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Xylanase Enzyme on Broiler Performance Fed Cassava Based Diet in Forms of Pellet and Mash

Ni Gusti Ayu Mulyantini S. Sekarsari[1,*]

[1] *Faculty of Animal Science Universitas Nusa Cendana Kupang, Indonesia*
[*]*Corresponding author. Email: ngamulyantini29@gmail.com*

ABSTRACT
Cassava contain a large quantity of starch, therefore it is good to be used as an energy source for poultry diet. However, cassava contain high level of insoluble fiber which are not well digested by poultry. Enzymes and diet forms are two things that must be considered for the provision of cassava-based diets for broiler. The research was undertaken to evaluate the performance of broiler chickens fed cassava-based feed supplemented with xylanase enzyme in the form of mash and pellets. The experimental design used in this experiment was completely randomized design in a 3x2x2 factorial design, three levels of cassava meal (0%, 20%, 30%), two levels of enzyme (without vs with enzyme) and 2 diet forms (pellet vs mash). A total of 240 broiler chickens were divided into 10 treatments. Each treatment replicated 4 times with 5 chickens for each treatment. The body weight, weight gain, feed intake and feed conversion ratio were calculated per week. There was interaction between level of cassava meal; enzyme and diet forms on final weight, carcass yield, and abdominal fat. The chickens given pellet diets had better performance. Enzyme supplementation can improve final weight, carcas yield, and decrease abdominal fat of broiler fed 30% cassava-based diet . In conclusion, 30% cassava in pellet form supplemented with enzyme can be used as an energy sources and also reduce abdominal fat deposition in broiler.

Keywords: *broiler, cassava, enzyme, xylanase, mash.*

1. INTRODUCTION

Substantial efforts have been made to replace expensive cereals with cassava in poultry feeding. Cassava (*Manihot esculenta crantz*) contains a large quantity of starch, therefore it is certainly worthwhile to be used as an energy source for poultry feed [1]. However, cassava contain high level of insoluble fiber which are not well digested by poultry [2]. Over the past decade, dietary enzymes have been used as a tool to improve nutrient utilization in chicken diet. The use of exogenous enzymes to degrade indigestible dietary components has yielded inconsistent results mainly because of use of enzymes often not suitable for effective hydrolysis of such components [3]. Akinfala et al [4] suggested that a combination of different enzymes of different activities is required for complete degradation of complex NSP and improved nutrient utilization. Research should exactly define in scientific reports, the cassava products being used in the studies to enables realistic comparison.

While the benefits of feeding pelleted diets over mash diets are well documented and readily accepted by the commercial poultry industry. In the manufacture of poultry feeds, pelleting is the most common form of thermal treatment [5]. Although enzyme are known for being resistant to high temperatures, there is a scarcity in data of their ability to survive typical pelleting conditions used by the poultry feed industry. The low percentage of research concerning the interaction between diet forms (pellet vs mash), and enzyme supplementation on cassava meal has been conducted. The objective of the present study were to determine the performance of broiler chickens from 21-42 days of age fed diets containing varying levels of cassava meal in forms of pellet and mash supplemented with enzyme.

2. MATERIALS AND METHOD

2.1. Preparation of Cassava Meal

Cassava was sun-dried to a moisture content of approximately 10%. Dried cassava was ground to pass through a 1.0 mm mesh sieve. Prior to diet formulation, proximate and other analyses of cassava meal were determined.

2.2. Dietary Treatment

Chickens were fed a starter diet from d 1 to 21. From d 22 to 42, broiler chickens were subjected to 10 different treatment. Three levels of cassava meal-based diets (0%, 20% and 30%), two forms of diets (pellet and mash), and two levels of enzymes (without and with enzyme) were used in a 3x2x2 factorial design. For those purposes, each level of cassava-based diet was divided into four equals groups. The first group was pelleted at temperature 85ºC by adjusting the steam flow rate without enzyme (as control diet), the second group was mash without enzyme supplementation. The third group was pelleted with enzyme supplementation, and the fourth group was mash with enzyme supplementation. Non enzyme containing feeds were made before enzyme containing feeds. The pellet diameter was 3.0 mm and 1.6 mm length. Feed samples used for further analyses were collected at the end of each pelleting process. Experimental diets were mixed one day before experiment. Each ingredient was accurately weighed and mixed thoroughly into the diet. Nutrient concentrations of the basal diet met the minimum requirements according to the NRC [6]. Each dietary treatment was fed ad libitum to five replicate pens. For each pen, body weight and feed intake were recorded at 21 and 42 days of age.

2.3. Birds and Housing

The experiment involved a total number of 240 one-day-old broilers. The chickens were allocated to 10 diets treatments, with 4 replicates of 5 birds per replicate pen for each treatment. The age of all birds was 21 days of age at the beginning of the experiment. The experiment lasted 2 weeks in the finisher period. Birds were reared on litter floor. Feed and water were freely available to all birds throughout the feeding trial.

2.4. Statistic

SAS (SAS/STAT 6.04, 1987; SAS Institute Inc., Cary, North California) was used to perform the analyses. Superscripts were used in tables to indicate statistical differences between means. The significant level was set at $P<0.05$ and, if the F-ratio indicated significance, the differences between the means were separated using the Least Significant Difference test [7].

3. RESULT AND DISCUSSION

The result of the performance of broiler chicken from 21 to 42 d of age fed varying levels of cassava meal supplemented with enzyme in pellet and mash form diet is presented in Table 1.

Table 1. Performance of broiler fed cassava based diet in pellet and mash form supplemented with xylanase

Factor	Parameter measured		
	FI (g/b/d)	WG (g/b/d)	FCR
Level of Cassava			
0% (C0)	161.31 [a]	70.61	2.28[a]
20% (C1)	145.37 [a]	62.63	2.32 [b]
30% (C2)	140.42 [b]	63.31	2.22 [a]
SEM	12.98	5.03	0.07
P-value	0.999	0.247	0.006
Enzyme			
Without (E0)	159.80	71.44	2.24
With (E1)	152.11	68.02	2.24
SEM	8.09	5.44	0.04
P-value	0.072	0.072	0.136
Feed form			
Pelet (P)	162.04	65.40 [a]	2.48
Mash (M)	156.34	58.77 [b]	2.66
SEM	8.96	4.76	0.237
P-value	0.062	<0.001	0.113
Interaction			
C0 x E0 x P	159.40 [a]	67.04	2.38
C0 x E0 x M	160.20 [a]	69.02	2.32
C0 x E1 x P	161.23 [a]	72.33	2.24
C0 x E1 x M	162.44 [a]	76.05	2.13
C1 x E0 x P	154.33 [a]	65.44	2.36
C1 x E0 x M	155.66 [a]	63,21	2.46
C1 x E1 x P	162.01 [a]	70.26	2.31
C1 x E1 x M	158.20 [a]	70.81	2.23
C2 x E0 x P	148.00 [a]	62.01	2.39
C2 x E0 x M	143.04 [b]	58.11	2.46
C2 x E1 x P	152.04 [b]	65.05	2.34
C2 x E1 x M	140.98 [b]	60.33	2.34
SEM	7.03	12.44	0.56
P-value	0.001	0.227	0.145

Values followed by the same superscripts in each parameter are not significantly different (P<0.05)

In the current study, chickens fed on a diet based on cassava had significantly (P<0.05) lower the feed intake compared to a control group, whereas the FCR of birds fed cassava was similar with the control group. A decrease in feed intake by inclusion of 20% and 30% cassava could be due to the increased bulkiness of the diet and limited digestive tract capacity in broilers. Increase in bulkiness has also been reported to reduce palatability [3], thus may limit the FI of broiler chickens. The maximum recommended level of cassava meal that can be used in broiler diets varies greatly among studies. Boonsinchai et al [8] found that body weight was highest in birds fed diets in which 50% of the maize was replaced by cassava flour meal. Iheukwumere et al [9] found that 15% cassava meal can substitute coconut meal in broiler diets with no negative effect on growth performance. Morgan and Choct [3] stated that feed intake of cassava products is limited in poultry by the palatability of cassava-based rations, due to its dustiness and bulkiness. Therefore, pelleting could improve texture and reduce dustiness, whilst simultaneously supplying essential fatty acids. Adeyemi et al [10] found pelleting significantly reduced abdominal fat compared with feeding the same diets as mash [11].

The current study showed that pellets have a better effect than the mash diet form in terms of weight gain and carsass yield as shown in Table 2.

Table 2. Carcas yield and abdominal fat of broiler fed cassava based diet in pellet and mash form supplemented with xylanase

Factor	Parameter measured		
	Final weight (g)	Carcass yield (%)	Abd fat (%)
Level of Cassava			
0% (C0)	2265.03 ^{a}	1325,52 ^{a}	2.79 ^{a}
20% (C1)	2315.23 ^{b}	1312.29 ^{a}	0.86 ^{b}
30% (C2)	2217.01 ^{a}	1297.97 ^{b}	1.23 ^{b}
SEM	22.04	22.47	0.42
P-value	<0.0001	0.0001	<0.001
Enzyme			
Without (E0)	2000.47 ^{a}	1190.66 ^{a}	2.07 ^{a}
With (E1)	2198.22 ^{b}	1208.44 ^{b}	1.63 ^{b}
SEM	18.45	37,22	0.001
P-value	<0.0005	0.006	0.0001
Feed form			
Pelet (P)	2189.00 ^{a}	1234.89 ^{a}	1.99
Mash (M)	1985.74 ^{b}	1098.78 ^{b}	1.96
SEM	23.44	60.77	0.32
P-value	<0.0001	0.0001	0.21
Interaction			
C0 x E0 x P	2001.03 ^{d}	1176.22 ^{a}	2.97 ^{a}
C0 x E0 x M	1988.22 ^{d}	989.45 ^{c}	2.16 ^{a}
C0 x E1 x P	2244.71 ^{ab}	1266.03 ^{a}	1.24 ^{b}
C0 x E1 x M	2273.40 ^{a}	1199.05 ^{b}	1.99 ^{a}
C1 x E0 x P	2103,62 ^{c}	1041.06 ^{c}	1.92 ^{a}
C1 x E0 x M	1976.99 ^{d}	983.45 ^{c}	1.04 ^{b}
C1 x E1 x P	2244,31 ^{ab}	977.37 ^{c}	0.75 ^{b}
C1 x E1 x M	2300.56^{a}	1207.33 ^{a}	0.83
C2 x E0 x P	1955.66 ^{d}	1000.56 ^{c}	1.22 ^{b}
C2 x E0 x M	2000.01 ^{d}	1000.67 ^{c}	1.03 ^{b}
C2 x E1 x P	2244.67 ^{ab}	1103.77 ^{bc}	1.56 ^{a}
C2 x E1 x M	2189.09 ^{b}	1102.99 ^{bc}	0.94 ^{b}
SEM	58.75	40.50	0.55
P-value	<0.0001	0.0002	0.0001

Values followed by the same superscripts in each parameter are not significantly different (P<0,05)

Chickens fed pelleted vs. mash diets had significantly (P<0.05) higher daily weight gain, final weight, higher carcass yield. These findings are in agreements to the reports from Silva et al [12] claiming that pelleted feed is thought to increase animal performance due to decreased feed loss at the feeder, reduced animal energy expenditure during consumption, and decreased ingredient segregation. The nutrients in cassava pellets were apparently used more efficiently for growth than nutrients in cassava mash form diets. Overall, response on the cassava mash products was inferior to that on the pellets diets.

The result of current study generally is in agreement with the findings of Choct [2], Khempaka et al [11] that broiler fed high in cassava had a reduced abdominal fat content. This may be related to the decrease in energy intake, and hence reduced energy available for fat deposition. The lowering in abdominal fat could be due to the inhibition of lipid synthesis in the liver and abdominal tissue because of the high fiber content in the experimental diet. Increasing levels of fiber caused large decrease in ME intake.

Generally, cassava starch is more digestible than control diets. Cassava also is higher in amylopectin [13], but is lower in protein and diets require enzyme supplementation to meet the growth requirement of broiler. The current study showed that enzyme supplementation had significantly (P<0.05) improved final weight gain, carcass yield, and abdominal fat of broiler chickens. Digestibility of starch was significantly improve due to enzyme supplementation of the diets based on cassava pellets. These findings are also in agreement with Chen et al [14], Choct [15] who have been shown that non-starch polysaccharides (NSP) enzyme are able to eliminate the effects of the non-

nutritive, non-starch water soluble polysaccharides when added to poultry diet which results in increased efficacy of feed utilization, and increased rates of growth. This may be due to the fact addition of enzyme has improve the digestibility and absorption of nutrients. This is in agreement with report of Bhuiyan and Iji [16] reported that xylanase supplementation has improved overall feed utlization efficiency by 3.88%. Akinfala et al [5], Acamovic [17] also found a beneficial effect of enzymes (hemicellulases) in cassava base diets fed to broiler chickens. There was interaction between level of cassava, enzyme, and feed form. Level of 30% cassava in the pellet form with suplementation enzyme gave lower abdominal fat and higher final weight than control diet in the mash form without enzyme, this was due to a significantly greater weight gain

4. CONCLUSION

Thirty percent (30%) of cassava meal can be used as feed ingredient to supply part of the dietary energy requirement of broilers, but it should be in the pellet form and supplemented with enzyme. Not only cassava useful as an energy sources but it may also reduce abdominal fat deposition in broiler.

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