Garag sheep phenotype and husbandry in Um Hani area in the White Nile State, Sudan

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ABSTRACT

Garag sheep phenotype and husbandry were studied in a survey of 295 animals at <1 - >4 years old in Um Hani area in the White Nile State, Sudan. Body weight (BW) and measurements generally increased with age from <1 to 4 years old. The tail was below the hock joint in most animals. The hair was short and rough and the coat colour varied and was mainly white (73.89% in females and 64.44% in males), black and white (9.49% in females and 17.78% in males) and white and red (5.08% in females and 6.67% in males). The face profile was convex and the animals were polled. There were strong correlations between BW and measurements and different linear regression equations were used to predict BW from heart girth (HG), height at withers (HW) and body length (BL) with no significant differences between measured and predicted BW. Flock size was 80.78 and females formed most of the flocks (88.37%). Lambs were weaned at 4.24 months old. Age at puberty was 6.82 months in males and 7.2 months in females. Age at first service was 8.12 months in males and 7.96 months in females. Gestation period was 154.2 days. Lambing interval was 356.4 days and lambing was from August to September. Lactation period was 124.8 days and average milk yield was 0.37 kg/day. Longevity was higher in females (6.48 years) than males (3.8 years).

INTRODUCTION

Sheep production is very important in the Sudan due to high population, wide distribution and self sufficiency in meat (Ministry of Animal Resources, 2004). Sheep and meat exports substantially increased due to premium meat quality, preference in some Arab countries and the animals depend mainly on natural pastures with no feed additives, especially of animal origin, or growth promoters that may endanger human and livestock health.

Different methods are used for the classification of Sudanese sheep including tail type (Mason and Maule, 1960), tail length: height at withers and ecotypes (Devendra and Mc Leroy, 1982). The term ecotype is proposed for Sudanese sheep classification since they are not improved to be considered as breeds according to western standards. The ecotypes are associated with tribes and their boundaries. There are 5 main ecotypes and 3 fused ones. Desert is the main ecotype and export sheep with many subtypes including Garag. However, it is suggested that Garag is probably a cross between Desert and Nilotic sheep in contact areas (Khalifa, 2002). Garag sheep is generally neglected and not preferred for meat production, but its numbers are increasing in local markets. It is considered hardy and disease resistant, but there is no evidence to support this. Sheep production is important in the White Nile State (WNS), Sudan and Garag is an important sheep type in the State. The animals depend mainly on natural pastures, which are deteriorating due to many factors, and crop residues (Khalifa, 2002). Information on Garag sheep phenotype is scarce (Devendra and Mc Leroy, 1982) and was only studied in Kenana Sugar Company (KSC) area in the WNS, Sudan (Khalifa, 2002). In addition, there is no information on the correlations between body weight (BW) and measurements and regression equations to predict BW. Furthermore, there is no available information on Garag sheep husbandry and performance in traditional areas. Consequently, this study was conducted to furnish information on Garag sheep phenotype, husbandry and performance in Um Hani area in the WNS, Sudan.

MATERIALS AND METHODS

A survey was conducted to furnish information on Garag sheep phenotype, husbandry and performance in Um Hani area in the WNS, Sudan, in March and April 2006 using a questionnaire.

Location

Um Hani is a large village in Kosti Municipality which lies between latitude 13°.00́ and 13° 15́N and longitude 32° 30́ and 32° 45́ E in the WNS (Ministry of Animal Resources, WNS, 2003). It is about 16 km south of Kosti and about 6 km from the west bank of the White Nile. The area is almost a flat plain in the rich Savanna. Mean temperature is 24 – 44C° and annual rainfall is 200 – 500 mm. Animal production is important in the area with about 1.25 million cattle, 0.5 million sheep, 0.18 million goats and 0.011 million camels. Most animals are kept along the While Nile bank and depend mainly on natural pastures and crop residues.

Phenotypic characteristics

A survey was conducted to determine Garag sheep BW and measurements in 295 animals at <1 - >4 years old. Age was estimated using the lower jaw incisors as described by Devendra and Mc Leroy (1982). Body weight was measured using a spring balance (50 kg capacity) and the animals were held in a sac hanged by the balance hook which is tied to a ceiling. Body measurements consisted of height at withers (HW), heart girth (HG), body length (BL), abdominal girth (AG), ear length (EL), ear width (EW), tail length (TL) and tail circumference (TC). They were measured for each animal using a measuring tape as described by Khalifa (2002). The hair length and texture, coat colours, face profile and horns were observed. Tail length: height at withers was calculated for each animal.

Body weight prediction

The correlations between BW and measurements were calculated and linear regression equations were used to predict BW from some body measurements at different ages as described by Khalifa (2002). Six animals were selected at random from each age group and used to predict BW from regression equations. Mean predicted and measured BW were compared for different age groups.

Husbandry and performance

Garag sheep husbandry and performance in Um Hani area were studied using a questionnaire for 50 animal owners.

Statistical analysis

Data were subjected to analysis of variance using SAS statistical package. The correlations between BW and measurements were calculated and linear regression equations were used to predict BW from HG, HW and BL at different ages. Measured and predicted BW were compared using student t test.

RESULTS

Table 1 shows Garag sheep mean BW and measurements at different ages in Um Hani area. Body weight increased significantly ($P \leq 0.05$) from 1 to 3 years old and was then almost constant. Height at withers significantly ($P \geq 0.05$) increased with age up to 2 years and was then almost constant. The heart girth, NL, TL and BL increased with age and the increase was significant ($P \geq 0.05$) up to 3 years old. The abdominal girth generally increased significantly ($P \leq 0.05$) with age with a peak at 4 years of age. Ear length increased up to 1 year and was then almost constant. Tail circumference increased with age up to 1 year old. The percentages of tails below the hock joint were 91.03%, 82.69%%, 76.32%, 89.47%, 78.57% and 81.25% at < 1, 1, 2, 3, 4 and > 4 years of age, respectively, and generally decreased with age. The tail touched the ground in 9.13% of the animals and was dragging in 7.65% of the animals. Tail length: height at withers was 1: 1.24, 1: 1.23, 1: 1.26, 1: 1.23, 1: 1.37 and 1: 1.43 at < 1, 1, 2, 3, 4 and > 4 years of age, respectively, and generally increased with age. All animals had a convex face profile and were polled. Coat colours varied and the main colours in females were white (73.89%) followed by black and white (9.49%) and in males they were white (64.44%) followed by black and white (17.78%).

Table 1. Body weight (kg) and measurements (cm) of Garag sheep at different ages in Um Hani area, White Nile State, Sudan.

Parameters	Age (years)					
	< 1 (n = 156)	1 (n = 52)	2 (n = 38)	3 (n = 19)	4 (n = 14)	> 4 (n = 16)
BW	22.65±0.48 ^{c}	31.79±0.65 ^{b}	34.18±0.98 ^{ab}	35.84±1.13 ^{a}	35.36±1.80 ^{a}	35.81±1.90 ^{a}
HW	62.68±0.49 ^{b}	69.60±0.54 ^{a}	72.42±0.73 ^{a}	70.47±0.66 ^{a}	72.64±1.80 ^{a}	72.12±1.20 ^{a}
HG	66.01±0.58 ^{b}	75.69±0.60 ^{a}	76.58±0.91 ^{a}	78.58±0.61 ^{a}	77.43±1.4 0^{a}	78.69±1.60 ^{a}
BL	47.21±0.39^{ab}	53.54±0.49 ^{a}	55.42±0.59 ^{a}	56.21±0.97 ^{a}	55.07±1.20 ^{a}	56.94±0.98 ^{a}
AG	72.86±0.68^{c}	82.38±0.65 ^{b}	84.74±1.10 ^{ab}	87.42±0.94 ^{a}	87.57±1.59 ^{a}	86.19±2.3 ^{ab}
NL	23.22±0.24 ^{b}	26.83±0.31 ^{a}	28.29±0.35 ^{a}	28.53±0.50 ^{a}	28.43±0.66 ^{a}	28.44±0.75 ^{a}
EL	14.11±0.13^{ab}	15.02±0.16 ^{a}	14.58±0.309 ^{b}	14.79±0.29 ^{a}	14.68±0.45 ^{ab}	13.69±0.80 ^{b}
EW	07.64±0.57 ^{b}	08.19±0.62 ^{a}	08.05±0.13 ^{ab}	08.24±0.11 ^{a}	7.86±0.26 ^{ab}	7.97±0.31 ^{ab}
TL	50.60±0.64 ^{b}	56.48±0.89 ^{a}	57.37±1.50 ^{a}	57.38±1.10 ^{a}	53.21±3.2 ^{ab}	50.38±3.9 ^{b}
TC	16.51±0.19^{cb}	18.81±0.35 ^{a}	17.92±0.39 ^{ab}	17.95±0.60 ^{a}	17.79±0.68 ^{ab}	16.25±0.82 ^{c}

BW = Body weight, HW = Height at withers, HG = Heart girth, BL = Body length, AG = Abdominal girth, NL = Neck length, EL = Ear length, EW = Ear width, TL = Tail length, TC= Tail Circumference.

Means with similar letters in a row are not significantly different ($P > 0.05$).

Means with different letters in a row are significantly different ($P \leq 0.05$).

SE = Standard error. n = Number of observations.

Table 2 shows the correlations between BW and measurements in Garag sheep in Um Hani area. Body weight was generally highly correlated with body measurements and was significantly ($P \leq 0.05$) correlated with HW and HG. The correlations between BW and BL were relatively weaker than those with HG and HW.

Table 2. Correlation coefficients between Garag sheep body weight (kg) and some body measurements (cm) at different ages in Um Hani area, White Nile State, Sudan.

Parameters	Age (Years)					
	< 1	1	2	3	4	> 4
HW	0.89**	0.71**	0.66**	0.61*	0.76**	0.92**
HG	0.94**	0.88**	0.89**	0.87**	0.78**	0.93**
BL	0.80**	0.49**	0.69**	0.34**	0.79**	0.64**
AG	0.85**	0.71**	0.85**	0.82**	0.94**	0.95**

* = Significant ($P \leq 0.05$). ** = Highly significant ($P \leq 0.01$).

HW = Height at withers, HG = Heart girth, BL = Body length, AG = Abdominal girth.

Table 3 shows that different regression equations were used to predict Garag sheep BW from some body measurements at different ages and the correlation coefficient was very high.

Table 3. Regression equations predicting Garag sheep body weight (kg) from some body measurements (cm) at different ages in Um Hani area, White Nile State, Sudan.

Age (years)	Equations	R^2
< 1	$Y = 0.347x_1+0.112x_2+0.274x_3+0.215x_4-35.009$	0.88
1	$Y = 0.052x_1+0.723x_2+0.114x_3+0.220x_4-50.815$	0.82
2	$Y = 0.202x_1+0.487x_2+0.055x_3+0.347x_4-50.187$	0.86
3	$Y = 0.260x_1+0.902x_2+0.028x_3+0.441_4-90.348$	0.82
4	$Y = 0.086x_1+0.056x_2+0.101x_3+1.031x_4-62.322$	0.89
> 4	$Y = 0.439x_1+0.443x_2+0.109x_3+0.310x_4-63.525$	0.94

Y = Body weight. x_1 = Height at withers. x_2 = Heart girth. x_3 = Body length. x_4 = Abdominal girth.

Table 4 shows that there were no significant differences between Garag sheep measured and predicted BW from regression equations at different ages.

Table 5 shows Garag sheep husbandry in Um Hani area. Mean flock size was 80.78 ± 5.59 heads. Females formed most of the flocks (88.37%) and longevity was higher in females than males. Average weaning age was 4.24 months.

The reproductive and productive performance of Garag sheep in Um Hani area is shown in Table 6. Males had lower age at puberty and higher age at first service than females. Gestation period was 154.2 days and lambing interval was less than one year. Lambing season is mainly in August and September. Lactation period was 124.8 days and average daily milk yield was 0.37 kg.

Table 4. Garag sheep predicted and measured body weights (kg) at different ages in Um Hani area, White Nile State, Sudan.

Age (years)	Predicted weight	Measured weight
< 1	15.70 ± 2.57[a]	15.83 ± 2.52[a]
1	29.77 ± 1.71[a]	29.69 ± 2.04[a]
2	30.47 ± 4.30[a]	29.83 ± 3.90[a]
3	34.98 ± 1.86[a]	35.33 ± 2.64[a]
4	34.81 ± 3.46[a]	34.67 ± 4.04[a]
> 4	34.60 ± 3.47[a]	34.83 ± 3.75[a]

Means with the same letters in a column were not significantly different ($P \geq 0.05$).

Table 5. Garag sheep husbandry in Um Hani area, White Nile State, Sudan.

Parameters	Means ± S.E
Flock size (heads)	80.78 ± 5.59
Flock structure (%):	
Adult males	3.14 ± 0.22
Male lambs	8.49 ± 0.67
Adult females	74.83 ± 1.68
Female lambs	13.54 ± 1.13
Longevity (productive life) (years):	
Males	3.8 ± 0.14
Females	6.48 ± 0.25
Weaning age (month)	4.24 ± 0.01

S.E = Standard error.

Table 6. Reproductive and production performance of Garag sheep in Um Hani area, White Nile State, Sudan.

Parameters	Means ± S.E
Age at puberty (month):	
Males	6.82 ± 0.10
Females	7.2 ± 0.31
Age at first service (month):	
Males	8.12 ± 0.22
Females	7.96 ± 0.15
Age at first lambing (month)	13.12 ± 0.15
Lambing interval (days)	356.4 ± 3.6
Lambing season	August and September
Gestation period (days)	154.2 ± 1.49
Milk yield (kg/day)	0.37 ± 0.01
Lactation period (days)	124.8 ± 3.01

DISCUSSION

The increased BW and measurements with age was similar to that found in Garag sheep in KSC area (Khalifa, 2002) and Shorani sheep in Nuba Mountains (Gibreel, 2003). Garag BW was similar to that reported by Devendra and Mc Leroy (1982), but lower than in KSC area (Khalifa, 2002). The variations in Garag BW among sites could be genetic or due to nutrition and management. Garag BW was lower than Kababish, Meidob, Wattish and Zaghawa sheep (Devendra and Mc Leroy, 1982) and Shorani (Gibreel, 2003). It was generally heavier than Nilotic sheep (Devendra and Mc Leroy, 1982). This shows that Garag is likely a cross between Desert and Nilotic sheep with higher Desert blood. Similar

suggestions were postulated for Garag sheep in KSC area (Khalifa, 2002). The finding that Garag reached mature BW at 3 years of age was similar to that in KSC (Khalifa, 2002).

Garag in Um Hani had higher HW than Garag in KSC (Khalifa, 2002), Shorani in Nuba Mountains (Gibreel, 2003) and the report by Devendra and Mc Leroy (1982) indicating that it was relatively less compact than them. Heart girth was less than Desert sheep and higher than Nilotic sheep (Devendra and Mc Leroy, 1982) suggesting that Garag is a cross between Desert and Nilotic sheep. The heart girth was higher than Garag in KSC (Khalifa, 2002). Body length in Um Hani was higher than Garag in KSC area (Khalifa, 2002) and Shorani (Gibreel, 2003). Garag AG was higher than Shorani at < 1 year reflecting variations in body development between the two sheep types. Garag ear length was close to that in KSC area and shorter than Shorani suggesting dominant effects of Nilotic sheep. Garag tails were below the hock joint in most animals as in KSC area (Khalifa, 2002). Garag convex face profile was similar to that in KSC (Khalifa, 2002) and is probably due to Desert sheep blood.

Garag colour variations were also found in Garag in KSC area and colour variations in the two areas could be due to different origins and suggested that Garag is not yet a well defined breed. The rough hair was similar to that in Desert sheep ecotypes.

The strong correlations between BW and measurements and different regression equations to predict BW substantiated using body measurements to predict BW (Khalifa, 2002; Gibreel, 2003). This is beneficial where weighing machines are not used.

Garag flock size was less than in Nuba Mountains (Gibreel, 2003). Flock size is determined by available resources, income and labour. The high percentages of females in flocks were also found in Shorani (Gibreel, 2003) and demonstrated a shift in traditional animal husbandry. Longevity was higher than Shorani in Nuba Mountains (Gibreel, 2003) and females were sold and culled at younger ages than in Nuba Mountains. The results showed that lambs were weaned at older ages and should be weaned earlier in favourable conditions.

Ages at puberty and first service were lower than Shorani lambs and may be due to genetic, management or nutritional differences. Age at first lambing was close to that for Shorani (Gibreel, 2003) and less than Kababish sheep, Dubasi, Shugor and Wattish (Devendra and Mc Leroy, 1982) and higher than Nilotic sheep (Devendra and Mc Leroy (1982). Gestation period is close to that for Shorani (Gibreel, 2003).

Lambing interval was longer than Shorani (Gibreel, 2003) and shorter than in Elhuda (Suliman, and Eissawi, 1984). Mean daily milk yield was lower than in KSC (Khalifa, 2002), Kababish (Devendra and Mc Leroy, 1982) and Wattish (Ganim, 1979).

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الصفات الظاهرية ونظام رعاية أغنام القرج في منطقة أم هاني في ولاية النيل الأبيض بالسودان

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الخلاصة

درست الصفات الظاهرية ونظام رعاية أغنام القرج باستخدام المسح الميداني في 256 حيوانا بعمر أقل من عام الى أكثر من 4 سنوات في منطقة أم هاني في ولاية النيل الأبيض بالسودان. زاد الوزن وقياسات الجسم عامة بزيادة عمر الحيوانات من أقل من عام الى 4 أعوام. كان طول الذيل تحت العرقوب في معظم الحيوانات. كان الشعر قصيرا وخشنا واختلف لون الفروة وكان أكثره أبيضا (73.89%في الإناث و 64.44% في الذكور) ثم أبيض وأسود (9.49% في الإناث و 17.78% في الذكور) ثم أبيض وأحمر (5.08 في الإناث و 6.67% في الذكور). وكان الوجه محدبا والحيوانات ليست لها قرون. وجدت علاقات قوية بين الوزن ومقاييس الجسم وإستخدمت معادلات إنحدار خطية مختلفة للأعمار المختلفة لتقدير وزن الجسم من الإرتفاع عند الكتف ، محيط الصدر ، طول الجسم ومحيط البطن ، مع عدم وجود إختلافات معنوية بين الوزن المقدر والمقاس. كان متوسط حجم القطيع 80.78 راساً وشكلت الإناث معظم القطعان (88.37%). فطمت الحملان بعمر 4.24 شهراً. وكان البلوغ بعمر 6.82 شهراً للذكور و 7.96 شهراً للإناث . وكان العمر عند التلقيح الأول 8.12 شهرا للذكور و 7.96 شهرا للإناث . وكان طول فترة الحمل 154.2 يوماً. كانت الفترة بين الولادتين 356.4 يوماً وكانت الولادة في شهري أغسطس وسبتمبر . متوسط موسم الحليب 124.8 يوماً ومتوسط إنتاج اللبن 0.37 كجم/يوم.. وكان العمر الإنتاجي أطول في الاناث (6.48 عاما) من الذكور (3.8 عاما)