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Influence of Dietary Fermented Tapioca By-Products on the Performance of Broilers and Ducklings

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Abstract: An experiment was conducted to determine the effects of substitution of *Bacillus amyloliquefaciens* fermented tapioca by-products for some of corn meal in the diets on the performance of broilers and ducklings. 200 unsexed day old broiler chicks and 200 male day old ducklings were randomly allocated into 40 pens (teen chicks or duckling/pen). This experiment was arranged in a completely randomized design with five dietary treatments (0, 10,20, 30 and 40% for broilers and 0, 30, 40, 50 and 60% for ducklings) of fermented by-product tapioca in diets and four replications. Measured variables were those of feed consumption, average body weight gain, feed conversion and carcass percentage. Results of experiment indicated that feed consumption, average body weight gain, feed conversion and carcass percentage were not affected ($p>0.05$) by levels of *Bacillus amyloliquefaciens* fermented tapioca by-products in the diets for broilers. However average body weight gain was affected ($p<0.05$) and feed conversion were highly affected ($p<0.01$) by levels of *Bacillus amyloliquefaciens* fermented tapioca by-products in the diets for ducklings. Increasing levels of *Bacillus amyloliquefaciens* by products of tapioca up to 60% in diets of ducklings increased their body weight gain and reduced their feed conversion. In conclusion, *Bacillus amyloliquefaciens*- fermented tapioca by-products can be included up to 40% in diets (replace 67% corn meal) for broilers and up to 60% in diets for ducklings (replace 100% corn meal).

Key words: Fermented tapioca by-products, *Bacillus amyloliquefaciens*, corn meal, broilers, ducklings

INTRODUCTION

The most important factors militating against increased commercial poultry in developing countries are high cost and scarcity of feed (Atteh *et al*., 1995). The high cost of feed is due to the competition between man and livestock for grains. Grains, especially corn meal constitute about 50-65% of compounded poultry feed. Research efforts are presently looking into alternatives to cereal grains that will be cheap and readily available. One of such alternative is tapioca by-products a waste product of tapioca. The militating problem affecting the utilization of tapioca by-products in chicken diet is the high fibre content. The use of fermentation procedures to improve the nutritive value utilization of fibrous feeds types as well as the generation of high protein by fermentation has been reported (Cantner, 1995; Rajagopal, 1977).

Bacillus amyloliquefaciens is one of the potent bacteria having capacity to produce enzymes viz. alfa-amilases, cellulases, beta glucanases, metalloproteases and serin proteases enzymes. The cellulase enzymes produced by *B. amyloliquefaciens* are most stable under acidic conditions that approximate the proventriculus (Wizna *et al*., 2007a). The nutritional value of the fermented of by-product tapioca with *B. amyloliquefaciens* for 6 days and 2% inoculum based on dry-substance as follows: 7.90% crude protein content, 2.75% crude fat content, 11.55% crude fiber content, 0.20% Ca, 0.16% P, ME 2190 kcal/kg (Wizna *et al*., 2008b).

Feeding broilers with diets containing sago ampullar (*Metroxylon sago* rottb) and rumen content mixture cultured with *B.amyloliquefaciens* significantly improved growth and feed utilization in broilers by increasing the availability of nutrients (Wizna, *et al*., 2007b). Hence, an attempt was made to study the effect of direct-feeding of *B. amyloliquefaciens* Fermented Tapioca By-product (FTB) on broiler and duckling performance.

MATERIALS AND METHODS

Dry tapioca by-product were milled through a screen size of 3.5 mm in an hammer mill. The milled by-product tapioca was mixed with water to form slurry. The slurry was placed in plastic buckets and sealed to ensure air-tight system for 6 days, 40°C and 2% inoculum, after which it was removed and sun dried, bagged, ready for use.

Unsexed "Arbor Acress" broilers and local ducklings (200), day old were used for this experiment. The birds were randomly allotted to 5 dietary treatments (Table 1 and 2) on weight equalization.

Tabel 1: Feed formulation, nutrient content and metabolizable energy of experimental diets to broilers (%)

	Experimental diets				
Feed Stuff	D1(0)	D2(10)	D3(20)	D4(30)	D5(40)
Corn meal	60.00	50.00	40.00	30.00	20.00
Rice bran	08.50	06.50	03.50	01.00	00.00
Soybean meal	09.00	10.00	11.00	12.00	09.00
Fish meal	22.00	22.00	22.00	22.00	24.50
Coconut oil	00.00	01.00	03.00	04.50	06.00
FTB	00.00	10.00	20.00	30.00	40.00
Top Mix	00.50	00.50	00.50	00.50	00.50
Total	100.00	100.00	100.00	100.00	100.00
Crude protein (%)	22.11	22.14	22.08	22.057	22.05
Crude fat (%)	03.49	04.06	05.52	06.53	07.74
Crude fiber (%)	05.23	05.57	05.75	06.01	06.31
Calcium (%)	01.14	01.12	01.09	01.07	01.09
Phosphor total (%)	00.39	00.39	00.40	00.39	00.41
Metabolizable energy (kca kg^{-1})	3040	3000	3030	3026	3033

Tabel 2: Feed formulation, nutrient content and metabolizable energy of experimental diets to duckling (%)

	Experimental diets				
Feed Stuff	D1(0)	D2(30)	D3(40)	D4(50)	D5(60)
Corn meal	60.00	30.00	20.00	10.00	00.00
Rice bran	10.50	05.00	03.00	00.00	00.00
Soybean meal	08.00	09.00	10.00	11.00	06.00
Fish meal	20.00	20.00	20.00	20.00	24.00
Coconut oil	00.00	05.50	06.50	08.50	09.50
FTB	00.00	30.00	40.00	50.00	60.00
Top Mix	00.50	00.50	00.50	00.50	00.50
Total	100.00	100.00	100.00	100.00	100.00
Crude protein (%)	20.73	20.07	20.10	20.03	20.00
Crude fat (%)	04.62	07.86	08.44	09.90	10.73
Crude fiber (%)	05.41	06.36	06.69	06.90	07.23
Calcium (%)	01.07	00.99	00.97	00.94	01.00
Phosphor total (%)	00.37	00.36	00.36	00.36	00.40
Metabolizable energy (kca kg^{-1})	3074	3048	3009	3039	3021

Each treatment was replicated 4 times with 10 birds each. Diet 1 was the corn meal based control while diets 2, 3, 4 and 5 were the test diets in which 0, 10, 20, 30 and 40 FTB to broiler and 0, 30, 40, 50 and 60 FTB to duckling quantitavely replaced corn meal of the total diet. The diets were fed ad lib for 28 days during which time feed intake, weight gain and carcass percentage were recorded.

Data collected were subjected to analysis of variance using the model for completing randomized design, significant treatment means were partitioned using the Duncan's Multiple Range Test (Steel and Torne, 1980).

RESULTS

The effect of dietary inclusion of Fermented Tapioca By-product (FTB) on the performance of broiler on similar diets are shown in Table 3. Statistical analysis of feed intake, weight gain and carcass percentage, irrespective of duration of by-product tapioca fermentation was not significantly ($p>0.05$) affected during the trials to broilers. Also no significant effects from replacing corn meal by FTB on feed consumption and carcass percentage data of these diets to ducklings (Table 4). A increase ($p<.05$) in mean body weight gain was observed for all treatment diets, but decrease ($p<.01$) in mean feed conversion was observed for all treatment diets to ducklings.

DISCUSSION

The broilers performance of 40 percent FTB fed group was not significantly ($p<0.05$) than control FTB fed group. This happened because of increased glucose content which was the hydrolysis product of cellulose from tapioca by-products by the cellulase of *Bacillus amyloliquefaciens* during digestion in gastrointestinal and later the glucose was counted as metabolic energy. In accordance with Geharzt (1990) who stated that cellulase was actually an enzyme complex that worked gradually or simultaneously breaking down cellulose into glucose unit. Wizna *et al.* (2008a) added that fermentation of sago pith and rumen content mixture by *Bacillus amyloliquefaciens* was able to reduce crude fiber content by 33% with the treatment of 2% inoculum dose, 9 day fermentation time and temperature 40°C.

The duckling body weight of 50 and 60 percent FTB fed group was significantly ($p<0.05$) higher than control, 30 and 40 percent FTB fed group. This finding is in agreement with earlier reports of Chah *et al.* (1975) who reported that chicks received diets containing soybeans cultured with desirable *Aspergilli* significantly improved the growth rate. This may be due to higher levels and digestibility of threonine, lysine, leucine and methionine as a result of fermentation. The increased digestibility is may be due to positive influence of fermented diet on gastrointestinal health by lowered gastric pH, increased level of short chain fatty acids, reduced pathogenic microbial activity and improved mucosal architecture (Scholten *et al.*, 1999). Wizna *et al.* (2007a) who reported that the cellulase activity of *B. amyloliquefaciens* were 1.200 unit ml^{-1} to C1 (b-exoglucanase) and 0.488 unit ml^{-1} to Cx (b-endoglucanase). The biological value of animal protein (single cell protein) is higher than that of corn meal protein, apparent protein digestibilities for fermented products were higher than that for not fermented and FTB contains spora of *Bacillus amyloliquefaciens* substances which are produce enzymes alfa-amylase, alfa acetolactate decarboxylase, beta glucanase, hemicellulose, maltogenic amylase, protease dan xylanase causing growth increase (Luizmera, 2005 and Wizna, 2008b). *Bacillus amyloliquefaciens* FZB42 also contain antifungal: lipopeptida, surfactin, fengycin and bacillomycin D; antibacterial: polyketide bacillaene which are produce enzymes alfa-amylase, beta glucanase, metalloprotease and serin protease substances which are responsible for increasing the activities digestibility of some fed ingredients (Koumoutsi *et al.*, 2004).

Tabel 3: Effects of experimental diets on the performance of broilers during 4 weeks experiment

	Experimental Diets*					
Performance	D1(0)	D2(10)	D3(20)	D4(30)	D5(40)	SE**
Feed intake (g/head)	2294.30	2308.92	2313.39	2326.62	2224.20	23.37
Weight gain (g/head)	1227.92	1233.50	1239.78	1242.58	1200.08	9.84
Feed conversion ratio	1.87	1.88	1.87	1.87	1.87	0.02
Carcass percentage	69.93	69.95	70.02	70.07	69.92	0.23

*Mean with at the same row indicated not significantly difference (p>0.05), **Standard error of the mean.

Tabel 4: Effects of experimental diets on the performance of ducklings during 4 weeks experiment

	Experimental Diets					
Performance	D1(0)	D2(30)	D3(40)	D4(50)	D5(60)	SE*
Feed intake (g/head)	2168	2216	2143	2124	2094	16.980
Weight gain (g/head)	610.60^{a}	626.60^{a}	633.90^{a}	686.60^{b}	684.30^{b}	17.280
Feed conversion ratio	3.55^{a}	3.54^{a}	3.33^{ab}	3.09^{b}	3.06^{b}	0.016
Carcass percentage	61.96	62.41	61.86	62.10	62.05	0.373

^{a,b}Mean in the same column followed by different letter are significantly different (p<0.05), *Standard error of the mean

Conclusion: In conclusion, *B. amyloliquefaciens* fermented tapioca by-products can be included up to 40% in diets (replace 67% corn meal) for broilers and up to 60% in diets for ducklings (replace 100% corn meal).

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