EVALUATION OF WHITE AND YELLOW MAIZE (*Zea mays*) VARIETIES ON THE PERFORMANCE OF BROILER CHICKENS

Ajide Elijah Oluwaseyi., Onimisi P.A., and Osijinore Esther Ajibaye

Department of Animal Science, Ahmadu Bello University Zaria Nigeria.

Abstract

Total of 180 day old Ross broiler chicks were used in a feeding trial to evaluate the performance of broiler chicken fed diets compounded with white and/or yellow maize varieties. Chicks were allotted randomly to three treatments each replicated four times, with 15 chicks per replicate. They were raised with a different diet T_1 having yellow maize in a ratio of 100%, T_2 having yellow maize and white maize mixed together in a ratio of 50:50% and T_3 having white maize in a ratio of 100%. Data was collected on growth performance, carcass characteristics and density comparisons of white and yellow maize. All data collected were subjected to analysis of variance and significant differences among treatment means were compared using Tukey's HSD test of significance. At the end of the experiment, there was a significant ($P<0.05$) difference in feed intake, birds fed white maize based diet showed the highest feed consumption, those fed yellow maize based diet showed the least feed consumption, whereas those fed yellow + white maize were statistically the same as birds of treatment 1 and 3. There was no significant ($P>0.05$) difference in their body weight gain, feed conversion ratio and feed cost per N/kg. The mass and density of the two maize varieties in different forms (whole grain and grinded forms) and as well the three experimental diets were also determined which shows a significant ($P<0.05$) difference in their mass and density. This findings indicate that different maize varieties (white or yellow) does not adversely affect growth performance of broiler chickens, but lesser feed quantity is required to obtain maximum performance when yellow maize is used to compound feed as a result of its density over the white maize. However, the naturally occurring pigment (β-carotene) which gives the yellow maize its yellow appearance exert the yellow colour on the shank and beak of the broiler birds fed diets compounded with the yellow maize.

Key words: Broiler chicken, Maize varieties, Growth performance, Feed consumption, β-carotene.

Introduction

Maize (*Zea mays*) has been the most commonly used conventional energy source of plant origin in feed formulation for poultry. It is sometimes highly expensive, limited or at times scarce. Also, maize and other cereal grains are highly competed for by animals and humans as food. Supply of essential nutrients in adequate quantities to poultry is necessary for optimum growth, production and/or reproduction. Energy and protein the major nutrients of poultry mash, need special consideration as both can bring a continued and increased production of eggs and meat with an entry of improved genetic stock (Lokesh and Singhal, 2011). The optimum biological performance of farm animals, especially the monogastrics is partly determined by feed quality. Feed quality is measured in terms of adequate amounts and correct proportions of the essential nutrients such as protein, minerals and vitamins to one another in animal feed in relation to its optimum energy content. Unlike cockerel, broiler chicken has genetic potential to attain live and dressed weights of 2.0kg and 1.5kg respectively in 6 – 8 weeks of age provided feeding is adequate not only in quantity but also in quality (Longe, 2006). Poultry keeping has become a commercial enterprise and many producers of poultry products such as meat and eggs have gone into large scale production so as to meet up with the increasing demand for poultry products by the economy.

Maize comes in varying colours viz: white, yellow and bi-colour varieties. Of the varieties of maize, the most prevalent are white and yellow maize. White maize is the most common colouration of maize, followed closely by yellow maize, while the remaining are referred to as bi-coloured (which can range from red to orange – hued varieties). The two (i.e. white and yellow maize) resemble one another physically, but

there are some slight differences. The only difference is that the naturally occurring pigment (Beta-carotene) exert a yellow colouration on the endosperm of the maize, hence its colour while for the white maize there is the absence of this pigment. Endosperm colour in maize is controlled by a single gene. The presence of a single (dominant) 'Y' allele leads to the production of carotenoid pigments in the endosperm and results in yellow seeds. White maize seeds occur when two (recessive) 'y' alleles are present: carotenoids are not produced and the endosperm is white. Beta-carotene gives the yellow maize a bit of a nutritional edge over white maize. Hence, the need to evaluate the nutritional effect/performance of feeding broiler chickens with either white and/or yellow maize.

Results and Discussion

Physical Characteristics

Maize Varieties

White maize is the most common colouration of maize, followed by yellow maize. The two resemble one another physically, but there are some slight differences. The only difference is that the yellow maize contains the naturally occurring pigment (β-carotene) which exerts the colour while for the white maize there is the absence of this pigment.

Table 1 shows the relative density of the two varieties of maize in different forms (i.e. whole grain and grinded). The mass and density (738.33g and 7.38gcm^{-3} respectively) were significantly (P<0.05) higher than the white maize whole grain (723.33 and 7.23gcm^{-3}). This also applies to the grinded form where the mass and density (471.67g and 4.72gcm^{-3}) for the yellow maize were significantly (P<0.05) higher than the mass and density (451.67g and 4.52gcm^{-3}) of the white maize, given the same volume.

Growth Performance of Birds

Results obtained for the final weight and weight gain of broiler chicken fed two varieties of maize (i.e. yellow and/or white maize) at starter – finisher phase revealed no significant (P>0.05) differences among the treatments as shown in Table 2. This may be due to the fact that the test ingredient (maize) though vary in physical appearance (yellow and white) are of similar chemical composition or nutrients. This contradicts the findings of Bai (2002) in which they conducted a study on broiler with quality protein maize replaced with normal maize and obtained significant different in weight gain.

Feed intake was significantly (P<0.05) different across the treatments. T_3 shows a significant (P<0.05) difference with birds in T_1, T_2 was statistically similar toT_1 and T_3. The highest feed consumption (4984.50g) was observed in birds fed 100% white maize (T_3). The treatment containing 100% yellow maize (T_1) had the least feed intake (4631.00g) while the treatment containing 50:50% yellow and white maize (4818.40g) proves to be statistically the same with T_1 and T_3. This may be as a result of the density difference between the test ingredients (yellow and white maize). Birds fed with the T_1 diet consume less as a result of the feed been denser than T_3 diet. Feed intake is affected by some physical factors such as palatability, colour, taste, smell and particle size as reported by Appleby *et al* (1993). Feed intake may also be based on appetite which is dependent on nutrients requirement of the chicks (Emmans and Fisher, 1986). At the end of the experiment starter, there was mortality for T_2 and T_3 which show significant (P<0.05) difference with T_1. This is in close agreement with Lokesh and Singhal (2011) stating that the nutrients which have immuno-modulating effect include protein and energy, methionine, Vitamin A, E and C. The presence of Vitamin A and lutein in the yellow maize help to boast immunity of the birds fed 100%yellow maize based diet which had no mortality.

Carcass Analysis

Table 3 shows the carcass characteristics of broilers fed two varieties of maize. The dressing percentage for T_1 (73.00%) and T_3 (71.62) proves to be significantly (P<0.05) different from T_2 (70.00%) same trend was also observed in dressed weight. The breast cut in T_2 (32.83%) and T_3 (33.06%) significantly (P<0.05) different from breast cut in T_1 (28.73%). In terms of thigh percentage, there was significant (P<0.05) difference across the treatments. There was significant (P<0.05) difference in drumstick percent across the treatments. The back percent in T_2 was significantly (P<0.05) different from T_1 and T_3.

Physical/Visual Quality of Broiler Chickens Fed White and Yellow Maize Varieties

Birds fed 100%yellow maize based diet (T_1) and 50:50% yellow and white maize based diet (T_2) were observed to be imparted with yellow coloration on their shank and beak. This is as a result of the pigment (β-carotene/xanthophil) present in the yellow maize. The accumulation of this pigment in the tissues of the animal imparted the colour as they are fed with these diets from day old. However, birds fed 100%white maize based diet (T_3) had their shank and beak to be dull white/normal as a result of the absence of beta-carotene pigment in the white maize.

Conclusion

From the results obtained from this research work, it may be concluded that different maize varieties (white or yellow) does not adversely affect growth performance of broiler chicken. However, less feed consumed by T_1 (4631.00g) gave equivalent weight with that of T_2 and T_3 (4813.40g and 4984.50g respectively). The 100% yellow maize based diet had a weight gain of 2223.27g, 50:50% yellow maize/white maize mixture had a weight gain of 2229.77g and 100%white maize based diet had a weight gain of 2272.82g. The presence of the naturally occurring pigment (β-carotene) which gives the maize its yellow appearance impacted the yellow colour on the shank and beak of the broiler birds fed diet compounded with the yellow maize. From the results obtained, the following recommendation can be; Either white or yellow maize can be used to compound diet to obtain maximum performance.

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List of Tables

Table 1: Density comparison of the two varieties of maize in different forms

		Varieties		
Samples	Parameters	Yellow maize	White maize	SEM
Whole grain	mass (g)	738.33[a]	723.33[b]	1.67
	Volume (cm^3)	100.00	100.00	
	Density (g/cm^3)	7.38[a]	7.23[b]	0.02
Grinded	Mass (g)	471.67[a]	451.67[b]	1.67
	Volume (cm^3)	100.00	100.00	
	Density (g/cm^3)	4.72[a]	4.52[b]	0.02

[a,b,] Means with different superscript differ significantly across the row ($P<0.05$), SEM = Standard error of mean.

Table 2: Growth performance of broiler chickens fed white and/or yellow maize at starter - finisher phase

	T_1	T_2	T_3	
Parameters	100%YM	50:50%YM/WM	100%WM	SEM
Initial weight (g/bird)	44.83	45.23	44.88	0.36
Final weight (g/bird)	2268.10	2275.00	2317.7	97.80
Weight gain (g/bird)	2223.27	2229.77	2272.82	97.83
Feed intake (g/bird)	4631.00[b]	4813.40[ab]	4984.50[a]	125.41
Feed conversion ratio	2.08	2.16	2.19	0.08

Feed cost (N/kg)	215.24[c]	212.42[b]	209.59[a]	0.00
Feed cost/weight gain (N/kg)	447.70	458.83	459.00	17.51
Mortality (%)	0.00[a]	6.67[a]	10.00[b]	3.69

[a,b,c] Means with different superscript differ significantly across the row (P<0.05), YM = Yellow maize, WM = White maize, SEM = Standard error of mean.

Table 3: Carcass characteristics of broilers fed two varieties of maize

	Treatments			
Parameters	T_1	T_2	T_3	SEM
Live weight (g)	2176.13	2138.03	2217.45	62.66
Dressed weight (g)	1587.50	1500.00	1588.25	58.63
Dressing percentage (%)	73.00[a]	70.00[b]	71.62[b]	1.36
Breast (%)	28.73[b]	32.83[a]	33.06[a]	0.60
Thigh (%)	15.37[a]	13.64[b]	14.56[ab]	0.48
Drumstick (%)	14.95[a]	13.48[b]	12.61[b]	0.47
Back (%)	20.09	21.15	20.13	0.65

[a,b,c] Means with different superscript differ significantly across the row (P<0.05), SEM = Standard error of mean.