatballs In conclusion of this study is that fenugreek is good to add to get quality meatballs.

Keywords: chicken, fenugreek, meatballs, physical, organoleptic

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1 Introduction

Meatballs is a processed meat product. The meat is mashed first, mixed with spices and flour, formed into small balls like small spheres, then boiled in boiling hot water and waited until cooked [1]. Almost all meatballs use beef, so it is necessary to consider using meat, not only beef but also meat from other livestock, such as chicken. Processed livestock products such as meatballs require ingredients that have added value and provide benefits [2]. For example, laying hens meat could be of better quality and be favored by the public and unfortunately it is tough. Therefore, it is necessary to make it a quality processed product highly appreciated by consumers [2]. One of the efforts that can be made is to process the chicken into meatball.

Fenugreek contains saponins that have health benefits such as antioxidant, antidiabetic, antibacterial, antifungal, anti-cancer, and antiatherogenic [3]. According to [4], fenugreek seeds

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contain amino acids, fatty acids, saponins, folic acid, trigogenin, and angiogenin. Fenugreek seeds have fiber protein content, stabilizing power, and emulsifying power, which can be recommended for product development and value addition [5].Fenugreek seeds contain 26.45% protein, 6.45% fat, 6.95% crude fiber, 13.96% moisture content,and 5.92% lysine, so it is very good to use [6].

2 Materials and Methods

2.1. Material

The ingredients used in this study are 1,000 grams of chicken meat, 100 grams of tapioca flour, 5 cloves or 80 grams of garlic, 80 grams of table salt (12.5%), 1 tsp pepper (3 grams), 400 ml of ice cubes and 1 liter of boiling water, and fenugreek powder paste 0%, 5%,10%, 15% of the meat weight. The tools used in this study are pots and pans for boiling meatballsand digital scales used to measure the weight of the sample of chicken meatballs.

2.2. Research Procedure

2.2.1. Process of Making Fenugreek Paste from Chickpea Seeds

Fenugreek seeds (Trigonella foenum- graecum) were obtained from the Medan traditional market. The fenugreek seeds were washed and soaked in cold water or distilled water inthe ratio of 1:5 (weight/volume) for 12 hours at room temperature, then rinsed twice using distilled water after cleaning. The soaked fenugreek seeds were ground using a blender and added water 1:1 (weight/volume), e.g., 10 grams of water 100 ml until it became a paste, and the paste was ready to be used in meatball dough and weighed according to the treatment [7].

2.2.2. Meatball Making Process with Fenugreek Paste Addition

1,000 grams of chicken meat was washed, cut into small pieces, finely ground using a blender, then mixed with 400 lm ice cubes and 80 grams of salt. 100 grams of tapioca flour plus 3 grams of pepper and white bottom, mix all ingredients until the dough becomes smooth [8]. Weigh the dough and add fenugreek paste every 4 treatmentsand 5 replicates. After weighing, mold the dough into a circle, put the circle into

Boiling water and, in each treatment and repetition, the water for boiling the meatballs isreplaced with the aim that there is no effect on the meatballs produced other thanthe effect of giving fenugreek pasta. The cooked meatballs were drained, and then the meatballs were observed for their research variables.

2.2.3. Procedure for calculating the pH value of meatballs

Weigh 5 grams of meatball sample. Turn on the pH meter that has been calibrated using a buffer solution. Insert the sensor needle into the meatball until the number displayed on the screen is stable [9].

2.2.4. The procedure for calculating cooking loss

Cooking shrinkage is the calculation of the weight lost during the cooking process. It can be done with the CSIRO method [10]. Meatball samples are weighed as initial weight. The meatball

sample is then boiled with water at 90ºC for 30 minutes. Remove the meatballs, then cool and dry with paper towels. Weigh the meatballs using a digital scale as the final weight, then calculate using the following formula:

$$Cooking\ loss\ = \frac{initial\ weight\ before\ boiling - final\ weight\ after\ boiling}{initial\ weight\ before\ boiling}\ X\ 100\%$$

2.2.5. Organoleptic quality test

Organoleptic assessment using 30 panelists. The questionnaire has several criteria: aroma, taste, color, and tenderness [2]. The taste organoleptic test had an assessment score of Good, the taste of chicken meat and fenugreek seeds (9); Good, the taste of chicken meat fenugreek seeds is quite dominant (8); Good, the taste of chicken meat fenugreek seeds is slightly reduced (7); Somewhat good, the taste of chicken meat, fenugreek seeds is less (6); Less tasty, chicken meat flavor, fenugreek seeds less (5); Less tasty, chicken meat flavor, fenugreek seeds absent (4); Fenugreek seeds flavor absent (3); Not unpleasant, fenugreek seeds absent (2); Very unpleasant, chicken flavor, fenugreek seeds absent (1). Scoring of color measurements on meatball samples, namely: Gray (9); Grayish (8); Slightly gray (7); Somewhat gray (6); Very gray (5); Blackish (4) Somewhat black (3); Black (2) and Very black (1).

Scoring of taste measurements on meatball samples, namely Good, the taste of chicken meat and fenugreek seeds (9); Good, the taste of chicken meat, fenugreek seeds is quite dominant (8); Good, the taste of chicken meat, fenugreek seeds is slightly reduced (7); Somewhat good, the taste of chicken meat, fenugreek seeds is less (6); Less good, chicken meat flavor, fenugreek seeds less (5); Less good, chicken meat flavor, fenugreek seeds absent (4); Fenugreek seeds flavor absent (3); Not bad, fenugreek seeds absent (2); Very bad, chicken flavor, fenugreek seeds absent (1). Scoring of aroma measurements is not fishy, fresh, and delicious with the aroma of chicken meatballs (9); Not fishy, fresh, fenugreek seed aroma and typical chicken meatballs (8);

Fresh, fenugreek seed aroma is very dominant (7); Fresh, fenugreek seed aroma is dominant (6); Somewhat fresh, fenugreek seed aroma quite dominant (5); Less fresh, fenugreek seed aroma absent (4); Not fresh, fenugreek seed aroma absent (3); Very not fresh, fenugreek seed aroma absent (2); Very odor, fenugreek seed aroma absent (1).

2.3. Research Design

This study used a completely randomized design (CRD) with 4 treatments and 5 replicates. The sample in this study was conducted 5 times, resulting in 20 treatment combinations or 4×5 experimental units. The data obtained were statistically analyzed using analysis of variance. If real results were obtained at the 5% level, the Duncan Multi Range Test (DMRT) was conducted.

The treatment of making meatballs with the addition of fenugreek paste are as follows:

P0 = Control (0%)

P1 = Chicken Meatball Dough + Fenugreek Paste (5%)

P2 = Chicken Meatball Dough + Fenugreek Paste (10%)

P3 = Chicken Meatball Dough + Fenugreek Paste (15%)

3. Results and Discussion

3.1. pH Value

Based on the statistical analysis results, the highest average pH after chicken meatballs is the P3 treatment, with a value of 6.90, while the lowest average is in the P0 treatment, with a value of 6.12. Based on the results, P1, P2, and P3 have a higher pH average than P0 or P Control. P0 treatment is significant ($P<0.05$) in the P1 treatment and very significant ($P<0.01$) in the P2 and P3 treatments. P1 treatment was significant ($P<0.05$) in P2 treatment and highly significant ($P<0.01$) in P3 treatment, and P2 treatment was significant ($P<0.05$) in P3 treatment. The results showed that adding fenugreek paste was highly significant ($P<0.01$).

Based on DMRT (Duncan Multiple Range Test) analysis, it is known that the use of fenugreek paste can indicate that 15% fenugreek paste will lower the quality of cooking shrinkage of meatballs. This is to research [11] that the increase in pH value is caused by fenugreek seeds containing 23% protein, which can increase water binding capacity because starch can bind water. During cooking, protein, and starch molecules are linked through the weakening of hydrogen bonds, which causes water molecules to enter between protein and starchmolecules. Fenugreek used as a spice can improve the quality of processed products [12].

Table 1. pH of Afkir Chicken Meatballs Using Fenugreek Paste.

Treatment	Repeat					Average
	U1	U2	U3	U4	U5	
P0 (0%)	6,00	6,00	6,10	6,20	6,30	6,12±0,13[a]
P1(5%)	6,60	6,40	6,50	6,70	6,50	6,54±0,11[b]
P2 (10%)	6,70	6,60	6,70	6,90	6,80	6,74±0,11[c]
P3 (15%)	6,80	7,00	6,90	7,00	6,80	6,90±0,10[d]
Average	6,53	6,5	6,55	6,7	6,53	

Description: differences superscript indicate highly significant differences ($P<0.01$)

Fenugreek, which is acidic, causes the pH value of the isoelectric point to be low in meat proteins, making it accessible to positive charges, causing loss of myofilament rejection, creating plenty of space for water molecules, and increasing water retention capacity. This addition of fenugreek canmaintain the average pH value [11]. The pH value of the meatballs is within the normal range; differences inthe composition and type of ingredients used also influence pH [1]. It shows that the results of the pH of the meatballs of chicken meat still meet the requirements of SNI [13] meatballs around 6 to 7.

3.2. Cooking loss

The results of statistical analysis of the average cooking loss of meatballs of chicken meat after the highest are in treatment P0 or P control with a value of 9.23% and the lowest cooking loss in treatment

P3 with a value of 4.61%. The P0, P1, and P2 treatments have higher cooking loss than the lower P3 treatment. P0 treatment was significant (P<0.05) to P1 treatment but highly significant (P<0.01) to P2 and P3 treatments. P1 treatment was significant (P<0.05) to P2 treatment and highly significant (P<0.01) to P3. P2 treatment is significant (P<0.05) on P3 treatment. The results of the statistical analysis also showed that the addition of fenugreek paste was significantly different (P<0.01).

Based on the DMRT (Duncan Multiple Range Test) analysis, it is known that the use of fenugreek paste can indicate that 15% fenugreek paste will lower the quality of cooking shrinkage of meatballs. According to research [11], it is adding fenugreek results in lowercooking shrinkage due to fiber content that can retain liquid and is released during cooking. Fenugreek can improve emulsions by binding water contained in proteins. According to [14], fenugreek contains amylose, amylopectin, and galactomannan. Galactomannan is anemulsifier and dough stabilizer that can control water [15]. The statement of [16] The cooking shrinkage of processed meatballs ranges from 9.23% to 5.53%. In line with the research statement [17] that cooking loss with a lower percentage has relatively better quality than cooking loss with a higher percentage due to meatball water containing nutrients, so the less water that comes out, the higher the nutrients in the meatballs [18].

Table 2. Cooking Shrinkage of Afkir Chicken Meatballs Using Fenugreek Paste.

Treatment	Repeat					Average
	U1	U2	U3	U4	U5	
P0 (0%)	10,15	9,35	8,75	9,06	8,85	9,23±0,62 [d]
P1 (5%)	7,00	5,75	8,55	7,10	6,45	6,97±0,10 [c]
P2 (10%)	5,50	5,60	5,65	5,55	5,85	5,63±0,13 [b]
P3 (15%)	4,40	4,55	5,85	4,95	3,30	4,61±0,92 [a]
Average	6,76	6,31	7,02	6,66	6,11	

Description: differences superscript indicate highly significant differences (P<0.01)

3.3. Aroma

Based on the analysis of the highest statistical average in the research results of the aroma of chicken meatballs contained in the P3 treatment with a value of 8.50 and the lowest treatment average contained in the P0 treatment with a value of 4.12. P1, P2, and P3 treatments have higher score values than P0. Treatment P0 is significantly different (P<0.05) from treatment P1 but highly significant (P<0.01) with treatment P2 and P3. P1 treatment is significant (P<0.05) in the P2 treatment and highly significant (P<0.01) in the P3 treatment. P2 treatment was significant (P<0.05) in P3 treatment. The statistical analysis results also showed that the addition of fenugreek paste showed significantly different results (P<0.01).

Table 3. Mean Organoleptic Aroma of Afkir Chicken Meatballs Using Fenugreek Paste

Treatment	Repeat					Average
	U1	U2	U3	U4	U5	
P0 (0%)	5,00	4,54	3,00	4,75	3,35	4,12±0,89 [a]
P1 (5%)	6,00	4,95	5,40	6,29	5,37	5,60±0,53 [b]
P2 (10%)	6,02	8,19	6,09	9,00	7,23	7,30±0,30 [c]
P3 (15%)	8,53	9,00	8,00	9,00	8,01	8,50±0,49 [d]
Average	6,39	6,67	5,63	7,26	5,99	

Description: differences superscript indicate highly significant differences (P<0.01)

Based on DMRT (Duncan Multiple Range Test) analysis, it is known that the use of fenugreek paste can indicate that 15% fenugreek paste can improve the aroma of meatballs made from chicken meat. Research [3] shows that fenugreek has a fragrant aroma that improves the physical quality of meatballs. In line with research [11], Fenugreek seeds are aromatic spices that can be applied to processed livestock products. Fenugreek is an aromatic spice used as a fragrance and flavoring for processed products [19]. According to research by [20] fenugreek is a food gelling agent.

3.4. Flavor

The highest average in the research results of the aroma of chicken meatballs after is found in the P3 treatment with a value of 8.65, and the lowest treatment average is found in the P0 treatment with a value of 3.52. Treatments P1, P2, and P3 have higher scores than P0, which is lower. P0 treatment is significant (P<0.05) with P1 treatment but highly significant (P<0.01) in P2 and P3 treatments. P1 treatment is significant (P<0.05) with P2 treatment and highly significant (P<0.01) in P3 treatment. P2 treatment was significant (P<0.05) to P3 treatment. The statistical analysis also showed that adding fenugreek paste showed significantly different results (P<0.01).

Table 4. Mean Organoleptic Flavour of Afkir Chicken Meatballs Using Fenugreek Paste.

Treatment	Repeat					Average
	U1	U2	U3	U4	U5	
P0 (0%)	2,00	4,54	3,00	4,75	3,35	3,52±0,13 [a]
P1 (5%)	6,00	4,00	5,40	5,00	4,00	4,88±0,87 [b]
P2 (10%)	5,00	6,00	6,25	7,00	6,00	6,05±0,71 [c]
P3 (15%)	8,53	9,00	8,65	9,00	8,10	8,65±0,37 [d]
Average	5,39	5,89	5,83	6,44	5,37	

Description: differences superscript indicate highly significant differences (P<0.01)

The highest average in the results of the study of the aroma of chicken meatballs was found in the P3 treatment (15% fenugreek paste) with a value of 8.65 on a score criterion of 8 (Delicious, the taste of chicken meat, fenugreek seeds is quite dominant) and the lowest treatment average was found in the P0 treatment (Control = 0%) with a value of 3.52 on a score of 3 (The taste of fenugreek seeds is not). Based on DMRT (Duncan Multiple Range Test) analysis, it is known that the use of fenugreek paste can indicate that 15% fenugreek paste can improve the flavor of the

meatballs. Fenugreekcontains gum as an emulsifier that stabilizes the emulsion to improve the dough [11]. According to [19] research, fenugreek seeds are fragrant and can be used as a flavor enhancer for processed products.

3.5. Color

The results of the analysis of the highest statistical average on the results of the color research of the chicken meatballs after are found in the P3 treatment with a value of 8.47, and the lowest treatment average is found in the P0 treatment with a value of 5.11. P1, P2, and P3 treatments have higher scores than P0, which is lower. P0 treatment is significant (P<0.05) to the P1 treatment but highly significant (P<0.01) to the P2 and P3 treatments. P1 treatment is significant (P<0.05) in the P2 treatment and highly significant (P<0.01) in the P3 treatment. P2 treatment was significant (P<0.05) in P3 treatment. The statistical analysis results also showed that adding fenugreek paste showed that the results were highly significant (P<0.01).

Table 5. Mean Organoleptic Colour of Afkir Chicken Meatballs Using Fenugreek Paste

Treatment	Repeat					Average
	U1	U2	U3	U4	U5	
P0 (0%)	6,00	4,54	5,10	4,75	5,20	5,11±0,56 [a]
P1 (5%)	7,00	6,00	5,00	7,00	6,00	6,20±0,83 [b]
P2 (10%)	8,75	7,00	6,95	8,00	7,00	7,54±0,80 [c]
P3 (15%)	8,00	9,00	8,45	8,80	8,10	8,47±0,43 [d]
Average	7,44	6,64	6,37	7,14	6,57	

Description: differences superscript indicate highly significant differences (P<0.01)

The highest average in the research results of the color of chicken meatballs was found in the P3 treatment (15% fenugreek paste) with a value of 8.47 criteria score 8 (Grayish). The lowest treatment average was found in the P0 treatment (Control = 0%) with a value of 5.11 and a score of 5 (Verygray). Based on DMRT (Duncan Multiple Range Test) analysis, it is known that the use of fenugreek paste can indicate that 15% fenugreek paste can improve the [9] color of meatballs made from chicken meat. The color of processed meatballs is influenced by meat myoglobin, so the higher the meat myoglobin, the redder the meat color will be and will turn grey during the cooking process due to oxidation.

3.6. Tenderness

The highest average in the research results of the tenderness of chicken meatballs, after is in the P3 treatment, with a value of 8.86, and the lowest treatment average, is in the P0 treatment, with a value of 5.09. Treatments P1, P2, and P3 have higher score values than P0, which is lower. P0 treatment is significantly different (P<0.05) from P1 treatment but very significant (P<0.01) in P2 and P3 treatments. The P1 treatment was significant (P<0.05) with the P2 treatment and highly significant (P<0.01) with the P3 treatment. P2 treatment is significant (P<0.05) in P3 treatment.

The statistical analysis also showed that adding fenugreek paste showed significantly different results (P<0.01).

Table 6. Mean Organoleptic Flabbiness of Afkir Chicken Meatballs Using Fenugreek Paste

Treatment	Repeat					Average
	U1	U2	U3	U4	U5	
P0 (0%)	5,00	4,54	5,00	6,00	5,00	5,09±0,56 [a]
P1 (5%)	7,00	6,00	5,00	7,85	6,00	6,37±0,88 [b]
P2 (10%)	8,00	7,00	7,00	8,00	9,00	7,80±0,83 [c]
P3 (15%)	8,90	9,00	8,65	9,00	8,75	8,86±0,15 [d]
Average	7,22	6,63	6,42	7,71	7,18	

Description: differences superscript indicate highly significant differences (P<0.01)

Based on DMRT (Duncan Multiple Range Test) analysis, it is known that the use of fenugreek paste can indicate that 15% fenugreek paste can increase the tenderness of chicken meatballs. This is by the research [21]. The tenderness can be influenced by the interaction of fenugreek gelatinase between starch molecules and myofibril molecules, and gelling agents can bind meat particles so that the dough becomes tender, fenugreek-containing gelatin, which becomes soft when mixed with water to emulsify and soften the dough. Good meatballs are meatballs that are easy to bite when eaten. The Indonesian National Standard states that the tenderness of good meatballs is soft and chewy [22]. Fillers influence meatballs' tenderness, and additives such as seasonings are used [23].

4. Conclusion

Using the best fenugreek paste in the P3 treatment at 15% effectively improves the physical quality, namely pH and cooking loss, and organoleptic quality, namely the aroma of meatballs, taste, color, and tenderness of chicken meatballs.

REFERENCES

[1] Hafid, H., Afriansyah, O., & Asminaya, N. S. 2023. "Organoleptic Quality of Beef Meatballs Using Chicken Giblets". *Jurnal Peternakan Integratif*, 11(1), 53-61.

[2] Patriani P and Apsari N L. 2022. "Improving the physical quality of beef meatballs using andaliman spice (Zanthoxylum acanthopodium DC)". *IOP Conf. Series: Earth and Environmental Science*. Vol. 977, pp 012134. doi:10.1088/1755-1315/977/1/012134

[3] Nursetiani, A., Herdiana, Y. 2018. "Potensi Biji Klabet (Trigonella foenum-graecum L) Sebagai Alternatif Pengolahan Herbal" Review Jurnal [Potency of Klabet as an Alternative Herbal Medicine, Journal Review] *Farmaka*, 16(2), 475-484.

[4] Khorshidian, N., Yousefi Asli, M., Arab, M., Adeli Mirzaie, A., & Mortazavian, A. M. 2016. "Fenugreek: potential applications as a functional food and nutraceutical". *Nutrition and Food Sciences Research*, 3(1): 5-16.

[5] Zaki, EF. 2018. "Incorporation of fenugreek Seed powder in the manufacturing of rabbit sausange and its effecs on the quality properties during frozen storange". *Journal of Advances in Food Science and Technology*, 5(1), 8-14.

[6] Żuk-Gołaszewska, K., & Wierzbowska, J. 2017. "Fenugreek: productivity, nutritional value and uses". *Journal of Elementology*, 22(3).

[7] Hegazy, A. I. 2011. "Influence is using fenugreek seed flour ol antioxidan and antimicrobial agent in the manufacturing of beef burger with emphasis on frozen storage stabilily". *World journal of agriculture science* 7 (4) hal 391-399.

[8] Meng, X., Wu, D., Zhang, Z., Wang, H., Wu, P., Xu, Z., Dabbour, M. 2022. "An overview of factors affecting the quality of beef meatballs: Processing and preservation". *Food Science & Nutrition*, 10(6), 1961-1974.

[9] Patriani P, Hafid H, Wahyuni T H and Sari T V. 2021. "Physical quality improvement of culled chicken meat with marinated technology using Gelugur acid (Garcinia atroviridis) biomass". *IOP Conf. Series: Earth and Environmental Science*, Vol. 749 pp 012001, doi:10.1088/1755-1315/749/1/012001

[10] Erdem, N., Babaoğlu, A. S., Poçan, H. B., & Karakaya, M. 2020. "The effect of transglutaminase on some quality properties of beef, chicken, and turkey meatballs". *Journal of Food Processing and Preservation*, 44(10), e14815.

[11] Hafid, H., & Patriani, P 2023. "Physicochemical and Microbiological Quality of Buffalo Meat Patty with the Addition of Fenugreek Seed (Trigonella foenum graecum) During Storage Time". *Jurnal Ilmu dan Teknologi Hasil Ternak (JITEK)*, vol. 18 (2). Pp 73-86.

[12] Wani, SA, & Kumar, P. 2018. "Fenugreek: Tinjauan tentang sifat nutraceutical dan pemanfaatannya dalam berbagai produk makanan". *Jurnal Masyarakat Ilmu Pertanian Saudi*,17(2),97-106.

[13] SNI 3932 ; 2009. "Mutu karkas dan daging ayam". Badan Standardisasi Nasional. Indonesia.

[14] Hellebois, T., Gaiani, C., Fortuin, J., Shaplov, A.,& Soukoulis, C. 2021. "Kapasitas pembentuk gel kriotropik galaktomanan biji alfalfa (Medicago sativaL.) dan fenugreek (Trigonellafoenumgraecum)".*PolimerKarbohidrat*,267,118190.

[15] Llavata, B., Albors, A., & Martin-Esparza, ME 2019. "Pasta segar bebas gluten berserat tinggi dengan kacang macan, buncis, dan fenugreek: Sifat teknofungsional, sensorik, dan nutrisi".

[16] Patriani P, Hellyward J, Hafid H, Apsari N L and Hasnudi 2021 ." Application of sweet basil (Ocimum basilicum) on physical and organoleptic qualities of chicken meatballs". *IOP Conf. Series: Earth and Environmental Science*, Vol. 782, pp 022083. doi:10.1088/1755-1315/782/2/022083

[17] Soeparno. 2009. "Ilmu dan Teknologi Daging". Gadjah Mada University Press, Yogyakarta.

[18] Muharrami, L. K. 2015. "Analisis kualitatif kandungan boraks pada krupuk puli di kecamatan kamal". *Jurnal Pena Sains*, 2(2).

[19] Robi, Y., & Kartikawati, S. M. 2019. "Etnobotani rempah tradisional di desa empoto kabupaten sanggau kalimantan barat". *Jurnal Hutan Lestari*, 7(1).

[20] Roberts, KT 2011. "Potensi fenugreek (Trigonella foenum graecum) sebagai pangan fungsional dan nutraceutical serta pengaruhnya terhadap glikemia dan lipidemia". *Jurnal makanan obat*,14(12),1485-1489.

[21] Patriani P, Hasanah U, and Sari, T V. 2023. "Incorporation of Fenugreek (Trigonella foenum) seed powder on the physical quality of buffalo meat patty during frozen storage". *IOP Conf. Series: Earth and Environmental Science*, Vol. 1241, pp 012134. doi:10.1088/1755-1315/1241/1/012134

[22] Efrilia, M., Prayoga, T., & Mekasari, N. 2016. "Identifikasi boraks dalam bakso di kelurahan bahagia Bekasi Utara Jawa Barat dengan metode analisa kualitatif". *Jurnal Ilmiah Ibnu Sina*, 1(1),112-120.

[23] Patriani P, Mirwandhono E, Wahyuni T H, Siregar G A W, Hasanah U, Hasnudi, N Ginting, and Yunilas. 2020. "Effect of kepayang (Pangium edule) seed extract on meat moisture content, drip loss and decay test of lamb meat at different shelf life". *Journal of Physics: Conference Series*, Vol. 1542, pp 012029. doi:10.1088/1742-6596/1542/1/012029