REPLACEMENT EFFECT OF CONVENTIONAL MAIZE WITH QUALITY PROTEIN MAIZE ON THE CARCASS CHARACTERISTICS OF BROILER CHICKENS

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ABSTRACT
This study assessed the effects of replacing conventional maize with Quality Protein Maize (QPM) on broiler chicken growth and carcass characteristics. Conducted at Abubakar Tafawa Balewa University, Bauchi, the experiment involved 240 unsexed Cobb broiler chicks fed with five different diets in a completely randomized design. The diets included varying ratios of QPM and normal maize (NM): 100% NM, 75% NM: 25% QPM, 50% NM: 50% QPM, 25% NM: 75% QPM, and 100% QPM. Data on live weight, plucked weight, eviscerated weight, carcass weight, dressing percentage, and organ weights were analyzed using one-way ANOVA and Duncan's post hoc test. Results showed a significant (P<0.05) influence of QPM on carcass and organ characteristics, with the 100% QPM diet yielding the highest live and carcass weights. However, no significant differences (P>0.05) were observed in dressing percentage, relative organ weights, and other carcass indices across the different diets. The study concluded that QPM can replace conventional maize in broiler diets without negatively affecting growth performance or carcass quality.
Keywords: Quality Protein Maize (QPM), Broiler Chickens, Carcass Characteristics, Feed Efficiency, Nutritional Quality

INTRODUCTION

Broiler chicken production, heavily reliant on maize as a staple feed ingredient globally, plays a critical role in ensuring food security amid rapid population growth. In Nigeria, the sector significantly contributes to both economic output and nutritional needs, producing substantial quantities of poultry meat and eggs annually (Edet *et al*., 2020). The efficiency of broiler chickens in converting feed into protein underscores their importance in agriculture (Tiwari *et al*., 2023). However, challenges such as feed costs, seasonal deficits, and nutritional deficiencies in maize, particularly in essential amino acids like lysine and tryptophan, limit optimal poultry nutrition and performance (Olam, 2018). The introduction of Quality Protein Maize (QPM), genetically enhanced to contain higher levels of lysine and tryptophan, represents a promising innovation to address these limitations (Dev *et al*., 2018). QPM offers improved nutritional quality over normal maize, potentially enhancing growth performance and carcass characteristics in broiler chickens (Onimisi *et al*., 2019). Despite its potential, the adoption and utilization of QPM in livestock diets, particularly in Nigeria, remain underexplored. This study aims to evaluate how replacing conventional maize with QPM affects the growth and carcass traits of broiler chickens, aiming to contribute insights into optimizing poultry nutrition and production efficiency in the region.

MATERIALS AND METHODS

Study area

The study was conducted at the teaching and research farm of Abubakar Tafawa Balewa University, Bauchi, located at Yelwa along Tafawa Balewa Road. Bauchi, situated at an altitude of 902 meters above sea level, experiences two distinct seasons: a rainy season from May to October and a dry season from November to April. The mean annual rainfall in the area is 1091mm (World Atlas, 2015).

Experimental diets

Five experimental diets were formulated at the university's feed mill, with varying ratios of Quality Protein Maize (QPM) to normal maize (NM). The diets were designed as follows: Diet 1 (100% NM), Diet 2 (75% NM: 25% QPM), Diet 3 (50% NM: 50% QPM), Diet 4 (25% NM: 75% QPM), and Diet 5 (100% QPM)

Source of experimental birds and management

A total of 240 unsexed, day-old Cobb broiler chicks were obtained from a reputable hatchery for the experiment. The experimental pens were cleaned, disinfected, and fumigated prior to the arrival of the chicks. The chicks were brooded for 14 days, with appropriate warmth and lighting provided by 200-watt electric bulbs. They were fed ad libitum with Ultima Super Starter® feed, and vaccines for Infectious Bursal Disease Virus (Gumboro) and Newcastle Disease Virus (NCDV) were administered during the trial.

Experimental design

The birds were then randomly assigned to the formulated diets in four replicates, with each replicate containing 12 birds, in a completely randomized design (CRD). The trial lasted for 42 days, during which diets and clean drinking water were provided *ad libitum*. At the end of the trial, 40 birds were selected for carcass analysis, where weights of the carcass and internal organs were measured, and dressing percentage was calculated.

Table 1: Ingredients and Composition (%) of Experimental Diets Containing QPM as Replacement for Normal Maize Fed to Finisher Broiler Chickens (6 – 8 weeks)

Ingredients	Diets				
	D1	D2	D3	D4	D5
Normal Maize	52.10	39.07	26.05	13.03	0.00
Quality Protein Maize	0.00	13.03	26.05	39.07	52.10
Full Fat Soya Bean	27.00	27.00	27.00	27.00	27.00
Wheat Offal	12.00	12.00	12.00	12.00	12.00
Fish Meal	3.00	3.00	3.00	3.00	3.00
Borne Meal	3.00	3.00	3.00	3.00	3.00
Limestone	2.00	2.00	2.00	2.00	2.00
Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20	0.20
Total	100.00	100.00	100.00	100.00	100.00
Calculated analysis (%)					
ME (kcal/kg)	3007.60	3007.60	3007.60	3007.60	3007.60
Crude protein	20.00	20.03	20.07	20.11	20.15
Crude fibre	3.58	3.58	3.58	3.58	3.58
Ether extract	7.50	7.50	7.50	7.50	7.50
Lysine	1.22	1.25	1.27	1.29	1.31
Methionine	0.52	0.52	0.52	0.52	0.52
Calcium	2.07	2.07	2.07	2.07	2.07
Phosphorus	0.71	0.71	0.71	0.71	0.71

ME = Metabolizable energy

Data analysis

Data were analyzed using one-way analysis of variance (ANOVA) with Minitab Statistical Package, and differences between treatment means were separated using Duncan's post hoc test (Duncan, 1955).

RESULTS AND DISCUSSION

Results for carcass and organ characteristics of broiler chickens fed graded levels of QPM are presented in Table 2. There was a significant ($P<0.05$) effect of Quality Protein Maize (QPM) on all carcass and organ characteristics.

Table 2: Carcass Characteristics of Broiler Chicken Fed Dietary Levels of QPM as Replacement for Normal Maize

Parameters	Diets					
	T1	T2	T3	T4	T5	SEM
Live weight	1.93	1.96	1.95	1.95	2.09	0.04^{NS}
Plucked weight	1.80	1.81	1.83	1.81	1.91	0.04^{NS}
Eviscerated weight	1.50	1.51	1.53	1.51	1.61	0.04^{NS}
Carcass weight	1.38	1.44	1.41	1.35	1.47	0.34^{NS}
Dressing (%)	71.13	67.63	71.50	68.50	70.43	0.92^{NS}
Organ weights expressed as percentage of live weight						
Lungs	0.10	0.11	0.11	0.11	0.10	0.01^{NS}
Heart	0.32	0.35	0.36	0.28	0.31	0.03^{NS}
Liver	0.52	0.51	0.53	0.53	0.49	0.02^{NS}
Abdominal fat	0.50	0.21	0.31	0.25	0.42	0.01^{NS}
Legs	2.78	2.78	2.61	2.79	2.62	0.03^{NS}
Caeca	0.53	0.45	0.51	0.38	0.45	0.09^{NS}
S/intestine	4.96	5.23	5.46	5.99	5.34	0.03^{NS}
Gizzard	1.56	1.59	1.36	1.36	1.11	0.14^{NS}
Spleen	0.11	0.13	0.11	0.10	0.10	0.07^{NS}
L/intestine	0.17	0.14	0.14	0.16	0.13	0.01^{NS}
Head	2.23	2.64	2.27	2.35	2.26	0.01^{NS}
Kidney	0.16	0.23	0.26	0.14	0.14	0.02^{NS}
Pancreases	0.17	0.16	0.19	0.17	0.09	0.02^{NS}

The live weight of birds ranged from 1.93 kg in T1 to 2.09 kg in T5. Plucked weight varied from 1.80 kg (T1) to 1.91 kg (T5), and eviscerated weight ranged from 1.50 kg (T1) to 1.61 kg (T5). Carcass weight was between 1.35 kg (T4) and 1.47 kg (T5), while dressing percentage ranged from 67.63% in T2 to 71.50% in T3. The relative weight of the lungs was consistent at 0.10% in T1 and T5, and 0.11% on the other diets. Abdominal fat weight varied from 0.21% (T2) to 0.50% (T1), while the relative weight of the small intestine ranged between 4.96% (T1) and 5.99% (T4). Gizzard weight ranged from 1.11% in T5 to 1.59% in T2. Kidney weight was between 0.14% in T4 and T5 and 0.26% in T3, while pancreas weight varied from 0.09% in T5 to 0.19% in T3.

The findings of this study, which showed no significant effect of QPM on carcass and organ indices, align with the report by Osei *et al*. (2019), who observed no significant variations in carcass and organ parameters in broiler chickens fed QPM-based diets. Similarly, Bai (2022) reported no significant effect of QPM on dressing percentage, abdominal fat, and eviscerated carcass yield in broiler chickens. However, Bai (2022) also noted that the dressing percentage of birds fed diets containing normal maize was higher than that of those fed QPM-based diets.

CONCLUSION

The study concludes that Quality Protein Maize (QPM) can effectively replace normal maize in broiler chicken diets without negatively impacting their carcass or organ characteristics, making it a viable alternative in poultry nutrition.

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