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Xylanase Supplementation on *Tamarindus Indica* and Cassava Meal in Mash and Pellet Form for Broiler Chickens

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ABSTRACT

The aims of this study were to analyse the effect of diets containing tamarind seed and cassava meal in mash and pellet form with enzyme supplementation on broiler performance. The experiment method used a 2 x 2 x 2 factorial design and compared the effects of diets (cassava meal vs *Tamarindus indica*), feed processing (pelleted vs. mash), and enzyme addition (with or without enzymes) on broiler performance. 240 broiler chicks were allocated to 8 treatments with 6 replicates of 5 chicks/replicate. The results show that a diet containing cassava meal in pellet form with xylanase significantly (P<0,05) improved the growth of the broiler in comparison to a diet formulation containing tamarind seed meal. A diet containing tamarind seed meal gave significantly (P<0,05) lower abdominal fat than cassava meal. In conclusion, in this study diets containing cassava meal gave the best results for broiler growth, and diets containing tamarind seed improved the abdominal fat of broiler chickens.

Keywords: broiler; cassava meal; *Tamarindus indica*; xylanase

INTRODUCTION

Conventional poultry feeds are not only costly but also scarce and in competition with human dietary needs. This promotes the hunt for unconventional feed ingredients that may be purchased for less money. Tamarind and cassava may offer an answer because they are highly available, easily grown, and have a high nutritional value. In Indonesia, especially in East Nusa Tenggara Island, tamarind seed (*Tamarindus indica L.*) and cassava are abundant agro-industrial by-products. Tamarind trees were naturally developed; however, a significant portion of those trees were merely squandered.

Casava (*Manihot esculenta crants*) has a high starch content, therefore it is used as a poultry energy source [1]. Tamarind seed is rich in protein (13.3–26.9%), fat (3.98–4.5%), calcium (1.2%), phosphorus (0.11%), and metabolic energy (3368 kcal/kg) [2,3,4]. Cassava and tamarind seeds are potential ingredients for chicken feed that can be used economically. However, the anti-nutrient properties of tamarind seed, particularly trypsin inhibitors, phytic acid, and tannins, as well as the indigestible nature of its polysaccharide, make it difficult for broiler chicks to use. These properties also inhibit enzymatic activity and reduce the amount of nutrients available. Additionally, cassava has a high content of insoluble fiber, which poultry find difficult to digest [5]. Numerous experiments have been conducted to lessen the harmful effects of cassava and tamarind seeds, but the outcomes have been inconsistent.

The use of xylanase supplementation in broiler diet formulation has become essential because of its capacity to reduce the anti-nutritional effects of non-starch polysaccharides (NSP) in cereal grains and raise AMEn levels [6]. Poultry growth performance is influenced by the feed form and feed ingredients given [7,8]. Pelletizing increases feed intake, enhances weight gain improves FCR, and reduces feed waste [9,10,11]. Additionally, mash provided some benefits for broiler chicks given insoluble fibre [12, 13].

Supplementing with enzymes combined with the appropriate feed form can enhance the quality of the local diet. There is little evidence to support the hypothesis that xylanase enzyme, feed processing (mash and pellet), and a diet high in cereals are related. Therefore, the objective of this study was to examine the effects of xylanase supplementation on *Tamarindus indica* and cassava meal in mash and pellet form on broiler growth performance over a period of five weeks.

MATERIALS AND METHODS

Ethical statement

All experimental design and sample collection procedures complied with the Guidelines for Animal Welfare and all experimental protocols were approved by the Animal Care Committee of the University of Nusa Cendana.

Preparation of Cassava meal and Tamarind seed meal

Tamarind seeds and cassava were collected from local resources of the forest area of East Nusa Tenggara Province, Indonesia, and dried in a hot air oven at 60ºC for 24 h, and ground to be included in the experimental diets.

Bird management and dietary treatment

A total of 240 broiler chicks were distributed to 48 pens that were randomly assigned to eight treatments. Each treatment was replicated six times (5 birds per pen). The experiment method used a 2 x 2 x 2 factorial design and compared the effects of diets (15% *Tamarindus indica* vs 15% Cassava), feed processing (pelleted vs. mash), and enzyme addition (with or without enzymes) on broiler performance for broilers. The temperature was maintained at 32ºC during the first-week post hatch and gradually decreased to reach 26ºC at 2 weeks. Chickens were fed a starter diet from day 1 to 14. From d 15 to 35 chickens were fed experimental diets which were formulated iso-nitrogenous and iso-energetic to meet or exceed the requirements of the finisher period (15 to 35d) according to the [14]. Each dietary treatment was fed ad libitum to six replicate pens. Compositions of experimental diets are shown in Table 1.

TABLE 1: The composition and calculated analysis of the experimental diets containing tamarind seed meal and cassava meal during the grower to finisher period (15-35d).

Ingredients (%)	Treatment	
	Cassava meal	Tamarind seed meal
Corn	46.5	46.2
Soybean meal	22.31	23
Fish meal	6.5	6.08
Rice bran	4.66	5.6
Tamarind seed meal	0	15
Dried cassava meal	15	0
Vegetable oil	2.1	1.15
Lysine-L 78.8%	0.1	0.1
DL-Met	0.21	0.25
Salt	0.22	0.22
Dicalcium phosphate	1	1
Limestone	0.9	0.9
Premix	0.5	0.5
Calculated analysis		
EM (kcal/kg)	3,098	3,101
Crude Protein (%)	19.09	19.05
Methionine	0.72	0.72
Lys	1.01	1.01
Ca	0.91	0,89
Available P	0.39	0.41

Data collection

Feed consumption, average weight gain, and feed conversion ratio were measured weekly. At day 35, two birds per replicate were selected according to their average weight and slaughtered to measure the carcass weights and abdominal fat weight.

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.

RESULT AND DISCUSIION

The effects of diets, enzymes, feed form, and the interaction between diet, enzyme, and feed form on the parameter measured are shown in Table 2.

TABLE 2: Effect of dietary incorporation of tamarind seed meal and cassava meal on broiler performance during the finisher period (14-35 d).

Factor	Parameter measured					
	Feed consumption (g/b/d)	**Weight gain (g/b/d)**	**Feed conversion ratio**	**Final weight (g)**	**Carcass yield (%)**	**Abdominal fat (%)**
Feed						
15% Tamarind (T)	167.45^{a}	67.04^{a}	2.50^{a}	1407.88^{a}	1019.17^{a}	0.97^{a}
15% Cassava (C)	177.35^{b}	78.88^{b}	2.25^{b}	1660.58^{b}	1169.86^{b}	2.04^{b}
SEM	5.75	8,65	0.02	20.05	22.47	0.02
P-value	0.001	0.001	0.0001	0.077	0.0001	<0.001
Enzyme						
Without (E0)	158.09	68.04	2.32	1428.24^{a}	975.06^{a}	0.89^{a}
With (E1)	160.01	74.33	2.15	1562.24^{b}	1047.81^{b}	1.63^{b}
SEM	14.02	6.47	0.05	11.45	10.05	0.001
P-value	0.277	0.07	0.046	<0.0005	0.001	0.0001
Feed form						
Pellet (P)	172.44	80.13	2.15	1683.77^{a}	1178.01^{a}	2.02
Mash (M)	165.35	76.49	2.16	1607.03^{b}	1100.42^{b}	1.98
SEM	9.01	4.76	0.237	23.44	35.77	0.32
P-value	0.051	0.074	0.113	<0.0001	0.0001	0.21
Interaction						
T x E0 x P	160.79	74.21^{a}	2.17	1586.52^{a}	1035.77^{a}	0.98^{a}
T x E0 x M	162.04	70.04^{a}	2.31	1478.92^{a}	978.99^{b}	0.94^{a}
T x E1 x P	164.77	77.65^{b}	2.12	1650.72^{b}	1024.56^{a}	0.98^{a}
T x E1 x M	163.98	71.22^{a}	2.30	1500.22^{a}	1015.45^{a}	1.04^{a}
C x E0 x P	168.91	78.66^{b}	2.15	1662.91^{b}	1130.11^{c}	2.24^{b}
C x E0 x M	167.44	73.21^{a}	2.29	1540.24^{a}	1010.47^{a}	2.27^{b}
C x E1 x P	175.67	78.06^{b}	2.25	1640.33^{b}	1100.78^{c}	2.34^{b}
C x E1 x M	174.89	72.45^{a}	2.41	1522.88^{a}	1028.66^{a}	1.99^{a}
SEM	15.85	5.78	0.56	15.56	24.76	0.04
P-value	0.047	0.0003	0.145	0.0023	0.0002	0.0001

SEM= standard error means.
Values are means ± SEM.
Values followed by the same superscripts in each parameter are not significantly different at the 5% level.

Chickens fed cassava meal supplemented with an enzyme in pellet form were significantly (P<0.05) heavier, consumed more, and were more efficient in converting feed into body weight than tamarind seed meal. The greatest carcass weight was also observed with cassava treatment (P≤0.01). However, the abdominal fat of chickens fed tamarind seed meal was significantly (P<0,05) lower than those fed cassava meal irrespective of feed form or xylanase supplementation. Overall, the mash diets produced a lower response than the pellet diets. Chickens fed pelleted vs. mash diets either tamarind or cassava-based diets had significantly (P<0.05) higher daily weight gain, final weight, and higher carcass yield.

The current study shows that diets containing cassava meal were reportedly utilized for growth more effectively than diets containing tamarind seed meal.

In general, tamarind diets are less digestible than cassava starch, and cassava also has a higher amount of amylopectin. Tamarind seed meal is lower in protein and requires enzyme supplementation to meet the growth requirement of the broiler. The significant (P<0.05) interaction between feed form and enzyme supplementation for final weight was due to a significantly greater weight gain on pellet diets supplemented with enzymes than on mash diets. Pelleting could improve texture and reduce the dustiness of cassava and tamarind seed meal. This result generally agrees with studies by some researchers that show that pelleting improves FCR, increases feed intake, and enhances weight gain of broiler chickens [6,9,10].

Pelleting might increase feed intake of the birds, because of the faster emptying of the upper part of the gastrointestinal tract and the dysfunction of the proventriculus-gizzard complex [15].

Mash diets, on the other hand, are not as well retained in the gizzard as pellet diets [8]. As a result, mash diets pass through the small intestine quickly and have little effect on the growth of muscles or the function of the gizzard [16, 15].

The lower feed intake reported with tamarind treatments may be due to their tannin content. Tamarind seeds were poorly utilized by broiler chicks. A high tannin content reduced nutritional availability and impeded enzymatic activity. However, [3], found that fermenting dietary tamarind seeds lessened the adverse effects of tannin, and as a result, broiler performance improved.

Furthermore, tamarind feeding combined with boiling treatment has been demonstrated by [17] to enhance gastric and salivary secretions, which support digestion and subsequently growth performance. In the current study, xylanase did not improve the nutritive value of tamarind seed diets. The main factors responsible for the poor utilization of tamarind seed may be the indigestible polysaccharide, the tannin content of tamarind seed, and the potential presence of toxins. On the other hand, as compared to a diet based on cassava meal, tamarind seed meal considerably decreased the abdominal fat of broiler chickens. This could be due to tamarind seed meal having a high fiber content, it may have inhibited lipid synthesis in the liver and abdominal tissue, which has resulted in a decrease in abdominal fat. Increasing levels of fiber caused a large decrease in ME intake. The result of the current study did not agree with the findings of [17] that broiler-fed 10% tamarind seed meal did not reduce abdominal fat content. This may be related to the decrease in energy intake, and hence reduced energy available for fat deposition.

The results of the current study demonstrate that broilers, regardless of feed type, react favorably to xylanase added to their diet. Regardless of the feed form, the broiler chickens' final weight, FCR, carcass weight, and abdominal fat were all considerably ($P<0.05$) improved when the enzyme xylanase was added to the diet. According to the current study, adding xylanase to the diet had an impact on either tamarind or cassava, suggesting that broilers use feed more efficiently to compensate for the decreased calorie content of bulky feed.

The digestibility of starch was significantly improved due to enzyme supplementation of the diets based on cassava pellets. This may be due to the fact addition of enzymes has improved the digestibility and absorption of nutrients. This is in agreement with the report of [6] which found a beneficial effect of enzymes in cassava base diets fed to broiler chickens.

CONCLUSION

The digestibility of starch was significantly improved due to enzyme supplementation of the diets based on cassava pellets. This may be due to the fact addition of enzymes has improved the digestibility and absorption of nutrients. This is in agreement with the report of Masey-O'Neill et al. (2014) which found a beneficial effect of enzymes in cassava base diets fed to broiler chickens.

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