Effect of Noni (*Morinda citrifolia* L.) Leaves Extract Supplementation in Feed on Physical Quality of Broiler Breast Meat

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ABSTRACT

This research was conducted to know the effect of noni (*Morinda citrifolia* L.) leaves extract supplementation in feed on physical quality of broiler breast meat such as pH, Water Holding Capacity (WHC), Cooking Loss (CL), and tenderness. Ninety six 8-days old broiler chickens strain Lohmann and of undifferentiated sex (unsexed) were used in this research. The broiler chickens will be reared until 35-days old. The research method was experimental using Completely Randomized Design (CRD) with six treatments and four replications, each replication consisted of four broiler chickens. The treatments consisted of P_0 (Basal Feed), P_1 (Basal Feed + tetracycline 0.05%), P_2 (Basal Feed + noni leaves extract 0.05%), P_3 (Basal feed + noni leaves extract 0.1%), P_4 (Basal feed + noni leaves extract 0.15%), P_5 (Basal feed + noni leaves extract 0.2%). The data were analyzed by ANOVA and continued by Least Significant Difference (LSD) test if there was significantly different result. The results showed that noni leaves extract did not give significant effect (P>0.05) on meat pH, water holding capacity (WHC), cooking loss (CL), and tenderness. However, these results were still acceptable normally such as pH between 5.38-5.57, water holding capacity 34.13-45.64%, cooking loss 33.05-36.97%, but tenderness 16.22-20.57N were less acceptable. The research concluded that supplementation of noni (*Morinda citrifolia* L.) leaves extract in feed did not increase physical quality of broiler breast meat on pH, Water Holding Capacity (WHC), Cooking Loss (CL), and tenderness.

Keywords: noni leaves, broiler chicken, physical quality of meat.

INTRODUCTION

Public awareness about the importance of nutritious food contributes to an increase in Indonesian people's consumption of chicken meat (Ditjennak, 2009). However, high mortality condition would have a serious impact on meeting the demand and supply for chicken meat. Antibiotics are the main options very commonly used to act against deadly diseases such as fowl cholera, colibacillosis, and salmonellosis. This occurs because antibiotics are very efficacious to reduce the population of pathogenic bacteria in the digestive tract. Even though antibiotics are choosen to reduce mortality, but improper used of antibiotics may cause a serious problem to the consumer health.

Pathological effects due to antibiotic residues in food products are allergies, reproductive system disorders, impaired liver function, and even cause carcinogenic effects in humans (Nisha, 2008). Other side effects resulted from the use of antibiotic is the emergence of resistant mutant bacteria (Yurdakul *et al.*, 2013) that can infect humans through physical or food contact (Snel *et al.*, 2002). Existence of food-borne infection causes the difficulty of medicinal treatment to the infected human by resistant bacteria.

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Therefore, an effort to create safety food, especially the prohibition use of antibiotics in the poultry industry has been done globally, in order to prevent the growth of resistant bacteria worldwide. As the case in Europe, during the period 2003-2006 the EU Commission has gradually reduce the use of antibiotics as a feed additive in the European Union (EU) (Simon *et al.*, 2005), and then followed by a strict prohibition toward the use of antibiotics in the entire European poultry industry. This pressure is intended to eliminate the antibiotic addiction of poultry industry that able to create a diseases resistance. Therefore, synthetic antibiotics are using in the poultry industry to demanding alternatives as a replacement.

Phytobiotic is known as natural feed additive from plant containing bioactive substances and works for the prevention of various diseases through antibacterial activity. Previous studies found that noni plant (*Morinda citrifolia* L.), especially the leaves and fruit are medicinal plants that contain antibacterial compounds such as anthraquinone, flavonoid, alkaloids, and saponins which are able to inhibit the growth of pathogenic bacteria in the gastrointestinal tract as well as *Salmonella* sp. and *Shigella* sp. (Murdiati *et al.*, 2000). It is expected the normal condition of animal prior to slaughter will affect the normal postmortem glycolysis for conversion rate of muscle into meat to improve the quality of meat produced (Strasburg and Chiang, 2009).

The objectives of current research was conducted to know the effect of noni (*Morinda citrifolia* L.) leaves extract supplementation in feed on physical quality of broiler breast meat such as pH, Water Holding Capacity (WHC), Cooking Loss (CL), and tenderness.

MATERIAL AND METHOD

Materials

Ninety six 8-days old broiler chicken strain Lohmann and of undifferentiated sex were used in this research. The broiler chickens will be reared until 35-days old. Basal feed made of mixture of corn, rice bran, concentrate, and palm oil as shown on Table 1. Noni leaves extract as feed additive obtained from extraction of young and old noni leaves according to method of Wati (2009).

Table 1. Ingredients and nutrients on basal feeds for broiler chicken, starter (0-21 days) and finisher (22-35 days).

Feedstuff	Starter	Finisher
Corn (%)	60	56
Concentrate (%)	38.40	33
Palm oil (%)	1.60	2.40
Rice bran (%)	-	8.60
Total (%)	**100**	**100**

Nutrients	Starter	Finisher
Metabolizable Energy (Kcal/kg)	2967	3032
Crude protein (%)	20.90	19.22
Crude fat (%)	5.86	6.84
Crude fiber (%)	2.93	2.86
Ca (%)	0.96	0.91
P (%)	0.67	0.63

Note: nutrients content were in accordance with SNI (2006[a]) and SNI (2006[b]) for broiler nutrient requirements

Research Method

The research method was experimental using Completely Randomized Design (CRD). The treatments used in this research were 6 treatments and each treatment had 4 replications and each replication using 4 broiler chickens. The treatments consisted of:

P_0 = Basal feed

P_1 = Basal feed + tetracycline 0.05%
P_2 = Basal feed + noni leaves extract 0.05%
P_3 = Basal feed + noni leaves extract 0.1%
P_4 = Basal feed + noni leaves extract 0.15%
P_5 = Basal feed + noni leaves extract 0.2 %

Feed was given on *ad libitum* basis from 8 to 35 days of age. Drinking water was also provided *ad libitum*.

Research Variables.

The variables observed in this research were the physical quality of broiler breast meat included:

a. pH measurements was carried out with a pH meter according to the method of AOAC (1995).
b. Water Holding Capacity (WHC) measurement was according to the method of AOAC (1975).
c. Cooking Loss (CL) measurement was according to the method of AOAC (1975).
d. Tenderness was according to the method of AOAC (1975).

Data Analysis.

Data was obtained from this research will be analyzed by analysis of variance (ANOVA). If there is a difference or significant between treatments will be followed by Duncan's LSD test at the 0.05 significance level.

RESULTS AND DISCUSSION

Effect of noni leaves extract supplementation in feed on physical quality of broiler breast meat such as pH, water holding capacity (WHC), cooking loss (CL), and tenderness are shown on Table 2.

Table 2. Effect of noni leaves extract supplementation in feed on pH, WHC, CL, and tenderness of broiler breast meat.

Treatment	pH	WHC (%)	CL (%)	Tenderness (Newton)
P_0	5.38± 0.04	42.72± 12.43	35.60± 1.27	20.57± 2.74
P_1	5.56± 0.13	45.64± 13.70	34.75± 1.13	17.97± 7.23
P_2	5.57± 0.15	34.13± 6.51	33.05± 3.90	18.77± 9.05
P_3	5.53± 0.15	42.27± 8.74	35.67± 1.58	16.27± 4.21
P_4	5.46± 0.10	40.84± 6.47	36.97± 1.07	16.22± 3.05
P_5	5.53± 0.03	38.69± 9.88	36.04± 2.52	17.37± 3.15
P-value	**0.22**	**0.68**	**0.23**	**0.86**

Potential Hydrogen (pH)

Table 2 showed the effect of noni leaves extract supplementation in feed on pH of broiler breast meat. The treatments did not give significant effect (P>0.05) on pH of broiler breast meat. However, all of pH values resulted in this research were still in normal range (5.3 to 5.7) of ultimate meat pH based on glycogen reserves. Aberle *et al*. (2001) reported that rate of pH decline of normal meat pH decreased gradually from 7.0 to 5.6-5.7 within 6-8 hours after slaughtered and achieved a normal pH about 5.3 to 5.7.

The decline meat pH during postmortem is regulated by the rate of postmortem glycolysis and muscle glycogen reserves derived from energy consumed. The higher energy consumption is expected to reach the normal ultimate pH. The consumption of energy, crude fiber, crude protein, and crude fat are showed on Table 3.

Table 3. Mean value of nutrient consumption

Treatment	ME (Kcal/bird /day)	Crude Fiber	Crude Protein	Crude Fat
		(g/bird/day)		
P_0	284.84± 6.93	2.75± 0.06	19.05± 0.46	6.03± 0.14
P_1	267.56± 26.12	2.58± 0.25	17.89± 1.74	5.66± 0.55
P_2	279.99± 6.73	2.70± 0.06	18.72± 0.45	5.93± 0.14

Treatment	ME (Kcal/bird/day)	Crude Fiber	Crude Protein	Crude Fat
		(g/bird/day)		
P_3	300.07± 6.66	2.89± 0.06	20.07± 0.44	6.35± 0.14
P_4	274.98± 11.61	2.65± 0.11	18.39± 0.77	5.82± 0.24
P_5	263.44± 11.84	2.54± 0.11	17.62± 0.79	5.58± 0.25

The high glycogen reserves in the passive muscle as consequences of higher energy consumption will provide a better pH decline, due to high lactic acid produced (Lawrie, 2003). However, in this research showed the highest energy consumed 300.07 Kcal/bird/day only gave pH value 5.53 and similar with lowest energy consumed 263.44 Kcal/bird/day. This may be due to different energy consumed still in normal range since similar muscle type and less variability in animal genetic may lead to no intrinsic enzyme activity. As stated by Soeparno (2005) that several intrinsic factors affects meat pH decline included species, muscle type, muscle glycogen, enzyme activity, and variability among animals.

Water Holding Capacity (WHC)

Table 2 showed the effect of noni leaves extract supplementation in feed on water holding capacity (WHC) of broiler breast meat. The treatments did not give significant effect (P>0.05) on WHC of broiler breast meat. Nevertheless, all of WHC values resulted in this research were higher than Hartono *et al*. (2013) who observed the addition of the functional feed based on fat and crude fiber contents which was only capable to achieve the mean value of meat WHC of broiler between 16.97 to 21.74%. This may be due to the negative correlation between fat and crude fiber contents with protein content increment as one of factor affects the WHC value. According to Young *et al*. (2004) that higher WHC value will increase meat quality in term of meat tenderness after cooking process.

In addition, composition and total nutrients consumed affects to the value of WHC. As mentioned by Oktaviana (2009) that higher meat protein content due to higher protein consumption will increase the ability of meat protein in binding water. According to Suryanti *et al*. (2011) meat protein and water were interacted via hydrogen molecule. Protein is capable to bind water molecule, because it is composed by the hydrophilic amino acids which tend to interact in globular protein where a place of amino acids are not in contact with water. In addition, protein is also composed by hydrophobic amino acids which are usually located on the surface of protein where a place of amino acids interacts with the surrounding water.

Postmortem meat pH was known as one of important factor that affects on WHC as physical meat properties (Soeparno, 2005). That was in accordance with Lawrie (2003) that if the pH is lower or higher than the isoelectric point of meat protein (5.0 to 5.1), the value of WHC will be higher. Theoritically, when the pH is higher, there is an excess of negative charge (Rendle and Keely, 2010), adversely if the pH is lower, there is an excess of positive charge (Soeparno, 2005). Both conditions result in myofilaments rejection and give more space for water molecules, therefore WHC will increase.

Cooking Loss (CL)

Table 2 showed the effect of noni leaves extract supplementation in feed on cooking loss (CL) of broiler breast meat. The treatments did not give significant effect (P>0.05) on CL of broiler breast meat.

Nonetheless, all of CL values resulted in this research were still in acceptable range between 33.05±3.90 to 36.97±1.07%. As reported by Lawrie (2003) the value of meat CL is quite varied between 15 to 40%.

CL is the main indicator affecting the nutritional value of meat and always closely relates to the number of bound water in the cells between the muscle fibers. CL value can be affected by WHC value where the higher WHC will result to the lower CL, hence the loss of nutritional value will be minimized. However, the similar result in CL in this research indicates that WHC and other factors such as pH, muscle fibers, myofibril contraction status, size, and weight of meat (Soeparno, 2005) may not influence CL.

According to Lawrie (2003) the higher meat pH than the isoelectric point of meat protein (5.0 to 5.1), the higher meat WHC. As reported by Lawrie (2003) that increased CL can be due to lower postmortem pH which causes in many protein myofibrils was denatured, so it caused loss of protein ability to bind water and ultimately increase CL (Shanks *et al*., 2002). Protein myofibrils composes of myosin, actin, tropomyosin, and actomyosins of which combination of actin and myosin are responsible for the elasticity and WHC of meat (Damodaran, 1997).

In addition, CL may also occur due to denaturation of the protein in the meat through heating process. As stated by Ophart (2003) protein will also be denatured at around 50-80°C because hydrogen binding and hydrophobic interactions of non-polar protein will be broken. In addition, according to Soeparno (2005) the higher temperature and cooking time, the greater fluid level of the meat will lost until a constant level.

Tenderness

Table 2 showed the effect of noni leaves extract supplementation in feed on tenderness of broiler breast meat. The treatments did not give significant effect (P>0.05) on tenderness of broiler breast meat. This may be due to the poultry fats accumulation under the skin (subcutan) and in abdominal fat, hence fats content as marbling of meat remains low (Hartono *et al*., 2013).

In addition, tenderness results of this research (16.22 to 20.57N) were higher or less tender than Muhbianto (2009) who observed the addition of shrimp waste fermented *Aspergillus niger* in feed has resulted tenderness of broiler meat between 13.47 to 16.2 N. This due to the shrimp waste contained more fat that contributes to meat tenderness. As stated by Purbowati *et al*. (2006) that meat tenderness can be affected by protein myofibrils status and muscle components which contributes to the tenderness of meat or rigidity namely connective tissue, muscle fibers, and adipose tissue. Less connective tissue will produce more tender meat, because connective tissue containing higher amounts of large fibers.

Tenderness is one of the factor affects to the quality of meat particularly in term of consumer tastes and the general acceptances. Meat tenderness can be determined by measuring the tensile strength of meat, the lower value of tensile strength indicated that meat is more tender. Increase tenderness (tough meat) is undoubtedly a reflection of the greater water content and WHC. In addition, this tenderness results can also be affected by addition of additive materials (Soeparno, 2005). Protease enzyme within noni leaves induces increment of endogenous proteases in the meat (Effendi *et al*., 2006) and increases number of denatured protein then lead to squeeze water out of the meat protein (Lawrie, 2003), so the meat will be more tender.

CONCLUSION

Supplementation of noni (*Morinda citrifolia* L.) leaves extract in feed did not increase physical quality of broiler breast meat on pH, Water Holding Capacity (WHC), Cooking Loss (CL), and tenderness.

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