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CARCASS CHARACTERISTICS OF DESERT SHEEP UNDER RANGE CONDITIONS IN NORTH KORDOFAN STATE, SUDAN

M.A.M. TIBIN[1], I. BUSHARA[2], M.B. ELEMAM[3], I.M. TIBIN [4] and J.B. JADALLA[5]

[1] *Department of Animal Production and Pasture, Faculty of Natural Resource and Environmental Studies, Pease University, Sudan*

[2]*Department of Animal production, Faculty of Agricultural Sciences, Dalanj University, Sudan; Email: bushara3000@yahoo.ccom*

[3]*Department of Animal Production, Faculty of Agriculture and Natural Resources, University of Kassala, P.O. Box 12, New-Halfa, Sudan.*

[4]*Dept of meat science, Faculty of Animal Production, University of Khartoum, Sudan*

[5]*Faculty of Natural Resources and Environmental Studies, Department of Animal Production University of Kordofan*

*Email: murtadaelemam@yahoo.com

ABSTRACT: *This experiment was conducted to study the performance, carcass characteristics and meat quality attributes of desert sheep raised under range conditions around El Nuhood. Thirty desert sheep (15 males and 15 females) of almost the same age (about 8 months) were used in a 16 weeks study period. The sheep were randomly allocated to three groups (treatments) of ten animals (5 males and 5 females). The three groups were allowed to graze on natural range grasses at night only and were kept under shade during the day from 7:00 am to 6:00 pm. The first group was allowed water every 2-3 days and was considered as control. The second group was allowed access to water daily. The third group was allowed daily access to water and received concentrates supplement. At the end of the experimental period, eighteen animals (nine males and nine females) were randomly taken, weighed and slaughtered to study the carcass characteristics. The results included that were significant (P<0.05) differences among the treatment groups with regard to the warm carcass, cold carcass and empty body weight. There were significant (P<0.05) differences between females and males of the three treatments in slaughter weight, warm carcass weight and cold carcass weight. Males obtained higher weights than females. The dressing percentage on the basis of warm carcass and cold carcass was significantly (P<0.05) different in the three treatments. The gut fill expressed as a percentage of empty body weight was significantly (P<0.05) different among the three treatments. These results concluded that management strategy which involves shorter watering intervals and feed supplementation will probably reflect positively on the performance, carcass characteristic of Hamari sheep under range conditions.*

Key words: *Dessert sheep, Performance, Carcass characteristic, Concentrate ration, Sudan*

ORIGINAL ARTICLE

INTRODUCTION

Sudan and Africa is largest country, with nearly one million square miles area (more than 2.5 million square kilometers). It also has one of the largest livestock populations. This wealth was estimated in year 2004, to a number of 47.043, 39.952, 38.325 and 3.203 million head for sheep, goats, cattle and camels, respectively (El-Samani, 2005). This livestock shares with about 22.3% in total national production and the animal exported share about 18.2% of total exported about 38% of agriculture. The livestock industry is of great importance to the Sudanese economy as it is one of the main sources of food, employment and foreign currency. Proper exploitation of these livestock can contribute greatly towards the alleviation of the present world deficient in animal protein which is expected to grow continuously due to low livestock productivity, increase in per capital consumption of meat, due to improvement in the standard of living of many people and increase in the human population of the world (FAO, 1994).

In spite of the importance of sheep they are still raised under nomadic condition with traditional methods of management and national grazing. Many socio-economic factors affected mobility of nomadic flocks including national pasture. The specific problem regarding sheep nutrition under range land condition is that of feed shortage and nutrient deficiencies. This situation is critical during the dry season which extends from November-June. This is reflected in seasonality of reproduction, high mortality rate in both young and adult animals and low reproductive performance (EL Hag et al., 1998). Rarely farmers provide their animals with different supplements during the

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critical period of feed shortage. Supplements used are mainly oilseed cakes and cereal grains. The objectives of this research are:

1- To study the effect of feed supplementation and husbandry practices on the general performance and meat quality attributes of desert sheep of hamari subtype.

2- To compare the performance and carcass characteristics of male and female desert sheep of the same age and raised under the same environmental condition.

3- To adopt an applied extension for sheep producers of the importance of concentrate supplementation to grazing sheep under range system.

4- To improve the economical condition of Sudan in general and sheep producers in particular by increasing sheep numbers.

MATERIAL AND METHODS

The study was conducted in Mhagor-Area about 30 km south of El-Nuhood (lies within latitudes 11.5-13.75 N° and longitudes 27-29.5 E°) about 900 km west to Khartoum. Average annual rainfall is 300 and 400 mm in the north and southern parts respectively. Average maximum temperature is 24-39°C during most of the year, with peaks above 36°C during April, May and June. The soil types varied from sandy (Goze) dissected by batches of loamy sands (Gardud or gurraba) in the southern part. The main cash crop grown in the locality is mainly millets, sorghum, watermelon, rosella (*Hibiscus sabdariffa*) and groundnut. Large amounts of agricultural post harvesting residues are produced such as groundnut and *Hibiscus sabdariffa* (karkadeh) hay which are used on a large scale for feeding animals.

Experimental animal's management

Thirty desert sheep (15 males +15 females) of the same age (about 8 months) were used in this study. The animals were ear tagged and randomly divided into three groups according to age and body weight and designed as A, B and C respectively, each group consist of 10 animals (5 male and 5 female). The first group (Group A) was allowed to drink water every day and was supplemented with additional concentrates, consisting of 40% durra grains, 30% groundnut cake, 29% groundnut hulls and 1% salts. Every head from this group was given 750g concentrates daily. The second group (group B) was allowed to drink water every day without supplementation. The third group (group C) was allowed to drink water at 2-3 days intervals without supplementation. This group was considered as control. All the groups were allowed to graze at night on natural grasses available on pasture and kept in shade during the day from 7:00 am to 6:00 pm. At the end of the adaptation period, the animals were individually weighed after an overnight fast to give the initial live weight.

Slaughter procedure and data collection

After 16 weeks when the animals reached the age of one year, six animals (three males and three females) from each group were randomly slaughtered. The animals were slaughtered every day in the morning after twelve hours fast from feeding, except water. The animals were weight before slaughter to give slaughter weight. After complete bleeding the head was removed at the atlanto-oxcepital joint, and after skinning all thoracic and abdominal organs were removed leaving the kidneys and kidney knob channel intact in the carcass. The hot carcass weights were immediately recorded and the carcasses were moved for chilling at 4°C for 24 hours. The head, four feet, skin, heart, lungs and trachea, liver, pancreas, spleen, omentum and messentery were separated and weighed. The alimentary tract was weighed full, then emptied and re-weighed and the gut "fill" weight was determined by difference. The empty body weight (EBW) was calculated by subtractive the gut fill from the slaughter weight. To avoid weight losses due to evaporation all organs and offal's were weighed immediately after dressing and each weight was recorded. Cold carcass weight was recorded after 24 hours chilling. The tail was removed at its articulation and weight. Kidneys and kidney knob channel fat were also removed and weighed. The prepared carcass was split along the vertebral column into left and right sides. The right half of the carcass was weighed and cut according to (Smith et al., 1978) into major cuts that included leg, sirloin, loin, rack and shoulder, minor cuts included, shank, breast, flank and neck. The thickness of subcutaneous fat for the sections was recorded by a vernia, at 12-13 ribs longissmus dorsi the subcutaneous fat was removed using scalpel and forceps. Each cut was weighed and dissected into fat, muscle, bone and trim, and separately.

Statistical analysis

Statistically analyzed according to complete randomizes design using Statistical Package for the Social Sciences, software package (SPSS version 10 1996) in factorial arrangement using LSD was also used to test means significance differences, analysis of covariance was carried out.

RESULTS AND DISCUSSION

Effects of the three different management systems on carcass characteristics:

There were significant differences ($P<0.05$) among the treatment groups with regard to the warm carcass, cold carcass, half carcass and empty body weight in treatments A, B and C, respectively (Table 1). This finding is in agreement with Ahmed (1993) who found that, there were significant differences in warm carcass and cold carcass

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weights when Sudan desert lambs were fed sorghum grains and molasses at ratios of, 40:0, 20:20 and 0:40. Mansour et al. (1988[b]) who found that, lambs fed rations containing 45% and 30% groundnut hay gave slaughter weight of 31.5 and 32.1 kg and hot carcass of 13.3 and 14 kg, respectively. Similarly, Mohamed (2002) reported that, slaughter weight, empty body weight and hot carcass were 34, 29.5 and 16 kg for pen fed Kabashi lambs, and were 33.17, 27.6 and 13.8 kg for pen fed Hamari lambs. Their values were 29.1, 22.7 and 11.2 kg for free grazing Kabashi lambs and 28.5, 22.7 and 10.7 kg for free grazing Hamari, respectively. Mansour (1987) reported a mean slaughter weight of 32.3 kg yield 15.9 kg warm carcass with dressing percentage of 49.1 (on empty body weight). The results are in disagreement with, Marouf (1996) who found that there were no significant difference among treatment groups in slaughter weight and carcass weight (cold or warm). These differences may be due to rations age or physical conditions.

The results observed that there were significant (P<0.05) differences between females and males of the three treatments in slaughter weight, hot carcass weight cold carcass weight, half carcass weight, gut fill weight and empty body weight (Table 2). Males obtained higher weights than females. This result is in harmony with the results of Mohamed (2004) who found that the average hot and cold carcass weights were significantly (P<0.05) heavier in male than in female lambs. The results are in disagreement with Beshir (1996) who found that there were no significant differences among treatment groups in slaughter weight and carcass weight (cold or warm). These differences may be due to rations and age of animals or physical conditions.

Table 1 - Effects of the three different management systems on carcass characteristics

Trait	Sl.wt	Hot.wt	Cold.wt	Half.wt	Gut fill.wt	EBW
A	43.04[a]	21.58[a]	20.79	10.08[a]	7.18[a]	35.86[a]
B	41.63[b]	19.58[b]	18.58	9.06[b]	8.02[a]	33.61[b]
C	36.38[c]	16.67[c]	16.25	7.75[c]	7.75[c]	28.63[a]
S.E	1.11*	0.40*	0.45*	0.14*	0.87*	1.17*

[abc] Values in same columns with different superscripts differ at P<0.05. Sl.wt = Slaughter weight (kg). Hot.wt= Hot carcass weight (kg). Cold.wt= Cold carcass weight (kg). Half.wt= Half carcass weight (kg). Gut.wt= Gut fill weight (kg). EBW= Empty body weight (kg). S.E = Standard error of the mean.

Table 2 Effects within sex and management systems on different parameters

Sex	Treatment	Slaughter Wt (kg)	Hot carcass wt (kg)	Cold carcass wt (kg)	Half carcass wt (kg)	Gut fill wt (kg)	EBW (kg)
Femae	A	42.25[a]	22.67[a]	21.50[a]	10.83[a]	5.72[c]	36.53
	B	42.25[a]	17.67[b]	17.17[b]	8.00[b]	6.52[a]	35.73
	C	36.08[c]	15.83[c]	15.50[c]	7.33[c]	6.00[b]	30.08
	S.E	1.56*	1.56*	0.64*	0.19*	1.23*	1.01*
Male	A	45.57[a]	20.50[b]	20.08[b]	9.33[b]	8.63[b]	36.94
	B	45.25[a]	21.50[a]	21.00[a]	10.13[a]	9.53[a]	35.72
	C	36.67[c]	17.50[c]	17.00[c]	8.17[c]	6.33[c]	30.34
	S.E	84.77*	0.56*	0.64*	0.19*	1.23*	1.01*

[abc] Values in same raw with different superscripts differ at P<0.05

Dressing percentage of desert sheep

The dressing percentage on the basis of warm carcass and cold carcass was significantly (P<0.05) different in the three treatments. The means of the three management systems A, B and C were 50.14, 47.03 and 45.82% on the basis of warm carcass, and 48.30, 44.63 and 44.67% on the basis of cold carcass, respectively (Table. 3). This is in agreement with the results of Ahmed and Suleiman (1988) and Mansour et al (1988a) reported a dressing percentage of up to 54.3 in fattened lambs. The result also supported by El karim and Owen (1987) who reported respective dressing percentages of 45.06 and 43.35 for Sudan Desert sheep ecotypes Watish and Shugor. Similarly, El-Hag (1981) found a dressing percentage of 46.3- 47.5.

Table 3 - Dressing percentage of desert sheep (Hamari sub type)

Parameters	A	B	C	S.E	L.S
Hot%	50.30[a]	47.03[b]	45.82[c]	1.15	*
Cold%	48.30[a]	44.63c	44.67[b]	1.06	*
Hot/EBW%	60.18	58.26	55.18	1.14	NS
Cold/EBW%	57.98	55.28	53.79	1.04	NS
Gut fill as(%) of EBW	20.02[c]	23.86[b]	27.06[a]	1.11	*

[abc] Values in same raw with different superscripts differ at P<0.05

The gut fill expressed as a percentage of empty body weight was significantly (P<0.05) different among the three treatments. Its values were 20.02, 23.86 and 27.06% for treatments A, B and C, respectively (Table. 3). This finding is in agreement with the reported of El Khidir et al (1984) and Osman (1985) in Sudan Desert sheep which ranged between 17- 28%. El-Khidir (1989) reported a gut fill of 21.2, 18.4 and 17.0 in Sudan Desert sheep.

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On the other hand the dressing percentage calculated as a proportion of empty body weight (hot/ EBW) was 60.18, 58.26 and 55.18 on the basis of hot carcass, and 57.98, 55.28 and 53.79 on cold carcass basis (cold/EBW) in the three treatments A, B and C, respectively (Table 3). This is in agreement with the findings reported by Ahmed (1993) of 56.55, 55.5 and 54.7 for treatments A, B and C, respectively. These results are also similar to the results of El-Amin (1981) who found that, the dressing-out percentage ranged 52.8-56.6, and similar to the 53% dressing percentage reported by Gaili (1977) in Sudan Desert sheep.

Non-carcass components of desert sheep:

The results of non-carcass components expressed as percentage of empty body weight are summarized in (Table. 4). There were no significant differences among the treatments except tail, lung and trachea, testicles, mesenteric fat and skin which showed significant (P<0.05) differences among the three treatments. Their values were 1.87, 1.79 and 1.93% for the tail, 2.11, 2.37 and 1.95% for the lung and trachea, 2.71, 1.59 and 1.61% for the genital organs, 1.06, 1.30 and 1.08% for the messentric fat and 8, 7.71 and 8.52% for the skin, in treatments A, B and C, respectively (Table. 4). These results are in agreement with the result of El -Typeb et al (1987) who reported that the percentage of lung and trachea, testicles and tail was 8.24, 1.20 and 2.10, respectively. Also Mansour et al (1988b) found that, lung and trachea, sex organs, and mesenteric fat percentage were 2.70, 1.12 and 1.08%, respectively.

Table 4 - Effect of management systems on non-carcass components (as percentage of empty body weight) of desert sheep

Parameters	A	B	C	S.E	L.S
Rumen full	18.18	21.83	21.97	0.72	N.S
Rumen empty	3.63	4.25	4.51	0.09	N.S
Intestine full	8.48	9.67	8.98	0.21	N.S
Intestine empty	3.01	3.57	4.02	0.08	N.S
Tail	1.87^{b}	1.79^{c}	1.93^{a}	59.94	**
Liver	1.37	1.54	1.66	26.11	N.S
Heart	2.27	1.80	1.72	13.03	N.S
Lung and trachea	2.11^{b}	2.37^{a}	1.95^{c}	32.08	**
Kidney	1.27	1.15	1.07	3.96	N.S
Reproductive organs	2.71^{a}	1.59^{b}	1.61^{b}	27.74	*
Mesenteric fat	1.06^{b}	1.30^{a}	1.08^{b}	39.09	**
Head	6.83	7.02	7.93	0.09	N.S
Skin	8.00^{a}	7.71^{b}	8.52^{a}	0.11	***
Four feet	3.12	3	3.26	0.44	N.S
Gut fill%	20.02^{c}	23.86^{b}	27.06^{a}	1.11	*

^{abc} *Values in same raw with different superscripts differ at P<0.05*

Table 5 - Effect of sex on non-carcass components of desert sheep

Parameters	Females	Males	S.E	L.S
Rumen full (kg)	5.79^{b}	7.64^{a}	0.63	*
Rumen empty kg)	1.27	1.42	0.08	NS
Intestine full (kg)	2.85^{b}	3.05^{a}	0.19	*
Intestine empty(kg)	1.18	1.11	0.07	NS
Tail wt (g)	572.2^{b}	646.82^{a}	52.86	*
Liver wt (g)	466.67^{b}	522.22^{a}	13.62	*
Heart wt (g)	144.44	150.0	23.03	NS
Lung and trachea (g)	638.89^{b}	769.44^{a}	11.49	*
Kidney wt (g)	84.08	90.71	3.50	NS
Reproductive organs wt(g)	162.22^{a}	136.11^{b}	24.46	*
Mesenteric fat wt(g)	383.33^{a}	366.11^{b}	34.47	*
Omentum fat wt (g)	600^{a}	516.67^{b}	34.47	**
K.N.C.F wt(g)	518.96^{a}	410.84^{b}	53.89	**
Spleen wt (g)	48.89^{b}	410.84^{a}	5.30	*
Subcutaneous fat (dm^3)	0.34	0.27	0.03	NS
Head wt (kg)	2.24	2.47	0.08	NS
For feet wt (g)	888.89^{b}	1147.22^{a}	44.48	**

^{abc} *Values in same raw with different superscripts differ at P<0.05*

There were significant (P<0.05) differences in the non-carcass components of rumen full, intestine full, tail weight, liver weight, lung and trachea, genital organs, mesenteric fat, omentum fat, kidney knob channel fat, spleen and four feet (Table 5). Females had the highest weight in reproductive organs, mesenteric fat, omentum fat and

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kidney knob channel fat compared to males. This result is in agreement with the results of Mohamed (2004) who found that, the mesenteric fat, omentum and kidney knob and channel fats were heavier in ewes than in the rams. The results are also similar to Kashan et al (2005) who reported that the percentage of inter muscular fat, and internal fat in males were 7.1, and 6.6 and the corresponding values in females were 9.1, and 11.7, respectively.

The study revealed no significant (P>0.05) differences within females in the three treatments with regard to rumen full, rumen empty, intestine full, intestine empty, liver, heart, spleen, head and skin (Table 6) this attributed to age. However, there were significant (P>0.05) differences in lung and trachea, kidney, testicles, mesenteric fat, omentum fat, kidney knob channel fat and four feet. Females in treatment A recorded the highest weights compared to those in the other treatments. These differences may be due to the effects of the different rations. On the other hand, males showed no significant (P>0.05) differences among the three treatments in the rumen empty, intestine full, intestine empty, liver, heart, kidney, head and skin (Table7) this may be due to age also.

However, there were significant (P<0.05) differences in rumen full, lung and trachea, genital organs, mesenteric fat, omentum fat, kidney knob channel fat, spleen and four feet. These findings are in agreement with those of Mohamed (2002) who reported that there were no significant differences in head, empty stomach and spleen. However, there were significant differences in heart, testicles, mesenteric fat, kidney fat, tail, lung and trachea, pancreas, kidneys and empty intestines (Table 7).

Table 6 - The effect of management systems on female non-carcass components (as percentage of empty body weight)

Parameters	A	B	C	S.E	L.S
Rumen full	14.29	16.51	20.84	1.02	NS
Rumen empty	3.50	3.97	3.66	0.12	NS
Intestine full	7.80	8.45	8.91	0.30	NS
Intestine empty	2.93	3.16	4.49	0.11	NS
Tail	1.74	1.76	1.50	84.77	*
Liver	1.28	1.35	1.50	36.93	NS
Heart	1.2	1.1	1.5	18.4	NS
Lung and trachea	1.87b	2.00a	1.72c	45.37	*
Kidney	6.80b	6.50b	8.70a	5.60	*
Genital organs	1.50a	1.30b	1.30b	39.23	*
Mesenteric fat	1.23	90.20	1.05	55.28	*
Omentum fat	2.16a	2.02a	1.16b	123.71	*
K.N.C.F	2.03a	1.65b	1.08c	86.42	*
Spleen	3.7	3.9	3.2	8.5	NS
Head	6.52	5.93	7.41	0.12	NS
Skin	8.08	7.08	7.88	0.15	NS
Four feet	2.69a	1.62b	2.77a	71.33	*

[abc] Values in same raw with different superscripts differ at P<0.05

Table 7 - The effect of male and management systems on non-carcass components (as percentage of empty body weight)

Parameters	A	B	C	S.E	L.S
Rumen full	21.17[b]	24.58[a]	20.83[c]	1.02	*
Rumen empty	3.57	4.06	4.88	0.12	NS
Intestine full	8.74	9.74	8.08	0.30	NS
Intestine empty	2.98	3.58	3.13	0.11	NS
Tail	1.92[b]	1.91[b]	2.16[a]	84.77	*
Liver	1.40	1.54	1.65	36.93	NS
Heart	1.20	1.20	1.40	18.4	NS
Lung and trachea	2.26[a]	2.45[a]	1.98[b]	45.37	*
Kidney	6.70[c]	7.30[b]	9.50[a]	5.60	*
Genital organs	1.40a	1.20b	1.40a	39.23	*
Mesenteric fat	1.20b	2.50a	2.80a	55.28	*
Omentum fat	1.20	1.10	1.10	123.71	*
K.N.C.F	1.50a	1.17b	1.2b	86.42	*
Spleen	4.60b	5.90a	4.90b	8.5	*
Head	6.82	7.28	7.58	0.12	NS
Skin	7.53	7.42	8.31	0.15	NS
Four feet	3.34	3.29	3.41	71.33	*

[abc] Values in same raw with different superscripts differ at P<0.05

CONCLUSION

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It could be concluded that the total carcass tissues among the three groups and within females and males of Hamari sheep supplemented with concentrates were greater than those grazed on natural pasture. Short watering intervals gave better results on slaughter weight and carcass weight of Hamari sheep compared to long watering intervals.

Recommendation

It could be recommended that the fattening program of the Hamari sheep that depend on natural pasture must be supplemented with concentrates with short watering intervals so as to improve the growth performance and carcass characteristics.

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