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Influence of Exogenous Microbial Enzyme Supplements in Layer Breeder Diets Containing Cassava Pulp

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Abstract: An experiment was conducted to examine the benefits of using cassava pulp in layer breeder diet. Six hundred and eight female and sixty four male Hisex Layer Breeders at 22 weeks of age were distributed into four different diets (a Control, Control+enzyme, Cassava pulp and Cassava pulp+enzyme). Inclusion of 10% cassava pulp and exogenous enzyme (Catazyme-P®) did not significantly affect egg production during the period of assessment (23-37 weeks of age). There were no apparent effects of treatment diet on egg quality, except yolk color score which tended to decrease when cassava pulp was added into the diet. Cassava pulp and enzyme supplementation did not significantly affect fertility and hatchability. However, enzyme supplementation marginally improved the hatchability of fertile eggs. From the results of this experiment, cassava pulp can be included at 10% in diets for breeding layer chickens.

Key words: Cassava pulp, enzyme, layers

INTRODUCTION

In a recent study cassava pulp (CSP) was identified as an alternative ingredient to maize at rates of up to 15% without a negative effect on performance and egg production in commercial layer hens (Chauynarong *et al*., 2010). Moreover, Chauynarong *et al*. (2010) also reported that this level of CSP supported the highest hen-day production, 91.7%, at peak production. Many researchers also have supported the use of exogenous enzymes in improving the digestibility of more fibrous cereals like wheat, rye and barley (Almirall *et al*., 1995; Persia *et al*., 2002; Scott *et al*., 2003; He *et al*., 2003). Thus, the present study will focus on the benefits of supplementing diets containing high levels of CSP with microbial enzymes, when fed to breeder layer hens.

MATERIALS AND METHODS

Experimental birds and diets: Six hundred and eight female and sixty four male Hisex Layer Breeders were used in this study. Birds were divided into 4 treatment groups of four replicates each. Each replicate contained 4 males and 38 females in one colony cage. Each group was randomly fed 2 levels of CSP (Table 1) and with or without supplementation of enzyme (Catazyme-P®). Birds were given layer feeds from 22 to 35 weeks of age and data collection start at 23 weeks of age. The birds were fed an amount of the diets sufficient to supply the recommended daily protein intake of Hisex layer breeder (105 g/bird/day). The recommended lighting management for Hisex Brown layer breeder during the pre-lay and lay stages was followed. The disease and

Table 1: Nutrient composition of diets fed during 22-35 weeks of age

	DCPL (%)	
Ingredient (%)	0	10
Maize	44	28
Cassava	5	5
Rice bran oil	2	5.5
Broken-milled rice	10	10
Soybean meal	25	27.5
Meat and bone meal	5	5
Cassava Pulp	0	10
DL-Methionine	0.2	0.2
Monodicalcium Phosphate	0.15	0.15
Calcium carbonate	8.2	8.2
Common Salt	0.25	0.25
Premix[1]	0.35	0.35
Total Batch	100	100
Nutrient composition (g/kg)		
ME (kcal/kg)	2840	2845
Crude Protein	17.8	17.8
Fat	4.37	7.34
Fiber	3.13	4.2
Calcium	3.76	3.76
Available P for poultry	0.38	0.37
Lysine	0.93	0.96
Met+Cys	0.70	0.68
Methionine	0.48	0.47
Threonine	0.67	0.67

[1]Supplying vitamin A, 4.8 million units/kg; vitamin D_3, 0.96 million units/kg; vitamin E, 3, 200 units/kg; vitamin K_3, 0.8 g/kg; vitamin B_1, 0.4 g/kg; vitamin B_2, 1.6 g/kg; vitamin B_6, 1.2 g/kg; vitamin B_{12}, 0.004 g/kg; Folic acid, 0.2 g/kg; Niacin, 6.0 g/kg; pantothenic acid, 4.0 g/kg; biotin, 0.012 g/kg; manganese, 24.0 g/kg; iron, 16.0 g/kg; zinc, 16.0 g/kg; copper, 2.4 g/kg; iodine, 0.14 g/kg; selenium, 0.028 g/kg and an anti-caking + antimold + antioxidant, 0.1868 g/kg. DCPL: Dietary cassava pulp level.

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parasite prevention and control programmes were followed according to the management guide.

Catazyme-P® composition: α-amylase, Protease, Xylanase, Cellulase, α-amylase, β- glucanase, Phytase.

Measurements: Body weight was recorded at the start (approximately 1800 g/bird). The total number of eggs, cracked eggs and dead birds were recorded on a daily basis. Feed intake was measured on a weekly basis and converted to daily values. Percent hen-housed egg production, egg weight, egg breakage and mortality rate were calculated on a weekly basis. Egg quality parameters were measured at 50% and peak production. About 50% of total eggs per replicate were sampled to measure egg weight, shell thickness, albumen height, Haugh unit and yolk colour. Three pieces of the eggshell were taken for measurement of shell thickness, using a micrometer screw-gauge (Model SM-112, Teclock, Tokyo, Japan), accurate to 0.001 mm. The Haugh Unit (HU) values were calculated using the formula:

$$HU = 100 \log (H-1.7W^{0.37}+7.6)$$

where, HU is Haugh unit, H is observed height of the albumen in millimeters and W is weight of egg in grams (Doyon *et al*., 1986). Yolk colour was measured using a Hoffmann-La Roche Fan (Hoffmann-La Roche, Inc., Nutley, NJ, USA). Percent of fertile egg and hatchability were recorded at 25, 30 and 35 weeks of age. Fertility was determined by candling after 18 days of incubation. Fertility and hatchability were calculated as follows:

$$\text{Fertiliy (\%)} = \frac{\text{No. of fertile eggs}}{\text{Total eggs}} \times 100$$

$$\text{Hatchability of fertile eggs (\%)} = \frac{\text{No. of live chicks}}{\text{No. of fertile eggs}} \times 100$$

$$\text{Hatchability of Total eggs (\%)} = \frac{\text{No. of live chicks}}{\text{Total eggs}} \times 100$$

Data analysis and reporting: The data were summarized on a weekly basis. Analyses were conducted using the Minitab statistical package (Minitab, 1998). Data collected were analyzed following the general linear model. All statistics presented in this study were mean values with standard errors and differences between means were determined by Least Significant Difference (LSD). Differences between mean values were considered to be significant at $P \leq 0.05$.

RESULTS

Egg production: Initially, birds on CSP diet tended to have a better egg production than those on the other diet

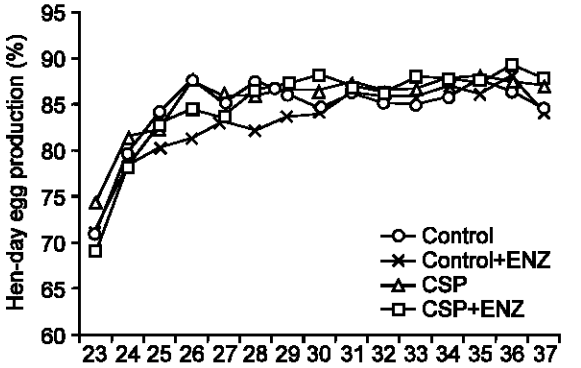

Fig. 1: Hen-day egg production (%) over the entire period (23-37 weeks)

but there was no significant difference between the treatments. Inclusion of 10% CSP in diet and using exogenous enzyme did not significantly affect egg production during the entire period (23-37 weeks of age). Hen-day production was lowest on the CSP+ENZ diet initially but by the end of the trial hen-day production in this group was the highest, at 87.8% (Fig. 1).

Egg qualities: Egg quality values from 25 and 31 weeks of age are shown in Table 2. Egg weight did not differ significantly with diet at any age. At 25 weeks the average egg weight was between 57.4 and 58.3 g and 58.5-59.2 g at 31 weeks. At 31 weeks, inclusion of CSP in diet significantly decreased yolk color score from approximately 8 to 7. Yolk weight at 25 and 31 weeks ranged between 13.4 and 13.6 g and 15.3 and 15.4 g, respectively; however, these were not significantly affected by CSP or enzyme supplementation. There were no apparent effects of treatment on shell weight and thickness. At 25 weeks, albumen weight ranged between 38.1 and 38.9 g. A similar trend was evident in the Haugh unit score; however, the highest Haugh unit score at 31 weeks, was 75.3 which was observed on the CSP+ENZ diet, while the lowest was 73.5 on the CSP diet.

Hatchability: Cassava pulp and enzyme supplementation did not significantly affect fertility and hatchability (Table 3). Enzyme supplementation of the CSP diet tended to increase fertility from 89.9 to 90.6% at 25wks and 90.7-93.7% at 30 wks, however this was not consistent at 36 wks. Enzyme supplementation marginally improved hatchability of fertile eggs at all periods of data collection. The highest hatchability of all eggs collected at 25 wks (87.2%) was the in CSP+ENZ group. Similar results were found at 30 and 36 wks, the highest hatchability was 89.1 and 89.0%, respectively on the CSP+ENZ diet. Hatchability of all eggs at 36 wks averaged 88.8, 86.9, 89.0 and 89.0% for control, control+ENZ, CSP and CSP+ENZ, respectively.

Table 2: Egg quality of hens on different diets at 25 and 31 weeks of age

Diet	E wt. (g)	AH (mm)	YCS	Y wt. (g)	S wt. (g)	ST (mm)	A wt. (g)	HU
25 weeks								
Control	58.3	6.5	7.2	13.6	5.8	0.5	38.9	79.9
Control+ENZ	57.4	6.1	6.9	13.4	5.8	0.5	38.2	77.8
CSP	57.5	6.4	6.2	13.5	5.8	0.5	38.1	79.8
CSP+ENZ	57.8	6.3	6.7	13.6	5.8	0.5	38.3	78.9
SEM	0.82	0.24	0.69	0.23	0.15	0.03	0.70	1.54
31 weeks								
Control	59.2	5.7	7.8[a]	15.4	5.9	0.4	37.9	74.6
Control+ENZ	58.5	5.7	7.9[a]	15.3	5.8	0.4	37.4	74.4
CSP	59.0	5.6	6.7[b]	15.3	5.8	0.4	37.9	73.5
CSP+ENZ	59.1	5.9	6.7[b]	15.4	5.8	0.4	37.9	75.3
SEM	1.46	0.27	0.33	0.33	0.20	0.02	1.07	1.92

E: Egg, AH: Albumen height, YCS: Yolk colour score, Y: Yolk, S: Shell, ST: Shell thickness, A: Albumen, HU: Haugh units

Table 3: Fertility and hatchability at 25, 30 and 36 weeks of age

	Weeks		
Diet	25	30	36
Fertility (%)			
Control	86.3	94.5	94.9
Control+ENZ	89.4	92.9	91.2
CSP	89.9	90.7	93.5
CSP+ENZ	90.6	93.7	93.0
SEM	3.03	2.25	2.32
Hatchability of fertile eggs (%)			
Control	97.0	94.3	93.6
Control+ENZ	93.4	94.1	95.4
CSP	94.7	93.2	95.1
CSP+ENZ	96.2	95.1	95.6
SEM	2.32	2.26	1.13
Hatchability of all egg (%)			
Control	83.8	89.1	88.8
Control+ENZ	83.5	87.5	86.9
CSP	85.2	84.5	89.0
CSP+ENZ	87.2	89.1	89.0
SEM	2.97	3.64	1.58

DISCUSSION

The current results demonstrate that hen-day production from birds fed cassava pulp in diet is not significantly different from that on corn-based diets. This is similar to the observations by Chauynarong *et al.* (2010) that CSP can be used in commercial layer diets at up to 15% without negative effect on egg production. Moreover, enzyme supplementation marginally improved egg production at 36 and 37 weeks on CSP diets. The improvement in egg production may be due to the ability of NSP-targeting enzymes to increase nutrient digestibility. Chauynarong *et al.* (2009) reported that although CSP has low content of soluble NSP, the non-digested part (cellulose, xylose arabinose and galactonic acid) and some other anti-nutritive factors in this feed ingredient can inhibit nutrient availability and utilization by birds. Thus, the use of enzymes on such diets can improve performance as reported by Bayram *et al.* (2008) in a study on xylanase which was found to promote energy efficiency in the diet.

The data from the current trial showed that using 10% CSP or supplementation with enzyme in diet did not significantly affect egg qualities. However, yolk colour score was decreased at 31 weeks of age due to addition of 10% CSP to the diet. Similar to these observations, Chauynarong *et al.* (2010) also reported that CSP up to 30% in commercial layer diets did not significantly affect egg quality except yolk colour score that tended to decrease as the level of CSP was increased in the diet due to lack of pigments in CSP. Egg yolk colour would have not effect on fertility and hatchability, as was observed in this study.

Conclusion: It can be concluded from the present study that using 10% cassava pulp in layer breeder diet did not have any adverse effect on egg production and hatchability. Enzyme supplementation may also be beneficial in maintaining egg production in breeders on diets containing cassava pulp.

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