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BODY WEIGHT CHANGES OF SHEEP UNDER AGRO-PASTORAL SYSTEM IN ZAMFARA GRAZING RESERVE, NORTH-WESTERN NIGERIA

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ABSTRACT

Body weight of 141 agro-pastoral sheep across Zamfara grazing reserve, Nigeria was monitored monthly to evaluate effects of location and season. The study animals were identified using plastic number-tags and allocated record cards and were weighed monthly, using mobile scale, for 12 months. Data collected were analyzed using the SPSS package. Means that showed significant difference were separated using LSD-test $_{(t < 0.05)}$. Results obtained showed that non-lactating ewes and weaner lambs in the south recorded higher ($P < 0.05$) weight gains (1.2±0.73; 2.08±1.01 kg month^{-1}) than those in the north (0.22±0.74; 0.70±0.37 kg month^{-1}) and centre (0.06±1.12; 0.83±0.35 kg month^{-1}). Lactating ewes in the north and centre recorded higher ($P < 0.05$) weight gains (0.18±0.59 and 0.14±0.59 kg month^{-1}) than those in the south (0.06±0.46 kg month^{-1}). Breeding rams in the centre gained higher ($P < 0.05$) (3.69±1.53 kg month^{-1}) than those in the south (1.13±1.11 kg month^{-1}). Non-lactating ewes gained higher ($P < 0.05$) during rainy season (4.3±0.38 kg) and lost weight (-1.1±2.08 kg) during late dry season. Lactating ewes gained higher ($P < 0.05$) during early dry season (1.3±0.59 kg) and lost weight (-0.1±0.49 kg) during late dry season. Breeding rams gained higher ($P < 0.05$) during early dry season (14.4±0.67 kg) than in late dry season (3.0±0.31 kg). Weaner lambs gained higher ($P < 0.05$) during late dry season (16.2±0.83 kg) and lost weight (-1.6±0.37 kg) during rainy season. Both location and season had significant effect on body weight changes of agro-pastoral sheep in the study area.

Keywords: Body weight change; Agro-pastoral sheep; Zamfara grazing reserve

INTRODUCTION

FAO (2009) estimated that there were about 33 million domestic sheep in Nigeria. The Federal Department of Livestock and Pest Control Services (FDLPCS, 1992) reported that the domestic sheep in Nigeria play significant roles in the socio-economic, cultural and religious well being of many citizens. They are valuable assets to the farmers and make significant contributions to the nation's economy. They provide income almost on regular basis and are often substituted for staple grains to provide food security to the farmers

during period of food shortages. Sheep are also important as sacrificial animals during the Muslims' Eid-El-Kabir festival and for child naming ceremonies, just to mention a few.

According to FDLPCS (1992), about 83% of the sheep in Nigeria are produced in villages under various agro-pastoral systems, with about 70% located in the Savanna region of the country. The animals rely mainly on natural pastures, crop residues and by-products for nutrition and sustenance (FDLPCS, 1992; Hassan, 2000). However, in the dry Savanna, pasture feed availability persist only during the short rainy season (June to September), while in the long dry season (October to May) feed shortages are usually encountered by herbivorous and ruminant animals in the area (Ileoje, 2001; Aregheore, 2009). This normally results in body weight gains by the animals during the rainy season and losses during the dry season each year (FDLPCS, 1992; Babayemi and Bamikole, 2006). According to Cronjé (1990), the effects of seasonal weight losses by animals include stunted growth, loss of body condition, predisposing the animals to attack by diseases, reduced rate of conception and successful birth and high mortality rate of the young animals. Thus, in order to improve livestock productivity in the Savanna region of Nigeria, there is need to arrest the seasonal weight losses by animals. This can be achieved through evaluation of body weight change of the animals during the various seasons to map out strategies for proper feed supplementation. The objective of this study, therefore, was to evaluate the effects of season and location of animals on the body weight changes of sheep under agro-pastoral system in Zamfara grazing reserve of northwestern Nigeria.

MATERIALS AND METHODS

Study Area

This study was conducted in the four Agro-pastoral communities in Zamfara grazing reserve, Nigeria. The reserve is situated at the extreme northern part of Zamfara state, northwestern Nigeria, located between Latitudes $12^{o}10$" and $13^{o}05$" N, and Longitudes 6^{o} 30" and 7^{o} 15" E, at an altitude of 350 m above sea level. It occupies a land area of about 232,500 ha of rangeland which extends about 130 km from north to south and about 30 km from east to west. The reserve encloses four agro-pastoral communities, namely; Dumburum, Shamushalle, Tsabre and Ajja and their farmlands. About 27,250 people living in the enclave villages are mainly crop and livestock farmers and the major crops cultivated are millet, sorghum, cowpea and groundnut while sheep and goats are the major livestock species reared by the farmers (Hoffmann, 1998). The climate of Zamfara reserve was described as semi-arid with short rainy season (from May/June to September) and long dry season (October to April/May). Mean annual rainfall varies from 500 mm in the north to 900 mm in the south (Hofmann *et al*., 1998). The vegetation in the reserve also varies from Sudan Savanna in the north to northern Guinea Savanna in the south, and herbage biomass production increases from north to south. Mean annual temperatures average 27^{o}C, with minimum of 17^{o}C in December/January and maximum of 40^{o}c in April/May (Arnborg, 1988).

Methodology

Due to the observed variations in the herbage biomass productivity between north and south of the reserve (Arnborg, 1988), it was stratified into North, Centre and South. Dumburum and Shamashalle representing North and Centre, respectively, with Tsabre and

Ajja villages, representing the South. Malami (2005) described three grazing seasons for livestock in the zamfara reserve, namely; rainy (from June to September) with high feed supply, early dry (from October to January) with medium feed supply and late dry seasons (from February to May) with low feed supply for ruminant animals. A total of 188 sheep from 30 cooperating farmers' flocks (10 farmers from each zone) were purposefully sampled, with 67, 63 and 58 sheep from the North, Centre and South of the reserve. Monthly body weight change of the selected animals was monitored for a period of twelve months, from June 2000 to May 2001.

The study animals, which comprised generally of ungraded Uda x Yankassa crossbreeds, consisted of 61 dry (non-lactating) ewes, 20 lactating ewes, two breeding rams and 58 weaner lambs (males and females), totaling 141 sheep. The remaining 47 were suckling lambs whose pre-weaning and post-weaning body weight changes have already been reported (Na-Allah *et al*., 2004). The animals were grazed daily in the Zamfara reserve; between 10.00am and 6.00pm. During the rainy season (June – September), the animals relied almost exclusively on the range grazing for their feed supply. However, during the early dry season (October – January), the animals were supplemented with crop residues; such as cowpea and groundnut hays (*Harawa*) and cereal grain processing by-products (*Dusa* and *Kasari*) and the farmlands were also grazed in addition to range grazing. Lactating ewes were given priority considerations in the supplementation.

Data Collection and Analysis

Prior to weighing, each of the study animals were identified using a plastic number-tag tied to the neck and was allocated a bodyweight record card. First week of each month was slated for visits and weighing of the animals, using a mobile scale (KILCOM – 1). Monthly body weight changes were computed from body weights measured of the various animals' categories changes and subjected to analysis of variance (ANOVA) using the SPSS statistical package (SPSS, 1995). Means that showed significant difference were separated using LSD-test $_{(t < 0.05)}$.

RESULTS

Effect of Season on Bodyweight Changes

Result on bodyweight changes of the four categories of the study sheep during the rainy, early dry and late dry seasons in Zamfara grazing reserve is shown in Table 1. The result showed that the seasonal bodyweight changes of the four sheep categories differed significantly ($P < 0.05$) between the seasons.

Non-lactating ewes recorded a net annual weight gain of 5.9±0.49 kg (equivalent to 0.49 kg month^{-1} or 16.4 gday^{-1}), recorded higher ($P < 0.05$) weight gains during the rainy season and lower body weight change (weight losses) during the late dry season. The weight loss encountered during the late dry season amounted to about 15.7% of the total weight gained. The lactating ewes, which recorded a net annual weight gain of 1.5±0.88 kg (equivalent to about 0.4 kg month^{-1} or 12.5g day^{-1}) gained higher ($P < 0.05$) during the early dry season and lower (weight losses) during the late dry season. The body weight loss encountered amounted to about 6.3% of the total weight gained. Breeding rams recorded a net annual weight gain of 18.6±0.55 kg (equivalent to about 2.3 kg month^{-1} or 77.5g day^{-1})

gained higher ($P < 0.05$) during the early dry season compared to the rainy season. No breeding ram was available (NA) in the study flocks during the late dry season. Weaner lambs recorded a net annual weight gain of 20.5±0.10 kg (equivalent to 1.7 kg month^{-1} or 56.9g day^{-1}), gained higher ($P < 0.05$) during the late dry season and lower (weight losses) during the rainy season. The weight loss amounted to 12.8% of the weight gained (Table 1).

Table 1: Body weight changes (kg) of agro-pastoral sheep during rainy, early dry and late dry seasons

Category	Seasonal bodyweight changes (Mean ± SEM)			Net gain
	Rainy	Early dry	Late dry	
Non-lactating ewes	4.3±0.38^{a}	2.7±0.40^{b}	*-1.1±2.08^{c}	5.9±0.59^{y}
Lactating ewes	0.3±0.50^{b}	1.3±0.59^{a}	-0.1±0.49^{b}	1.5±0.88^{z}
Breeding rams	4.2±0.42^{b}	14.4±0.67^{a}	NA	18.6±0.55^{x}
Weaner lambs	-1.6±0.37^{c}	4.3±0.30^{b}	16.2±0.83^{a}	20.5±0.10^{x}

a, b, c, values in the same row carrying different superscripts differ significantly ($P < 0.05$); x, y, z, values in the same column carrying different superscripts differ significantly ($P < 0.05$); SEM = standard error of mean; * Negative values indicate loss of body weight; NA = Not Available.

Effect of Location on Bodyweight Changes

Result on mean monthly bodyweight changes of four categories of the agro-pastoral sheep in the North, Centre and South of Zamfara grazing reserve, is presented in Table 2. The result showed that the mean monthly bodyweight changes differ significantly between the locations in the reserve and between the four sheep categories.

Table 2: Monthly body weight changes (kg/month) of agro-pastoral sheep in the North, Centre and South of zamfara grazing reserve

Category	Bodyweight changes (Mean ± SEM)			Mean
	North	Centre	South	
Non-lactating ewes	0.22±0.74^{b}	0.06±0.12^{b}	1.21±0.73^{a}	0.50±0.23^{y}
Lactating ewes	0.18±0.59^{a}	0.14±0.59^{a}	0.06±0.46^{b}	0.38±0.28^{y}
Breeding rams	NA	3.69±1.53^{a}	1.13±1.11^{b}	2.41±0.55^{x}
Weaner lambs	0.70±0.37^{b}	0.83±0.55^{b}	2.08±1.01^{a}	1.20±0.10^{x}

a, b, c, values in the same row carrying different superscripts differ significantly ($P < 0.05$); x, y values in the same column carrying different superscripts differ significantly ($P < 0.05$); SEM= standard error of mean; NA = Not Available

Non-lactating ewes recorded mean weight gain of 0.50±0.23 kg month^{-1} (or 16.0 g day^{-1}), gained higher ($P < 0.05$) in the southern zone compared to the ewes in the north and centre. Conversely the lactating ewes, which recorded mean weight gain of 0.38±0.28 kg month^{-1} (or 12.7 g day^{-1}), gained higher ($P < 0.05$) in the North and Centre compared to the ewes in the south of the reserve. Breeding rams in the Central and Southern zones gained 2.41±0.55 kg month^{-1} (or 80.3g day^{-1}), and rams in the Central zone gained higher ($P < 0.05$) compared to those in the south of the reserve. Weaner lambs recorded mean weight gain of 1.20±0.10 kg month^{-1} (or 40.0 g day^{-1}) gained higher ($P < 0.05$) in the southern zone

compared to those in the North and Centre of the reserve. The mean weight gains by breeding rams and weaner lambs were similar ($P > 0.05$) and higher ($P < 0.05$) than the weight gains by the non-lactating and lactating ewes (Table 2).

DISCUSSION

Effect of Season

The significantly higher weight gains by Non-lactating ewes during the rainy and early dry seasons compared to the late dry season recorded in this study may be explained in terms of the availability of pasture resources in the reserve during the rainy season and in farmlands together with crop residue supplementation during the early dry season, while in the late dry season, the rangeland pastures are depleted and crop residues for supplementation are exhausted (Na-Allah, 2003). Also the higher ($P < 0.05$) body weight gains by the lactating ewes and breeding rams during the early dry season than in the rainy and late dry seasons recorded in this study may be attributed to adequate feeding provided from the farmlands grazing and crop residues supplementation by the farmers (Malami, 2005).

The higher ($P < 0.05$) body weight gains by the weaner lambs during the late dry season than in the rainy and early dry seasons appeared abnormal, but may be explained by the fact that during rainy season many of the weaner lambs in this study were observed to suffer from diarrhea, which resulted in loss of body weight. The lambs might have exhibited a compensatory growth during the late dry season, after recovering from the diarrhea, which could lead to a higher weight gain. Also many of the female lambs engaged in breeding activities might be already pregnant and could lead to a higher weight gain by the animals. The lower ($P < 0.05$) net weight gains by the lactating and non-lactating ewes compared to the breeding rams and weaner lambs could be attributed to the body weight losses recorded by the lactating and non-lactating female animals during the late dry season, probably due to their higher nutritional demands for maintenance, growth, breeding activities and lactation, which inadequate and poor quality of feeds during the late dry season could be responsible (Malami, 2005; Babayemi and Bamikole, 2006). The breeding rams on the other hand did not encounter any weight loss while only a little weight loss (7.8%) was encountered by the weaner lambs.

Effect of Location

The high ($P < 0.05$) bodyweight changes recorded for the non-lactating ewes and weaner lambs in the southern zone of Zamfara grazing reserve was similar to the results obtained by Malami (2005) for un-supplemented ruminant animals in the study area. This could be attributed to the higher rainfall received and higher herbage biomass production reported for this zone over the northern and central zones (Anborg, 1988; Hofmann *et al*., 1998). However, the high ($P < 0.05$) body weight changes recorded for the lactating ewes and breeding rams in the north and centre may be explained by better management of the animals, especially feed supplementation, by farmers in these zone compared to those in the southern zone. High level of feed supplementation by farmers in the North and Centre of the reserve may be triggered by the lower herbage biomass production of these zones of the rangeland as well as crop residues (Anborg, 1988; Hofmann *et al*., 1998) to meet the

animals' high nutritional demands for maintenance, growth, breeding activities and lactation.

The higher ($P < 0.05$) monthly body weight gains by the breeding rams and weaner lambs in this study may be due to better attention given to these categories of animals by the farmers to enhance breeding abilities of the mature breeding males (Gefu and Adu, 1984; Ademosun, 1985), and for better growth of the grower males to be used for replacement of the old breeding males, or to earn farmers more money when sold for cash, or to serve better when slaughtered at home during religious festivals and naming or marriage ceremonies (FDLPCS, 1992). The mean weight gain recorded by the breeding rams (80.3 g day^{-1}) in this study was similar to the 80.4 gday^{-1} rate of gain reported for station-managed Uda lambs by Hassan (2000) in the Zamfara reserve, Nigeria.

The mean weight gain by the weaner lambs in this study (40.0 g day^{-1}) was lower than the rate of gains of 51 and 53 g day^{-1} reported for station-managed Uda and Yankassa lambs respectively, during 91 – 182 days by Buvanendran *et al*. (1981) in Zaria, Nigeria, and the 80.4 g day^{-1} reported for station-managed Uda lambs during 151 – 210 days by Hassan (2000) in Zamfara reserve, Nigeria. The lower ($P < 0.05$) monthly weight gains by the lactating and non-lactating ewes in this study may be explained by their higher nutritional demands for maintenance, growth, breeding activities, pregnancy maintenance, lactation, etc which might resulted in the body weight losses during the late dry season as well as the comparatively lower weight gains during the rainy and early dry seasons. Though no report was available to compare the mean weight gains by the non-lactating (16.0 g day^{-1}) and lactating ewes (12.7 g day^{-1}) in this study, the values are low and may not be enough to achieve the high productivity desired from the animals.

CONCLUSION

The results obtained from this study showed significant influence of both season and location of the agro-pastoral sheep in the Zamfara grazing reserve on body weight changes in the four categories of sheep considered. The net weight gains by the lactating and non-lactating ewes were significantly lower than the gains by the breeding rams and weaner lams, due to mainly body weight losses during the late dry season.

REFERENCES

Ademosun, A. A. (1985). Contributions of research to small ruminant production in Nigeria. *In:* Adu I. F., Osinowo, O. A., Taiwo, B. B. A. and W. S. Alhassan (eds.). *Small Ruminant Production in Nigeria*. Proceedings of the National conference on small ruminant production in Nigeria, held 6^{th} – 10^{th} October, 1985. NAPRI, Ahmadu Bello University, Zaria, Nigeria. Pp 18 – 34.

Arnborg, T. (1988). Where savanna turn into desert. *Rural Development Studies, No 24*. Swedish University of Agricultural Sciences, Uppsala, Sweden.

Aregheore, E. M. (2009). *Nigeria: Country Pasture/Forage Resource Profiles.* Accessed at; http://www.fao.org/AGP/agpc/doc/Counprof/region/index.htm. Retrieved; June 9, 2010.

Buvanendran, V., I. F. Adu and B. A. Oyejola (1981). Breed and environmental effects on lamb production. *Nigerian Journal of Agricultural Science*, 98: 9 – 15.

Babayemi, O. J. and M. A. Bamikole (2006). Supplementary value of *Tephrosia bracteolate*, *Tephrosia candida*, *Leucaena leucocephala* and *Gliricididia sepium* hay for West African dwarf goats kept on range. *Journal of central European Agriculture*, 7 (2): 323 – 328.

Cronjé, P. B. (1990). Supplementary feeding in ruminants – A physiological approach. *South African Journal of Animal Nutrition*, 20 (3): 110 – 117.

FAO (2009). FAO Statistical database (FAOSTAT), Food and Agriculture Organization of the United Nations. FAO on line resource from: htpp://www.fao.org/ag/AGPC/doc/Gbase/default.htm. August 18, 2009.

FDLPCS (1992). *Nigerian Livestock Resources, Vol. II, National Synthesis*. Federal Department of Livestock and Pest Control Services, FDLPCS. Federal Ministry of Agriculture, Abuja, Nigeria. Resource Inventory and Management Ltd. Jersey, UK. 287 pp.

Gefu, J. O. and I. F. Adu. (1984). Understanding small ruminant production in Northern Nigeria. *World Review on Animal Production*, 20 (3): 35 – 38.

Hassan, W. A. (2000). Biological productivity of sheep and goats under agro-pastoral systems in the Zamfara reserve in north – western Nigeria. Ph.D. Thesis, Justus Liebig University, Giessien, Germany. 259 pp.

Hoffmann, I. (1998). Zamfara reserve – past and present. *In:* Hoffmann, I. (ed.) *Prospects of Pastoralism in West Africa*. Justus-liebig University, Giesen, Germany. Pp 1 – 9.

Hoffmann, I., Willeke-Wetstein and C. Schafer (1998). Description of a grazing ecosystem in northwestern Nigeria using environmental indicators. *Animal Research and Development*, 48: 69-83.

Iloeje, N. P. (2001). *A New Geography of Nigeria*. New Revised Edition. Longman Nigeria PLC. 200pp.

Malami, B. S. (2005). Balancing nutrient supply and requirement of ruminants in Zamfara Researve, Northwestern Nigeria. Ph. D. Theses. Department of Animal Science, Usmanu Danfodiyo University, Sokoto, Nigeria. 243 pp.

Na-Allah, Y. (2003). Production Performance of Traditionally – managed Sheep and Goats in the Enclaved – villages in Zamfara Grazing Reserve, Nigeria. An M. Sc. Dissertation, Department of Animal Science, Faculty of Agriculture, Usmanu Danfodiyo University, Sokoto, Nigeria. Pp 101.

Na-Allah, Y., S. A. Maigandi, H. M. Tukur and A. I. Daneji (2004). Body weight and body weight gains of lambs under traditional management systems in villages of Zamfara reserve, north – western Nigeria. *In*: Tukur, H. M., W. A. Hassan, S. A. Maigandi, J. K. Ipinjolu, A. I. Daneji, K. M. Baba and B. R. Olorede (eds.), *Sustaining Livestock Production Under changing Economic Fortunes*. Proceedings of the 29th Annual Conference of Nigerian Society for Animal Production (NSAP), held at Usmanu Danfodiyo University, Sokoto, Nigeria. March 21st – 25th.

SEPP (1996). Meteorological data of Sokoto state. Sokoto Environmental Protection Programme, SEPP.

SPSS (1996). Statistical Package for Social Sciences (SPSS) SPSS production facility. Release 9.0.