Research Journal of Animal Sciences 2 (2): 36-40 2008
ISSN: 1993-5269

The Effect of Housing Type on Body Parameters, Feed Intake and Feed Conversion Ratio of Guinea Fowl (*Numida meleagris*) Keets and Chemical Composition of Their Meat During Growth and Development in Botswana

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Abstract: The objectives of this study were to investigate the effect of housing type i.e., Poultry House (PH), Semi-Poultry House (SPH) and a Fenced Open Natural area (FON) on body parameters, feed intake and feed conversion ratio of guinea fowl keets from 5-42 days of age and chemical composition of their meat at 3 and 5 weeks of age in Botswana. A total of 117 5-day old keets were randomly allocated to 3 housing types, which were replicated 3 times (n =13/replicate). All keets were fed commercial chick starter and grower's mashes ad libitum for 4 and 2 weeks, respectively. Water was provided all the time. Body weight, body length, shank length and its circumference and feed intake were measured weekly on 5 keets randomly selected per replicate. Feed conversion ratio was calculated. Two keets from each replicate were randomly selected and slaughtered at 3 and 5 weeks of age. Dry matter, crude protein, ash, phosphorus, sodium and potassium were determined for each carcass. Procedure ANOVA in Statistical Analysis System was used to analyse the data. Generally, housing type did not affect ($p>0.05$) all parameters including chemical composition of meat at the same age. However, all parameters significantly increased from 5-42 days of age, respectively. Keets raised under different housing types can bring the same output hence for better profit it is best to choose FON than both PH and SPH, which increase production costs because of the purchase of building materials required for the latter housing types.

Key words: Chemical composition, feed, growth, guinea fowls, housing type, meat

INTRODUCTION

Although Botswana is endowed with diverse wildlife resources, these have not been extensively exploited to provide food security and reduce poverty. Comparatively, in neighbouring countries there is commercial utilization of such resources in enclosed farms and ranches outside wildlife areas (Game Ranching Policy for Botswana, 2002). The theme "diversification for sustainable development" promoted during the Botswana International Trade Fair (BITF) (BITF, 1996) emphasized diversifying the economy away from dependence on diamonds and cattle. This has resulted in the Botswana Government providing an incentive for the domestication of guinea fowls (*Numida meleagris*) to provide alternative farm animals and increase more white meat to meet its high demand for human consumption. Profitability of guinea fowl production is hampered by poor production and reproduction efficiencies due in part to lack of management and feeding guidelines (Nahashon *et al*., 2006a). While most poultry improvement programs are directed towards chickens and turkeys in the United States of America, the guinea fowl has been least studied and understood (Nahashon *et al*., 2006a and b). This is also true in Botswana where commercial guinea fowl production is hampered by lack of information on management and feeding guidelines (Nsoso *et al*., 2006a and b).

The objectives of this study were to investigate the effect of housing type i.e. Poultry House (PH), Semi-Poultry House (SPH) and a Fenced Open Natural area (FON) on body parameters, feed intake and feed conversion ratio of guinea fowl keets from 5-42 days of age and chemical composition of their meat at 3 and 5 weeks of age in Botswana.

MATERIALS AND METHODS

A total of 117 guinea fowl keets of 5 days of age were randomly selected and allocated to three housing types, each replicated 3 times (n = 13 per replicate). The housing types were; a typical poultry house with a concrete floor covered with saw dust (poultry house), a typical poultry house with an earth floor (semi-poultry house) and a

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fenced open natural area with live grass and small bushes (fenced open natural raea). The keets were fed the same amount of feed ad libitum with water provided all the time in all the housing types. Chick starter mash was fed for 4 weeks and grower's mash for 2 weeks. Feeding was done every morning to ensure that feeds were ad libitum. Birds were raised under natural light during summer.

Body weight, body length, shank length and its circumference were measured on weekly basis by randomly selecting 5 keets per replicate for each housing type. To measure feed intake; the amount of feed was weighed and recorded before feeding every day and once a week the remaining feeds in trough were weighed in all replicates. Feed intake was calculated by subtracting the remaining feeds from the cumulative amount of feed given. Feed conversion ratio was calculated by dividing the feed consumed each week by the corresponding body weight.

A total of 6 keets i.e., 2 keets per replicate for each housing type were randomly selected and slaughtered following standard abattoir procedures at 3 and 5 weeks of age. From each bird a thigh and half the breast were randomly chosen, de-skinned and minced. Then duplicate sub samples were used for proximate and mineral analyses. Dry Matter (DM), Crude Protein (CP) and ash including minerals; Phosphorus (P), sodium (Na) and potassium (K) were analyzed for using the procedures of AOAC (1996).

DM was determined by the loss in weight of samples dried in an oven at 105°C for 24 h. CP was estimated using the Kjeldahl method. CP was calculated as nitrogen content in percentage multiplied by 6.25. Ash or total mineral content was determined by burning weighed samples in a muffle furnace at 550°C for 4 h. P was determined using Visible Spectrophotometer while K and Na were determined using Flame Spectrophotometer.

The data were analyzed using the Procedure ANOVA in Statistical Analysis System (SAS, 1999-2000) and the means were separated using Duncan Multiple Range t-test. The reported means and standard error of the mean were derived using the Procedure MEANS in SAS (1999-2000).

RESULTS AND DISCUSSION

Although, the body weight of birds in the different housing types significantly ($p<0.05$) increased, they generally did not differ significantly between housing types; 22.53 ± 0.66 g vs. 346.87 ± 11.90 g in poultry house, 22.00 ± 0.66 vs.385.47 ± 11.90 g in semi-poultry house and 22.07 ± 0.66 vs. 394.80 ± 11.90 g in fenced open natural area at 5 and 42 days, respectively (Fig. 1). The increase in body weights over time is consistent with the findings

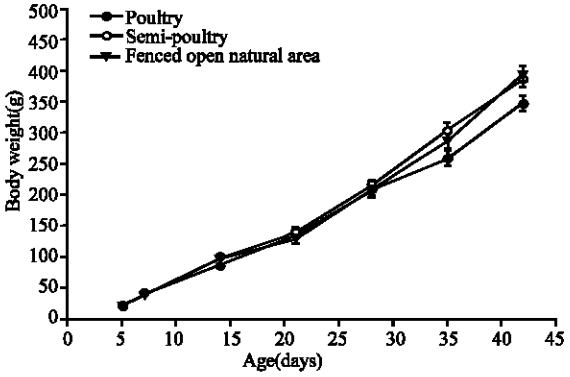

Fig. 1: Body weight of guinea fowl keets raised under different housing types in Botswana from 5-42 days of age

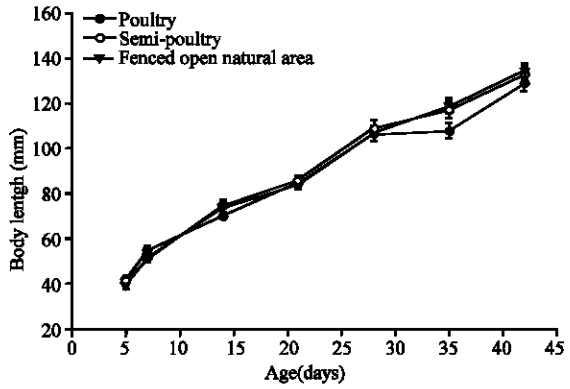

Fig. 2: Body length of guinea fowl keets raised under different housing types in Botswana from 5-42 days of age

of Nsoso *et al.* (2006a and b) where guinea fowl keets had similar body weights at the same stage of growth and development. These represent growth and development of farm animals (Butterfield, 1988). These are slow growth rates compared to broilers which can weigh more than 2 kg at 6 weeks of age (Smith, 2001). Ayorinde and Ayeni (1983) also reported that guinea fowls tend to be slow in growing, weighing less than 1 kg at 8 weeks of age. Ayorinde *et al.* (1988) also showed low live weight to be a characteristic of guinea fowl. It could be that the low body weight and body structure of guinea fowl suited for rapid flight and fast running are evolutionary adoptions for survival in the wild and that nature has selected against heavy weight or plumpness (CAB International, 1987). Genetic improvement has reduced the slaughtering age of chickens from 12-6 weeks of age and increased live weight from 1.5 to more than 2 kg (Smith, 2001). Similar reductions in slaughter age and

increases in body weight to those achieved in chicken breeding could be possible, given that the heritability estimates for body weight of the indigenous guinea fowl ranges from 35% at day old to 40% at 16 weeks of age (Ayorinde *et al*., 1988) and there is large phenotypic variation in this trait (Nahashon *et al*., 2006a and b).

Body length of keets raised under different housing types significantly increased; 42.53 ± 1.43 vs. 129.00 ± 1.93 mm in poultry house, 42.00 ± 1.43 vs. 132.93 ± 1.93 mm in semi-poultry house and 40.00 ± 1.43 vs. 135.00 ± 1.93 mm in fenced open natural area (Fig. 2). Nsoso *et al*. (2006b) reported similar increases in body length for keets of the same age under poultry and semi-poultry house types. Consistent with the findings of Nsoso *et al*. (2006b) the housing type did not significantly influence body length growth and development. Shank length significantly increased 16.53±0.36 vs. 71.93±15.28 mm in poultry house, 16.07±0.36 vs. 45.60±15.28 mm in semi-poultry house and 16.53±0.36 vs. 46.20±15.28 mm in fenced open natural area at 5 and 42 weeks of age, respectively (Fig. 3). While shank circumference significantly increased; 0.22±0.00 vs. 0.57±0.00 mm in poultry house, 0.22±0.00 vs. 0.57±0.00 mm in semi-poultry house and 0.21±0.00 vs. 0.56±0.00 mm in fenced open natural area (Fig. 4). Generally, neither shank length nor shank circumference were significantly influenced by housing type. The shanks support or carry the weight of the bird when it is on ground, therefore it should be strong as keets grow and develop.

Generally, keets in the different housing types consumed significantly higher amounts of feeds as they grew and developed. However, the feed amounts consumed did not significantly differ at the same age and stage of development (Fig. 5). Keets raised in the poultry house consumed more than semi-poultry house starting from week 3-6 weeks, which was also in turn higher than that of the fenced open natural area (Fig. 5). It might be expected that eating more lead to gaining more weight, however, in this study this was not the case since the keets raised in the fenced open natural area consumed less feed but gained more weight (Fig. 1). There may be many reasons which might be associated with this phenomenon which include factors such as differences in feed conversion ratio, stress and the presence of extra feeds such as insects and vegetation matter in the different housing types. The increase in feed consumption as birds grew is consistent with Smith (2001) who reported this phenomenon in various avian species. Ayorinde (1991) analyzed the crop content of a wild guinea fowls and found that they feed on grass, seeds, leaves, bulbs, other vegetable matter, insects and worms together with small stones. This means that the semi-poultry house and the fenced open natural area

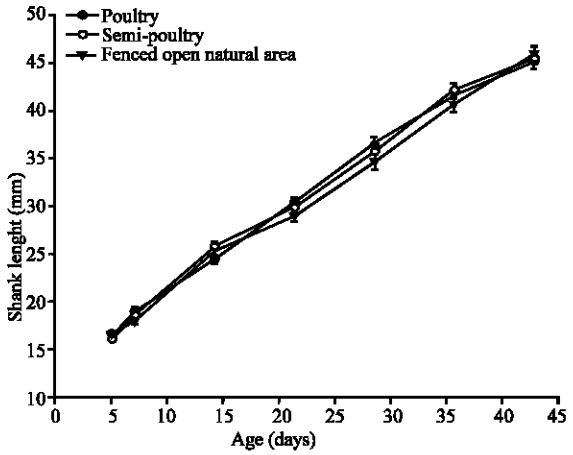

Fig. 3: Shank length of guinea fowl keets raised under different housing types in Botswana from 5-42 days of age

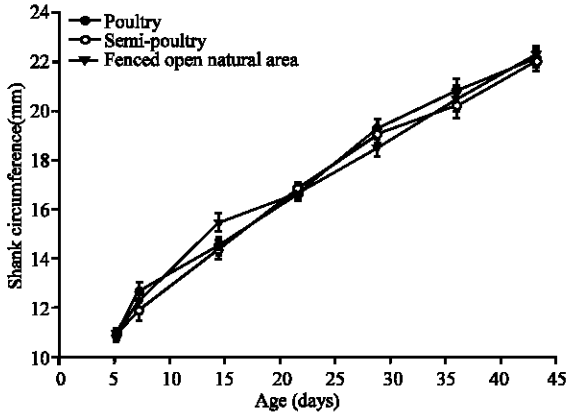

Fig. 4: Shank circumference of guinea fowl keets raised under different housing types in Botswana from 5-42 days of age

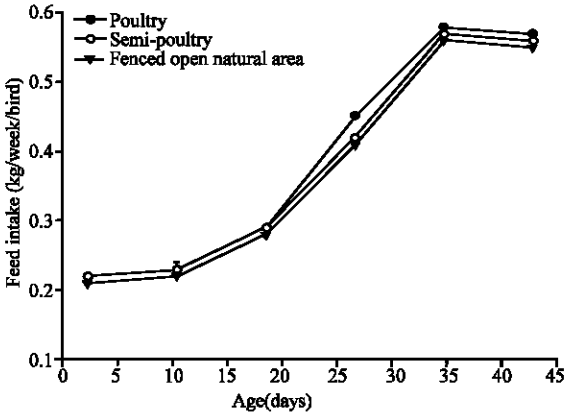

Fig. 5: Feed Intake of Keets raised under different housing types in Botswana from 5-42 days of age

Table 1: Feed conversion ratio of guinea fowl keets raised under different housing types in Botswana

Age (weeks)	Housing type: Poultry house	Semi-poultry house	Fenced open natural area
1	5.33	5.49	5.32
2	5.20	4.55	4.41
3	5.45	5.26	5.46
4	5.72	5.39	5.36
5	6.83	5.69	5.85
6	6.75	5.94	5.90

Table 2: Chemical composition of meat of guinea fowl keets at 3 weeks raised under different housing types in Botswana

Parameter	Housing type: Poultry house	Semi-poultry house	Fenced open natural area
DM (%)	18.13±0.48^{ab}	16.68±0.48^{a}	20.03±0.48^{b}
ASH (%)	6.23±0.33^{a}	5.46±0.33^{a}	5.67±0.33^{a}
CP(%)	80.23±0.89^{a}	77.79±0.89^{a}	59.73±0.89^{b}
P (%)	2.47±0.13^{a}	2.32±0.13^{a}	2.25±0.13^{a}
Na(%)	0.26±0.03^{a}	0.24±0.03^{a}	0.30±0.03^{a}
K (%)	1.00±0.02^{a}	0.98±0.02^{a}	0.97±0.02^{a}

^{a,b}Row means with common superscripts do not differ (p>0.05)

Table 3: Chemical composition of meat of guinea fowl keets at 5 weeks raised under different housing types in Botswana

Parameter	Housing type: Poultry house	Semi-poultry house	Fenced open natural area
DM (%)	9.68±0.48^{a}	10.87±0.48^{a}	9.64±0.48^{a}
ASH (%)	8.74±0.33^{a}	10.26±0.33^{b}	10.91±0.33^{b}
CP(%)	78.97±0.89^{a}	75.62±89^{a}	42.00±89^{b}
P (%)	2.90±0.13^{a}	2.68±0.13^{a}	3.09±0.13^{a}
Na(%)	0.19±0.03^{a}	0.20±0.03^{a}	0.27±0.03^{a}
K (%)	1.09±0.02^{a}	1.07±0.02^{a}	1.14±0.02^{a}

^{a,b}Row means with common superscripts do not differ2

housing types as compared to poultry house provided the above mentioned extra feeds in addition to starter and grower's mashes which were provided in same amounts in all the housing types. Darre (2005) stated that guinea fowls will not eat much supplementary feed if they can find plenty to eat on their own, which implies that the semi-poultry house and fenced open natural area keets were able to find feed on their own since the rooms were large enough for the birds to roam about. Keets raised in the poultry house type were depending entirely on the feed provided since the room was concrete floored, covered with saw dust and did not allow birds to have free access to insects and vegetation matter.

Food Conversion Ratio (FCR) increased with the age of the birds irrespective of housing type (Table 1). Generally, FCR was higher in the poultry house than both in the semi-poultry house and fenced open natural area, which were similar (Table 1). The FCR figures of the present study were higher than those reported by Bell and Smith (2006) who stated that guinea fowls have a feed conversion ratio of 4:1 to 4.5:1. It is not clear what housing type and breed the review of Bell and Smith (2006) used. However, their results show that guinea fowls have a low FCR, which is consistent with findings of the present study. It is generally accepted that consistent with other bird species, feed conversion ratio increases with age in guinea fowls with an optimum slaughtering age of 16 weeks (Saina, 2005).

Generally, the chemical composition of the meat of guinea fowl keets under different housing types were not significantly different at 3 (Table 2) and 5 (Table 3) weeks of age, respectively. Similar results were reported by Saina (2005) for chemical composition of guinea fowls under intensive and semi-intensive management systems in Zimbabwe. Overall performance shows that the semi-poultry house is the best followed by fenced open natural area and poultry house the least. These results agree with Saina (2005) who reported that the keets thrive better in scavenging conditions than they do in improved conditions. Bonkoungou (2005) also reported that the implementation of new technology package increased the growth rate and reduced mortality therefore as a result the semi-poultry house system allows the keets to scavenge and at the same time allows the new technology to be implemented. During the study there were no problems of diseases and the mortality rate was very low. It is important to take into consideration that the guinea fowls are not the same as chickens therefore for maximum production they may require different housing type altogether.

CONCLUSION

Body weight, body length, shank length and its circumference of guinea fowl keets significantly increased from 5-42 days weeks of age, irrespective of housing type. Keets were slow growing with the least weight of 22 g at 5 days of age and a maximum of 347-395 g at 42 days of age weeks for the different housing types. Generally, for all phenotypic traits measured and the chemical composition of meat of guinea fowl keets there was no significant difference between the different housing types at the same stage of growth and development. The similarity between housing types means that farmers should choose the cheapest option of housing types to minimise costs of production hence maximise profits. Further studies on housing type, feeding guidelines, meat taste panels and chemical composition of meat should be conducted comparing the 3 housing types to point of slaughter, which is 16 weeks of age in guinea fowls, such studies would provide information for selection and breeding programs to enhance commercial production in the country.

ACKNOWLEDGEMENTS

The authors thank Botswana College of Agriculture for providing funds for this study.

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