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Enzyme Supplementation of Commercial Feed Diluted with Copra Meal for Growing Pullets

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TWO hundred 42 days old Shaver Star-cross pullets were subjected to five dietary treatments comprising of a commercial pullet feed alone and commercial pullet feed diluted with two levels of copra meal (CM) at two levels (200 and 300g/kg) with or without Challenzyme. Data were collected on growth performance (feed intake, weight gain and feed conversion ratio) fora period of 84 days (42-126 days). Results showed no significant difference between supplemented and control groups in growth performance across the dietary treatments at ($P > 0.05$). Cost of the kg feed was linearly reduced on the dilution diets but feed cost per unit live weight gain was not different among the treatments ($P > 0.05$). In conclusion, diluting commercial feed with CM up to 300g/kg does not compromise pullet performance during the growing period. These findings will reduce cost of pullet rearing and add value to copra meal in coconut producing regions. There is need for more research into higher rates of dilution, composition of basal diet, enzyme source and inclusion level.

Keywords: Alternative Ingredients, Complex structure, Commercial additive, Poultry performance.

Introduction

Soybean, meat and bone meal and fish meal are four traditional protein sources used in the poultry industry. However, they are increasingly becoming unavailable and expensive; thus the need to investigate into alternative sources that are available and cheap. Copra meal (CM) is available at competitive prices in tropical copra producing countries including those in the South Pacific regions. Its oil content varies from 65 to 72 percent [1], and has moderate amount of protein (19.6-24.9%) [2- 4]. Utilization of CM is limited by poor palatability [5], high fibre content [6-8], poor essential amino acid profile [5, 9, 10], and physicochemical properties, including high water holding capacity [5, 11]. The fibre in copra meal is primarily in the form of non-starch polysaccharides: β-mannans, galactomannans, arabinoxylogalactans and cellulose [12] which exert anti-nutritional properties and depressed nutrient absorption from CM-based diets[5]. Copra meal has been included in poultry diets with varying levels of success depending on the species, age, and class of poultry and composition of basal diet. In broiler chickens, [13] recommended 5 and 17.5% CM inclusion in diets for 7-21 and 21-42 days old broiler chickens, respectively. On the other hand, Sundu et al. [14] reported depressed performance of 1-14 days old broiler chicks above 10% CM inclusion level. Egg-type birds seem to tolerate higher levels of CM than meat-type birds. Some authors[11, 15] observed that at enzyme supplementation is no required at 20% CM inclusion level to maintain performance of laying hens.

Several feed technologies including enzyme supplementation [5,15], amino acids [15, 16, 17, 18], physical modification (pelleting, crumbling,

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and soaking) [19] and dilution of commercial feed [16,20]are found to improve the feeding value of CMin poultry. In an earlier study, Pandi [20] found no adverse effect of diluting commercial feed with 200 g/kg CM on village broilers grown to 53 days. However, studies on diet dilution and enzyme supplementation in growing egg-type pullets are still limited. The potential of diluting commercial pullet feed with CM and exogenous feed enzyme supplementationwas investigated. Hypothesis:

(i). Dilution of commercial feed with CMwill maintain the growth performance of egg-type pullets from 43 – 126 days, and

(ii). Challenzyme supplementation will beneficially affect utilisation of the diluted feed.

Materials and Methods

The study was carried out at the Poultry Unit of the Vanuatu Agriculture College Livestock-Based Integrated Farm in Luganville, Santo. Copra meal is readily available in Vanuatu with the annual production figure estimated at about 6,000 tonnes (Quigley [21]. The Animal Ethics Committee of the University of the South Pacific approved the experimental v protocol.

Experimental diets and treatments

A wheat-soybean based commercial pullet feed was purchased from the Pacific for the experiment. Five diets consisting of the commercial pullet feed alone and the commercial feed diluted with two levels (20 and 30%) of CM with or without enzyme. Full analysis of experimental feeds could not be provided due to lack of analytical facilities in Vanuatu and difficulties to send samples overseas. The commercial diet contained protein 190g/kg, fat50 g/kg, fibre 42 g/kg and ash 55 g/kg. The experimental CM was analysed in our previous experiment to containcrude protein 211 g/kg, crude fibre 164 g/kg, total NSP 523 g/kg, lysine 4.7 g/kg and methionine 2.9 g/kg. Challenzyme 1309A, a complex enzyme manufactured by Beijing Challenge in China was used for the experiment. Challenzyme 1309A has the following eight enzyme activities (U/g): *β*-glucannase 800, xylanase 15,000, β-mannanase 100, *α*-galactosidase 100, proteases 800, amylase 500, pectinase 500, and cellulase 300.

Experimental birds and management

Two hundred Shaver Start-cross DOC 42-day old pullets, purchased from the Bromely Park Hatchery Ltd in New Zealand were used for the experiment. The pullets were weighed and assignedto 20 floor pens of similar weight (349.7 ± 10.2 g). The birds were stocked at a density of 4 birds/m^2 with wood shavings as litter material. Each of the 5 diets was fed to birds in 4replicate pens in a completely randomised design. Water and feed were provided *ad libitum* during the experimental period. The lighting programme consisted of 24 hours light, a measure against predators (rats and feral cats) in the study area. The experiment lasted 84 days (42-126 s).

Data collection and analysis

Data were collected including feed intake (FI), body weight gain (BWG) and feed conversion ratio (FCR). FI was calculated as the difference between fed offered and the left over.The birds were individually weighed at the start and end of the experiment and weight gain calculated by difference to obtain body weight gain (BWG). Feed conversion ratio (FCR) was calculated per pen as the ratio of feed consumed to weight gained over the experimental period.

Growth data were treated to Analysis of Variance (ANOVA) using the General Liner Models (GLM) procedures of the Minitab 18 Statistical Software (Minitab Inc, USA). Pen was the experimental unit for feed intake and feed conversion ratio while weight gain was taken on individual birds. Treatments means were compared using the Tukey pairwise comparison test and significant differences reported at 5% probability level.

Results and Discussions

Growth performance

Results of pullet growth performance presented in Table 1 showed no significant effect between groups onFI, BWG and FCR ($P > 0.05$). No mortality was recorded during the entire course of the experiment. These results agree with those of [21], who reported that enzyme supplementation is not required at 20% inclusion level by Shaver Brown pullets grown to 126 d old. On the contrary, Diarra et al. [11] observed higher FI at 20% CM supplemented with enzyme than commercial feed in 56 to 132 d old growing pullets. The authors attributed the higher intake of the enzyme supplemented diet to low nutrient density and increased enzymatic hydrolysis. Compared to broiler chickens, egg-type birds may tolerate higher levels of CM due to their lower nutrient requirements. The higher FIof CM-based diets can be attributed to faster feed passage in the gastro-intestinal tract (GIT) [11, 15,17]. Mateos et al. [23] suggested that fibre improves GIT development and FI at onset of egg production. Feed intake was linearly increased from 10 to 40% CM in White Leghorn pullets [23]. In another study, Diarra et al. [18] reported higher intake of commercial feed compared to 15% CM in cassava copra meal-based diets in Shaver 579 pullets. The authors attributed the lower intake of cassava-CM based diet to longer transit time of fibrous diet in the GIT. The similarity in weight gain might be attributed to the lower nutrient requirement of egg-type birds which may explain their ability to tolerate higher levels of CM than broiler chickens. Contrary to these resultsDiarra et al. [15] found higher BWG on commercial feed compared test diets based on cassava CM. In contrast, Diarra et al. [11] reported that 20% CM inclusion depressed BWG in egg-type birds but supplementation with Challenzyme restoredweight gain. Wignjosoesastro et al. [24] alsoreported depressed weightgain when CM level was increased from 10 to 40% inclusion in White Leghorn pullets. The poorer weight gain may be due to difficulties in breaking CM fibre by younger birds as earlier observed by [11]. These findings suggest that the composition of the basal diet and age of birds are important factors in the utilisation of CM by poultry. Several authors [11, 15, 18, 23]also reported the ability of egg-types birds to tolerate higher levels of CM in the diet.

Contrary to our findings, Diarra et al. [11, 18] reported poor efficiency of feed utilization in pullets fed 20% CM and attributed this to the poor ability of young birds to digest CM fibre. The authors fed CM in cassava based diets compared to wheat-soybean based commercial diets in the present study. The effect of diet composition on the utilisation of CM by poultry is documented by Devi and Diarra [4].

Feed cost of growth

The cost of kg feed was linearly reduced with dilution (Table 2). Dietary treatments did not affect feed cost per kg weight gain ($P > 0.05$). Both cost per kg feed and feed cost per unit gain among the treatments did not differ. However, there was numerical increase in the feed intake of CM-based diets. The numerical increase may be attributed the slightly lower cost of the test diets compared to the control. In contrast to this study, the higher cost of rearing pullets on the commercial feed compared to CM-based diets reported by Diarra et al. [18] may be attributed increased FI and higher cost of the former feed compared to the latter.

TABLE 1. Average growth performance of pullets fed commercial grower feed alone or diluted with copra meal with and without enzyme.

Variables	Treatments (%)					SEM	P-value
	Control	CM no enzyme		CM with enzyme			
		20	30	20	30		
FI (g/bird)	5484	5828	6086	6050	5821	260	0.564
BWG (g/ bird)	1250.6	1186.1	1168.2	1193.7	1194.0	21.72	0.204
Feed: gain	4.38	4.93	5.12	5.07	4.88	0.22	0.215

CM: copra meal; SEM: standard error of mean; FI: feed intake; BWG: body weight gain.

TABLE.2. Feed cost of growth in pullets fed commercial grower feed alone or diluted with copra meal with and without enzyme.

Variables	Treatments					SEM	P Value
	Control	CM no enzyme		CM with enzyme			
		20	30	20	30		
Cost of kg feed (US$)	0.99	0.88	0.82	0.88	0.82	0.00	NA
Feed cost (US$/kg BWG)	4.34	4.33	4.28	4.45	4.01	0.19	0.671

CM: copra meal; SEM: standard error of mean; NA: not analysed; BWG: body weight gain.

Conclusions

Based on the results of this study, commercial pullet grower feed can be diluted with CM (on protein basis) up to 30% level without marked effects on growth performance. Enzyme supplementation may not be required at this level of dilution. Research is needed into higher levels of dilution and supplementation with different enzyme sources and concentrations that would maintain pullet performance and reduce cost of growth.

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Conflict of interest statement

Authors declare no conflict of interest.

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