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EGG QUALITY INDICES OF JAPANESE QUAILS (*Coturnix coturnix japonica*) FED CASSAVA TUBER MEAL WITH AND WITHOUT ENZYME SUPPLEMENTATION

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ABSTRACT

The study examined the egg profile from laying hens fed different levels of cassava tuber meal (0, 25, and 50%) in replacement of maize with or without enzyme supplementation. One hundred and ninety-five (195) point of lay (5 weeks old) Japanese quails were used in 8 weeks feeding trial. A total of 20 eggs were collected from each treatment at week six of the experiment and randomly sampled for analysis. Data were collected on egg quality profile. Results revealed significant differences in terms of egg quality parameters between the CRM +enzyme and CRM – enzyme. Quails with CRM + enzyme demonstrated superior characteristics in terms of egg weight, egg width, albumen quality and yolk quality. The results also revealed that replacing maize with cassava tuber meal at varying levels with or without enzyme supplementation did not negatively affect the profile of quail eggs. It was concluded that CRM +enzyme can replace maize up to 50% in quail laying birds diet with a significant egg quality in production.

Keywords: Egg quality indices, Japanese quails, cassava root meal, enzyme.

Description of Problem

The rising cost of conventional feed ingredients, such as maize and soybean meal, has driven the poultry industry to explore alternative, cost-effective feed sources like cassava tuber meal (CTM). Japanese quails (*Coturnix coturnix japonica*) are increasingly popular due to their high egg production efficiency, short generation interval, and low feed requirements (1). However, cassava tuber meal contains anti-nutritional factors, such as cyanogenic glycosides, which may affect nutrient digestibility and egg quality. The inclusion of exogenous enzymes, such as xylanase, beta-glucanase, and phytase, in poultry diets has been shown to improve nutrient utilization and mitigate anti-nutritional effects, potentially enhancing egg production and quality (2).

Egg quality is a critical factor in poultry production, influencing consumer preference and market value. External egg quality traits, such as weight, length, and width, ~~determine~~ eggshell integrity and marketability, while internal quality traits, including albumen (weight, height, and length) and yolk (weight, height, diameter, and color), affects nutritional value and consumer acceptability (3). Cassava tuber meal is a cost-effective energy source for poultry, but its high fiber content and anti-nutritional factors can reduce nutrient digestibility and affect egg quality (4). Studies have shown that enzyme supplementation can improve nutrient utilization by breaking down non-starch polysaccharides and reducing digesta viscosity (2).

Materials and Methods

Experimental site

The study was conducted at the Poultry Division, National Veterinary Research Institute Vom, Jos South Local Government Area (LGA), Plateau State, Nigeria. Vom lies on longitude 8°45 East and latitude 9°48 North and has an altitude of about 1280m above sea level. The average temperature is between 19°C to 22°C, mean annual rainfall of 131.75cm to 146cm with the

highest rainfall usually recorded during the wet months of July and August. [5]

The study employed a completely randomized design (CRD) with five treatments and three replicates containing 13 quails. The treatments included: T1: Control diet (0% CTM, no enzyme), T2: 25% CTM, +0.05 enzyme, T3: 50% CTM, + 0.10 enzyme, T4: 25% CTM, no enzyme, T5:50% CTM no enzyme complex (xylanase, beta-glucanase, phytase). 195 female Japanese quails (5 weeks old) with uniform body weight for egg production were used for the experiment.

Quails were housed in galvanized-wire cages (33 × 25 × 20 cm) at 22°C with 17 hours of light daily. Feed and water were provided *ad libitum*. Egg weight (g) was measured using a digital scale and length and width (mm) was measured using a digital caliper. Albumen weight (g) was determined by separating and weighing the albumen. Height and length (mm) were measured using a digital caliper on a flat glass surface. Yolk weight (g) was measured, height and diameter (mm) were determined using a caliper, and color was assessed using the Roche yolk color fan. The experiment lasted for 56 days, with egg quality measurements taken from the last three days of each 21-day cycle. Data was analyzed using Analysis of Variance (ANOVA) in SAS software. Means was separated using Duncan's Multiple Range Test at a 5% significance level.

RESULTS

The result in table 1 indicate the external egg quality parameters of quail hens fed different dietary treatments, with significant differences observed in some treatments. Egg weight ranged from 8.84g (Group 5) to 10.20g (group 1), indicating a significant difference ($P<0.05$) among treatment groups. Eggs from Group 1 were significantly heavier than those from group 5. Egg length varied from 30.43mm (Group 4) to 32.00mm (Group 5), but with a p-value of 0.382, the differences were not statistically significant, indicating that the diets did not significantly affect the elongation of eggs. Egg width, however, showed a highly significant difference ($P= 0.007$), ranging from 23.86mm (Group 5) to 32.57mm (Group 4) had significantly wider eggs compared to the other groups.

Table 1: External quality of quail egg fed cassava tuber meal with or without enzymes

Parameters(g)	1	2	3	4	5	SEM	P-value
Egg weight	10.20^{a}	9.67^{ab}	9.82^{a}	9.68^{ab}	8.84^{b}	0.15	0.045
Egg length	30.86	31.57	31.43	30.43	32.00	0.27	0.382
Egg width	24.29^{b}	24.14^{b}	32.57^{a}	24.14^{b}	23.86^{b}	0.96	0.007

The data in Table 2 presents the albumen (egg white) quality of quail eggs fed different diets. The parameters evaluated include albumen weight, height, length, and Haugh unit-a standard measure of egg freshness and quality. Albumen weight ranged from 2.76g (Group 4) to 4.71g (Group 3), but with a p-value of 0.490, the differences were not statistically significant. Albumen height, which reflects freshness, varied from 3.00cm (Group 5) to 4.14cm (Group 3), with a p-value of 0.294, showing no significant difference ($P>0.05$) across treatments. Albumen length showed a significant difference, ranging from 19.87cm (Group 4) to 45.57cm (Group 1). Eggs from Group 1 had significantly longer albumen compared to Group 4. Haugh unit, which combines egg weight and albumen height to assess internal quality, ranged from 90.40 to 94.21. However, with p-value of 0.689, this difference was not significant.

Table 2: Albumen quality of quail egg fed cassava tuber meal with or without enzymes

Parameters	1	2	3	4	5	SEM	P-value
Albumen weight (g)	3.99	3.67	4.71	2.76	3.11	0.36	0.490
Albumen height (cm)	4.00	3.86	4.14	3.43	3.00	0.19	0.294
Albumen length (cm)	45.57^{a}	38.00^{a}	38.00^{a}	19.87^{b}	31.57^{ab}	2.53	0.012

Haugh	94.13	94.02	94.21	92.90	90.40	0.94	0.689

The results in Table 3 show the yolk quality parameters of quail eggs from hens fed different dietary treatments. Although some numerical differences are observed, none of the parameters were statistically significantly significant at the 5% level (P>0.05). Yolk weight ranged from 2.77g (Group 5) to 3.63g (Group 1), with a p-value of 0.143, showing no significant difference. Yolk height varied from 8.00cm (Group 3) to 10.86cm (Group 1), with a p-value of 0.081. Yolk diameter ranged between 21.57cm (Group 1) and 23.71cm (Group 5), but the p-value of 0.177 shows no significant difference among groups. Yolk color scores ranged from 1.00 (Group 2 and 3) to 1.71 (Group 1), with a p-value of 0.218, again showing no significant effect of diet.

Table 3: Yolk quality of quail egg fed cassava tuber meal with or without enzymes

Parameters(g)	1	2	3	4	5	SEM	P-value
Yolk weight (g)	3.63a	3.01ab	3.26ab	3.10ab	2.77b	0.11	0.143
Yolk height (cm)	10.86a	8.86ab	8.00b	10.00ab	8.71ab	0.36	0.081
Yolk diameter	21.57	23.00	23.57	22.14	23.71	0.33	0.177
Yolk color	1.71	1.00	1.00	1.43	1.29	0.11	0.218

DISCUSSION

The study on the egg quality indices of Japanese quails fed cassava tuber meal with and without enzymes provides valuable insights into how dietary treatments influence both external and internal egg quality parameters. The results indicate significant variations in some external egg quality traits, such as egg weight and egg width, while egg length showed no significant differences across treatments. Specifically, eggs from Group 1 (fed cassava tuber meal with enzymes) exhibited the highest egg weight (10.20 g) compared to Group 5 (8.84 g), with a statistically significant p-value of 0.045. This aligns with findings by (6), who reported that enzyme supplementation in cassava-based diets improved nutrient digestibility, leading to enhanced egg weight in laying hens. The significant difference in egg width, with Group 3 having the widest eggs (32.57 mm), suggests that certain dietary treatments may influence eggshell formation or nutrient allocation, potentially due to variations in calcium and protein metabolism, as noted by (7).

For internal egg quality, albumen length showed a significant difference ($p = 0.012$), with Group 1 eggs having the longest albumen (45.57 cm) compared to Group 4 (19.87 cm). This finding is consistent with studies by (8), who found that enzyme supplementation improved protein utilization, potentially affecting albumen quality in quails. However, other albumen parameters, such as weight, height, and Haugh unit, showed no significant differences ($p > 0.05$), suggesting that the dietary treatments had limited impact on albumen freshness and overall internal quality. This corroborates work by (9), who reported that Haugh unit scores in quail eggs are relatively stable across different dietary regimes, as they are more influenced by storage conditions than diet.

Yolk quality parameters, including weight, height, diameter, and color, showed no significant differences across treatments ($p > 0.05$). This lack of significance aligns with findings by (10), who noted that yolk characteristics in quails are less responsive to dietary changes compared to external egg traits, possibly due to the stable lipid content in yolk formation. However, the numerical differences observed, such as higher yolk weight in Group 1 (3.63 g) compared to Group 5 (2.77 g), suggest a potential trend that may warrant further investigation with larger sample sizes or extended feeding periods.

The inclusion of enzymes in cassava-based diets appears to enhance certain egg quality

parameters, particularly egg weight and albumen length, likely due to improved nutrient bioavailability. Cassava tuber meal, while a cost-effective alternative to conventional feed ingredients, contains anti-nutritional factors like cyanogenic glycosides, which can reduce nutrient absorption (11). Enzyme supplementation mitigates these effects by breaking down complex carbohydrates and improving energy utilization, as supported by (6). However, the lack of significant effects on yolk quality and some albumen parameters indicates that enzyme supplementation may not uniformly impact all egg quality indices, possibly due to the specific enzyme types or dosages used in the study.

CONCLUSION AND APPLICATION

The study showed that feeding Japanese quails cassava tuber meal with enzyme supplementation significantly ($P<0.05$) improved egg weight and albumen length, while egg width showed variability across treatments. However, egg length, albumen weight, albumen height, Haugh unit, and all yolk quality parameters were not significantly ($P>0.05$) affected by the dietary treatments. These findings suggest that enzyme supplementation in cassava-based diets can enhance specific aspects of egg quality, likely by improving nutrient digestibility and utilization. However, the limited impact on yolk quality and some albumen traits indicates that other factors, such as enzyme type, dosage, or dietary balance, may need optimization to achieve broader improvements in egg quality.

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