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Growth Performance and Carcass Characteristics of Turkeys (*Meleagris gallopavo*) under semi intensive System in the Sudan.

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Abstract: The objectives of this study were to determine the growth performance and carcass traits of turkeys under semi intensive system in the Sudan. Atotal of 100 unsexed turkey growers from the commercial breed (B.U.T. Big 6) were used during 7th June to 6th August, 2011. Birds were kept in an open sided deep litter poultry house at the University of Bahri Farm from 9 to 16 weeks of age and fed on turkey grower and finisher diets. Results of feed intake and body weight showed a consistent increase with increase in age. Performance results showed that turkey had 2.42 kg, 6.64 kg, 79.49 g, 1.5 kg/ bird/ day, 2.8 and 4%, starting weight, finishing weight, average daily gain, average feed intake; average feed conversion ratio (FCR) and total mortality, respectively. Results also showed that turkey had 6.91 kg, 5.03 kg, 76.98%, 14.37%, 14.2% and 33.4% slaughter weight, carcass weight, dressing percentage and thigh, drumstick and breast weights as percentage of carcass weight, respectively. Males obtained significantly heavier slaughter, carcass, thigh, drumstick and breast weights than females. On the other hand PH, WHC and cooking loss were 5.63, 36.6 and 2.05, respectively. It can be concluded that, the rearing of B.U.T. Big 6 commercial breed of turkey is possible under semi intensive system in the Sudan. Further studies are needed to determine turkey performance and carcass attributes under range and intensive systems of management using the same breed or other turkey breeds.

Key words: Turkey; B.U.T; Big 6; Semi-intensive system; Carcass characteristics

INTRODUCTION

In Sudan, chickens have failed to satisfy the local demand for poultry meat. The most appropriate alternative is turkey's production. Turkeys are now an important source of food in many parts of the world (Brant 1998), and it was suggested that turkey red meat will be alternative to cattle meat in the future (Nixey 1986).

Turkey has good feed conversion ratio, lean meat with low cholesterol level, high dressing percentage compared with other domestic livestock (Sullivan *et al*. 1968). In addition, commercial turkey breeds have high yield of meat that reach about 14.6 kg and 10.25 kg at 16 weeks for male and female respectively, under ideal management conditions (BUT 2005).

The turkey (*Meleagris gallopavo*) is a well known bird in western countries but it is not commercially established in the rest of the world especially in developing countries. However, commercial turkey farming is becoming popular in some developing countries such as India (Anna Anandh *et al.* 2011). Similarly, commercial turkey production can be practiced in the Sudan under all systems of production. This is possible since local turkey breeds have been reared in the Sudan at small scale farming. In addition former studies (Platz *et al.* 2003) proved the possibility of rearing commercial turkey breeds B.U.T. Big 6 selected for intensive weight gain, under extensive conditions of organic management standards.

Information on the growth performance and carcass characteristics of commercial breeds of turkeys under semi intensive system of management are not available in Sudan. The availability of such information is very essential to provide data base for this type of poultry.

The objective of this study was to determine the growth performance and carcass characteristics of turkey's commercial breed (B.U.T. Big 6) under semi intensive system in the Sudan.

MATERIALS AND METHODS

The study was conducted in the College of Natural Resources Farm, University of Bahri, Khartoum North, during the period from 7th June to 6th August 2011. Turkey poults of the British United Turkey (B.U.T. Big 6) breed were used. Poults were obtained by hatching fertile eggs brought from France. Brooding was first done in a room with 3×4×2.5 m dimensions for four weeks and then on an open sided deep litter poultry house up to eight weeks. Poults were fed on the starter diet up to the end of week 8 Water and feed were provided ad-libitum . Ordinary and vapor fans were used to reduce temperature level during the hot times of the day. House temperature was measured using a thermometer where a temprature range between 38- 46 c^0 was recorded .

The ingredients compositions of the experimental diets are shown in Table 1 while their determined and calculated compositions are indicated in Table 2. The calculations are based on the actual analysis and book values (Ellis 1981; NRC 1994) of composite samples of feed ingredients involved. Metabolizable energy (ME) was calculated according to the modified equation of Lodhi *et al.* (1976). Diets were formulated to meet the requirements of starter, grower and finisher turkeys for essential nutrients as outlined by NRC (1994). Ingredients of the diets were sorghum grain, groundnut and sesame seed cakes and super concentrate as major sources of protein and energy and oyster shell and dicalcium phosphate as calcium and phosphorus sources. Lysine and salt were added to meet turkey's requirements for these essential nutrients. The analysis of ingredients of sorghum grains and other feeds used in ration formulation was carried out according to the Association of Official Analytical Chemist (AOAC 1994).
A completely randomized design was used to lay out the experimental units.At the beginning of week 9, one hundred poults were selected and further sub-divided into 10 groups with similar initial weights each one containing 10 poults inside a deep litter poultry house. Experimental pens were 1×2×3 meters dimension and made of strong iron expenders.

Table 1. Ingredients composition of the experimental diets on percent basis

Ingredient	Starter diet% 0-4weeks	Grower diet% 5-11 weeks	Finisher diet% 12-16 weeks
Sorghum	50.00	58.00	62.00
Groundnut cake	29.20	25.00	22.00
Sesame seed cake	15.00	5.00	0.00
Super concentrates	5.00	5.00	5.00
Vegetable oil	0.00	0 .00	0.90
Oyster shell	0.08	0.00	0.00
Dicalcium phosphate	0.00	0.30	1.20
Lysine	0.34	0.20	0.10
Salt	0.30	0.40	0.30
Vitamins premix	0.00	0.30	0.20
Wheat bran	0.00	5.80	8.30
Total	100.00	100.00	100.00

*Super concentrate: A concentrated source of protein, minerals and amino acids containing 35% CP, 12% Ca, 5.8%P, 5.3% Lysine, 2.8% methionine, 1650 Kcal/kg ME plus sufficient amounts of vitamins and minerals.

Table 2. Determined and calculated composition of the experimental diets

Ingredient	Experimental diets%		
	Starter 0-4 weeks	Grower 5-11 weeks	Finisher 12-16 weeks
	Determined diet composition		
Crude protein %	26.4	22.0	19.3
Crude fibre,%	7.50	7.60	8.1
Fats %	3.81	3.93	4.19
Ash, %	9.5	8.98	7.92
	Calculated diet composition*		
Dry matter	89.0	88.13	87.80
Crude protein	26.26	21.92	19.15
ME kcal/Kg	3050	3048	3100
Calcium	1.2	0.86	0.76
Phosphorus	0.88	0.7	0.61
Lysine	1.6	1.3	1.07
Methonine	0.48	0.42	0.32

*Calculated according to Ellis (1981) and actual analysis of sorghum samples
ME = Metabolizable energy

Growers and finishers were fed on their respective diets up to the end of weeks 12 and 16 respectively. Feed was provided in large iron feeders and water was given in oil's plastic vessels. Dim light was maintained throughout the night for the entire experimental period.

Feed intake and body weight were determined at the end of each week using a digital balance. Accordingly, the daily weight gain and the weekly feed conversion ratio (FCR) were calculated. Mortalities of birds were recorded when it occur and a diagnosis for mortality was recorded when birds died during the trial.

At the end of weeks 16, two birds (male and female) were selected from each pen. Birds were individually weighed after overnight fasting (except for water) and then slaughtered, handpicked, washed and drained. The heads, feet and shanks were removed. The birds were then eviscerated and the slaughter and carcass weights and dressing percentage were determined. Carcasses were placed on ice water for 3 hours cut up into components and weighed. Carcass yield was expressed as a percentage of the live body weight just before slaughter, and carcass components (Breast, thigh and drumstick) were expressed as a percentage of the chilled carcass weight. Ten random samples of breast, drumstick and thigh muscles were selected for chemical analysis. Samples were cut into small pieces, minced thoroughly hand mixed wrapped and frozen at -18 ^{0}c. Duplicate samples were then used and analyzed for fat, protein, ash and moisture contents according to (AOAC 1994). Samples from the frozen meat mixture were used for the determination of meat quality attributes. Raw meat colors were evaluated (L, +a, and +b) using a color meter.

The descriptive statistics (means and standard deviation) were used to determine overall means of the performance and carcass characteristics parameters. T- test was used to analyze the data for carcass characteristics between males and females.

RESULTS AND DISCUSSION

Feed intake of turkeys kept under the present study is shown in Figure 1. A consistent increase in feed intake with increasing age was seen except in week 13 where a decrease in feed intake was observed. This decrease can be attributed to severe weather changes (Rains and storms) that occurred during this week.

Body weight followed similar trend as feed intake (Figure 2). The general increasing trend of feed intake and body weight in the present study agreed with that reported in BUT (2005) for these two parameters. Moreover, the body weight results of this study are consistent with turkey growth pattern according to Gompertz- laird growth curve (Laird *et al.* 1965).

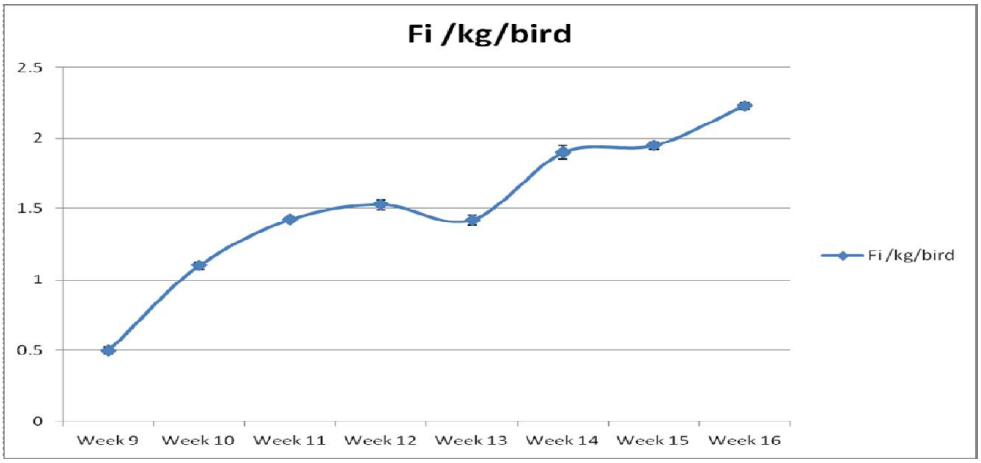

Fig. 1. Feed intake of turkeys kept under semi intensive system

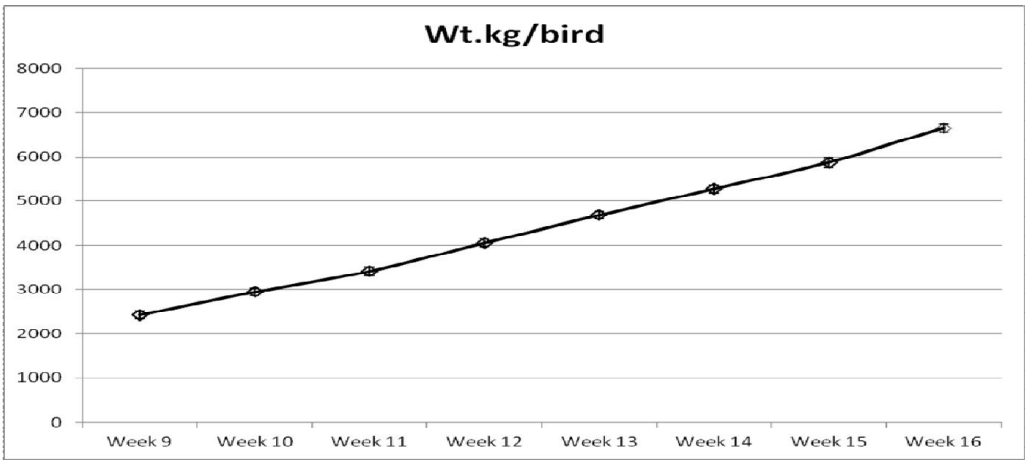

Fig. 2. Body weight kg/bird of turkeys kept under semi intensive system

The results of starting weight at week 9, finishing weight at week16, average daily gain, average feed intake, average FCR and mortality percentage are shown in Table 3.The starting weight was lighter than the average weight (5.18) obtained from male and female turkeys reported in BUT (2005). The starting weight was also lighter than that reported by Isguzar (2003), Roberson *et al.* (2003), and BIG 6 (2012) where body weights of 3.50, 5.74 and 5.3 kg at week 9 for the same breed were reported under intensive system of management. However, the present body weight at week 9 was heavier than that reported by Isguzar (2003) for bronze turkeys.

The finishing weight obtained was less than the average weight of 12.42 kg for male and female turkey reported in BUT (2005). It is also less than 14.6, and 13.02 kg reported in Roberson *et al.* (2003) and BIG 6 (2012) for the same breed of turkey under intensive system of management. On the other hand the present results of body weights at week 16 were heavier than 5.00 kg reported by Poescu and Puscatu (1979) for broad breasted white turkey and 6.39 kg obtained under tropical conditions (Turkey management guide 2012). Management system and breed difference were possibly behind these differences in results.

The result of average daily weight gain obtained was lighter than the average 99.2 and 102.87g for male and female turkeys reported in BUT (2005) and BIG 6 (2012) respectively, for the same breed of turkey under intensive management . The higher daily gain of turkeys reared under intensive system can be attributed to high feed consumption.

As far as the average feed intake is concerned the amount of 1.5 kg feed consumed by birds under the present study was less than the average feed intake of 2.07 and 1.66 for feed A and B eaten by males and females turkeys (BUT 2005). On the other hand the amount of feed consumed is higher than (1.11kg) reported for turkeys kept in India (Turkey management guide 2012).The lower feed intake of birds kept can be attributed to the management system and high temperature witnessed during the study which ranged between 38-46 c^0.

Table 3 shows that FCR obtained was higher than (FCR) of 2.26 and 2.62 obtained by males and females turkeys for feed A and B respectively (BUT 2005). It was also higher than 2.21 and 2.43 FCR reported by Roberson *et al.* (2003) and BIG 6 (2012), respectively. However, the present result is similar to 2.75 FCR obtained under tropical conditions (Turkey management guide 2012). This indicated that, the higher FCR obtained was due to management system and environmental conditions.

The causes for the 4 death incidences were heat stroke and pendulous crop (2 birds) for each.

The percentage of mortality (4%) found in the present study is less than the percentages 4.53 and 10.4 % reported in BUT (2005) and Roberson *et al*. (2003) respectively, for the same breed of turkey under intensive system of management. Moreover, the present mortality is lower than that reported by Anna Anandh *et al*. (2011) for turkeys kept under semi intensive system of management.

Differences in performance between this study and the breed manual (BUT 2005) could be attributed to different feeding, growing conditions, management and environment. Platz *et al.* (2003) reported that turkeys' exhibits higher performance in the winter season compared to the summer period.

Data were not available to compare the performance of B.U.T. Big 6 under semi-intensive system of management. However, the great difference between the present results and the breed manual encourage more work to determine whether the genetic prosperities of this breed can be exploited under semi intensive system of management or not. Better results would have been achieved under intensive management since this breed was genetically engineered for maximum production under ideal management conditions.

Table 3. Turkey performance from week 9 to week 16*

CV	SD.	Mean	Parameter
11.64	281.72	2.42	Starting weight kg (wk. 9)
4.20	279.18	6.64	Finishing weight kg (wk.16)
34.88	27.74	79.49	Average daily gain g
34.49	0.520	1.50	Average feed intake kg/bird/wk
35.87	1.00	2.80	Average FCR
-	-	4	Total mortality%

*means are values of 100 birds.
SD= Standard deviation
CV= Coefficient of variation

Carcass characteristics (Slaughter and carcass weights, dressing percentage and breast, thigh and drumstick weights) are shown in Table 4.The carcass weight (5.3 kg) obtained in the current study was lighter than the average 9.35 obtained from males and females of the same breed (BUT 2005) and 10.9 kg obtained by Roberson *et al.* (2003) from male turkeys. This could be due to the lower weight gain of the experimental birds. Forrest *et al.* (1957) reported that cold carcass weight decreased with the decrease in live body weight in chicken. On the other hand the dressing percentage 76.98 is higher than 75.04% reported in BUT (2005). Differences in management system, cutting technique and sex may account for this variation in results.

The weights of thigh, drum stick and breast as percentages of chilled carcass weight are shown in Table 4. The present results are higher than 14.1, 10.1 and 29.9% for the same cuts respectively, (BUT 2005). This could be due to the decrease in carcass weight of the experimental birds (Forrest *et al.* 1957). Variation in the yield of different parts may also be due to different cutting techniques (BUT 2005).

Table 4. Overall results of carcass characteristics*

CV	S.d	Mean	Variable
9.583	662.4112	6912.00	Slaughter weight g
8.903	472.3696	5305.73	Carcass Weight g
6.917	5.3252	76.75	Dressing %
6.353	0.4662	14.37	Thigh as % of carcass
7.444	0.5525	14.20	Drum stick as % of carcass
16.541	2.7668	33.60	Breast as % of carcass

*means are values of 20 birds of both sexes.
Sd= Standard deviation
CV= Coefficient of variation

Carcass characteristics of male and female turkey are shown in Table 5. Significant differences ($p \leq 0.05$) were observed in slaughter, carcass; breast, thigh and drumstick weights as percentage of carcass weight. However, no differences were seen between male and female thigh and dressing percentage. These results are consistent with BUT (2005). On the other hand dressing percentage and breast and thigh as percent of carcass weight obtained from male turkeys were lighter than 78.04, 38.07 and 18.3 respectively, reported by Roberson *et al.* (2003). These slight differences may be attributed to cutting errors.

The chemical analysis values of turkey meat was 75.85, 16.87, 1, and 0.91 for moisture, crude protein, ash and ether extracts respectively. The moisture content obtained was higher than 73.5% found by Roberson *et al.* (2003) and 71.8 % reported in USDA (2002). On the other hand the estimated crude protein is less than that reported by Roberson *et al.* (2003) and USDA (2002).

The decrease in carcass protein in the present study could possibly be due to the reduction in feed consumption which resulted from high environmental temperature. Summer *et al.* (1965) reported that carcass protein decreases with the decrease in dietary protein.

Color attributes were 39.46, 16.4 and 5.44 for l (lightness), a (redness) and b (yellowish), respectively. On the other hand PH, WHC and cooking loss were 5.63, 36.6 and 2.05, respectively. BUT (2005) lacks data on meat quality attributes for comparison. However, Qiao *et al.* (2001) reported that, wide differences in meat color attributes exist.

Cost and profit analysis would have given more weight to this study, unfortunately, the instability of feed ingredients and poultry meat prices during the study made it very difficult to determine the profit.

Table 5. Carcass characteristics of male and female turkey*

p	t-value	Female Mean±SD	Male Mean±SD	Variable
0.018	2.69	6502.86±522.22	7270.00±574.40	Slaughter weight g
0.023	2.55	5023.71±457.98	5552.50±342.58	Carcass weight g
0.869	-0.16	77.25±3.14	76.37±6.94	Dressing %
Cuts weight as % of carcass weight				
0.240	1.22	14.36±0.36	14.8±0.52	Thigh
0.032	2.40	14.2±0.62	15.4±0.31	Drum stick
0.050	-2.06	36.29±2.92	30.96±2.05	Breast

*Values are means of 10 birds
Significant at $P \leq 0.05$

CONCLUSIONS

No scientific studies were done on turkey performance and carcass characteristics under Sudan conditions and this manuscript showed an opportunity to produce meat in the Sudan. The preliminary results reported in this paper are a beginning and more in depth research is needed to determine the performance and carcass characteristics and production cost of this breed under range and intensive systems of production. This is very important in the Sudan and other developing countries where poultry meat is of high demand. In addition, the rearing of other breeds of turkeys could be investigated .

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أداء وخصائص زبيحة الدجاج الرومى بالسودان

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المستخلص : هدفت هذه الدراسة لتحديد خصائص الأداء والزبيحة للدجاج الرومى تحت النظام شبه المكثف بالسودان. تم إستخدام 100 دجاجة رومى زكوراً وإناثاً من سلالة (بى يو تى بق 6) فى الفترة من 7 يونيو الى 6 أغسطس 2011 . تم إسكان الرومى فى حظيرة مفتوحة بمزرعة جامعة بحرى من الإسبوع 9- الى الإسبوع 16 وغذيت على علائق رومى نامية ونهائية. أظهرت النتائج أن إستهلاك الغذاء والنمو زادا زيادة مطردة بزيادة العمر. أشارت النتائج الى أن الوزن الإبتدائى والوزن النهائى ومتوسط زيادة الوزن اليومى ومتوسط الغذاء المستهلك والكفاءة التحويلية للغذاء ونسبةالنفوق كانت 2.42 كيلوجرام و 6.64 كيلوجرام و 79.49 جرام و1.5 كيلوجرام و2.8 و4% على التوالى. كذلك أشارت النتائج الى أن الوزن عند الزبح و الوزن الصافى للزبيحة و نسبة التصافى ونسب الفخذ والرجل والصدرمنسوبة الى الوزن الصافى للزبيحة كانت 6.91 كيلوجرام و 5.05 كيلوجرام و 76.98% و 14.37 و 14.2 و 33.4% على التوالى. أعطت الزكور أوزانا أثقل من الإناث فى وزن الزبيحة و الوزن الصافى للزبيحة و نسبة التصافى ونسب الفخذ والرجل والصدر. كذلك كان الأس الهايدروجينى و قدرة الزبيحة على الإحتفاظ بالماء وفاقد الطهى 5.63 و36.6 و2.05 على التوالى. خلصت الدراسة الى أن تربية سلالة الرومى (بى يو تى بق 6) ممكنة تحت النظام شبه المكثف بالسودان. توصى الدراسة بإجراء دراسات أخرى لتحديد أداء وخصائص زبيحة الدجاج الرومى تحت نظامى التربية الرعوى والمكثف بإستخدام هذة السلالة او سلالات أخرى من الرومى.