

The physicochemical quality and meat microstructure of post laying hen with addition of Biduri (*Calotropis gigantea*) latex extract

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Abstract. The objective of this study was to evaluate the effect of extract level of Biduri latex on the meat quality of laying hens. The materials of this research were Biduri latex and thigh meat from hens strain Lohman. The latex was tapped from a young tissue stem and centrifuged for its supernatant. Meats were smeared with latex, punctured and incubated for 30 minutes. Concentrations of latex were 0, 3, 6 and 9% from the weight of meat (w/w). The variables were water, dissolved protein, crude fat content, tenderness and microstructure of meat. The statistical analysis method using ANOVA and if there was a mean difference, Duncan test was used. Descriptive analysis was used for microstructures of meat by comparing its hydrolysis conditions. The study showed that fat had significant difference ($P < 0.05$), dissolved protein and tenderness had very significance ($P < 0.01$). Descriptive analysis showed that there were different compositions of microstructures on meat structure. The fat content increased with addition of 3% latex. The value of dissolved protein increased but tenderness decreased by addition extract of 6% latex. The addition of Biduri latex extract showed that hydrolysis in the microstructure of meat. The addition of 6% latex was the best meat quality.

Keywords: Physicochemical quality of meat, microstructure of meat, Biduri latex, post laying hen

1. Introduction

In Indonesia, post laying hen is consumed as one source of animal protein, such as a broiler chicken meat. It has good protein and the fatty is low, but the flesh is hard because it was produced from older chicken. People prefer to choose tender one than hard one, so the post laying hen meat must be made more tender.

We can use physical and chemical method to make meat more tender. Method used were using protease. Protease used among others, bromelain, papain, ficin, actinidin, and calpain in the food industry [1]. Papain can be used to increase tenderness of post laying hen meat [2] and post laying duck meat [3]. Similarly, bromelain can be used to made post laying duck meat [4] and beef meat [5] more tender. Injection of bromelain and papain on beef meat can increased tenderness on preservation vacuum packaging [6]. Protease are mostly taken from fruit, and fruit are human food. This may cause competition in its use. We should be used proteases from other sources e.g. from plants.

Biduri plants (*Calotropis gigantean*) [7] and *Calotropis procera* [8] can produce protease-containing sap. Protease from *Calotropis gigantean* have enzymes those included in exopeptidase class and they can hydrolysis miofibril protein on fish meat with high specific value [9]. It can also hydrolyze systemin [10], casein, fibrinogen and fibrin [11]. With the hydrolysis of the protein then the meat can be more tender, so the protease from the



plant can be used as the tenderness ingredient [12]. The physic and hedonic quality of post laying hen can increased with adding crude extract of Biduri latex [13]. Crude enzyme extracted from *Calotropis procera* can improved physicochemical properties of meat [12].

Raw extract of biduri latex can be used to raise the quality of meat. The purpose of this research was to understand the effect of raw extract biduri latex and to increase the quality of meat (water, protein, crude lipid, tenderness and microstructure of meat).

2. Materials and methods

2.1. Materials and samples preparation

Material latex Biduri (*Calotropis gigantean*) was collected to product crude enzyme in this study. Post laying hen strain Lohman aged 90 weeks was processed and thigh samples was analyzed for chemical composition, physical quality and meat microstructure. Young stem tissue of Biduri was tapping for latex collection [14] and the latex was centrifuged to produce crude fluid of biduri latex (supernatant) [15]. Biduri latex was applied to meat sample and punctured using needle. The samples were then incubated for about 30 minutes inside sterile laminar air flow (LAF) in room temperature [16].

2.2. Methods

Moisture content was measured with gravitometric test [17], dissolved protein content by Biuret [18], crude fat by Soxhlet extraction [19], tenderness by breaking strength with Warner Blatzer method [16]. The microstructure of meat was analyzed by microtom and captured with a microscope at magnification of 40 times [20].

2.3. Experimental designs

The study used experiment design by One Way Randomized Design [21]. The levels of biduri latex concentration used were 0, 3, 6 and 9% from sample weight of meat.

The data of this study was analyzed by ANOVA on meat quality (water, protein, crude lipid, tenderness) and if there was a significant difference then further analyzed with Duncan's New Multiple Range Test [21]. Microstructure of meat was analyzed by descriptive analysis [21] by looking at the damage to the longitudinal and transverse structure of the meat.

3. Results and discussion

The meat quality of post laying hen with treatment of crude extract latex biduri can be seen in Table 1. Results showed that the value of dissolved protein increased by adding the concentration of 6% of crude extract biduri latex and similarly, crude fat content enhanced up to a level of 3%. However, the concentration of extract biduri latex 6% decreased tenderness and water content was not significant.

Table 1. The result of meat quality of post layin hen with the addition of Biduri latex concentration on 0, 3, 6 and 9%

Variables	Levels of addition of Biduri latex (%)				P
	0	3	6	9	
Tenderness	6,12±0,91 ^a	6,44±1,33 ^a	5,28±1,56 ^b	4,60±1,72 ^b	0,000
Dissolved protein	4,73+1,97 ^a	4,74+2,37 ^a	5,17+1,70 ^b	4,39+1,89 ^a	0,010
Crude fat	2,51+0,11 ^a	3,44+0,03 ^b	3,61+0,50 ^b	3,76+0,20 ^b	0,050
Moisture content	74,43+0,42	74,78+0,19	75,74+0,29	75,90+0,07	0,100

Description: ^{a,b}Different superscript in the same row indicates significantly

The addition of 3% crude extract Biduri latex did not show an increase in meat tenderness, but the addition of 6% extract Biduri latex increased the tenderness that indicated by the decreased of breaking strength

meat value. The meat tenderness was not different between the addition of 6 and 9% of extract biduri latex . Several studies have shown that the addition of proteases can improve the tenderness of the meat, but differ in the concentration given to the meat. This data is supported by dissolved proteins which also appear to increase at a concentration of 6% and the occurrence of microstructural the meat broken to also at a concentration of 6%.

Collagen solubility and TCA-soluble peptides were significant increased with the addition 2×10^3 to 6×10^3 activity units/100 g of muscle of protease from *Calotropis procera*, papaya and pineapple to chicken, giant catfish, pork and beef meat. Other than that on the microstructure level of meat, tissue fibers were broken, and the connections between the sarcolemma and the myofibrils were loosened on the meat in the presence of hydrolysis by proteases. Thus the tenderness of meat increases due to protease activity [22]. The same study also showed similar results using 0.05%, 0.1%, 0.2%, 0.3% and 0.5% (w/w) of crude enzyme extract powder from *Calotropis procera latex* in chicken, pork and beef meat [23].

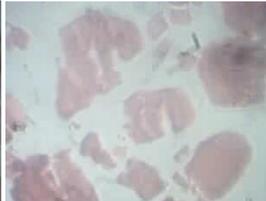
Dissolved protein was increased with addition 6% crude extract latex biduri in this research. Some studies show similar with this results. Water soluble proteins on beef meat increased with the addition extract crude bromelain and commercial bromelain [24]. This is due to the release of hydrophilic groups on the surface of protein molecules by proteases [25].

In this research elevated of fat content appear in the addition of latex biduri with a concentration of 3%. This is different from other studies, utilization unripe latex extract from papaya at levels 0, 0.5, 1.0, 1.5, 2.0, 2.5 and 3.0 mg/100g did not significant on fat content *in beef kababs* [26].

The addition of fresh crude extract of latex biduri until the percentage of 9% has no effect on the water content of meat in this research. The same result, addition of 0.05% and 0.1% (w/w) of crude enzyme extract powder from *Calotropis procera latex* is not significant in chicken and beef meat moisture content [23]. Utilization unripe latex extract from papaya at levels 0, 0.5, 1.0, 1.5, 2.0, 2.5 and 3.0 mg/100g did not significant on moisture content *in beef kababs* [26]. As well as bromelain and papain added to pork and beef do not affect water content [27].

The image of microstructure (40x magnification) of post laying hen with crude extract biduri latex can be seen in Table 2. Microstructure of meat was seen by longitudinal cuts.

Table 2. The picture of microscopic structure (40x longitude magnification) post laying hen with added concentrations of Biduri latex on 0, 3, 6 and 9%

The concentration of Biduri latex 0%	The concentration of Biduri latex 3%	The concentration of Biduri latex 6%	The concentration of Biduri latex 9%
			

Research shows the increasing concentration of extract of latex biduri resulted in increasingly break down microstructure of meat in post laying hen. This is in accordance with research, microstructure of meat shown was rupturing of tissue on the collagen fiber by adding extract crude bromelain and commercial bromelain on beef meat. So it seems to happen a breaking down of myofibril tissue [24].

4. Conclusions

The treatment of biduri latex with the concentration of 6% could increase physicochemical quality of meat of post laying hen (water, protein, crude lipid and tenderness of meat) . Hence, the microstructure of meat increased degradation with increasing levels of protease Biduri extract.

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