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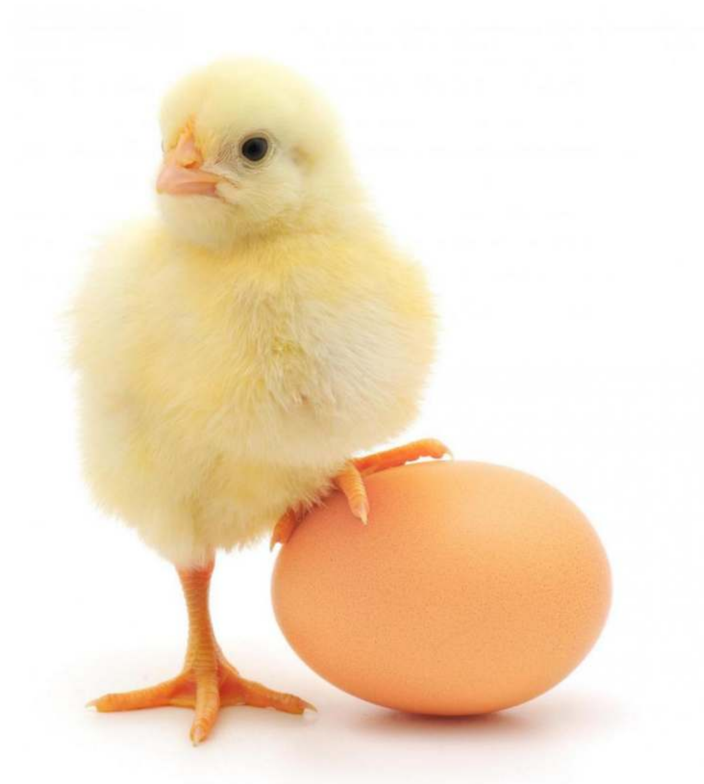

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Comparative Assessment of Growth in Pure and Crossbred Turkeys in a Humid Tropical Environment

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Abstract: Three hundred poults consisting of 120 local, 120 local x exotic crossbred and 60 exotic poults were generated from matings between indigenous and exotic turkeys. Feed and water intake, body weight and other linear body measurements were evaluated on weekly basis. These were used to compare the performance of pure and crossbred turkeys raised under natural heat stress environment. Growth parameters studied were significantly affected by turkey genotype ($p<0.01$). At week 20, the exotic turkey had the highest body weight (4484.74±52.07 g) followed by the crossbred (3330.79±34.00 g) and then the local turkey (2869.68±46.08 g). Male turkeys had a higher average body weight of 46.64±0.47 g and 3363.18±72.36 g while the females weighed the lowest (43.31±0.64 g and 3148.92±89.71 g) at weeks 0 and 20, respectively. The crossbreds consumed more feed on the average (14.13±2.02 to 343.00±40.04 g/day) as compared to the exotic and local turkeys. Also on the average, the local turkey had the highest feed efficiency followed by the exotic and then the crossbreds, implying that the higher the feed intake needed to achieve a proportional increase in body weight, the lower the feed efficiency obtained. The crossbreds drank more water (31.56±1.49 to 574.11±141.25 ml) than the exotic and local turkeys. It can therefore be concluded that variations in the genetic make-up of the turkeys accounted for the observed differences in growth and efficiency of feed utilization.

Key words: Feed efficiency, growth parameters, poults, water intake

INTRODUCTION

Environmental extremes have deleterious effects on the productive performance and well-being of all domestic animals. Hot ambient temperatures, above the zone of thermo-neutrality for domestic poultry, typify the summer season in the greater poultry producing area especially in tropical regions and these affect performance and overall adaptation to the climatic region (Ilori *et al*., 2009).

According to Reece and Lott (1983), these conditions reduce feed intake and growth rate and negatively affect feed efficiency in growing birds. Prolonged periods of elevated ambient temperature stress increase the time to reach market weight and increase mortality (Deaton *et al*., 1978). When high temperatures are coupled with high humidity, the combination can become lethal. ‘Heat stress’ not only causes serious welfare conditions of suffering and death in the birds, but also results in reduced or lost production that adversely affects the profit from the enterprise. Birds are heat-stressed if they have difficulty achieving a balance between body heat production and body heat loss. Birds will die from heat exhaustion if heat production is substantially greater than heat loss either in intensity (acute) or over long periods (chronic). Productive adaptability itself is a phenomenon whereby an animal gives acceptable level of production in a stressed environment (Ibe, 1990). The tropical environment is generally characterized by such stress factors as excessive heat, poor nutrition, poor housing and disease. Developing poultry stocks that can tolerate such an environment and give acceptable level of production is desirable (Nwachukwu *et al*., 2006). Heat stress can result in significant losses to producers with all types of poultry. The most obvious loss is due to mortality. Dead birds can be counted and a dollar value assessed. Unfortunately, there are other losses in production efficiency, such as reduced growth rate, egg production, shell quality and egg size and hatchability, which are very real. All are much more difficult to evaluate. Poultry producers should be aware that losses in production efficiency will occur long before significant mortality rates are observed (Joe and Raymond, 2005). Akinokun (1990) reported that the limitations of exotic breeds are temperature and humidity stress under

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tropical environment and suggested that a breeding policy in which the introduction of genes of local stock into the exotic stock be initiated. The controlled introduction of new and improved genetic materials into indigenous breeds of bird is expected to speed up genetic progress through the exploitation of hybrid vigour (Adebambo *et al.*, 2006). An evaluation of the growth performances of three strains of turkeys in an environment that is characterized by heat stress will help to justify the inclusion of the genes of the local turkey genotypes in the current narrow genetic base on which the turkey industry currently operates. The objective of this study was to compare the growth rates and the efficiencies of feed utilization of three strains of turkey.

MATERIALS AND METHODS

Study area: This research work was carried out at the Turkey Breeding Unit of the Teaching and Research Farm of the College of Animal Science and Livestock Production, University of Agriculture, Alabata Road, Abeokuta, Nigeria. The University of Agriculture, Abeokuta is located on latitude 7° 10'N and longitude 3°2'E and lies in the Southwestern part of Nigeria with a prevailing tropical climate with a mean annual rainfall of about 1037 mm. The mean monthly ambient temperature ranges from 28°C in December to 36°C in February with a yearly average relative humidity of about 82%. The vegetation in the University represents an interphase between the tropical rainforest and the derived savannah.

Management of parent stock: The birds were raised under intensive management system where they were subjected to standard methods of management at the layer house. They were fed *ad libitum* initially with grower mash and later breeder mash was provided a month before laying. Clean water was also supplied *ad libitum*. Multi-vitamin drugs were given to the birds on arrival on the farm to serve as an anti-stress and during the period of their acclimatization to stabilize their condition. Their vaccination programmes were strictly adhered to. Adequate sanitation was carried out to prevent occurrence of diseases. The two breeds of the turkey were reared under the same management system as described by Oluyemi and Roberts (2000).

Mating design and egg collection: Due to obvious differences in body size between the exotic and local parent stocks, artificial insemination technique as described by Lake (1962) was used. The main cross poults (local and exotic) were generated by mating exotic male turkey to exotic female turkey and likewise for local turkey. The crossbreds were generated by mating the exotic male to local females. Eggs from the three genetic groups were collected daily, identified appropriately with markers and set in the incubator on a weekly basis.

Management of poults: A total of 300 poults hatched in six batches were used for this study. The genetic groups contributed varied number of poults, thus resulting in unequal sample sizes. The poults were brooded in deep litter pens according to their genetic groups. All poults were wing-tagged for proper identification and subjected to the same management practices throughout the experimental period. Commercial feeds were provided for the birds *ad libitum*. Starter mash containing 28% Crude Protein (CP), grower mash containing 24% CP and finisher mash containing 20% CP, were fed to the birds from 0-6, from 7-16 and from 17-20 weeks of age respectively. Clean, cool water were supplied *ad libitum*. Necessary vaccinations against Newcastle, fowl pox and gumboro diseases as well prophylactic antibiotics and anticoccidial drugs were administered to the birds.

Body weights were taken on all genetic groups at day old and weekly up to 20 weeks of age. Feed intakes and water consumption were recorded while feed efficiency was computed for the various crosses throughout the study period. Brooding and rearing phase mortalities were also recorded for the genetic groups. The Linear Body Measurements (LBMs) were taken right from week 1 and differences in the parameters measured due to sex and age were noted. Body Length (BL) was measured as length of the body from the base of the comb to the base of the tail around the uropigial gland. Shank Length (SL) was measured from the hock joint to the tarsometarsus digit-3 joint. Thigh Length (TL) was taken as the distance between the hock joint and the pelvic joint. The Keel Length (KL) was taken as the length of the cartilaginous keel bone or metasternum while the Breast Girth (BG) was measured as the region of the largest breast expansion while the bird was positioned ventrally. All LBMs were measured with a meter rule in cm as described by Ibe and Nwachukwu (1988).

Experimental design and statistical analyses: Data obtained were analyzed using General Linear Model of SAS (1999). The model used was as specified below.

$$Y_{ijk} = \mu + B_i + P_j + (BP)_{ij} + e_{ijk}$$

Where,

Y_{ijk} = The parameter of interest

μ = Overall mean for the parameter of interest

B_i = Fixed effect of i^{th} sex (j = 1-2)

P_j = Fixed effect of j^{th} genotype (1-3)

$(BP)_{ij}$ = Interaction effect of i^{th} sex and j^{th} genotype.

$e_{ijk\sim \text{iid } N(0,\sigma^2)}$ = i.e errors are independent and identically distributed as normal with mean zero and constant variance

Duncan's multiple range test was used to separate the means that differed significantly (Gomez and Gomez, 1984). Correlation was also computed using SAS (1999) to ascertain the relationships between measurable traits.

Preliminary analysis of batch effect was not significant and therefore was removed from the final model.

Data on mortality were normalized by performing arcsine transformation before the final analysis.

RESULTS AND DISCUSSION

The performance of the pure and crossbred turkeys with respect to body weight, linear body measurements, average daily feed intake, feed efficiency, water consumption and mortalities are presented in Table 1-10. The results of this study showed significant differences in body weight and linear body measurements. Body weight increased with increase in age of the birds in all the genotypes. Body weight in exotic turkeys was significantly ($p<0.05$) higher than that of crossbred and local in all the weeks except at week 1 in which exotic turkeys had the lowest body weight although the difference was not significant ($p>0.05$). The mean body weights ranged from 85.68±15.33 g, 84.52±2.33 g and 76.22±2.66 g in week 1 for local, crossbred and exotic to 2869.68±46.08 g, 3330.79±34.00 g and 4484.74±52.07 g at twenty weeks of age respectively. Body length was also significantly ($p<0.05$) affected by genotype with increase in age of birds except at week 1. Body length was higher in crossbred and local turkeys in week 1. The reverse was the case from weeks 2-20. Although the lowest mean value for body length (8.82±0.16 cm) was recorded for exotic turkeys in week 1 compared to crossbreds (9.44±0.11 cm) and local turkeys (9.40±0.32 cm), the highest mean value (48.47±0.76 cm) was recorded for the exotic turkey in week 20 which was significantly ($p<0.05$) higher than 44.60±0.17 cm and 39.17±0.30 cm recorded for crossbred and local turkeys respectively. Shank length was also significantly ($p<0.05$) affected by genotype. Shank length increased as well with increase in age of the birds in all the genotypes ($p>0.05$). Shank length in exotic turkeys was significantly ($p<0.05$) higher than that of crossbred and local turkeys in all the weeks except at week 16 where the difference was not significant. Genotype was found to be significant ($p<0.05$) for thigh length. It increased with increase in age of the birds in all the genotypes. Exotic turkeys were found to be significantly ($p<0.05$) higher in thigh length than both the crossbred and the local turkeys. Meanwhile, there existed no significant ($p>0.05$) difference in the mean values of thigh length for the local and the crossbred turkeys except at week 20 where significant ($p<0.05$) differences were observed among the genotypes, favouring the crossbred turkeys. Keel length was significantly ($p<0.05$) affected by genotype although at week 1, the difference was not significant ($p>0.05$). Exotic turkeys were observed to have consistently higher mean values than the crossbreds and the locals. However, differences observed between the crossbred and local turkeys were not significant ($p<0.05$) for all the ages except at week 20 where significant differences among the genotypes were observed. Breast girth was significantly ($p<0.05$) affected by genotype as well with increase in age of birds. However, at week 1, the differences were not significant ($p>0.05$). Exotic turkeys consistently had the highest significant mean values at all ages; however the differences observed in the mean values for breast girth in crossbred and local turkeys were not significant ($p>0.05$) except at weeks 4, 12 and 20. At week 20, the differences observed in the mean values of breast girth among the genotypes were significant ($p<0.05$) with exotic turkeys having the highest mean value (53.60±1.00 cm) followed by crossbred (44.96±0.17 cm) and the local turkeys with the mean value of 40.13±0.34 cm.

The differences and superiority exhibited by the exotic turkey suggested that it had a better growth potential than its crossbred and local counterparts. This was due to the fact that the breed had gone through intense selection for higher growth rate. In terms of growth rate as well, the crossbred was the closest to the exotic. This showed that the local turkey had a high combining ability with the exotic breed. This was expected since the male parent here came from the exotic strain and that the local turkey combined significantly well with the exotic strain to achieve an improved body weight. The implication of these acquired attributes for the crossbreds is that they could be further screened as possible candidates for tropical turkey broiler breed development. More vigorous crossbreeding, selection and an improvement of the local turkey would need to be pursued to improve on the growth potential in these strains. The fact that the local turkey had lower growth rate is expected since our indigenous poultry have gone through more of natural selection for survival to the tropical climate rather than artificial selection for productivity (Ibe, 1998). The results on body measurements followed the same trend. The linear measurements studied (thigh length, body length, shank length, keel length and breast girth) showed that the exotic turkey had superiority over the crossbred and the local turkeys except at week one where the superiority was not significant. According to Gous (1997), growth is normally accompanied by an orderly sequence of maturational changes and involves accretion of protein and increase in length and size, not just an increase in body weight. The crossbred turkey, however, performed significantly better than the local turkey in all other linear body measurements although the differences were not significant in all cases. The superiority could, however, be credited to the exotic parent which transferred the better performance advantage to the crossbred during crossing.

Table 1: Least squares means and standard errors for the effects of genotype and sex on body weight (g) of turkeys

	Genotype			Sex	
Age in weeks	Local (120)	Exotic (60)	Crossbred (120)	Male (154)	Female (146)
0(day old)	44.27±0.62[b]	48.57±1.07[a]	44.32±0.58[b]	46.64±0.47[a]	43.31±0.64[b]
1	85.68±15.33	76.22±2.66	84.52±2.33	94.71±13.40	71.72±1.66
4	299.78±7.30[c]	449.74±26.76[a]	231.68±6.37	357.68±10.99[a]	316.14±10.52[b]
8	991.54±21.69[b]	1618.63±49.53[a]	1007.13±31.96[b]	1153.63±35.12[a]	997.74±34.79[b]
12	1743.00±38.50[b]	2607.63±63.76[a]	1740.72±36.92[b]	1976.12±49.85[a]	1729.77±50.65[b]
16	2312.56±45.78[c]	3606.16±56.99[a]	2479.91±43.42[b]	2668.92±64.28[a]	2426.96±74.13[b]
20	2869.68±46.08[c]	4484.74±52.07[a]	3330.79±34.00[b]	3363.18±72.36[a]	3148.92±89.71[b]

[a,b,c]Means in the same row within variable group with different superscripts are significantly different (p<0.05). Values in parenthesis = number of observations

Table 2: Least squares means and standard errors for the effects of genotype and sex on body length (cm) of turkeys

	Genotype			Sex	
Age in weeks	Local (120)	Exotic (60)	Crossbred (120)	Male (154)	Female (146)
1	9.40±0.32[a]	8.82±0.16[a]	9.44±0.11[a]	9.64±o.27[a]	8.98±0.13[b]
4	15.59±0.18[c]	17.78±0.41[a]	16.82±0.23[b]	16.67±0.21[a]	16.11±0.22[b]
8	26.13±0.27[a]	27.04±0.57[a]	24.88±0.25[b]	26.10±0.25[a]	25.38±0.30
12	31.94±0.24[b]	34.33±0.50[a]	32.60±0.21[b]	32.86±0.23[a]	32.07±0.25[b]
16	35.69±0.25[b]	42.37±21.27[a]	39.33±0.28[a]	38.68±5.77	37.32±0.40
20	39.17±0.30[c]	48.47±0.76[a]	44.60±0.17[b]	42.91±0.50[a]	41.78±0.55[b]

[a,b,c]Means in the same row within variable group with different superscripts are significantly different (p<0.05). Values in parenthesis = number of observations

Table 3: Least squares means and standard errors for the effects of genotype and sex on shank length (cm) of turkeys

	Genotype			Sex	
Age in weeks	Local (120)	Exotic (60)	Crossbred (120)	Male (154)	Female (146)
1	3.45±0.11[b]	3.90±0.09[a]	3.69±0.06[ab]	3.72±0.10	3.50±0.06
4	5.84±0.08[c]	7.02±0.15[a]	6.48±0.09[b]	6.33±0.09	6.21±0.10
8	10.01±0.10[a]	10.18±0.15[a]	9.46±0.16[b]	10.04±0.10[a]	9.54±0.13[b]
12	12.22±0.11[b]	12.93±0.21[a]	11.74±0.18[c]	12.51±0.12[a]	11.67±0.13[b]
16	13.79±0.11	15.32±0.41	18.83±4.72	14.56±0.15	17.35±3.82
20	15.25±0.12[c]	17.78±0.58[a]	16.49±0.20[b]	16.48±0.21[a]	15.48±0.18[b]

[a,b,c]Means in the same row within variable group with different superscripts are significantly different (p<0.05). Values in parenthesis = number of observations

Table 4: Least squares means and standard errors for the effects of genotype and sex on thigh length (cm) of turkeys

	Genotype			Sex	
Age in weeks	Local (120)	Exotic (60)	Crossbred (120)	Male (154)	Female (146)
1	4.51±0.12	5.09±0.08	5.40±0.54	4.85±0.11	5.04±0.44
4	8.04±0.11[b]	9.31±0.23[a]	8.02±0.20[b]	8.30±0.12	8.17±0.19
8	12.18±0.14[b]	13.45±0.25[a]	11.64±0.19[b]	12.33±0.14	11.95±0.19
12	14.85±0.22[b]	16.57±0.31[a]	15.30±0.19[b]	15.50±0.22[a]	14.94±0.16[b]
16	17.03±0.15[b]	18.78±0.41[a]	18.97±0.21[a]	18.31±0.18[a]	17.47±0.23[b]
20	18.56±0.18[c]	21.02±0.52[b]	22.65±0.18[a]	20.70±0.25[a]	19.80±0.36[b]

[a,b,c]Means in the same row within variable group with different superscripts are significantly different (p<0.05). Values in parenthesis = number of observations

The analyses of the results showed significant sex differences (p<0.05) in body weight, body length, shank length, thigh length, keel length and breast girth except in week 1 for body weight, week 16 for body length, weeks 1, 4 and 16 for shank length, weeks 1, 4 and 8 for thigh length, week 4 for keel length and weeks 16 and 20 for breast girth. The values for males and females ranged from 3363.18±72.36 to 3148.92±89.71 g for body weight, 42.91±0.50 to 41.78±0.55 cm for body length, 16.48±0.21 to 15.48±0.18 cm for shank length, 20.70±0.25 to 19.80±0.36 cm for thigh length, 14.42±0.12 to 13.99±0.13 cm for keel length and 44.05±0.67 to 43.53±0.69 cm for breast girth at 20 weeks of age.

The results from this research further revealed that male turkeys of both pure and crossbred genotypes showed remarkable and better growth performance than their female counterparts for all traits and ages except

Table 5: Least squares means and standard errors for the effects of genotype and sex on keel length (cm) of turkeys

	Genotype			Sex	
Age in weeks	Local (120)	Exotic (60)	Crossbred (120)	Male (154)	Female (146)
1	2.80±0.10	2.70±0.07	2.65±0.05	2.86±0.09[a]	2.58±0.05[b]
4	5.27±0.07[b]	6.03±0.14[a]	5.38±0.09[b]	5.50±0.08	5.36±0.08
8	8.29±0.09[b]	9.86±0.18[a]	8.02±0.11[b]	8.59±0.10[a]	8.17±0.13[b]
12	10.45±0.10[b]	12.46±0.14[a]	10.21±0.11[b]	10.91±0.12[a]	10.34±0.14[b]
16	12.10±0.10[b]	14.02±0.16[a]	12.24±0.10[b]	12.72±0.12[a]	12.07±0.13[b]
20	13.63±0.10[c]	15.56±0.17[a]	14.57±0.07[b]	14.42±0.12[a]	13.99±0.13[b]

[a,b,c]Means in the same row within variable group with different superscripts are significantly different (p<0.05). Values in parenthesis = number of observations

Table 6: Least squares means and standard errors for the effects of genotype and sex on breast girth (cm) of turkeys

	Genotype			Sex	
Age in weeks	Local (120)	Exotic (60)	Crossbred (120)	Male (154)	Female (146)
1	10.06±0.26	10.63±0.12	10.24±0.10	10.46±0.22[a]	9.96±0.10[b]
4	16.51±0.15[c]	19.35±0.51[a]	17.41±0.18[b]	17.59±0.21[a]	16.98±0.22[b]
8	25.26±0.24[b]	31.64±0.58[a]	25.39±0.30[b]	26.67±0.35[a]	25.63±0.39[b]
12	31.38±0.33[c]	38.38±0.46[a]	32.91±0.25[b]	33.45±0.39[a]	32.30±0.42[b]
16	35.75±0.33[b]	46.67±20.42[a]	39.94±0.27[b]	39.06±0.55	45.85±7.63
20	40.13±0.34[c]	53.60±1.00[a]	44.96±0.17[a]	44.05±0.67	43.53±0.69

[a,b,c]Means in the same row within variable group with different superscripts are significantly different (p<0.05). Values in parenthesis = number of observations

for body weight at week 1 and thigh length up to week 8 in which the differences were not significant. These results revealed that males generally had higher values in weight and in other body parameters which is in accordance with the report of Garcia *et al.* (1991) and Ikeobi *et al.* (1995) that sexual dimorphism was in favour of males in the performance of strains of birds studied. The male turkeys used for this study exhibited sexual dimorphism right from day old. Fayeye *et al.* (2006) attributed this difference to genetic effect of sex which arises from the male physiological activities. It has also been reported that sex differences were usually due to differences in hormonal profile, aggressiveness and dominance especially when both sexes are reared together (Ibe and Nwosu, 1999).

Table 7 showed that genotype had significant (p<0.05) effect on feed intake. Feed intake was significantly (p<0.05) affected by genotype in all the weeks of the experiment except at week 1. Feed intake increased with increase in age of the birds in all the genotypes. The crossbreds had higher feed intake but this was not significantly different from the values obtained for exotic turkeys except at week 8 and was significantly higher (p<0.05) than that of local turkeys at week 1. The mean feed intake per day in week 1 ranged from 14.13± 2.02g, 11.64±0.00 g and 10.93±1.05 g for crossbreds, exotic and local turkeys to 343.99±40.64 g, 300.00±0.00 g and 225.66±14.2 g per day at twenty weeks of age respectively.

Table 8 shows that the effect of genotype on feed efficiency was significant (p<0.05) at weeks 1, 4, 8 and 12. At week 1, the highest significant (p<0.05) feed efficiency of 0.57±0.06 was recorded for local turkeys.

Table 7: Least squares means and standard errors of means of the effect of genotype on feed intake (g/day)

	Genotype		
Age in weeks	Local (120)	Exotic (60)	Crossbred (120)
1	10.73±1.05[a]	11.64±0.00[a]	14.13±2.02[a]
4	31.93±2.78[b]	57.76±0.00[a]	65.20±10.77[a]
8	87.39±6.73[b]	88.44±0.00[b]	136.53±34.82[a]
12	131.83±16.79[b]	198.41±0.00[a]	212.02±28.31[a]
16	190.03±15.03[b]	247.06±0.00[a]	281.40±40.02[a]
20	225.66±14.26[b]	300.00±0.00[a]	343.99±40.64[a]

[a,b]Means in the same row with different superscripts are significantly different (p<0.05). Values in parenthesis = number of observations

Table 8: Least squares means and standard errors of mean for the effect of genotype on feed efficiency

	Genotype		
Age in weeks	Local (120)	Exotic (60)	Crossbred (120)
1	0.57±0.06[a]	0.34±0.01[b]	0.43±0.05[b]
4	0.50±0.05[a]	0.34±0.01[b]	0.26±0.05[b]
8	0.33±0.03[b]	0.51±0.01[a]	0.27±0.07[b]
12	0.21±0.03[a]	0.18±0.01[b]	0.13±0.02[b]
16	0.12±0.01[a]	0.14±0.01[a]	0.10±0.01[a]
20	0.11±0.01[a]	0.10±0.01[a]	0.11±0.01[a]

[a,b]Means in the same row with different superscripts are significantly different (p<0.05). Values in parenthesis = number of observations

At week 4, local turkeys had the highest significant (p<0.05) feed efficiency of 0.50±0.05 followed by that of exotic turkeys (0.34±0.01) and finally crossbred (0.26±0.05). The highest significant (p<0.05) feed efficiency of 0.51±0.00 was recorded for exotic turkeys at week 8, followed by that of local (0.33±0.03) and finally (0.27±0.07) for crossbreds. At week 12, local turkeys had the highest significant ($p<0.05$) feed efficiency of 0.21±0.03, followed by that of the exotic turkeys (0.18±0.01) and finally the crossbreds (0.13±0.02). The crossbred turkey was observed to have recorded the highest mean for feed intake. This may be due to the fact that they combined the genetic make-up of both the indigenous and the exotic turkey in terms of feed intake. However, it recorded the least mean value for feed efficiency. This implies that the higher the feed intake needed to achieve a proportional increase in body weight, the lower the feed efficiency obtained and when feed efficiency is low, the quantity of feed to achieve a kilogram body weight is high. However, the local and exotic turkeys had lower feed intake but higher feed efficiency meaning that they were able to utilize efficiently the minimal feed consumed to achieve a proportionate increase in body weight. This is also in agreement with the report of Ain-Baziz *et al.* (1996) that broilers exposed to excess heat stress decrease feed intake to reduce metabolic heat production and maintain homeothermy resulting in slower growth, reduced breast muscle yield, higher fat deposition and feed conversion rate. Efficiency of feed was not significant at week 20 which is in line with the report of Cooper and Washburn (1997) that effect of heat stress on efficiency of feed utilization vary with age. Ryder *et al.* (2004) affirmed that heat stress was a major economic concern due to reduced growth and feed efficiency. It increased the probability of death, especially of larger broilers into which several weeks of input cost had been invested. Ayorinde and Oke (1995) reported that the quantity of feed consumed in kilograms by different strains differed as well as the efficiency in converting the feed to flesh.

Table 9 showed the least squares means in millimeter/ day of water intake of the birds as affected by turkey genotype. Water intake was significantly ($p<0.05$) affected by genotype in all the weeks of the experiment except at weeks 1 and 20. Water intake increased with increase in age of the birds in all the turkey genotypes. Exotic turkeys had the highest water intakes at weeks 1, 4 and 12. However, the reverse was the case in weeks 8, 16 and 20 as the crossbreds had the highest significant ($p<0.05$) water intake. The mean water intake per day in week 1 ranged from 31.55±2.09 ml, 36.19±0.00 ml and 31.56±1.49 ml for crossbred, exotic and local turkeys to 626.41±67.51 ml, 605.04±0.01 ml and 574.11±41.15 ml per day at twenty weeks of age respectively. Exotic turkeys had the highest water intake from the onset while crossbreds had it till the end of the experiment, since heat production is affected by body weight, species and breed, level of production, level of feed intake, feed quality and, to a lesser extent, by the amount of activity and exercise. This implies that the birds increased water consumption to compensate for water loss and to increase the heat dissipation capacity. However, water retention is reduced due to the increased electrolyte excretion in urine and faeces (Belay *et al.*, 1992; Belay and Teeter, 1996). At this point, if the amount of water lost is not completely compensated, dehydration and increased body temperature will occur. To overcome this problem, birds consume markedly more water (Zhou *et al.*, 1999; Tanveer *et al.*, 2005), causing plasma expansion, reduced plasma osmolarity and whole blood viscosity (Zhou *et al.*, 1999). Although birds consume more water to overcome these consequences, water retention is reduced due to increased electrolyte excretion (Belay *et al.*, 1992) and due to continuous loss of water through panting. According to Georgai (2001) and Lott *et al.* (2003), research has demonstrated that there was a relationship between feed and water consumption. The crossbred had the highest feed intake as well as the highest water intake at the end of the study.

Mortality, as seen in Table 10, was generally high, exceeding 10% in all genetic groups and was higher among exotic turkeys (44.82±0.00%) followed by that of the crossbreds (35.56±0.12%) and finally that of the local turkeys (33.08±0.11%). The results also suggested that exotic turkeys had the highest number of mortality than the crossbred and the local turkeys though not significant which implied that the local turkeys were able to adapt better to the tropical environment since they had been majorly selected based on their ability to survive in the tropics and the crosses because they possessed the genes of the local turkeys for survival in the local environment. The higher level of mortality incurred was in accordance with the report of Joe and Raymond (2005) that heat stress could result in significant losses to producers with all types of poultry, the most obvious loss of which was due to mortality. Ryder *et al.*

Table 9: Least squares means and standard errors of the effect of genotype on water intake (ml)/day

Age in weeks	Genotype		
	Local (120)	Exotic (60)	Crossbred (120)
1	31.56±1.49[a]	36.19±0.01[a]	31.55±2.09[a]
4	76.13±9.44[b]	105.74±0.02[a]	98.02±18.10[a]
8	196.30±5.65[b]	250.35±0.01[a]	264.22±26.89[a]
12	360.50±16.60[c]	742.86±0.02[a]	602.82±31.39[b]
16	303.44±31.73[c]	587.40±0.02[b]	643.83±57.97[a]
20	574.11±41.15[a]	605.04±0.01[a]	626.41±67.51[a]

[a,b,c]Means in the same row with different superscripts are significantly different ($p<0.05$). Values in parenthesis = number of observations

Table 10: Least squares means and standard errors of the effect of genotype on mortality rate

Genotype	N	Least squares means±SE
Local	40	33.08±0.11
Exotic	27	44.82±0.01
Crossbred	43	35.56±0.12

(2004) indicated that mortality and poor performance of broiler chicken was a problem for broiler producers in regions in which temperature approaches or exceeds the body temperature of the bird (40°C).

Conclusion: Variations in the genetic make-up of the turkeys accounted for the observed differences in growth and efficiency of feed utilization. The highest values of body weight and all other linear body parameters were observed in the exotic turkeys followed by the crossbreds and then the local turkeys. The crossbred turkeys showed close proximity with the exotic turkeys in the values obtained for growth parameters.

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