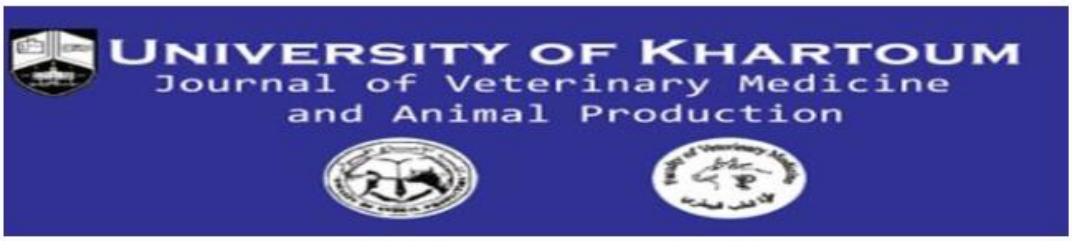
U. of K. J. Vet. Med. Anim. Prod., Vol.11, Issue 1&2 (2020) page 375-386
ISSN: 243456



Phenotypic Characterization of Sudanese Watish Desert Sheep Ewes in the Blue Nile State, Sudan

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Abstract

This study was conducted to generate baseline information on the phenotypic characteristics of Watish sheep breed and their production system which is a prerequisite step toward future conservation and improvements. One hundred and twenty sheep owners were selected on population density from six villages and interviewed using a semi structured questionnaire. Linear body measurements were taken, the data was classified according to age and sex then analyzed as a completely randomized setup using the Statistical Package for Social Sciences (SPSS). The results showed that 83%, 11.9% and 4.8 % of the owners were full time livestock keepers, farmers and traders respectively. Sheep ranked top as most preferred species by owners (96.56%), goats came second (3%), cattle third (0.44%). The owner's decision of selling animals was based on weight (91.7%), emergencies (5.6%) and age (2.8%), The most common disease problem was small ruminants plague (74%). The main constraints to sheep production activities according to respondents were availability of feed (42.9%), water (22.2%), diseases (31.7%), workers (1.6%), and security (1. 6%). The owners depended on natural range and agricultural by products as feed supplement during the dry season. Water was obtained from earth dug reservoirs (Hafirs) during the rainy season and from water yards during the dry season. Most sampled owners (94.3%) did not cross breed their Watish with another sheep breed while 5.7% said they did so. Most ewes dropped single lambs (87.9%) and 12.1% produced twins. The overall means of height at withers, body length, heart girth, tail length and neck length were 76.8cm, 68.9cm, 87.5cm, 73.2cm and 1.5cm respectively. The effect of parity was highly significant ($P \leq 0.05$) on heart girth while other traits were not significantly affected. The birth type significantly ($P \leq 0.05$) affected all traits except tail length. The study concluded that Watish

has the potential to serve as a dam breed in a crossbreeding system with one of the large desert sheep breeds.

Key words: Watish, Desert Sheep, Phenotypic characterization, Sudan.

المستخلص

أجريت هذه الدراسة من اجل توفير معلومات أساسية عن الخصائص المظهرية لسلالة الوتيش ونظام إنتاجها والتي تعد خطوة أساسية نحو جهود الحفظ والتحسين المستقبلية. تم اختيار مائة وعشرين من مربي الأغنام من ست قرى على أساس كثافة الحيوانات وتم اجراء معاينة لهم باستخدام استبيان شبه منظم. أخذ ت قياسات الجسم الخطية ، وتم تصنيف البيانات حسب العمر والجنس ثم حللت احصائيا كتصميم كامل العشوائية باستخدام برنامج الحزمة الإحصائية للعلوم الاجتماعية (SPSS) اصدار 10.5 .أظهرت النتائج أن 83٪ و 11.9٪ و 4.8٪ من المربيين هم رعاة الماشية والمزارعين والتجار على التوالي ، واحتلت الأغنام المرتبة الأولى كأكثر الأنواع تفضيلاً من قبل المالكين (96.56٪) تليها الماعز في المرتبة الثانية (3٪) ثم ثالثا الأبقار (0.44٪) و لا تربى الإبل . يتم اتخاذ قرار بيع الحيوانات على أساس الوزن (91.7٪) ثم حالات الطوارئ (5.6٪) واخيرا العمر (2.8٪) ، وكان المرض الأكثر شيوعًا هو طاعون المجترات الصغيرة (74٪). حسب افادة المربين نجد ان المعوقات الرئيسية لأنشطة إنتاج الأغنام هي عدم توافر العلف (42.9٪) والمياه (22.2٪) والأمراض (31.7٪) والعمالة (1.6٪) والأمن (1.6٪). يعتمد المربين على المراعي الطبيعية وعلى المخلفات الزراعية كمكمل غذائي خلال موسم الجفاف. تم الحصول على المياه من الحفائر خلال موسم الأمطار ومن أحواض المياه خلال موسم الجفاف. افاد اغلبية ألمربين تحت الدراسة (94.3٪) إنهم لم يستخدموا التهجين لتحسين سلالة اغنام الوتيش بينما اقلية منهم (5.7٪) مارسوا التهجين. معظم ولادات النعاج (87.9٪) كانت مفردة بينما 12.1٪ من الولادات توائم. المتوسطات الكلية للارتفاع عند الغارب وطول الجسم ومحيط الصدر وطول الذيل وطول الرقبة كانت 76.8 سم ، 68.9 سم ، 87.5 سم ، 73.2 سم ، 1.5 سم على التوالي. كان تأثير الولادة عالي المعنوية ($P\leq 0.05$) على محيط الصدر بينما لم تتأثر الصفات الأخرى معنويا. كان لنوع الولادة تاثيرا معنوياً ($P\leq 0.05$) على جميع الصفات باستثناء طول الذيل ، وخلصت الدراسة إلى أن اغنام الواتيش لديها القدرة لتصبح بمثابة سلالة للامهات في نظام التهجين مع إحدى سلالات الأغنام الصحراوية الكبيرة.

الكلمات المفتاحية : ضان الوتيش،الضان الصحراوى، الخصائص المظهرية، السودان .

Introduction

Sheep are widely distributed in Sudan and form an important component of the income and livelihood of many rural families. This means that conservation and improvement of indigenous sheep breeds should take a high priority in efforts to alleviate poverty and improve the livelihoods of rural populations (Shiawoya 2006). Both conservation and improvement require research on two fronts: Phenotypic and molecular characterization of local breeds (FAO 2012).

Watish is a subtype of Desert sheep found in the Blue Nile State, south of Wad Medani. Mature male live weight ranges between 46–55 kg with a dressing percentage of 46 - 50%. The coat color is dominantly white and may probably be red. No horns are found in females and the ears are pendulous. Mature male measures 60 – 70 cm at the shoulders. The Watish tribal type is smaller in size than other Desert sheep subtypes and is reported to have a higher litter size than other subtypes. Mohamed *et al.* (2018) reported that Watish sheep were produced under a nomadic system (81.4%) a sedentary system (8.5%) or a semi nomadic system (10.2%) and the main production constraints were water (25.0%), feed (20.6%), disease (19.6%), capital (18.1%), and security (16.7%).

Linear measurements can be used in assessing growth rate, live weight and feed utilization and carcass characteristics in farm animals (Brown, and Butts, 1973: Kumar *et al*., 2017). El Khider (1980) reported that measurements have been widely used for estimating animals live weight, especially when there is no access to weighing equipment. The method is more common for cattle and to a lesser extent in sheep, pigs and poultry (Lawrence and Fowler, 1997).

Body measurements may vary due to the influence of breed, environment and nutrition. (Riva, *et al.,* 2004). The objective of this study was to characterize the Watish subtype and its production system in the Blue Nile State in Sudan to contribute to establishing baseline data for future conservation and improvements efforts.

Materials and methods

This study was performed on Watish desert sheep subtype which is distributed between longitudes 32-36°East and latitude12-14° North in Blue Nile State. In contrast with other Desert sheep subtypes Watish thrives in areas of relatively high rainfall (700- 900 mm/anum) and heavy clay soils. A semi structured questionnaires targeting 120 sheep owners was pretested to ensure suitability and clarity of questions. The questionnaire was designed to obtain information on general household characteristics, flock structure, management, breeding practices, production objectives, prevalence of diseases and parasites, and production constraints. Six villages (Garabin, Agadi, Abusuwelik, Werket, Salha, Abgega) were selected on the basis of population density. Morphometric measurements (Ear length, trunk length, tail length, neck length, heart girth, belly girth and height at withers) were measured using a steel tape and a measurement stick in the manner of Owen *et al*. (1977).
The statistical package SPSS (IBM Corp., 2017) was used in data analysis. Gene and genotype frequencies were calculated as described by Falconer and Mackay (1996) and association with genotypes was determined using Chi square test.

Results

Owner and flock information

About 31.4% of surveyed Watish owners were illiterate, 17.1% of owners were khalwa educated (Religious school), 14.3% completed primary school, 34.3% secondary school and 2.9% were university graduates (Figure:1). Full time livestock keepers constituted 83% of the sample, 11.9% were farmers and 4.8% were traders (Figure:2). Sheep ranked top as the species most preferred by owners (96.56%), goats second (3%) cows came third (0.44%) and camels were not raised (Figure: 3). Table (1) shows Watish sheep flock information, own fortune is the major source of sheep flock (82.9%) while 17.1 % of the owners said that their flocks were inherited. Regarding the purpose of rearing, 94.3% said it was targeting local markets and 5.7% said it was for export markets. All flock owners indicated that they do not keep animal records, but about 97.1%of owners said that their flocks were increasing in numbers and 2.9% said their flocks were declining. The decision to sell the animals was made mainly on the basis of a specific weight followed by the response to emergency conditions and lastly due to a specific age.

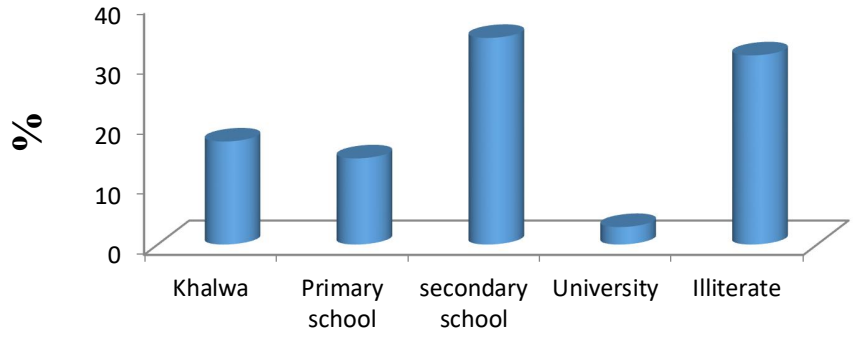

Figure 1: Educational level of respondants

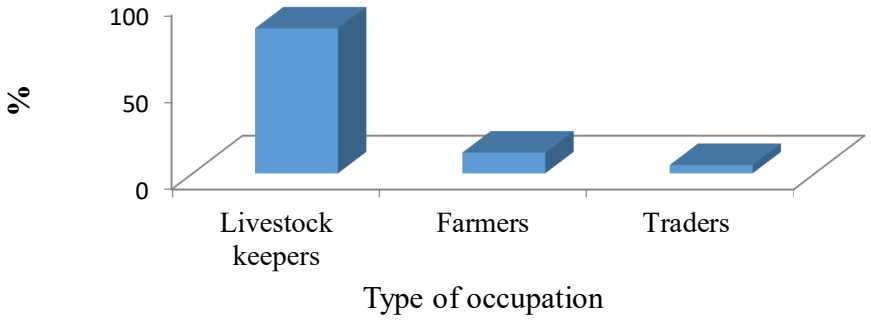

Figure 2: Household occupation

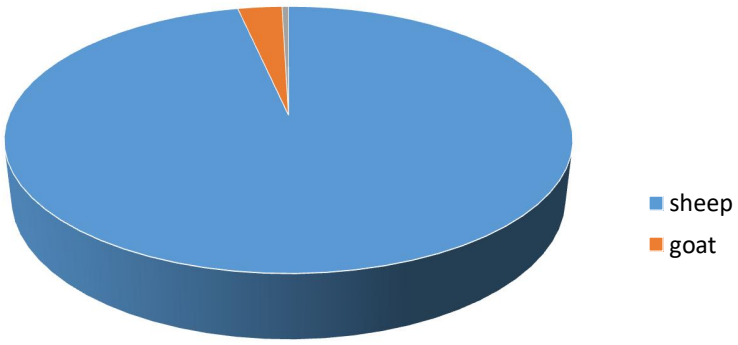

Figure 3:Animal species preferred by owners

Table: 1. Flock information

Source of flock		Purpose		Size trend		Decision to sell	
Source	**%**	**Objective**	**%**	**Item**	**%**	**Item**	**%**
Inheritance	17.1	Local markets	94.3	Increasing	97.1	Specific age and emergencies	8.4
Own fortune	82.9	For export	5.7	Decreasing	2.9	Specific weight	91.7

Production System

Table 2 presents information on farm ownership, work force, types of crops and feed. Most of the Watish sheep owners (88.6%) do not have farms only 11.4 of them had farms. About 50%reported that they grew forages, 37.5% said they grew cash crops and 12.5% other crops. All owners questioned had workers helping them in flock management most of them (82.9%) were hired labour and only 17.1% of the owners used family members as labour. About 2.9% of the owners depend on rangeland only to feed their sheep while 97.1%provided supplementary feeding be side grazing for all animals and they depend on agricultural residues in the dry season. All the breeders in this study had no regular sheds, and the animals spent noon time under trees. The basic data on Watish sheep husbandry practices is presented in Table 3, water was obtained from earth dug reservoirs (Hafirs) by 65.7% of owners while 34.3% obtained water from water yards equipped with pumps (local name donkeys). About 40% of flock owners moved their animals to the water source, while 60% of owners transported water to the flock. Castration was practiced by 5.7% of the respondents when ram lambs were about two months old, while 94.3% did not practice it. Most sampled owners (94.3%) said they did not cross breed their Watish with other breeds while 5.7% said they did so. The method of mating used by an owners questioned was that of a free uncontrolled mating. The season in which most lambings took place was winter (87.9), summer (9.1%) and autumn (3%). The preferred method of weaning by 97.1% of respondents was by tying of nipple (Sorar) and separation of lamb from ewe came second (2.9%).

Table 2: Farm ownership, work force, types of crops and feed

Farm ownership	%	Have help	Type of help	%	Types of crops	%	Type of feed	%
Yes	11.4	Yes	Family	17.1	Forages	50	Range pasture	2.9
No	88.6	No	Hired	82.9	Cash crops	37.5	Agricultural residues supplement	97.1

Table: 3: Basic data of Watish sheep husbandry practices

Water source	%	Watering	%	Practice castration	%	Crossing with other breeds	%	Lambing season	%	Method of weaning	%
Water yard	34.3	Water fetched	60	Yes	5.7	Yes	5.7	Winter	87.9	Tying of nipple	97.1
Earth dug reservoir	65.7	Moved to source	40	No	94.3	No	94.3	Summer	9.1	Separation of lamb from ewe	2.9

The mean age at first mating for ewes and rams was estimated as 9.64 ± 0.268 and 10.33 ± 0.253, respectively. Age at first lambing, average birth weight, lambing interval, weaning age and average weaning weight were 14.11 ± 0.331 months, 3.00 ± 0.00 Kg, 7.14 ± 0.085 months, 4.25 ± 0.083 months, 20.64 ± 0.364 Kg, respectively. Most ewes dropped single lambs (87.9%) and 12.1% produced twins (Table 4).

Table 4. Means and standard errors of some reproductive traits

Trait	**N**	**Mean ± SE**
Age of ewe at first mating (months)	33	9.64 ± 0.268
Age of ram at first mating (months)	33	10.33 ± 0.253
Age at first lambing (months)	28	14.11 ± 0.331
Lambing intervals(months)	28	7.14 ± 0.085
Average birth weight (kg)	23	3.00 ± 0.00
Weaning age	28	4.25 ± 0.083
Average weaning weight(kg)	28	20.64 ± 0.364
Type of birth		**%**
single		87.9
Twins		12.1

Morphometric traits

The overall means of height, body length, heart girth, tail length and neck length were estimated as 76.808 ± 1.304, 68.953 ± 1.326,87.513 ± 1.746, 73.249 ± 2.867 and 31.518 ± 0.741, respectively (Figure 4). The means of height, body length, heart girth and neck length in ewes dropping singles and those dropping twins were significantly different (P≤ 0.05, Table 8).

The analysis of variance showed that the effect of parity on heart girth was highly significant (P≤ 0.01) and close to significance on body length P=0.060). Birth type affected neck length highly significantly (P≤ 0.01), and significantly (P≤ 0.05) influenced height, body length and heart girth (Table 5). The coat colour of Watish ewe was predominantly white and the shape of the face was mostly convex, similar to other Desert sheep types. The tail type of most ewes was fat and long, all ewes were polled (Table 6).

Table.5. Analysis of variance: The effect of parity and birth type on some morphometric measurements

Source	Trait	Df	Mean Square	F	Sig.
Parity	Height	4	8.853	.629	.643
	Body length	4	33.845	2.325	.060
	Heart girth	4	188.183	7.463	.000
	Tail length	4	79.495	1.169	.327
	Neck length	4	5.310	1.170	.327
Birth type	Height	1	81.852	5.816	.017
	Body length	1	74.343	5.106	.025
	Heart girth	1	113.420	4.498	.036
	Tail length	1	146.389	2.153	.145
	Neck length	1	37.107	8.175	.005
Error	Height	133	14.072		
	Body length	133	14.559		
	Heart girth	133	25.216		
	Tail length	133	67.997		
	Neck length	133	4.539		

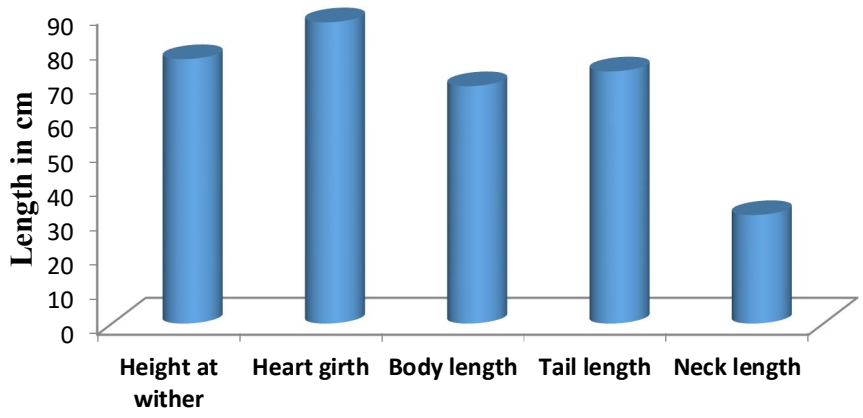

Figure 4 : Linear body measurement of Watish sheep

Table 6. Some external characteristics of Watish ewes

Item	Frequency	Percent
Coat colour		
White	134	95.7
White, black patches	1	.7
Black	5	3.6
Total	140	100.0
Face shape		
Convex	138	98.6
Concave	1	.7
Straight	1	.7
Total	140	100.0
Ear shape		
Curved	139	99.3
Curved pointing back	1	.7
Total	140	100.0
Tail type		
Thin	3	2.1
Fat	108	77.1
Long	8	5.7
Fat long	15	10.7
Fat short	6	4.3
	140	100.0
Ear length		
Valid	14	.10.0

Flock health and constraints to production

The results revealed that about 60% of the sampled owners said their flock health was excellent 40% said it was good. About 28.6% of owners reported that there had been disease incidents in their flocks during the past 12 months while for 71.4 there was no incidence of disease (Table7).

Table 7. Health status and availability of veterinary services

Flock health				Veterinary services			
Status	**%**	**Disease in last 12 months**	**%**	**Availability**	**%**	**provider**	**%**
Excellent	60	yes	28.6	Accessible	5.7	Veterinarian	6.1
Good	40	No	71.4	Sometimes	82.9	vet assistant	22.2
				non-existent	11.4	vet associate	72.7

Vaccination against endemic diseases was used by 84.6% of the sampled owners and 15.4% did not vaccinate. Vaccination was done periodically against Peste de petit ruminant, Foot and Mouth disease and Sheep Pox by 64.3%, 3.6% and 32.1% of owners, respectively.

Administration of oral treatment against internal and external parasites was done by 92% of the sample while 8% did not use the treatment. Treatment against internal and external parasites was done by 95.7% of owners once a year and 4.3% of them did it twice a year (Table 8). The main constraints to sheep production activities according to respondents were availability of water and feed, diseases mainly parasites, availability of labour and security were also mentioned as major constraints (Figure 5).

Table 8. Percentage of owners vaccinating against particular diseases and use of anti-parasitic drugs

vaccine	**%**	**Anti-parasitic treatment**	**%**	**Number of applications**	**%**
Pestes de petites	64.3	Practiced	92	Once a year	95.7
Foot and mouth	3.6	Not practiced	8	Twice a year	4.3
Sheep Pox	32.1				

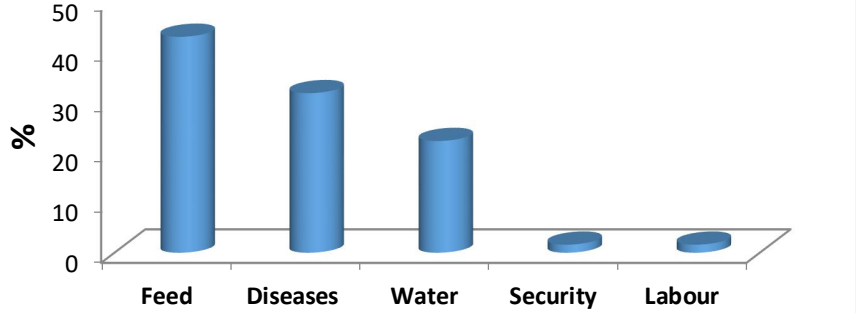

Figure 5: Constraints to sheep production in the study area

Discussion

The majority of respondents in this study were illiterate which presents a challenge to improvement efforts as no records are kept. However, they were mostly full time sheep keepers and production is targeting the export market. All the sheep owners in this study said they had no animal sheds, but the animals made use of trees shade during mid-day and at night. About 2.9% of owners were dependent mainly on rangeland pastures only to feed their animals while 97.1% provided supplementary feeding in addition to grazing for all animals. In the dry season they made use of agricultural residues from the mechanized crop production schemes in the area and some owners move with their animal's southwards in search of pastures. The dry season is a period of weight loss and mortality of animals. The direct effects of poor nutrition are reflected in reduced conception, embryonic losses, reduced lambing rates (Asín,*et al* 2021Diskin and Niswender, 1989) and high ewe mortality (Yoder *et al*., 1990).

Breeding rams are usually selected with major emphasis on size, conformation, and colour, with little or no attention to performance of parents or other relatives (Mohamed, 2002). The season of most lambings was winter which indicates that matings occur at the beginning of the rainy season. Breeding usually means an attempt to induce lambing at what is considered to be the most favorable period of the year. This control normally results in longer parturition interval than is found when breeding is allowed year round. Control of breeding leads to only one lamb crop per year, while uncontrolled breeding results in shorter parturition interval enabling approximately three lamb crops to be obtained in two years (FAO, 1985). Lambing three times in two years is possible with Desert sheep provided adequate nutrition is available. The results of the present study showed that the Watish is raised under an agro-pastoral system in which animals are mainly dependent on natural pastures with some use of agricultural residues in the dry season.

Lambing results indicate that 19.3% of ewes gave twins and one ewe (0.7%) gave tripplets. Awatif Abdalla (2016) found twinning rates ranging between 17.1 and 45.7% in Watish ewes given different nutritional treatments. Evidence obtained suggested that with better supplementation twinning rates Riesel-Hag *et al* (2007) found that supplementary feeding of Desert ewes resulted in increased lambing and twinning rates and heavier weights at birth.

In the present study 95.7% of ewes were white, the remainder were brown or white with black patches. Mcleroy, (1961) reported three colour groups among the Watish: white with light spotting, red and fawn colours. The effect of parity was highly significant on heart girth (P≤ 0.01) and close to significance on body length (P=0.060). Birth type significantly (P≤ 0.05) influenced height, body length and heart girth and affected neck length highly significantly (P≤ 0.01). Watish is barrel shaped with relatively shorter legs and smaller body size compared to other Desert sheep types. The respondents in this study indicated that the main constraints to sheep production were availability of feed and water. In the dry season tropical pastures that are low in soluble carbohydrates become even poorer and the nutritive value of rangeland grasses declines (El-Hag *et al* 2001, Fernandes *et al* 2020).

Conclusion

The results of the present study showed that the Watish is raised under an agro pastoral system in which animals are mainly dependent on natural pastures with some use of agricultural residues in the dry season. Baling of crop residues and training of producers in improving the nutritional value of residues can go a long way towards solving dry season feeding problems. Another improvement in feeding can arise from cultivation of leguminous crops during the rainy season. An effective extension service is necessary to raise awareness of farmers in methods of feed conservation and improving its nutritional value. Morphometric measurements and twinning rates of Watish imply that it might have an important role in crossbreeding systems. Improvements in the availability of veterinary services are required as most respondents complained of disease problems.

Acknowledgement

Many thanks to the Ministry of Higher Education and Scientific Research, Sudan and the Institute for Studies and Promotion of Animal Exports, University of Khartoum for funding and financial support.

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