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The Effects of Papain Crude Extract Addition in Diets on Broilers Production Performances

Laurentius Rumokoy, Endang Pudjihastuti, Ivonne Maria Untu, Wisje Lusia Toar

Department of Nutrition and Feed Sciences, Faculty of Animal Husbandry, Sam Ratulangi University, Jalan Kampus Unsrat, Manado 95115, Indonesia
Corresponding author email: rumokoy@msn.com

Abstract: This study was conducted to evaluate the effects of papain crude extract addition in mash and pellet feed forms on production performance of broiler chickens in order to obtain the best level of extract papain in mash or pellet form. This natural protease enzyme was extracted from unripe papaya. A complete random design was applied in this study and it was arranged with factorial 4*2 and three replications. The treatments were 4 levels of papain (0, 0.03, 0.05, and 0.07 %) and two physical forms of feed (mash and pellet). Broilers production parameters measured were: feed intake, body weight, feed conversion ratio (FCR) and carcass percentage. The results of analysis of variance showed that the interaction was highly significant (P<0.01) for feed intake, body weight, carcass percentage respectively while feed conversions have significant interaction (P<0.05). The significant differences in the feed consumption described the role of papain enzyme through treatment of CEP and the physical form of feed. The results indicate that the all treatment of papain crude extract level both in mash and pellet feed form were able to improve feed intake, body weight, FCR and carcass percentage of broiler chickens, whereas the best performance was obtained in the treatment of 0.05% papain crude extract in mash form of diets.

Key words: papain, FCR, carcass, mash, pellet

Abstrak. Penelitian ini dilakukan untuk mengetahui lebih dalam efek penambahan ekstrak kasar papain dalam pakan berbentuk *mash* dan *pellet* terhadap penampilan produksi broiler. Enzim protease alami ini diekstrak dari pepaya muda. Rancangan acak lengkap diterapkan dalam penelitian ini yang disusun secara faktorial 4 * 2 dan tiga ulangan. Perlakuan yang diberikan adalah 4 tingkatan papain (0, 0,03, 0,05, dan 0,07%) dan dua bentuk fisik pakan (mash dan pelet). Parameter poduksi broiler yang diukur adalah konsumsi pakan, berat badan, rasio konversi pakan (FCR) dan persentase karkas. Hasil analisis varians menunjukkan ada interaksi yang sangat signifikan (P<0,01) menyangkut konsumsi pakan, berat badan dan persentase karkas masing-masing, sementara konversi pakan menunjukkan interaksi yang nyata (P<0,05). Perbedaan yang signifikan dalam konsumsi pakan menggambarkan peran enzim papain melalui perlakuan CEP dan bentuk fisik pakan. Hasil menunjukkan bahwa semua perlakuan tingkat ekstrak kasar papain baik di mash dan pakan pelet bentuk mampu meningkatkan konsumsi pakan, berat badan, FCR dan persentase karkas ayam broiler, sedangkan performan terbaik diperoleh pada perlakuan 0,05% papain ekstrak kasar dalam pakan berbentuk mash.

Kata kunci: papain, konversi pakan, karkas, *mash*, pellet

Introduction

Production of broiler chickens is determined by feed quality among various factors. Although nutrients content in the diet has been qualified as a balanced nutrient, various supporting factors are also important such as particle size and feed form to affect the broilers' performances production. The role of papain extracted from unripe papaya fruits as an exogenous enzymes can be used to simplify the nutrients when absorbing digestive tract in the chicken gut, while until know there has not reached yet a precise level of papain crude extract recommended to be applied in animal nutrition for broiler production improvement. Therefore, it is necessary to reveal the best concentration of crude papain extract to be used as an organic supplement either in mash form or pellet form of feed to support the production of broiler chickens.

This papain crude extract is a proteolytic enzyme that can break down peptide bonds of a protein molecule (Aravind et al., 2013).The papain crude extract typically derived from the sap of unripe papaya fruits (Li et al., 2010; Jeana et al., 2013; Nitsawang et al., 2006) or from papaya latex which can be collected directly from the fruit which are still hanging on the tree (Macalood et al.,2013). An application of papain in rations for poultry has been studied by Kanyinji and Zulu (2014) showed an improvement on feed conversion. Other researchers used papaya leaf as a source of papain other than crude extract from the sap of the papaya fruit. Sudjatinah et al. (2009) reported the use of papaya leaf extract to be mixed into the feed of poultry until a concentration of 25ml per liter of drinking water has not shown any significant influence on performance of broiler production. Widjastuti (2009) used the papaya leaf meal up to 10% in layer rations did not provide a significant effect on the quality of the eggs production.

Materials and Method

Experimental Broilers and Treatments.

Ninety-six male broiler chickens, starting from day old chick (DOC) until six week of age, were housed in 24 pens (four chicken in each pen) with a dimension of 70x70x75 cm. All pens were equipped with feeders and drinkers. At the first weeks the animals received the heater lamp and the temperature was controlled according to animal growth. The chickens were randomly divided in eight treatments combination using the completely randomized design in 4x2 factorial arrangement of 8 treatments with three replications. The factors were physical form of diets: mash and pellet and crude papain extract level 0, 0.03, 0.05, and 0.07 % of feed. Feed and water were offered *ad libitum*.

Parameters Measured and Feed Preparation

The parameters of broiler production under the treatments effects were feed intake, body weight, feed conversion ratio (FCR), and carcass presentation. Both mash and pellet feed form were formulated by using the ingredients as shown in table 1 and the feed were added with crude papain extract according to the level of treatments, excepted in the control (0.00%). After adding and mixing the substances of papain crude extract in the ingredient then the pellet and mash form were produced. The pellet forms were produced by using a pelleting machine under a temperature of 40 ºC. To avoid the enzymes denaturation all diets were formulated and produced each day before distributing to the chickens. Live body weight, feed intake, weight gain and feed conversion ratio were calculated weekly from the 1st to 6th week. At the end of experiment, two birds per treatments were slaughtered for carcass measurements.

Feed Ingredient and Nutrients: The nutrients composition of ingredient, as shown in table 1, while the content of amino acids in papain crude extract used in this experiment is presented in table 2.

Results and Discussion

The proximate of nutrients composition of diets is presented in table3. The two types of diets were formulated regarding to the age of broiler chickens: the diets along 0 to 3 weeks and then 3 to 6 weeks of ages.

This results showed that all treatment level of papain crude extract (0.03, 0.05 and 0.07%) improved a better value for BW, FCR and carcass performances of broilers than the performances of animals consumed the diets without any papain both in mash and pellet form. It revealed also that the interaction of papain crude extract and feed form were significant for feed intake, body weight, feed conversion ratio, and carcass percentage throughout observation.

Table1. Chemical composition of raw materials*

Ingredients	ME (Kcal/kg)	CP	CF	Lipid	Calcium	Phosphor
		---------- (%) ----------				
Yellow corn	3350	8.5	2.2	3.8	0.02	0.28
Rice bran	2980	12.9	11.4	13.0	0.07	0.22
Soybean cake	2230	44.0	7.0	0.8	0.29	0.65
Fish meal	2820	60.0	0.7	9.4	5.11	2.88
Coconut oil	8600			100		
Bone meal					29.8	12.5
Chalk					35	

* The calculation based on proximate analysis

Table 2. Amino acids content in crude extract papain

Amino acids	Concentration (%)
Arginine	5.70
Glycine	9.82
Histidin	0.95
Leucine	4.09
Isoleucine	5.50
Lysine	4.52
Methionine	-
Cysteine	2.83
Phenylalanine	1.65
Threonine	2.88
Tryptophan	2.20
Valine	7.45
Tyrosine	4.68

*The amino acids of crude papain extract calculation was based on laboratory analysis

The benefit values of papain crude extract expressed in all parameters were significantly higher than in control both in mash and pellet feed forms. The addition of papain crude extract as exogenous protease source in mash diets increased significantly feed intake compared to the control. The same performance for feed intake in pellet form showed a significant increasing according to the treatment of this crude extract compared to control. The highest average (3,244 g) of feed intake of broiler discovered in treatment of papain crude extract at 0.05% added in mash form while the lowest average of feed intake 1,983 g found in the crude papain up to 0.03% applied in pellet form. The positive effect of crude papain was appeared also for body weight of chickens which had received papain crude extract in each level compared to the control. The addition of papain in pellet form tended to provide a lower on body weight of broilers than the addition in mash form. This was linked to broiler feed intake that were more high by consuming the diet with a mash form than in the pellet form.

Results and Discussion

The performances values of broilers as provided in this study: body weight, feed intake, carcass percentage and feed conversion ratio. By its results enabled us to decide which level of papain treatment was the best either in mash or pellet form. The papain extract influenced a higher palatability both in mash and pellet followed by the positive response on body weight, consequently it affected the feed intake and in the same time feed form affect broiler productions. Amerah et al. (2007) has similar results with Kanyinji and Zulu (2014) that confirmed the increasing of feed intake led a better body weight gain by using papain extracted from papaya plant in the diets. Ahmed and Abas (2013) demonstrated broiler feed intake was higher in mash than in pellet. This performance caused by the particle size and feed form (Chewning et al., 2012; Ebrahimi et al., 2010). Furthermore the significance of interaction of papain crude extract and feed forms for feed conversion ratio (FCR) throughout the observation affirmed the role of crude papain application levels up to 0.07% in diets. Several previous researchers observed

the role of supplementation of protease in the diet(Vieira et al., 2013) resulted a better feed intake (Mahejabin et al., 2015), body weight and FCR values to the chicken (Kame et al., 2015).This condition facilitated digestibility of amino acids in the diets to get a better FCR of broilers (Mejia et al., 2011). Similar response was reported by Yadav and Sah (2006)the use of 0.07% and 0.1 % acid protease in diets improved the feed efficiency of layer chicken, while Rada et al.(2013)was divergent showed that the exogenous mono-component protease added into low protein broiler diet had no significant effect on both observed growth parameters carcass characteristic. The results described that the use of crude papain extract in broilers diets both through mash and pellets feed form could improve FCR although the pellet diet was less able to rise FCR than the smash diet. This state seems triggered by decreasing of papain function in pellet when passed through the pelleting process under temperature about 40 ºC which reduced the papain activity. The treatment effects observed on broiler production performances are shown in table 4.

The variance analysis indicated a significant effect ($P<0.01$) of treatment combination of crude papain levels and feed forms on broilers carcass percentage. The interaction of mash feed form with each level of papain gave a higher average of carcass percentage than in the form of pellets. The similar effect of feed form has been investigated by Corzo et al.(2012) and Cerrate et al. (2009) which related to difference size mash compared to pellet form (Abdollahi et al., 2012; Zohair et al., 2012 and Dozier et al., 2010). The highest carcass percentage was significant obtained from broilers received the treatment of mash form combined with crude papain 0.05%, while the lowest response of this parameter was revealed in the broilers consumed pellet feed form with crude papain 0.07% addition. The response of a lower of body weight in broilers that consumed pellet diets than mash with crude papain addition seems related to the decreasing role of papain in pellet. Amirabdollahian et al. (2014); Creswell and Bedford (2006) stated that pelleting temperature is a limit factor that effect on pellet quality. Beside that enzyme feed particle size contributed also to the quality of diets as reported by Attia et al. (2014); Rezaeipour and Gazani (2014) and Aderibigbe et al. (2013).

Table 3.Composition and calculated analysis of the diets (%) according to chicken age

Composition of Diets	0 to 3 weeks	3 to 6 weeks
Ingredients		
Extract papain supplementation		
Yellow corn	60	55
Rice bran	4	14
Soybean cake	25	20
Fish meal	7.5	3.45
Coconut oil	0.25	1
Bone Meal	0.5	4
Premix A	0.5	2
Methionine	0.5	0.2
Chalk	0.2	0.35
Calculated nutrients composition		
Metabolic energy	3091	2888
Crude Protein	21	17
Lipids	5.9	5.2
Crude Fiber	3.6	4.0
Calcium	0.68	2.1
Phosphor	0.61	0.9
Arginine	1.3	1.1
Glycine	0.97	0.78
Histidine	0.65	0.46
Leucine	1.85	1.52
Isoleucine	0.91	0.72
Lysine	1.23	0.93
Methionine	0.46	0.47
Sistine	0.32	0.28
Phenylalanine	0.99	0.81
Threonine	1.83	1.36
Tryptophan	0.28	0.22
Valine	1.04	0.84
Tyrosine	0.84	0.68

*The calculation of nutrient values of diets was based on laboratory as approximate analysis

Table 4. Treatment effects on broiler production performance

Papain crude extract Supplementation	Mash				Pellet				*P*
	0.00	0.03	0.05	0.07	0.00	0.03	0.05	0.07	
Parameters:									
Initial BW (g)	43	43	43	43	43	43	43	43	
Feed Intake (kg)	2.69^{e}	2.83^{f}	3.24^{h}	3.07^{g}	1.98^{a}	2.55^{d}	2.33^{c}	2.21^{b}	< 0.01
BW (kg)	1.42^{e}	1.51^{f}	1.79^{h}	1.67^{g}	0.99^{a}	1.34^{d}	1.20^{c}	1.12^{b}	< 0.01
FCR (g/g)	1.90^{cd}	1.87^{bc}	1.81^{a}	1.84^{ab}	2.00^{f}	1.91^{cd}	1.94^{de}	1.97^{ef}	< 0.05
Carcass (%)	59.5^{bc}	62.3^{cd}	69.8^{e}	63.3^{d}	53.0^{a}	58.6^{b}	58.0^{b}	54.7^{a}	< 0.01

^{abc} Means in the same row without common letter are different at P<0.05

Through this works, it can be summarized that papain crude extract added in mash and pellet form are suitable to improve the broiler production performance, and to get the best performance it should be considered the temperature in pelleting processing to avoid the reducing of crude papain function in the diets of broilers.

Conclusions

The best level of papain crude extract was at 0.05% in mash form of diets to increase the broilers performances for feed intake, body weight, feed conversion ratio and carcass production. When the broilers consumed diets with addition of papain crude extract in mash form resulted a better production performances than those consumed pellet form with papain crude extract addition.

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