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Study on the Physico-Chemical Characteristics of Meat from Goat Given Ration Papaya Leaves (*Carica papaya L.*)

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ABSTRACT: This research was conducted to study the effect of papaya leaves feeding on the physico-chemical characteristics of goat meat. Twelve (12) Bligon goats with bodyweight of about 16 kg were divided into three groups, each group consisted of 4 Bligon goat. Group A was fed (as the control) 0% Papaya leaves+60% Elephant grass+40% concentrate, group B was fed 15% Papaya leaves+45% Elephant grass+40% concentrate, and group C was fed 30% Papaya leaves+30% Elephant grass+40% concentrate. The goat growth period was conducted for two months and the goats were slaughtered to take samples from *Longissimus dorsi* (LD) and *Biceps femoris* (BF) muscles. The data from Completely Randomized design were analyzed by analysis of variance of factorial pattern 3x2 (three levels of Papaya leaves feeding and two kinds of meat samples) with three replications for each treatment. The mean differences were further tested by Duncan's New Multiple Range Test. The result showed that there were not significant differences ($P>0.05$) on the chemical composition (moisture, protein, fat, and collagen) as affected by levels of Papaya leaves. The levels of Papaya leaves resulted in significant differences ($P<0.05$) on color and water-holding capacity, and there were no further differences for pH, cooking loss, and tenderness.

Keywords: Physical characteristic, Chemical composition, Goat meat, Papaya leaves

INTRODUCTION

Meat is one of food source which plays a great role to fulfill daily nutrition of human life. Meat and meat products are essential in the diet and required to maintain the health of a human body (Nestle, 1999), The nutritive value of meat is very high due to the presence of high quality protein, vitamins, minerals and fat (Mallika *et al.*, 2009). The goat meat is widely consumed and is important source of animal protein, preferred and comparable with other meats in respects to its moisture, protein and ash contents, contains more arginine, isoleucine and adequate amount of essential amino acids (Rahman *et al*., 2012). But recently, negative campaign about muscle food, and their possible health hazard effects, shows that consumers are increasingly interested about health oriented functional meat products (Biswas *et al.*, 2011). To clarify the minor opinion, some researches of animal feeding modification are undergone, expected to result animal source food especially meat that not only fulfilling nutritional need but to raising consumer's health status as well.

Feeding Papaya leaves as ration for goat is one effort to utilize herbs and medicinal plants, considering food feeding has positive influent to livestock that will increase meat quality and give

benefits to health status. The plant might provide a useful source of new medicines, pharmaceutical entities and bioactive compounds for enhancing animal production and health; and food safety and quality, while conserving environment (Makkar *et al.,* 2007). Ayoola & Adeyeye (2010) analyzed for the phytochemical composition, phytochemical screening and revealed the presence of bioactive compound such as saponins, cardiac glycoside, alkaloids and absence of tannins in the green, yellow and brown Papaya leaf. The qualitative phytochemical analysis of *Carica papaya* leaves showed the presence of alkaloid, flavanoid, Saponin, Tannin and Glycosides (Adachukwu, 2013). It is obvious from plant secondary metabolites (PSM) biochemistry that PSM have a wide range of biological activities and ernomous potential for uses in animal production (Mirzaei, 2012). Therefore, the objective of this study was to evaluate the effects of papaya leaves feeding on the physico-chemical characteristics of goat meat.

MATERIALS AND METHODS

Before this biologic experiment was begun, animal care and handling were accomplished based on experimental method with through 2 phases; palatability phase and adaptive phase.

Animals and Diets. Twelve Bligon goats (mean body weight 16 ± 0.5 kg) were used in this study and divided into 3 groups. Each group consisted of 4 Bligon goat and fed 3 dietary treatments. These 3 diets were: 1) Group A (R0): 0% Papaya leaves + 60% Elephant grass + 40% concentrate, 2) Group B (R1): 15% Papaya leaves + 45%Elephant grass + 40% concentrate, and 3) Group C (R2): 30% Papaya leaves + 30% Elephant grass + 40% concentrate. Goats were housed in 1.5 x 0.75 m individual pens and allowed ad libitum access to water during 8 weeks.

Goat Slaughter and Sample Collection. After feed treatment, all of goats were slaughtered by Halal method (Sivakumar, 2013; Budiharta, 2009; Soeparno, 2009). Muscle sampling (*Longissimus dorsi*/LD and *Biceps femoris*/BF) were taken from the half of each carcass. The samples was trimmed free of all subcutaneous fat and epimysial connective tissue, approximately 100 g, was frozen and stored at -20°C until chemical analysis (Sanudo *et al.*, 2000).

Meat Quality Measurement. The pH level postmortem of *L.dorsi* and *B.femoris* muscles were measured using a pH meter equipped with a penetrating electrode. The color was measured on the muscle surface at 60 min after cutting, using a color chart provided by Meat Colour Scores AUSMEAT. Cooking loss was evaluated in refrigerated meat samples of similar geometry, individually placed inside polyethylene bags in a water bath at 80°C during 30 min and cooled for 15 min under running tap water. They were taken from the bags, dried with filter paper and weighed. The Warner-Bratzler shear force was evaluated in subsampels, prepared manually, of 1.5 cm^2 cross section and 3 to 4 cm in length. The water-holding capacity (WHC) was determined by using the method recommended by Hertog-Meischke *et al.* (1997) cited Cetin *et al.* (2012), 300 mg meat samples placed on Whatman filter paper. The samples were kept between glass slip and under a fixed weight of 1 kg for 20 minutes. At the end of the waiting period, the filter paper was taken. The impressions released by the water were measured using milimetric paper and calculated. The proximate composition such as moisture, protein, fat and collagen were determined on fresh *L.dorsi* and *B.femoris* muscle samples by using foodscan the method of NIRS (Near infrared spectroscopy) according to AOAC (2007).

Statistical Analysis. A completely randomized design of factorial 3 x 2 analysis with feeding treatment factor and meat sample factor was used to evaluate chemical composition and physical quality. When analysis of variance revealed a significant ($P<0.05$) effect, means were separated using Duncan's Multiple Range Test (DMRT) (Steel & Torrie, 1993).

RESULTS AND DISCUSSION

Chemical Composition. The chemical composition of *L.dorsi* and *B.femoris* muscles are presented in the Table 1.

Table 1. The effect of fed papaya leaves on chemical composition of goat meat

Parameter (%)	Muscle	Papaya leaves levels (%)			Average^{ns}
		R0 (0% Pl)	R1(15% Pl)	R2(30% Pl)	
Moisture content	LD	70.96±2.15	72.20±1.26	72.67±1.48	71.93±1,67
	BF	73.76±0.79	73.37±0.96	72.76±0.51	73.30±0.82
	Average^{ns}	72.36±2.12	72.79±1.17	72.72±1.03	
Crude Protein	LD	19.85±1.21	20.22±0.93	19.74±0.43	19.94±0.85
	BF	20.52±0.34	20.40±0.73	20,42±0.16	20.45±0.43
	Average^{ns}	20.18±0.90	20.31±0.78	20.08±0.47	
Crude Fat	LD	7.37±2.98	5.47±1.75	5.27±1.83	6.04±2.27
	BF	3.28±0.96	3.57±0.92	4.55±0.60	3.80±0.95
	Average^{ns}	5.32±2.99	4.52±1.65	4.91±1.32	
Collagen	LD	1.76±0.25	1.56±0.10	1.59±0.18	1.64±0.19
	BF	1.57±0.10	1.69±0.11	1.58±0.13	1.62±0.12
	Average^{ns}	1.67±0.20	1.63±0.12	1.59±0.15	

^{ns} = not significant
Pl = Papaya leaves

The analysis of variance on chemical composition revealed that there were no significant ($P>0.05$) difference between the three Papaya leaves levels. The result showed that Papaya leaves feeding (R1 & R2) did not significantly effect on the chemical composition including moisture content, crude protein, crude fat and collagen.

Physical Quality. The Physical Quality of *L.dorsi* and *B.femoris* muscles are presented in the Table-2. The evaluation of physicochemical quality (instrumental color, pH, water-holding capacity = WHC, cooking loss and shear force value) was found to the considerably variables. Papaya leaves feeding did not affect on pH value, cooking loss and shear force value, but on color and WHC were significantly different ($P<0.05$). According to the result, suggest that myoglobin pigment concentration in group R1 (Papaya leaves level 15%) is clearly deposited in red fiber in muscle, this result is in agreement with Biswas *et al.* (2011) who stated that color atributes (hue, chroma and value) were affected by the addition of fiber, color is one of the most important quality attribute that affects consumer's acceptability of the meat. Lawrie & Ledward (2006) stated that myoglobin pigment concentration is the determinant for meat color. Water holding capacity of LD and BF muscles showed difference among treatments R0, R1 and R2, this described that Papaya leaves feeding could increase the water holding capacity in LD and BF muscles. Water holding capacity is very important to determine meat taste and texture so it is substantial for food formulation. Soeparno (2009) stated that food water holding capacity is associated with protein involvement therefore the main factors affecting water holding are pH, salt and temperature.

Table 2. The effect of fed papaya leaves on physical quality of goat meat

Parameter (%)	Muscle	Papaya leaves levels (%)			Average[ns]
		R0 (0% Pl)	R1(15% Pl)	R2(30% Pl)	
Color	LD	3.33±0.72	4.33±0.48	3.20±0.86	3.62±0.86
	BF	3.80±0.86	4.33±0.62	3.13±1.18	3.75±1.02
	Average	3.57±0.82[a]	4.33±0.55[b]	3.16±1.02[a]	
pH	LD	6.17±0.99	6.20±0.19	6.18±0.07	6.18±0.06
	BF	6.17±0.09	6.13±0.03	6.18±0.04	6.16±0.06
	Average[ns]	6.17±0.09	6.17±0.04	6.18±0.05	
WHC (%)	LD	17.14±7.44	27.60±5.17	18.76±7.38	21.17±7.76
	BF	15.86±6.63	20.34±8.03	20.76±4.88	18.99±6.43
	Average	16.51±6.56[a]	23.97±7.36[b]	19.76±5.89[ab]	
Cooking Loss (%)	LD	35.52±4.10	36.75±5.07	34.17±3.54	35.48±4.03
	BF	42.45±1.43	39.67±2.49	41.06±1.44	41.96±2.06
	Average[ns]	38.99±4.67	38.21±4.01	37.61±4.45	
Shear force value (kg/ cm2)	LD	7.94±3.25	7.11±3.54	4.19±1.31	6,42±3,10
	BF	10.55±4.45	6.48±3.09	9.79±3.14	8,94±3,76
	Average[ns]	9.25±3.87	6.80±3.10	6.99±3.73	

[ab:] Average in the same row with different superscript are significantly different -(P<0,05)
[ns] = not significant
Pl = Papaya leaves

CONCLUSIONS

The most important of this study was the chemical composition which did not change by Papaya leaves feeding for goat. The most of the physical quality of goat meat did not change significantly, but the color scores and water-holding capacity increased. It was shown that Papaya leaves in the diet did not influence on physicochemical quality of goat meat.

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