Performance of Turkeys Under Extensive and Semi - intensive Systems of Management in Khartoum State

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Abstract An experiment was carried out to determine and compare the performance traits of turkeys under semi-intensive and extensive systems of management in Khartoum State, Sudan. A commercial breed of turkey (BUT Big 6) was used. Birds were kept in an open-sided, deep litter poultry house (semi intensive system) and fenced enclosures (extensive system) from week 17 to weeks 24 and 28 and fed on turkey finisher and supplement diets, respectively. Parameters assessed were feed intake, body weight, body weight gain, feed conversion ratio (for each feed), mortality and cost and profit. Results of feed intake indicated a consistent increase with increase in age in both systems of management up to week 22 followed by a consistent decrease in feed intake up to the end of the experiment at week 28. Body weight increased with increase in age in both systems of management up to week 24 followed by a slight increase up to week 28. Turkeys kept under semi-intensive system of management consumed higher amounts of feed, gave heavier finishing weight, average weight gain, heavier carcass weight and higher profit than those kept under extensive system up to week 24 and lower mortality percentage and profit from week 25 to week 28. No difference between treatments was found in dressing percentage and wholesale cuts. The study concluded that the semi- intensive system is better for turkey production up to week 24.
Key words: Turkey; BUT Big 6; semi-intensive system; extensive system; performance; Sudan

INTRODUCTION

In Sudan, there is a need to increase the supply of poultry meat by introducing other poultry classes such as turkeys. It was suggested that turkey's red meat will be an alternative to cattle meat in the future (Nixey 1986).

The majority of global turkey meat originates from heavy type turkey hybrids reared under intensive systems of management. The main turkey commercial breeds include British United Turkey, (B.U.T.) Converter and Nicholas. The rearing of the commercial breeds of turkeys under semi-intensive and extensive systems is possible. 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.

The rearing of the commercial breeds of turkeys under semi-intensive and extensive systems in the Sudan is justified on the ground that the local breeds are of low productivity (Yassin *et al.* 2013). In addition, large scale farmers and companies cannot adopt the business under intensive system before seeing positive results under semi-intensive and extensive housing. Moreover, the extensive system is most suitable to small scale farmers, where scavenge feeds and native ranges can provide a wealth of edible plants and insects for turkeys. The extensive system also seems to gain ground considering the animal welfare which became one of the important factors in the market (Bentley 2002).

The performance of the commercial breeds is very good. For example, male and female British United Turkey breed reach 14.6 kg and 10.25 kg at 16 weeks respectively (BUT 2005).
Unfortunately, only 54% and 52% of the above weight was obtained under semi-intensive (Gibril *et al.* 2013a) and extensive (Gibril *et al.* 2013b) conditions at 16 weeks of age in the Sudan, but with steady increase with time. This indicates that more body weight could have been obtained if the birds were kept for more few weeks under high management system.

Hence, further rearing of turkey needs the assessment of the best time for the different parameters under these systems.

The objective of this study was to determine and compare the performance traits of BUT Big 6 breed of turkey under semi-intensive and extensive systems from week 17 to week 28.

MATERIALS AND METHODS

The present study was carried out during the period from 7th August to 5th November 2011. Turkey growers of the British United Turkey (BUT Big 6) breed, hatched from fertile eggs brought from France and brooded in Sudan, were used. The fertile eggs of this breed were the single choice available when efforts to obtain day old poults or fertile eggs from other turkey breeds failed. Rearing and feeding were done in accordance with BUT (2005) guide from day one through brooding up to week 16 and from then up to the end of week 28. Birds were allowed free access to feed and water during the entire period of the study. Ordinary and vapour fans were used to reduce temperature level during the hot times of the day. House temperature was measured, using a thermometer; it ranged between 38°C and 46°C during the day.

The ingredients compositions of the experimental diets are shown in Table 1 and their calculated composition in Table 2. The calculations were based on the actual analysis and book values (Ellis 1981; NRC 1994) of composite samples of the feed ingredients involved. Metabolizable energy (ME) was calculated according to the modified equation of Lodhi et al. (1976). Diets fed to birds in the semi intensive system were formulated to meet the requirements of finisher turkeys for essential nutrients as outlined by NRC (1994). The analysis of ingredients used in ration formulation was carried out according to AOAC (1994).

A completely randomized design was used to lay out the experimental units. At the start of week 17, unsexed 48 and 50 birds from birds kept under extensive and semi- intensive systems, respectively, were left as experimental birds for this study which was a continuation of a previous study that ended at week 16 as stated before. Birds in the semi-intensive system were further subdivided into 10 groups with similar initial weights

of 7.441 kg., each containing 5 birds. Birds were then allotted to 10 experimental pens inside a deep litter poultry house. Experimental pens were 1×2×3 metres dimension and made of strong iron expenders.

On the other hand, birds assigned to extensive system were further subdivided into 4 groups, each group contained 12 birds with similar initial weights of 6.708 kg. Birds were then allotted to four experimental areas each of 17.5×15 metres dimension. A shed of 3×6 metres dimension, made of local materials, was constructed in each fenced area to house the birds during the night. The sheds were tightly closed to represent second defense line against predators. The rest of the area was a yard with some trees. Birds were allowed to roam freely inside the fenced area and in addition, to scavenge feeds and insects found in the yard, turkeys, were fed a supplemented diet containing 70%, 20% and 10% sorghum, groundnut seed cake and alfalfa (Berseem Hijazi, dry weight) respectively . A land plot of 800 square metres was planted with alfalfa to provide continuous forage supply to the birds in the extensive system.

In both systems, feed was offered in iron containers hanged to the roof of the house and shed and water was provided in oil plastic vessels. Dim light was maintained throughout the night for the whole experimental period.

Table 1. Ingredients of the experimental diets

Ingredient	Inclusion rate	
	Finishe diet[*] (%)	Supplement diet[*] (%)
Sorghum	62.0	70.0
Groundnut seed cake	22.0	20.0
Sesame seed cake	0.0	0.0
Super concentrates	5.0	0.0
Vegetable oil	0.9	0.0
Oyster shell	0.0	0.0
Dicalcium phosphate	1.2	0.0
Lysine	0.1	0.0
Salt	0.3	0.0
Vitamins premix	0.2	0.0
Wheat bran	8.3	0.0
Alfalfa	0.0	10.0
Total	100.0	100.0

*Finisher diet for semi intensive system and supplement diet for extensive system.

Table 2. Determined and calculated compositions of the experimental diets

Ingredient	Finisher diet (%)	Supplement diet (%)
Determined composition		
Crude protein	19.3	18
Crude fibre	8.1	8.28
Fats	4.14	3.5
Ash	7.92	3.58
Calculated composition[*]		
Dry matter	87.80	86.18
C rude protein	19.15	17.63
ME Kcal/Kg	3100	2958.3
Calcium	0.76	0.16
Phosphorus	0.61	0.35
Lysine	1.07	0.47
Methionine	0.32	0.18

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

Feed intake and body weight were determined at the end of each week for birds in both systems, using a digital balance. Daily weight gain was calculated at the end of each week from week 17 up to the end of week 28. Mortality of birds was recorded. Feed conversion ratio (FCR) was calculated for each feeding system.

At the end of week 28, twenty birds were chosen from each system for carcass analysis. Birds were individually weighed after overnight fasting (except for water) and then slaughtered, handpicked and carcasses were washed and drained. The heads, feet and shanks were removed manually. The birds were then eviscerated, and the slaughter and carcass weights and dressing percentage were recorded. Carcasses were put in ice water for 3 hours, and the carcasses were then cut up into portions and weighed. Carcass yield was expressed as a percentage of the live body weight just before slaughter, and carcass portions (breast, thigh and drumstick) were expressed as a percentage of the chilled carcass weight.

Cost and profit analysis were calculated for each system, based on feed and meat prices at the time of the study.

Descriptive statistics (means and standard deviation) were used to determine overall means of the performance and carcass characteristics parameters for each system. T-test was used to analyze data obtained from extensive and semi-intensive system.

RESULTS AND DISCUSSION

A consistent increase in feed intake with increase in age was obtained in the semi intensive-system of management up to week 22, followed by a consistent decrease in feed intake with age up to the end of the experiment at week 28 (Fig.1). The extensive system showed a decreasing trend up to week 20 followed by increasing trend to a peak at week 22 and was then followed by a gradual decrease in feed intake with increasing age similar to the semi intensive-system. Turkeys kept under semi-intensive system of management consumed higher amounts of feed than those kept under extensive system in all weeks except week 17 where birds consumed similar amounts of feed.

 The factors behind the lower amount of feed consumed in the extensive system could be attributed to the type and quality of feed, physiological reasons (such as possibly low metabolism or low feed efficiency) and system of management where birds were most exposed to environmental conditions. The consistent increase in feed intake (in a decreasing manner) recorded after week 22 in both systems could probably be to decreasing feed efficiency, feed conversion and growth (Fig.2)

Turkeys kept under semi-intensive-system had significantly (P<0.05) heavier weights throughout the experimental period, but both systems showed increasing body weight gain up to week 24 followed by gradual increase in a decreasing manner with increase in age up to week 28. (Fig.2). Possible causes may be better accommodation, feed efficiency and less mobility. There was a consistent increase in body weight with increase in age in both systems up to week 24 then a slight increase, in a decreasing trend, with increase in age till the end of the experiment. The consistent increase in body weight up to 28 weeks of age is in accords with Summers and Spratt (1990) who studied males turkey performance up to that age.

The consistent increase in body weight with increase in age, in both systems up to week 24 indicates that turkey could gain more weight up to this age, irrespective of the management or feeding system. This result agrees with that reported in BUT (2005) up to this age under the intensive system of management. Moreover, the body weight results of this study are consistent with turkey growth pattern according to Gompertz- laird growth curve (Laird et al. 1965).

Lower weight gains were obtained in the period between weeks 25 and 28. Only 0.4 and 0.33 kg were gained by birds kept under the extensive and semi-intensive systems, respectively. Similarly average body gain decreased by 43.5 g for intensive system and 51.0 g for the semi-intensive system. This may indicates that raising turkeys for meat production for more than 24 weeks is not economical or feasible. In addition, it may indicate that the genetic potential of turkeys cannot be properly expressed after this age and more studies may be needed for more scientific explanation of the trend.

The results of starting weight at week 17, finishing weight, average daily gains, average feed intake, average FCR (for each diet) and percentage mortality percentage at weeks 24 and 28 are shown in Table 3. Turkeys kept under semi-intensive system had significantly (P<0.05) heavier starting weight, finishing weight and average daily gain at weeks 24. In addition, turkeys kept under semi-intensive system recorded significantly (P<0.05) heavier finishing weight, consumed more feed and scored lower mortality at week 28 compared to their mates kept under extensive system.

The food conversion ratio was calculated for each diet separately and the two systems were not since the diets offered were of different composition and type as the comparison is mainly between the two systems per se.
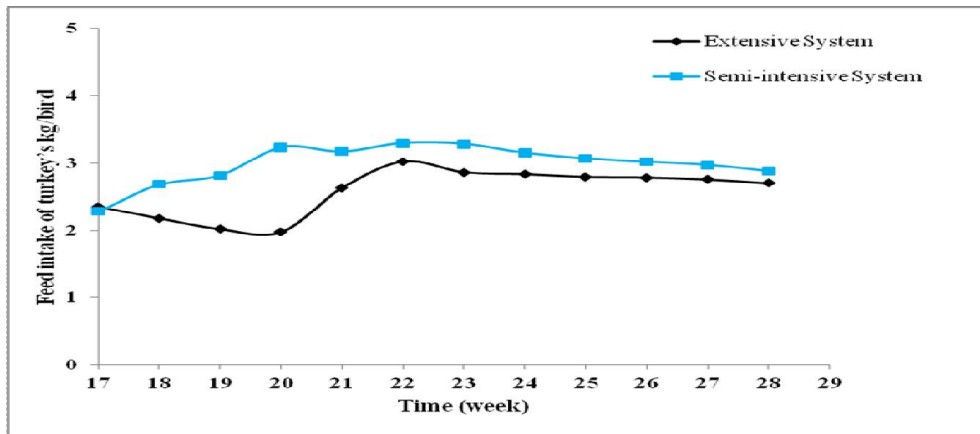

Fig. 1. Feed intake (kg/ bird) of turkeys kept under extrusive and semi-
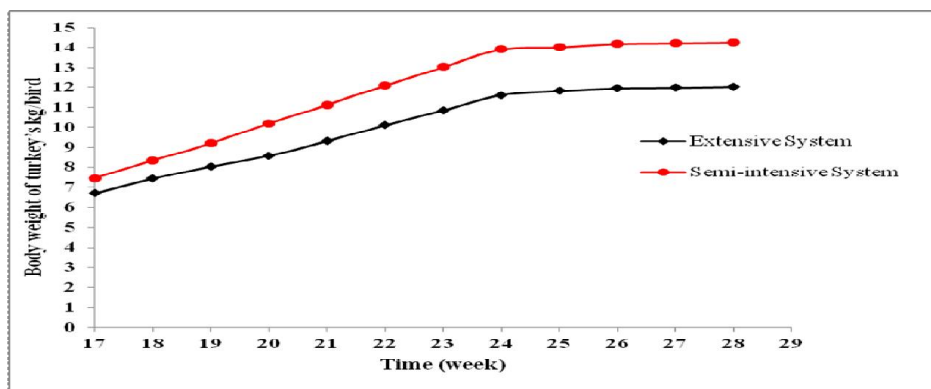intensive systems of management

Fig. 2. Body weight (kg/ bird) of turkeys kept under two systems of management

As far as the mortality percentage is concerned, the results showed no significant difference between treatments up to week 24 (Table 3). A significant (P<0.05) difference, however, was obtained in the period between week 25 up to week 28. Mortality increased by 13% in the extensive system and 6% in the semi- intensive system during this period.

The similarity of mortality percentage up to week 24 supports the previous comments on raising turkeys after week 24 and indicates that birds under both systems were adaptable to the conditions under which the experiment was calculated. On the other hand, the difference in mortality between the two systems between week 25 and week 28 may indicate that the adaptability of birds under extensive system started to decline. Possible causes of high mortality from week 25 and week 28 were heavy body weight (mostly fats), leg malformation, increased heat sensitivity and the functional disorder of the immune system as a result of impaired physiological functions of the high performance hybrids due to these stresses as stated by Veronika *et al.* (2004).

The mortality percentage from both systems up to 24 weeks of age were within the range 15%-25% of mortality reported in the American Livestock Breeds Conservancy (2007). The variations in mortality in the present study could be attributed to management system.

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The results of turkey performance indicated that semi-intensive system supported better performance than the extensive system. This agrees with Castellini *et al*. (2002) who noted that the performance of birds with outdoor access would be inferior to that in a more controlled environment, because the outdoor birds would be exposed to fluctuating temperatures and increased exercise in yard. Diets preparations, management system and environmental conditions were the main causes for these variations.

Dressing percentage and wholesale cuts of turkeys kept under the present experiment are shown in Table 4. All meat quality attributes under study were better for the semi-intensive system than the extensive system and showed better numerical values.
No difference between treatments was obtained in dressing percentage and wholesale cuts. The low percentage of thigh cut may be probably due to less mobility.
The figures of dressing percentage obtained under the two systems were within the range reported by BUT (2005).

Regarding the carcass yield, advantageous changes could be predicted in case of dressing percentages in both systems with increase in slaughter weight. Turkeys gave 86.03 and 87.44 dressing percentages in the extensive and semi-intensive systems, respectively, at week 28 and 76.75 and 78.44 at week 16.

The semi-intensive system gave higher profit than the extensive system at week 24 (Table 5). On the other hand, the extensive system had similar profit at week 28 which was higher than that given by the semi-intensive system, but higher mortality and lower body weight. These results indicate that it is not economical to keep turkeys after week 24 under both systems of management.

Table 3. Turkey performance from week 17 to weeks 24 and 28

Parameter	Extensive system	Semi-intensive system	t-value	Level of significance
Starting weight kg (wk. 17)	6.708.5±252	7.441.3±368	-3.606	*
Finishing weight kg (wk.24)	11.612.5±278	13.900.8±390	-10.56	*
Average daily gain g(wk.24)	101.87	115.5	- 4.118	*
Average feed intake g /bird/wk(wk.24)	2480	2990	- 8.90	*
Average FCR(wk.24)	3.48	3.14		
Total mortality %(wk.24)	16	14		NS
Finishing weight at (wk. 28)	12.020.0	14.250.0	-10.43	*
Average daily gain (wk. 28)	58.38	64.18		NS
Average feed intake(wk. 28)	2620	2989		*
Total mortality % (wk. 28)	29	20		*

Means are values of 48 and 50 birds from extensive and semi-intensive system, respectively.

* Significant at P=0.05

NS= non - significant

Table 4. Dressing percentage and wholesale cuts of turkeys kept under
two management systems up to week 28

Parameter	Extensive system	Semi-intensive System	SE±	Level of significance
Finishing wt at week 28	12.03	14.25	-10.43	*
Carcass Wt	10.35	12.46	- 9.54	*
Dressing (%)	86.03	87.44	1.61	NS
Breast cut (%)	34.62	36.3	1,49	NS
Drumstick cut (%)	12.76	12.78	0.35	NS
Thigh cut (%)	11.97	13.94	0.52	NS

Means are values from 20 birds.
   *significant at P= 0.05
   NS= non- significant

Table 5. Cost and profit analysis of turkey production under semi
intensive and extensive systems in the Sudan

Variable	Semi-intensive system	Extensive system
Period from week 17 to week 24		
Kg. of feed consumed	23.92	19.84
Price of kg. feed (Sudanese pounds)	1.46	0.95
Total cost of feed	34.92	18.84
Carcass weight (kg)	5.16	3.92
Returns from sale of meat (Sudanese pounds)	77.4	58.8
Profit (Sudanese pounds)	42.48	39.96
Period from week 25 to week 28		
Kg. of feed consumed	35.88	31.44
Total cost of feed (Sudanese pounds)	52.38	28.29
Carcass weight (kg)	5.78	4.52
Returns from sale of meat(Sudanese pounds)	86.7	67.8
Profit(Sudanese pounds)	34.23	39.51

CONCLUSIONS

1. The study highlighted the possibility of raising turkeys commercially by investigating the potentials of semi-intensive and extensive management systems.
2. Heavy type turkey hybrids are able to adapt to both systems of management
3. Twenty-four weeks of age is the optimum for best production parameters and best economic results for both systems of management.
4. The semi-intensive system is profitable at 24 weeks of age than the extensive system.
5. More promotive studies on turkey production, as a potentially cheap rich animal protein source, are needed.

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REFRENCES

American Livestock Breeds Conservancy (2007). P.O. Box 477 Pittsboro, NC 27312 USA phone (919) 542-5704 fax (919) 542-0022 albc@albc-usa.org www.albc-usa.org.

AOAC (1994). *Official Methods of Analysis* (15th edn.), Association of Official Analytical Chemists (AOAC), Washington, D.C. U.S.A.

Bentley, J.S. (2002). Breeding turkeys to meet changing market demands. In: *11th European Poultry Conference, Brema, Germany,* 06.10. 2002.

BUT (2005). *Commercial Performance Goals,* 5th ed. British United Turkeys (BUT) Ltd., Warren Hall, Broughton, U.K.

Castellini, C.; Mugnai, C. and Dal Bosco, A. (2002). Effect of organic production system on broiler carcass and meat quality. *Meat Science* 60, 219-225.

Ellis, S.N. (1981). The nutrient composition of Sudanese animal feeds, *Bulletin* (1), Central Animal Nutrition Research Laboratory, Kuku, Khartoum North.

Gibril, S.; Hassan, A.A.; Yassin, O.E. and Shamseldin, R.M. (2013a). Growth performance and carcass characteristics of turkeys (*Meleagris gallopavo*) under semi-intensive system in the Sudan *University of Khartoum Journal of Agricultural Science*s 21(1), 99-115.

Gibril, S.; Shamseldin, R.M.; Yassin, O.E.; Hassan, A.A. and Atta, M. A. (2013b). Body gain and carcass characteristics of turkeys (*Meleagris gallopavo*) under extensive system of management in the Sudan. *International Journal of Applied Poultry Res*earch 2(2), 23-26.

Laird, A.K.; Tyler, S.A. and Burton, A.D. (1965). Dynamics of normal growth. *Growth* 29, 233- 248.

Lodhi, G.N.; Singh, D. and Ichponani, J.S. (1976).Variation in nutrient contents of feedstuffs rich in protein and reassessment of the chemical methods for ME estimation for poultry. *Journal of Agricultural Sciences* 86, 293-303.

Nixey, C. (1986). A comparison of growth and fat deposition of commercial avian species. 7th European Poultry Conference, Paris, pp. 24-28.

NRC (1994). *Nutrient Requirements of Poultry* (9th edn.), National Research Council (Revised), National Academy of Science, Washington, D.C. U.S.A.

Platz, S.; Berger, J.; Ahrens, F., Wehr, U.; Rambeck, W.; Amselgruber, W. and Erhard, M.H. **(**2003). Health, productivity and behavior of conventional turkey breeds under organic outdoor rearing conditions. In: *Turkey Production: Balance Act Between Consumer Protection, Animal Welfare and Economic Aspects* (H.M. Hafez ed), Eugen Ulmer Verlag, Stuttgart, ISBN 3-8001-4630-4, 115-121.

Summers, J.D. and Spratt, D. (1990).Weight gain, carcass yield, and composition of large white male turkeys reared to 28 weeks of age on growing and finishing diets with varying levels of dietary protein. *Poultry Sci*ence 69(4), 584-591

Veronika, H.; Zoltán S.; Péter, H. and István, S. (2004). Effect of the housing system on the meat production of turkey. *Acta Agriculturae Slovenica Suplemen*t 209-213

Yassin, O.E.; Gibril, S.; Hassan, A.A. and Bushara, A.B. (2013). A study on Turkey (*Meleagris gallopavo*) raising in the Sudan. *Journal of Applied and Industrial Sciences* 1(4), 11-15.