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ANTIOXIDANT ACTIVITY AND NUTRITION VALUES OF SHREDDED MEAT OF LAYING HENS REJECT IMMERSION IN PINEAPPLE PEEL EXTRACTS

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ABSTRACT: Shredded meat is one of the processed meat products that contain antioxidants and does not have a negative impact on health for those who consume them. The study aims to determine the effect of the level of pineapple peel extract (*Ananas comosus*) use and muscle location on antioxidant activity and chemical characteristics of shredded meat of laying hens reject. The material used was 3000 grams meat of laying hens reject. The meat, before being processed into shredded meat was soaked first in a pineapple peel extract solution in accordance with treatment. The research data were analyzed using analysis of variance based on a 2 × 3 factorial Completely Randomized Design (CRD) and followed by Duncan's multiple range test. The results showed that the level of pineapple peel extract use and muscle location had a significant effect ($P < 0.05$) on moisture, protein, fat, and ash content, while the antioxidant activity had no significant effect ($P > 0.05$). Protein and fat content were fulfill the Standard of National Indonesia (SNI) industry because the protein content of shredded meat based on pineapple Peel extract level ranges from 21.37 - 23.01% and fat content of 23.71 – 27. 77 %, while based on muscle location ranges from 20.34 to 24.05% and fat content of 23.65 - 28.98 %. Protein and fat content according to the SNI is 15 % and 30 % respectively. Protein and ashes content of shredded meat were highest at the level of 40% pineapple peel extract use with antioxidant content of 66.38%, while the lowest fat content occurred at the level of 20 % pineapple peel extract use with antioxidant content of 64.41%.

KEYWORDS: Pineapple peel extract, antioxidants, nutritional value

I. INTRODUCTION

Meat as a source of animal protein generally has nutrient content in the form of 75 % water, 19 % protein, and other nutrients such as vitamin B12, niacin, vitamin B6, iron, zinc and phosphorus [1, 2]. Meat can be interpreted as all animal tissue and all edible processed products that do not interfere with health for those who consume them [3]. According to Murtidjo [4], chicken meat is a food that has a high nutritional value at a price that can be reached by the community. Chicken meat contains nutrients such as protein 18.10 g/ 100 g with fat content 25 g/ 100 g. Bulkaini and Ichsan [5] explained that the chemical characteristics of beef and chicken such as water, protein and fat content in general greatly determine the level of meat quality and affect the quality of the processed products. Laying hens reject are a type of laying hens where their productivity has declined, but these chickens can still be used as food to meet the needs of animal protein. According to Zulfahmi [6], Meat of laying hens reject has a low quality, namely the meat is tougher and the level of community preference is low. Furthermore it is said to increase the selling value of laying hens reject, the process of tenderized needs to be done and continued with the processing into a ready-to-eat product with a relatively longer shelf life that is made into shredded meat. Meat tenderising can be done by several methods including electrical stimulation and by using meat tenderizer such as flesh pineapple fruit or pineapple peel, papaya fruit and papaya leaves [3]. In an effort to obtain a meat tenderizer that does not compete with its use as a human food ingredient, it is necessary to think of an alternative meat tenderizer by utilizing non-conventional local ingredients such as pineapple peel (PP).

PP is pineapple waste 25 – 35 % of the weight of pineapple [7]. PP is available in large quantities and does not recognize season, so that it has the potential to be an ingredient in making shredded meat of laying hens reject. Pineapple production in NTB reaches 24,463.90 tons/ year so that there are 7,339 tons/year PP available [8]. PP before use should be made first in extracts with conventional methods [6]. Furthermore, it was reported that soaking meat of laying hens reject with pineapple peel extract (*Ananas comosus* L. Merr) at a concentration of

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27.5 % could increase tenderness ie tough of meat became somewhat tender with water holding capacity ranging from 0.32 - 1.29 % and pH of meat that is still normal of 5.56 - 5.90. Shredded meat is a processed product with the basic ingredients of meat with the addition of various types of seasonings and fried. Shredded meat is a food ingredient that is well known by the people of Indonesia because shredded meat has a distinctive taste and its easily accepted by consumers. In general, shredded meat of layer hens has a fairly good nutritional composition, namely protein ranging from 29.98 - 40.13% with a moisture content ranging from 14.83 - 17.83 % [9]. Sukisman and Rahim [1] report that conventional shredded chicken made in Palu city has a chemical composition: water 4.32-12.35%, ash content: 4.20-5.91%, protein: 29.71 - 40, 72 %, 17.74 - 21.98 % fat content and antioxidant activity of 5126 ppm = 0.513%. Data related to the potential of pineapple peel extract as a scraper of meat to be processed into shredded meat and its effect on the antioxidant activity and chemical composition is very necessary for the development of the shredded meat industry.

II. MATERIALS AND METHODS

The material used was 3000 grams meat of laying hens reject. The meat, before being processed into shredded meat was soaked first in a pineapple peel extract solution in accordance with treatment. The shredded meat formula used was presented in Table 1.

Table 1. Formula of Shredded Chicken of Laying Layers in 1000 grams

Ingradients	Amount	Unit
Meat	1000	gram
Coconut milk	725	mL
Broth	5	L
Cooking oil	250	mL
Galangal	5	gram
Laos	50	gram
Coriander	5	Cup
Bay leaf	5	Sheet
Shallot	125	gram
Garlic	75	gram
Sugar	50	gram
Flavoring	10	gram
Salt	50	gram

Shredded Chicken made using conventional methods [10], namely boiled chicken using a medium size pan for 37.5 minutes at (70–75) ^{o}C. Before boiling, the meat was done by soaking in a pineapple peel extract solution for 30 minutes at room temperature [6] according to the treatment, namely: P1 = 0% pineapple peel extract from the amount of solvent (aquades), P2 = 20% pineapple peel extract from the number of solvents (aquades) and P3 = 40% extract of pineapple peels from the number of solvents (aquades). Antioxidant activity was measured by the DPPH method [11]. Antioxidant activity was calculated by the Equation 1:

$$\text{Antioxidant Activities (\%)} = \frac{(A\ DPPH - A\ Sample)}{(A\ DPPH)} \times 100 \qquad (1)$$

where A_{sample} is sample absorbance and A_{DPPH} is DPPH absorbance. Determination of the nutritional value of shredded meat of laying hens reject in the form of: water content, ash content, protein content, and fat content were carried out by the Proximate analysis method (AOAC, 2005) in Sophia and Fendjalang [12]. Data on antioxidant activity and chemical characteristics were analyzed using analysis of variance based on the Completely Randomized Design of the 2x3 Factorial pattern with 3 replications and continued with the Duncan's Multiple Range Test [13].

III. RESULTS AND DISCUSSION

3.1 Antioxidant Activity

The results of the antioxidant activity test for shredded meat of laying hens reject were presented in Table 2. The results of the analysis of variance showed that the muscle location, the level of pineapple peel extract and their interactions did not significantly influence (P> 0.05) on the antioxidant activity of shredded meat of laying hens reject. The antioxidant activity of shredded meat based on muscle location ranges from (68.37 to 66.01) %, while based on the level of soaking pineapple peel extracts ranges from (64.41 - 70.79) %. The results of this study indicate that the shredded meat have higher antioxidant activity compared to the traditional shredded chicken meat floss which was (20.89 - 51.16) % [1]. The high number of antioxidants was due to differences in the formula in making shredded chicken meat. The shredded meat of the laying henes reject in the formula was

added shallot and local garlic of 125 grams and 75 grams respectively. Shallots contain a substance called quercetin, which is a substance that makes a dark red color. According to the University of Maryland Medical Center [14], quercetin is an antioxidant that plays an important role in overcoming the process of free radicals that are considered to cause cancer. In addition, antioxidants such as quercetin can inhibit the growth of cancer cells. It was also explained that quercetin in onions could prevent the growth of lung cancer cells, prostate cancer, ovarian cancer, colon cancer, and endometrial cancer. The results research of Angelia [11] showed that the onion antioxidant activity was 0.4879 mmol Fe^{+2}/100 g while the garlic was 0.5184 mmol Fe^{+2}/100 g. According to Prasonto et al. [15], that local garlic of a single have higher antioxidants compared to local garlic varieties of ciwidey and imported garlic, the laboratory analysis results show that local garlic has a lower Inhibition Concentration (IC50 10.61 mg/ ml) compared to imported garlic (11.32 mg / ml) and local garlic varieties Ciwidey (13.61 mg / ml). According to Banuriawan [16], local garlic of a single have an antioxidant activity of IC50 of 212.169 ppm.

Table 2. Average Antioxidant Value of Shredded Meat Based on Treatments Levels

Factor A (Muscle Location)	Factor B (Pineapple Peel Extract Level)			Total	Average A^{NS}
	B1 (0 %)	B2 (20 %)	B3 (40 %)		
A1 (breast)	68.1 ± 6.57	66.73 ± 3.29	70.29 ± 4.04	205.12 ± 13.90	68.37 ± 4.63
A2 (thighs)	73.48 ± 4.60	62.09 ± 1.32	62.47 ± 1.88	198.04 ± 7.80	66.01 ± 2.6
Total	141.58 ± 11.17	128.82 ± 4.61	132.76 ± 5.92	403.16 ± 21.7	-
Average B^{NS}	70.79 ± 5.59	64.41 ± 2.30	66.38 ± 2.96	-	-

Another factor that affects the antioxidant activity of shredded meat was the temperature in the process of boiling and frying [17]. In the production of shredded meat, before frying the meat was boiled and shredded, seasoned, fried, then pressed [5]. The process that occurs during the cooking of meat results in an increase in temperature causing myofibril protein and connective tissue to denaturate at different levels. Changes in the chemical and physical properties of meat that occur during frying include gelatinization, protein denaturation, water evaporation, and also decreased microbial content [18]. Its stated also by Aina and Dawam [17], that heating will reduce levels of vitamin C in food because vitamin C is susceptible to air, light, heat, and easily damaged during storage. The use of certain spices in high concentration can also affect the increase in different antioxidant activities, this is evidenced by research from Kurniasari [19] antioxidant activity of shredded skipjack fish with the addition of 33% spice concentration was the addition of the best spice concentration compared to the addition of other spice concentrations.

A food ingredient called to have good antioxidant activity if it has a low concentration and has a high percentage of microbial inhibition [18]. Angelia [11] states that testing the antioxidant activity of food ingredients usually uses DPPH as a detecting compound. DPPH is a free radical compound that is stable, so it can react with hydrogen atoms derived from antioxidant compounds to form reduced DPPH compounds. Shih et al. [20] stated that DPPH is commonly used as a free radical detection of plant and food samples reaching 60%. Kim et al. [21] added that DPPH compounds are widely used to evaluate the ability of a compound to capture free radicals such as samples from plants, and are also widely used to evaluate the antioxidant activity of food and its preparations.

3.2 Nutritional Value Of Shredded Meat of Laying Hens Reject

The average of moisture content of shredded meat based on treatments was presented in Table 3. The results of the analysis of variance showed that the use of pineapple peel extract level, muscle location and the interaction had a significant effect ($P < 0.05$) on moisture content. Table 3 shows that the level of pineapple peel extract can produce shredded meat with consecutive moisture content: B1 = 15.19 ± 0.33 %; B2 = 15.38 ± 0.29 % and B3 = 16.31 ± 0.22 %, while based on the location of the muscle it has a moisture content of A1 = 14.33 ± 0.33% and A2 = 20. 8 8 ± 0. 23%. Furthermore, the moisture content based on the treatment combination was (13.10±0.22 – 18.97±0.05) %. The results of this study indicate that there were differences in the moisture content among treatment levels. This is presumably due to the different temperature and length of frying time, so the amount of water evaporated also varies. The use of different temperatures and time of frying have an effect on shredded water content, so the amount of water evaporated also varies [10]. The results of this study were not much different from the results of research by Sukisman and Rahim [1] that the highest moisture content of shredded

beef was 12.35 ± 0.09 %, with the lowest moisture content of 4.32 ± 0.30 %. According to Ockerman and Li [22] that the moisture content of shredded pork ranged from 3.47 ± 5.23 %. Ogunsola and Omojola [23] reported that the moisture content of shredded beef was 6.50 ± 7.37 % while Leksono and Syahrul [24] found that shredded fish had moisture content of 3.64 - 9.78 %.

Table 3. Average Moisture Content of Shredded Meat Based on Treatments Levels

Factor A (Muscle Location)	Factor B (Pineapple Peel Extract Level)			Total	Average A
	B1 (0 %)	B2 (20 %)	B3 (40 %)		
A1 (breast)	14.66 ± 0.38^{d}	13.10 ± 0.22^{e}	15.23 ± 0.40^{c}	42.99±1.00	14.33 ± 0.33^{p}
A2 (thighs)	15.71 ± 0.29^{c}	17.66 ± 0.37^{b}	18.97 ± 0.05^{a}	52.34±0,71	20.78 ± 0.23^{q}
Total	30.37±0.67	30.76±0.59	34.20±0.45	95.33±1.71	-
Average B	15.19 ± 0.33^{q}	15.38 ± 0.29^{q}	17.31 ± 0.22^{p}	-	-

Note: Different superscripts on average A, average B and their interactions show significant differences ($p < 0.05$).

The average fat content of shredded meat based on treatment was presented in Table 4. The results of the analysis of variance showed that the use of pineapple peel extract level, muscle location and interaction of treatment combinations had a significant effect ($P < 0.05$) on fat content. Table 4 shows that the value of the fat content of shredded meat based on the level of pineapple peel extract respectively: B1 = 27.43 ± 1.61%; B2 = 23.75 ± 0.15% and B3 = 27.77 ± 0.16%. While based on muscle location, A1 = 28.98 ± 0.31% and A2 = 23.65 ± 0.97%. Furthermore, the crude fat content based on the treatments interaction ranged from (17.12 ± 0.15 to 30.37 ± 0.16) %. Ogunsola and Omojola [23] reported that shredded beef in Nigeria had a fat content of 35.57 - 40.85 %, further Chang and Huang in Halid and Rahim [18] also reported that zousoon in Taiwan had a fat content of 43 %.

Table 4. Average Fat Content of shredded meat based on Treatments Levels

Factor A (Muscle Location)	Factor B (Pineapple Peel Extract Level)			Total	Average A
	B1 (0 %)	B2 (20 %)	B3 (40 %)		
A1 (breast)	28.41 ± 0.65^{b}	30.37 ± 0.16^{a}	$28.17\pm0,14^{b}$	86.95±0.95	28.98 ± 0.31^{p}
A2 (thighs)	26.45 ± 2.57^{c}	17.12 ± 0.15^{d}	27.37 ± 0.19^{bc}	70.94±2.91	23.65 ± 0.97^{q}
Total	54.86±3.22	47.49±0.31	55.54±0.33	157.89±3.86	-
Average B	27.43 ± 1.61^{p}	23.75 ± 0.15^{q}	27.77 ± 0.16^{p}	-	-

Note: Different superscripts on average A, mean B and average AxB interaction show significant differences ($p < 0.05$).

Table 4 shows that based on the further Duncan tests, there were differences in fat content both based on the level of pineapple peel extract and muscle location. There were differences in the fat content caused by several factors: 1). In the process of cooking oil extortion using manual tools, so that the level of squeezing strength was vary, where the stronger the squeeze level to the shredded meat, the lower cooking oil left in shredded meat, 2). Differences in meat fat content as the main ingredient of shredded meat, and 3). The difference in cooking oil left in shredded meat during pressing [25]. Furthermore it was said that pressing shredded meat in a cold condition makes difficulty in removing oil from the shredded meat, so that some cooking oil was retained in the shredded meat. Huda et al. [26], who examined Malaysian shredded (*Serunding*), stated that variations in shredded oil content produced had a close relationship between shredded making and post-frying oil removal or removal techniques.

The average protein content of the shredded meat based on the treatments were presented in Table 5. The results of the analysis of variance showed that the influence of the use of pineapple peel extract level, muscle location

and treatments interaction had a significant effect (P <0.05) on protein content. Table 5 shows that the protein content of shredded meat based on pineapple peel extract levels, successively: B1 = 21.37 ± 0.05%; B2 = 22.21 ± 0.13% and B3 = 23.01 ± 0.09%, while based on muscle location, protein content were A1 = 20.34 ± 0.05% and A2 = 24.05 ± 0.13 %. Furthermore, shredded meat protein content based on interactions of treatments combination ranged from 19.11 ± 0.02 to 25.32 ± 0.24 %.

Table 5. Average Protein Content of Shredded Meat Based on Treatments Levels

Factor A (Muscle Location)	Factor B (Pineapple Peel Extract Level)			Total	Average A
	B1 (0 %)	B2 (20 %)	B3 (40 %)		
A1 (breast)	19.33 ± 0.07^{d}	19.11 ± 0.02^{d}	$22,.58\pm0.06^{c}$	61.02±0.15	20.34 ± 0.05^{q}
A2 (thighs)	23.40 ± 0.03^{b}	25.32 ± 0.24^{a}	2.44 ± 0.13^{b}	72.16±0.40	24.05 ± 0.13^{p}
Total	42.73±0.10	44.43±0.26	46.02±0.19	133.18±0,55	-
Average B	21.37 ± 0.05^{r}	22.21 ± 0.13^{q}	23.01 ± 0.09^{p}	-	-

Note: Different superscripts on average A, mean B and AxB interactions show significant differences (p <0.05)

The results of this study indicate that the higher the addition of pineapple peel extract, the higher the protein content of shredded meat of laying hens rejects. Increased in protein content both based on the level of pineapple peel extracts and muscle location due to the contribution of protein content in fresh pineapple peel and various types of seasonings in the formulla. Fresh pineapple peel extract has protein content of 4.81% [27]. Based on the proximate analysis at the Laboratory that fresh pineapple peel contains crude protein of 4.42 % [28]. Reinforced by Prasetyo et al. [10] that pineapple peel extracts can coagulate proteins so that the protein structure becomes more dense (solid) which can cause a reduction in dissolved protein. Soeparno [3] states that processed products which have a dense protein structure can reduce dissolved proteins. The study in Nigeria by Ogunsola and Omojola [23] revieled that shredded beef has protein content of (38.92 - 41.21 %). Ockerman and Li [22] reported that shredded pork contains crude protein of 34.09 - 42.90 %. The average ash content of shredded meat from laying hens based on treatment is presented in Table 6.

Table 6. Average Ash Content of shredded meat based on Treatments Levels

Factor A (Muscle Location)	Factor B (Pineapple Peel Extract Level)			Total	Average A
	B1 (0 %)	B2 (20 %)	B3 (40 %)		
A1 (breast)	5.06 ± 0.18^{a}	5.78 ± 0.05^{a}	4.67 ± 0.01^{b}	15.51±0.24	5.17 ± 0.08^{p}
A2 (thighs)	5.26 ± 0.17^{a}	5.49 ± 0.08^{a}	5.28 ± 0.21^{a}	16.03±0.46	5.34 ± 0.15^{p}
Total	10.32±0.35	11.27±0.13	9.95±0.22	31.54±0.7	-
Average B	5.16 ± 0.17^{p}	5.64 ± 0.06^{p}	4.97 ± 0.11^{q}	-	-

Note: Different superscripts on average A, mean B and AxB interactions show significant differences (p <0.05).

The results of the analysis of variance showed that the use of pineapple peel extract levels, muscle location and treatments combination had a significant effect (P <0.05) on ash content. The results show that the ash content based on the level of pineapple peel extract, successively: B1 = 5.16 ± 0.17 %; B2 = 5.64 ± 0.06 % and B3 = 4.97 ± 0.11 %, while based on muscle location, the ash content was A1 = 5.17 ± 0.08 % and A2 = 5.34 ± 0.15 %. Furthermore, the ash content based on treatments intraction ranged from (4.67 ± 0.02 to 5.78 ± 0.21) %. Further statistical analysis showed that ash content based on the level of pineapple peel extract was significantly different (P <0.05) between B3; B1 and B2 treatments, while based on muscle location there was no significant difference (P> 0.05) between the thigh muscles and chest muscles. The results of this study indicate that the ash content was still below the ash content determined by SNI 01-3707-1995, which is 7 %. The low ash content

obtained in this study was due to the one contributing factors of boneless chicken meat, which was processed into shredded meat. Emphasized by Eiliyasmi and Marnzah [29], who examined the use of Breadfruit (*Keluwih*) as supplement ingredient in the production of shredded fish as a source of protein in the context of food diversification, concluded that the ash content of shredded fish produced under SNI 01-3707-1995, because fish were used without bones. Ash content of a food item shows the large amount of minerals contained in that foodstuff. Ash content is the residue that remains when a food sample is completely burned in the furnace. Ash content describes the amount of unburnt minerals into volatile substances [30].

IV. CONCLUSION AND RECOMMENDATION

The use of pineapple peel extract at the level of 40 % can maintain antioxidant activity and increase the nutritional value of shredded chicken meat. As recommendations, further research needs to be done using pineapple peel at different harvest ages. To get shredded meat of laying hens reject in a good quality in terms of antioxidant content and nutritional value should use thigh meat with a level of soaking pineapple peel extract as much as 40 %.

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