ISSN 1682-8356
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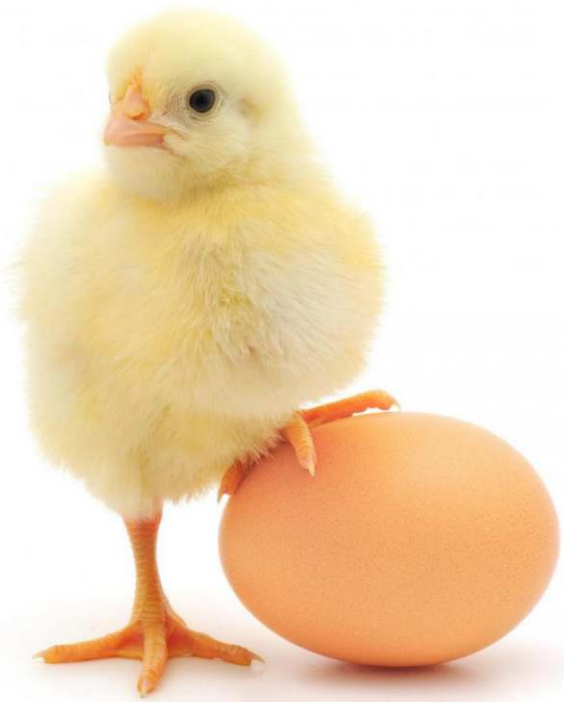

INTERNATIONAL JOURNAL OF

POULTRY SCIENCE

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International Journal of Poultry Science 11 (8): 500-504, 2012
ISSN 1682-8356

A Comparison of Performance among Exotic Meat Strains and Local Chicken Ecotypes under Sudan Conditions

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Abstract: The present study was conducted to compare the performance of exotic meat strains (Hybro and Hubbard) and native chicken ecotypes (Bare- neck, Large Beladi and Betwil) under hot climate of the Sudan. A total of 505 one day old chicks were reared together using a Completely Randomized Design with 9 replicates for each genotype. Traits studied up to 8 weeks of age were body weight, feed intake, live weight gain, feed conversion ratio and mortality. Results revealed that there were significant differences ($p<0.01$) for body weight at various ages among the different genotypes. Body weights for the exotic strains at hatch, 4 and 8 weeks were in the range of 37.85±2.23 - 39.76±3.77, 497.37±101.50 - 516.25±107.95 g and 1230.46±258.06 - 1269.63±242.16 g respectively, whereas the corresponding results for the local ecotypes were 24.68±2.60 - 27.83±4.24, 109.28±25.77 - 141.53±33.75 g and 271.90±25.18 - 341.73±63.77 g. Average live weight gain during the first 4 weeks of age (starter stage) was significantly lower than that during the second 4 weeks (finisher stage) for both exotic strains and native ecotypes. Hybro strain exhibited the highest total live weight gain (1231.78 g.) whereas Large Baladi ecotype was the lowest (247.22). Feed intake and feed conversion ratio showed significant differences ($p<0.01$) between the exotic strains and the local ecotypes with the former consumed amount of feed three times that consumed by the latter and had better feed efficiency. Although the overall mortality and mortality during the first 4 weeks of age were higher among the local ecotypes than those of the exotics, the reverse was true during the second 4 weeks of age. It can be concluded that the performance of the exotic strains was substantially higher than that of the local chicken ecotypes. This can be attributed to the unimproved genetic potentials of the local chicken ecotypes. On the other hand, the performance of the exotic strains was also lower than that which can be expected under optimum environmental conditions. This may be due to the effect of high ambient temperature.

Key words: Bare-neck, betwil, large beladi, hybro, hubbard

INTRODUCTION

Performance of local chickens in developing countries has been studied by many researchers (Elamin *et al*., 2004; Al-Yousef, 2007; Fassill *et al*., 2010; Udeh and Omeje, 2011). Although growth pattern of local chickens is similar to that of temperate breeds the production level is relatively low, which can be attributed to the unimproved genetic potentials and the poor managerial conditions in which the local chickens are reared (Nowsu, 1979; Yousif *et al*., 2006). On the other hand Oluyemi *et al*. (1979) and Gueye (1998) reported that indigenous fowl is extremely adapted to harsh managerial conditions in the tropics resulted from natural selection that occurred through a long period of time. It has been well known that indigenous chickens play a very essential role in the socioeconomic life of the rural communities in developing countries; this necessitates that effort must be employed to improve their production performance. Heat stress represents the major challenge for optimum poultry production in tropical countries. The effect of hot climate on performance of exotic broiler strains has been studied by several authors (Yalcin *et al*., 1997; Cahaner and Leenstra, 1992; Tibin and Mohamed, 1990), it causes high mortality and severe reduction in feed intake and hence poor growth. Azoulay *et al*. (2011) confirmed that being featherless improved the livability and performance of fast-growing broilers in hot conditions.

Furthermore, crossbreeding programs involving indigenous chickens which are more adapted to harsh environmental conditions and suitable exotic fowl breeds could possibly exploit the phenomenon of heterosis to evolve a relatively heat tolerant and highly productive hybrid chicks (Mekki *et al*., 2005ab). The present research aims at comparing the production performance of exotic meat strains and local ecotypes under Sudan conditions.

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MATERIALS AND METHODS

Study location: This experiment was carried out at poultry houses located in the Faculty of Animal Production, University of Khartoum, Sudan. The highest and lowest ranges of temperature during the experimental period were 37-44 and 22-30°C respectively.

Experimental chicks: Fertilized eggs of the native chicken ecotypes, Bare-neck, Large Beladi and Betwil (dwarf) were collected from the stocks kept at the Indigenous Chicken Research Unit in the Faculty of Animal Production, University of Khartoum. Furthermore, fertilized eggs of the exotic broiler strains (Hybro and Hubbard) were obtained from local hatcheries at Khartoum state. Eggs of each genotype were graded and separately allocated in a tray within an automatic turning device incubator (Funki model) with capacity of 5000 eggs. A total of 105 Hybro, 105 Hubbard, 102 Bare-necks, 129 Large Beladi and 75 Betwil (dwarf) one day old chicks were obtained. Hatched chicks were graded by culling the deformed or weak ones, weighed, wing banded and transferred in covered plastic trays to brooders.

Housing and management: Prior to chick's arrival, brooders were incinerated and disinfected by administration of Potassium Permanganate and Formaldehyde solution in a ratio of (1 g: 2 ml). Each brooder (3.5 x 3 x 3 m dimensions) was internally divided into 8 small brooder units and covered with 5 inches depth of wood Shaving litter. Chicks from each strain or ecotype were randomly distributed into brooder units (10-15 chicks per unit), representing a Completely Randomized Design (CRD) with 9 replicates for each genotype. During the first 4 weeks of age chicks were provided with a starter ration containing 24% CP and 3123 ME *ad-libitum* (Table 1); also clean fresh water with vitamins and minerals added at weekly interval were continuously available. Continuous Light was provided using four 100 watt bulb lambs. Chicks were vaccinated against New Castle disease at the first and the third weeks of age while Gumbro vaccine was administered at the second week of age. Chicks were transferred to open sided poultry house with dimensions of 10 x 4 x 3 m at the end of the 4th week of age. The house was divided internally into 15 small pen units each with dimensions of 1 x 1 x 0.8 m. The pen units were covered with 5 inches depth of wooden shaving litter and equipped with feeders and water containers. Artificial light was also provided using four 100 watt bulb lams. From 4to 8 weeks of age, finisher ration with 21% CP and 3180 ME (Table 1) was provided *ad-libitum*.

Data collection and statistical analysis: Chick's body weight and weight gain were measured individually from hatch up to 8 weeks of age at weekly interval. Feed intake and feed conversion ratio were also calculated for each replicate in each genotype at weekly interval. Mortality during the starter stage (first 4 weeks of age), finisher stage (second 4 weeks of age) and overall mortality were calculated.

Table 1: Formulation of starter and finisher ration

Ingredients	Starter	Finisher
	-------------------- (%)	------------------
Sorghum	58.00	63.23
Groundnut meal	19.00	15.00
Sesame meal	14.03	12.30
Super concentrate	5.00	5.00
Dcal	1.00	1.00
Oyster shell	1.50	1.50
NaCl	0.30	0.30
Lysine	0.10	0.10
Meth.	0.07	0.07
V. oil	1.00	1.50
Total	100.00	100.00

Chemical composition of starter and finisher ration

Constituents	Amounts	Amounts
Crude protein %	24.12	21.35
ME (kcal/kg)	3123.00	3180.00
Dry matter %	93.14	93.46
Ether extract	7.40	7.39
Ash %	7.29	8.35

*Broiler concentrate 5% Hendrix contains: Crude protein 40%; crude fiber, 4.52%; fat 5.20%; Ash, 3.20%; ME 2200 kcal/kg; lysine 8.75%; Methionine, 1.6% spp. Methionine + cystine 2.0%; calcium 7.6%; phosphorus (av.) 4.8%.
*ME = Metabolizable energy. Source: AOAC 1984

Data set consisted of 498 observations was subjected to statistical analysis using the General Linear Model (GLM) of the Statistical Analysis System (SAS, 2004). The model used was:

$$y_{ij} = \mu + b_i + e_{ij}$$

μ = Over all mean
b_i = Effect of ith breed (I = 1, 2, 3, 4 and 5)
e_{ij} = ij the residual effect

Duncan Multiple Range (DMR) test was used for comparison of differences among means. Mortality was calculated as percentage for each genotype.

RESULTS

Table 2 and 3 show that there were significant differences ($p<0.01$) in body weight and body weight gain between the exotic meat strains and the native chicken ecotypes from hatch up to 8th week of age. A significant difference ($p<0.01$) was found between the exotic meat type strains (Hybro and Hubbard) with Hybro being heavier than Hubbard. Moreover a significant difference ($p<0.01$) was found among native chicken ecotypes with Bare-neck being heavier than Large Baladi and Betwil from hatch up to 8th week of age. Growth pattern as well as weight gain curve of the exotic meat strains and the native chicken ecotypes are shown

Table 2: Comparison of growth performance of exotic meat strains and native chicken ecotypes

	Hybro	Hubbard	Bare-neck	Large Baladi	Betwil
Trait	Means±SD				
BW0	37.85^{b}±002.23	39.76^{a}±003.77	27.83^{c}±04.24	24.68^{d}±02.60	25.42^{d}±03.27
BW1	80.37^{a}±012.46	83.77^{a}±010.03	46.37^{b}±11.32	35.66^{c}±06.32	37.15^{c}±06.55
BW2	158.37^{a}±037.42	154.65^{a}±030.63	65.28^{b}±12.74	51.50^{c}±11.02	57.02^{c}±13.89
BW3	208.50^{a}±074.19	286.54^{b}±064.06	102.84^{c}±25.07	79.53^{d}±19.69	89.24^{cd}±20.84
BW4	516.25^{a}±107.95	497.37^{a}±101.50	141.53^{b}±33.75	109.28^{c}±25.77	121.23^{cb}±26.68
BW5	709.16^{a}±137.19	671.92^{b}±134.44	190.37^{c}±51.45	141.23^{d}±36.04	159.89^{d}±35.60
BW6	881.07^{a}±189.53	883.97^{b}±202.13	241.80^{c}±50.93	185.25^{d}±47.02	202.40^{d}±50.98
BW7	1117.32^{a}±211.71	1054.10^{b}±209.13	289.19^{c}±68.41	229.76^{d}±57.05	248.27^{cd}±54.97
BW8	1269.63^{a}±242.16	1230.46^{a}±258.06	341.73^{b}±63.77	271.90^{c}±25.18	301.80^{bc}±62.36

*Means with the same super script letter in a row are not significantly different; while means with different super script letter in a row are significantly different (p<0.01).

*BW0, BW1, BW2, BW3, BW4, BW5, BW6, BW7 and BW8 = Body weight at hatch 1, 2, 3, 4, 5, 6, 7 and 8 weeks of age

Table 3: Body weight gain of exotic meat strains and native chicken ecotypes

Trait	Hybro	Hubbard	Bare-neck	Large Baladi	Betwil
BWG 4	478.40	456.78	113.7	84.60	95.81
BWG 8	753.38	733.09	200.2	162.62	180.57
BWG T	1231.78	1189.87	313.9	247.22	276.38

*BWG 4, 8 and BWGT = Body Weight Gain at 4, 8 weeks and Total body weight gain

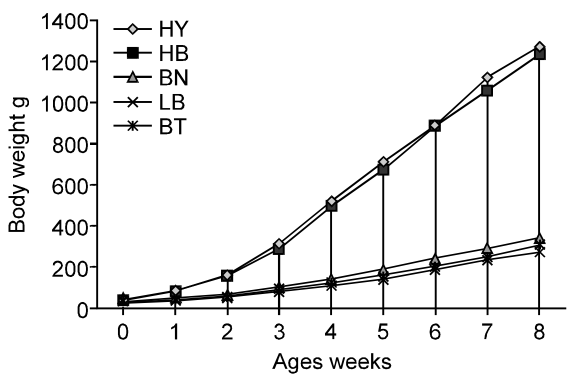

Fig. 1: Comparison of growth pattern of exotic meat strains and native chicken ecotypes

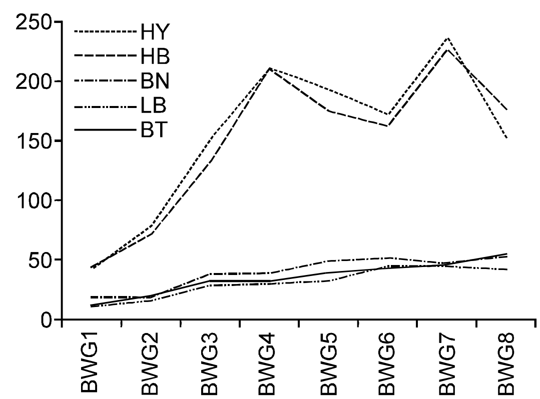

Fig. 2: Comparison of body weight gain of exotic meat type strains and native chicken ecotypes

in Fig. 1 and 2. The weekly body gain curve of the exotic strains showed a marked fluctuation and attained the highest weight gain at week 7 however this trend was not clear for the native chicken ecotypes. Hybro and Large Beladi scored the highest and the lowest performance respectively. Results also showed that body weight gain during the finisher stage (the last four weeks of age) was significantly higher (p<0.01) than that at starter stage (the first four week of age) in all genotypes.

Table 4 shows a comparison of feed intake and feed conversion ratio of exotic meat strains (Hybro and Hubbard) and native chicken ecotypes (Bare-neck, Large Baladi and Betwil) at different ages. Significant differences (p<0.01) between exotic meat strains and native chicken ecotypes were observed with the former consumed amount of feed three times greater than the latter and had a better feed conversion ratio. There was no significant difference in feed intake and feed conversion ratio between Hybro and Hubbard exotic meat strain, however significant difference (p<0.01) was found among the native ecotypes. Mortality during the whole experimental period was higher in the native chicken compared to that of the exotic strains (9.5-10.4 vs 11-11.8). However the reverse was true during the last 4 weeks of age.

DISCUSSION

Growth is a function of genetic and environmental factors at different ages. In this study body weight and weight gain of the exotic strains were significantly higher (p<0.01) than those of the native chicken ecotypes from hatch up to 8th weeks of age (Table 2). These results are in agreement with those reported by Chhbardra and Sapra (1973) in India, Tibin and Mohamed (1990) in Sudan and Ali *et al.* (2006) in Tanzania. The great variation in growth between exotic meat strains and the

Table 4: Comparison of feed intake and feed conversion ratio of exotic meat strain type and native chicken ecotypes

Trait	Hybro	Hubbard	Bare-neck	Large Baladi	Betwil
	Means±SD				
Inatke 1	72.22^{b}±004.89	78.84^{a}±008.53	39.08^{c}±07.22	34.91^{c}±03.88	37.57^{c}±07.40
Intake 2	188.56^{a}±050.16	171.44^{a}±037.96	74.11^{b}±18.87	63.92^{b}±19.42	74.14^{b}±15.77
Intake 3	265.22^{a}±022.96	250.96^{a}±010.16	81.43^{b}±16.68	67.45^{b}±13.71	79.67^{b}±16.11
Intake 4	358.52^{a}±054.55	348.10^{a}±074.78	87.97^{b}±07.27	77.60^{b}±12.89	81.08^{b}±12.04
Intake 5	412.33^{a}±083.56	413.72^{a}±082.62	135.30^{b}±20.33	125.08^{b}±16.94	132.77^{b}±32.70
Intake 6	492.92^{a}±083.24	528.12^{a}±097.26	170.80^{b}±21.95	169.07^{b}±32.29	167.57^{b}±35.89
Intake 7	543.00^{a}±064.29	556.13^{a}±136.17	183.46^{b}±31.02	178.93^{b}±32.65	189.31^{b}±32.11
Intake 8	671.44^{a}±155.03	673.24^{a}±137.62	214.83^{b}±28.20	202.11^{b}±16.97	223.27^{b}±70.14
T. intake	3004.21	3020.55	986.98	919.07	985.00
FCR	2.35^{c}±0.16	2.44^{c}±0.25	2.77^{b}±0.24	3.33^{a}±0.45	3.34^{a}±00.28

*Means with the same super script letter in a row are not significantly different; while means with different super script letter in a row are significantly different (p<0.01).

*Intake 1, intake 2, intake 3, intake 4, intake 5, intake 6, intake 7, intake 8 and T. intake = feed intake g/bird at 1, 2, 3, 4, 5, 6, 7, 8 weeks of age and total feed intake. FCR = Feed Conversion Ratio

indigenous fowl can be attributed to the differences in their genetic make-up since the former has been extensively selected for rapid growth. Generally, growth performance of the exotic meat strains in this study was lower than that of their counterpart in temperate zone, this may reflect the drastic effect of high ambient temperature on growth. On the other hand the differences among growth performance of the native chickens in the present study may indicate the presence of genetic variation that can be exploited for improving the indigenous chicken breed by selection.

Feed intake is one of important factors that affect body weight and weight gain of the broiler chickens. In the present study the feed intake results showed a significant difference (p<0.01) between the exotic meat strains and native chicken ecotypes from 1st week up to 8th weeks of age (Table 4). Similar results were found by Oluyemi *et al.* (1979); Tibin and Mohamed (1990) and Hassan *et al.* (2006) who reported that exotic breeds consumed significantly (p<0.05) more feed than indigenous chickens of Africa. Regarding feed Conversion Ratio (FCR) in the present study exotic meat strains were found to be highly (p<0.01) efficient compared to the native chicken ecotypes. Hybro and Hubbard consumed total amount of 2.35 and 244 kg of feed for each kg of life body weight respectively whereas the native chickens consumed amount of 2.77, 3.33 and 3.34 kg of food for each kg of life body weight for Bare-neck, Large Baladi and Betwil respectively. These results are in the range of those found by Oluyemi *et al.* (1979) and Tibin and Mohamed (1990), they reported that exotic broiler breeds were significantly (p<0.01) better in feed conversion ratio than indigenous chicken breeds. Although the overall mortality and mortality during the first 4 weeks of age (grower stage) were higher in the native chicken ecotypes the reverse was true for the second 4 weeks of age (finisher stage), this may be due to the fact that exotic broilers have become more sensitive to heat stress as age advances.

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