



Phenotypic Characterization of Fulani Sheep Subtypes

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Abstract

The objective of this study was an attempt to study some field management practices adopted by shepherds and sheep owners and to describe and characterize different Fulani sheep local subtypes in natural habitat in South Darfur State. A fitted form of detailed structured questionnaire was used to gather information from two hundred Fulani sheep owners in Tolus villagers and its surrounding villages in South Darfur state. The results revealed that more than 68% of sheep owners had above 15 years of experience in rearing their animals reflected in their educational level where about 80% of them were either illiterate or had basic or “Khalwa” education. It revealed also the respondents reared mainly sheep beside other farm animals and the Umsaen sheep was the most raised sheep ecotype. The results showed that most Fulani ecotypes were similar in many morphological features, also it showed that there were local Sudanese names for different Fulani sheep ecotypes (Alabiad – Balami), (Umgaba – Uda) and (Umkehail – Yankasa). The majority of sheep owners adopted semi sedentary and open range system (98.5%) and fed their animals with different kinds of agriculture by-products such as groundnut cake and millet bran. The major priority selection criteria of ewes and rams were size – feature while the main culling criteria were diseases and overage for both ewes and rams. Three to four months was the most weaning age. The most frequent diseases among adults and lamb of Fulani sheep were bacterial diseases and unspecific diarrhea for adults and lambs respectively; also they showed that the main production handicaps of Fulani were diseases. The study concludes that Fulani sheep had different colours represented in various ecotypes and that sex and ecotype had slightly affected many body measurements.

Keywords: Sheep, Umsaen, body measurements, heart girth.

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Introduction

Fulani sheep type related to the West African breeds in Sudan known as (*Fellata* and *M'Bororo*) (McDawal, 1961) also known as Sahel breed in other western African countries (Davendra and Mcleory, 1982a). It consists of several types such as

Uda, *Macina*, *Samburu* these names come from ethical group that reared this breed. In Sudan few studies have been done to describe and characterise the Fulani sheep type and the sheep owner's community.

Sheep population represents about 34.3% of total livestock estimation in South

Darfur State and around 5.4% from total livestock population in Sudan (MARF, 2016). Fulani sheep type is the most abundant type in this State. In Sudan the majority of sheep population are raised under extensive system by nomadic people who adopted traditional practices neither modern nor scientific ones. Sheep are raised besides other livestock species such as goats and cattle searching for natural range and water (Ockerman and Abdelrahman, 1985), however the sheep owners supply their animals with agricultural by-products either crop residues schemes or purchased from the market (Daragge and Fadl ELMula, 1994).

Several research studies have been conducted to investigate sheep production practices, nutrition, health and production handicaps (Mufarrih, 1991, El-Hag et al., 2001, Elrasheed et al., (2010), Hamed, et al., 2017). These studies mainly showed that extensive-open range-system was the dominant animal production system. Lack of water, feed shortage, diseases and limited extension services were the main constraints in sheep production. The objectives of this study are to describe some field management practices adopted by shepherds and sheep owners and to characterize different Fulani sheep local ecotypes.

Materials and methods

Study area:

The study was carried out in Tulus locality in South Darfur State in western Sudan from September and November to 2017. Tulus locality located in savanna zone between the latitude 11-12° North and longitude 24-25° East (Fig. 1). The average annual rainfall is 541.1 mm. Rainfall from May or June to October results in seasonal marshlands or small rivers. Tulus locality characterized by solid clay and sand soil. The residents are work in mixed crop-livestock form of cultivation. The area has large livestock population spreads in its all parts. Nomadic system is most adopted in rearing animals at

the area where animals are grazing and watering on communal areas.

Methodology:

A structured questionnaire was used to collect information from Fulani sheep owners (N=200) in study area in interview conducted over a single visit. The questionnaire was designed to obtain information on general household information, herd formation, production system and flock feeding, flock management including some productive and reproductive practiced by sheep owners and production constraints.

Two hundred adult Fulani sheep subtype (average age 3.8 years) were randomly selected from the study area represented six ecotypes [38 Umgaba, 37 Alabiad, 25 Abrug, 17 Umkehail, 78 Umsaen and 5 Wadsarari] and according to sex [males (n=64) and females (n=136)]. Body measurements of these animals are taken as recommended by FAO (2012), The studied body measurements include: body length, height at wither, heart girth, chest depth, rump length, rump width, head length, head width, ear length, tail length and horn length.

Statistical analysis

The obtained data were summarized in form of descriptive tabular and graphs. Also analysis of variance ANOVA followed by least significant difference (LSD), Independent samples T. test was used and the statistical significance was set at a p-value of ≤ 0.05 using SPSS statistics for Windows program, Version 16.

Results and discussion

General household information:

The relationship between age groups and experience of Fulani sheep owners (table 1) showed that more than 80% were above 25 years old while 18% of them were less than 25 years old, therefore they had a good practices and experience which showed

more than 68% of respondents had more than 15 years of experience and 31.5% of them had less than 15 years of experience. These findings were similar to Hamed, *et al.*, (2017) Figure (2) showed that most of sheep owners (80.5%) were either illiterate or had a basic or “Khalwa” education

whereas few of them had higher educational level (2%). Similar results were found by Ishag and Ahmed (2011) and Osman *et al.*, (2015). Also the results showed that the respondents were mainly animal breeders beside other activities (table 2) such as farming and public sector employee.

Table.1. Association between age group and experience of Fulani sheep owners

Age group (years)	Experience (year)							
	Less than 15		15-40		More than 40		Total	
	n	%	n	%	n	%	n	%
Less than 25 year	36	18.0	0	0.0	0	0.0	36	18.0
25-45 year	27	13.5	75	37.5	0	0.0	102	51.0
Above 45 year	0	0.0	26	13.0	36	18.0	62	31.0
Total	63	31.5	101	50.5	36	18.0	200	100.0

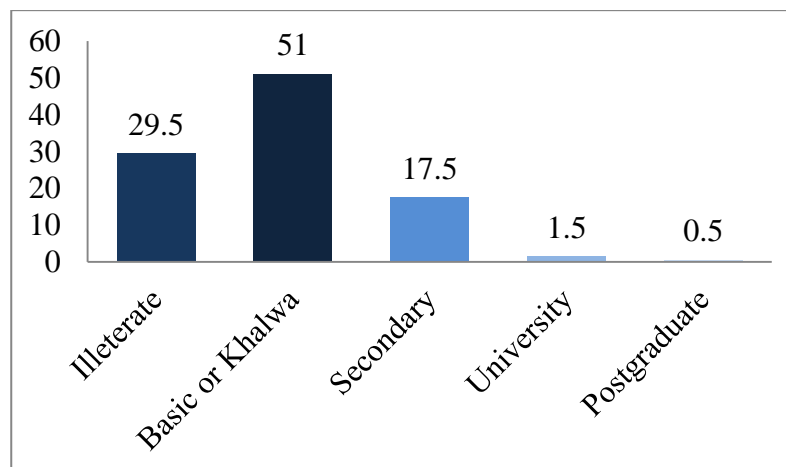


Figure 2. Educational level of sheep owners

Table 2. Occupation of sheep owners

Occupation	n	%
Animal breeder	130	65
Animal breeder and farming	65	32.5
Public sector and animal breeder	5	2.5
Total	200	100

Herd formation and description

The questionnaire survey revealed that the respondents reared mainly sheep beside other livestock species (table 3) particularly

cattle at the first rank (38.4%). These findings are similar to Hamed, *et al.*, (2017). From table (4) the most abundant and frequent Fulani sheep sub-type among flocks

was Umsaen (88.5%) followed by Wadsarari sub-ecotype (71%) then Alabiad comes in the third rank while Umkehail was less frequent. These findings differed from those of Blench (1999) who found that Fulani people herd large flocks of Umgaba subtypes (*Uda*) in Niger and Nigerian middle belt. This could be due to differences in ecological zone and demographic reasons. Table (5) and figure (3) point out the phenotypic description of the six Fulani sheep subtype. The results showed that most subtypes have more or less similar morphological features including: (colour patterns, face profile, ear size and orientation, horn shape and direction and tail length. Umsaen seems to have light brown

colour in the whole body graded to white toward the belly and the chest and have long, wide tail. White (Alabiad) have a uniform white colour, while Wadsarari appear as result of different crosses between other sheep subtypes hence it showed different colours according to the crossing process. Umgaba females often characterized with short horn pointed backward and mostly were poled. Referring to (Devendra and McElroy, 1982), RIMS, (1992), Blench (1999) and Adamu, (2005) and based on observations from this study it seems to be that Alabiad, Umgaba and Umkehail are the local Sudanese name of Balami, Uda and Yankasa sheep subtypes respectively.

Table3. Herd composition (N=200)

Herd	n	%	Cases %
Sheep	200	42.9	100.0
Cattle	179	38.4	89.5
Goat	87	18.7	43.5
Total	466	100.0	233.0

Table 4. Percentage of Fulani sheep subtype in the study area

Sheep type	N	%	Cases %
Umsaen	177	27.06	88.5
Wadsarari	142	21.71	71.0
Alabiad	141	21.56	70.5
Umgaba	138	21.10	69.0
Abrag	38	5.81	19.0
Umkehail	18	2.75	9.0
Total	654	100	327

5. Phenotypic descriptions of Fulani sheep subtype in the study area

Characteristics	Fulani ecotypes					
	Umsaen	White, Balami	Umgaba, Uda	Wadsarari	Umkehail Yankasa,	Abrag
Body colour	Light brown, white	White	Dark head and forequarter and white hindquarter	White, Light brown, black	White with black patches around eyes	White with black and/or brown
Colour patterns	Not uniform	Uniform	Not uniform		Not uniform	Not uniform
Face profile	Slightly convex	Slightly convex	Slightly convex	Slightly convex	Slightly convex	Slightly convex
Ear size	Moderate length	Moderate length	Moderate length	Moderate length	Moderate length	Moderate length
Ear orientation	Pendant	Pendant	Pendant	Pendant	Pendant	Pendant
Horn shape	Corkscrew in rams, ewes are poled	Corkscrew in rams, ewes are poled or have short horns	Corkscrew in rams, ewes are poled or have short horns	Corkscrew	Corkscrew in rams, ewes are poled	Corkscrew
Horn orientation	Outwards	Outwards	Outwards, Outwards and Backwards in ewes	Outwards	Outwards	Outwards
Tail shape, length	Wide, Long	Long	Thin, Long	Long	Long	Thin, Long





Figure 3. Fulani sheep subtypes in the study area: (A1-A3) Umgaba; (B1,B2) Alabiad; (C1,C2) Umsaen; D) Umkehail; E) Abrag; F) Wadsarari

Management systems and flock feeding:

Figure 4 shows that 52% of Fulani sheep owners adopted the semi sedentary system, followed by 47.5% of them who adopted the open range system, this agrees with RIMS, (1992) and (El-Dieran, 1995), who found the most common systems for Fulani sheep are semi-intensive and extensive system while intensive system is adopted for a small number especially rams which are kept for religious festivals such as Muslim Eid- El - kabir celebration. Furthermore, the obtained results from the interviewers showed that all of them were dependent basically on the

natural range and agricultural by-products from agricultural cultivated schemes on feeding their animals alongside to other feedstuffs such as feterita grain, ground nut cake and millet bran (Table 6), these findings agreed with those of (Devendra and McElroy, 1982) who found that little number of sheep are fed on other feed like concentrate supplementations, stall-feeding depending on accessibility of land.

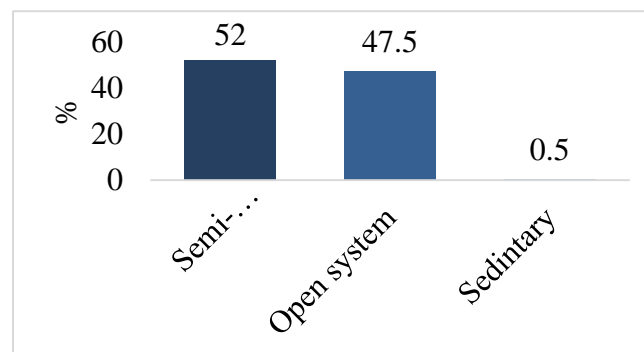


Figure 4. Management systems in the study area

Table 6. Feeding systems of Fulani Sheep subtype

Type of nutrition	n	%	Cases %
Natural range	200	42.9	100.0
Agricultural by-products	200	42.9	100.0
Sorghum (Feterita)	36	7.7	18.0
Ground nut cake	25	5.4	12.5
Millet bran	5	1.1	2.5
Total	466	100.0	233.0

Selection and culling criteria of ewes and rams:

The results revealed that sheep owner's focus mainly on the size and features in the selection process (table 7) of the ewes followed by the sub-ecotype of the ewe (39.3%) as the second rank of the selection criteria. Similar results were recorded in the selection criteria of the rams (table 8) where the ram's feature comes in the first rank followed by its physical growth and the pedigree of the ram comes in the last rank. This result is in line with those of Adamu, (2005) who reported that Balami and Ouda are generally favoured by sheep owners particularly in fattening program. On the other hand, the obtained results of the culling criteria of ewes (table 9) showed that Fulani sheep owners culled their ewes due to

diseases and overage criteria at first rank however the low productivity criterion was coming at last culling criteria. Also, the results of the rams culling criteria (table 10) showed that Fulani sheep owners culled their rams because of diseases followed by overage of the rams while low sexual activity criterion was in the last list of their practices in culling rams. These results were in accordance with findings which showed diseases were the major problems that faced sheep production. Also, the majority of sheep owners (87%) weaned their lambs between 3 to 4 months age compared to 13% who tended to wean them at 4 to 5 months (table 11), these results were agree with those of (Carles, 1983; Payne, 1990 and Sulieman *et al.*, 1990).

Table 7. Selection criteria of ewes

Criterion	n	%	Cases %
Size and feature	200	39.7	100.0
Coat colour	198	39.3	99.0
Twining rate	80	15.9	40.0
Maturity age	26	5.2	13.0
Total	506	100.0	252.0

Table 8. Selection criteria of rams

Criterion	n	%	Cases %
Feature	200	21.2	100.0
Physical growth	200	21.1	100.0
Coat colour	199	21.2	99.5
Adaptation	189	16.3	94.5
Pedigree	154	20.1	77.0
Total	942	100.0	471.0

Table 9. Culling criteria of ewes

criterion	n	%	Cases %
Diseases	200	20.6	100.0
Overage	200	20.6	100.0
Sterility	196	20.2	98.0
Weakness	199	20.5	99.5
Low productivity	176	18.1	88.0
Total	971	100.0	485.5

Table 10. Culling criteria of rams

criterion	n	%	Cases %
Diseases	200	25.5	100.0
Overage	200	25.5	100.0
Weakness	200	25.5	100.0
Less sexual capacity	183	23.4	91.5
Total	783	100.0	391.5

Table 11. Weaning age of Fulani sheep

Weaning age (month)	n	%
3-4	760	87
4-5	26	13
Total	200	100

Most frequent diseases among adults and lamb of Fulani Sheep

Table 12 shows that bacterial diseases were at first rank of the most frequent diseases among adult sheep followed by external and internal parasites 85%. These results agree with those of Bale *et al.*, (1982) and Brisibe *et al.*, (1996), Shehu *et al.*, (1999) and Maiga, (1992), who found different types of bacterial diseases such as brucellosis and several respiratory diseases and lameness (Mohammed *et al.*, 1996) among adult Fulani sheep. It also shows that viral diseases come in the last rank 9% where many studies reported different viral diseases (Maiga and Sarr, 1992, Maiga 1992, Radostits *et al.*, 1994 and Olaleye *et al.*, 1996). The results in table (13) revealed

that unspecific diarrhoea cases represented the most frequent symptom in lambs (50.5%) followed by bacterial diseases (26.1%) and pneumonia (17.0%), while external and internal parasitic infestations recorded the lowest value (0.3%). These results are similar to the findings of (Mohammed *et al.*, 1996) who reported that diarrhoea in lambs is connected with many causes including parasitic infestations.

Table 12. Most frequent diseases among adult Fulani Sheep

Disease	n	%	Cases %
Bacterial diseases	200	25.9	100.0
External and internal parasite	181	23.4	90.5
Unspecific diarrhea	178	23.0	89.0
Pneumonia	170	22.0	85.0
Abscess	26	3.4	13.0
Viral diseases	18	2.3	9.0
Total	773	100.0	386.5

Table13. Most frequent of diseases among Fulani sheep lambs

Disease	Mean of ranks	%	Cases %
Un specific diarrhea	199	50.5	100.0
Bacterial diseases	103	26.1	51.8
Pneumonia	67	17.0	33.7
Viral diseases	24	6.1	12.1
External and internal parasite	1	0.3	0.5
Total	394	100.0	198.1

Production constraints

The questionnaire survey revealed that diseases, lack of extension services and security (particularly robbing) come at first rank among production constrains of Fulani

sheep flowed by shortage of feed while few sheep owners (8.5%) suffer from lack of labour (Table 14). These results are in line with those of Elrasheed *et al.*, (2010) who found that the main handicaps in rearing

sheep were diseases, lack of water and shortage in feed.

Table 14. Production constrains of Fulani sheep

Constrains	n	%	Cases %
Diseases	200	15.3	100.0
Lack of extension	200	15.3	100.0
Security	200	15.3	100.0
Lack of feed	199	15.2	99.5
Lack of water	199	15.2	99.5
Predators	197	15.1	98.5
Lack of Labour	111	8.5	55.5
Total	1306	100.0	653.0

Body measurements

Table 15 shows that sex had significant effect on rump length, head length and width and horn length. These findings agree with those of (Devandra and McElroy, 1992) however partially agreed with those of Ali *et al.*, (2017) who found sex of sheep had

significant effect on most of body measurements, Also sheep subtype had significantly influenced height at wither, heart girth, ear length and tail length, these results were inline with those of Ali *et al.*, (2017).

Table 15. Effect of sex on body measurements of Fulani sheep

	Male (n=64)	Female (n=136)	Significant
Body length	70.44±9.66	69.23±7.44	NS
Height at wither	82.87±8.12	81.01±5.85	NS
Heart girth	89.46±10.68	87.23±7.47	NS
Chest depth	44.80±5.38	43.65±3.71	NS
Rump length	21.74±3.28	20.65±2.60	*
Rum width	16.90±2.48	16.69±1.82	NS
Head length	23.16±3.09	22.22±2.11	*
Head width	13.39±1.89	12.72±1.08	*
Ear length	17.44±2.31	17.83±1.86	NS
Tail length	62.72±13.87	59.58±10.04	NS
Horn length	18.56±8.51	10.20±3.08	**

*=significant differences at P<0.05, **= significant differences at P<0.01

NS=No significant differences

Table 16. Effect of subtypes on body measurements of Fulani sheep

	Umgaba (n=38)	Alabiad (n=37)	Abrag (n=25)	Umkehail (n=17)	Umsaen (n=78)	Wadsarari (n=5)	Sig.
Body length	70.55±7.76	67.97±7.71	70.28±6.55	72.71±8.49	69.13±8.94	67.80±8.32	NS
Height at wither	82.82±5.63 ^a	78.51±7.29 ^b	82.04±4.51 ^a	81.71±4.93 ^{ab}	82.45±7.38 ^a	78.60±6.31 ^{ab}	*
Heart girth	89.29±10.71 ^{ab}	84.92±6.86 ^c	85.44±5.46 ^{bc}	88.47±9.04 ^{ac}	88.97±8.75 ^{ab}	93.80±4.82 ^a	*
Chest depth	44.68±5.35	42.51±3.22	42.92±2.93	44.47±4.39	44.44±4.46	47.00±2.45	NS
Rump length	20.97±3.34	20.08±2.99	21.28±2.56	21.59±2.21	21.14±2.73	21.80±3.11	NS
Rum width	16.87±1.74	16.11±1.78	16.60±2.18	16.71±1.36	17.09±2.35	16.40±1.67	NS
Head length	22.74±2.49	22.08±2.23	22.28±1.28	22.41±1.58	22.61±2.98	24.00±2.83	NS
Head width	13.26±1.70	12.49±0.96	12.72±1.24	12.82±1.19	12.97±1.40	14.20±2.39	NS
Ear length	18.89±1.81 ^a	17.27±2.43 ^b	17.44±1.80 ^b	17.53±1.84 ^b	17.44±1.85 ^b	18.20±1.10 ^{ab}	**
Tail length	55.58±10.06 ^c	56.38±9.83 ^c	63.20±7.98 ^{ab}	57.47±12.14 ^{bc}	65.03±11.47 ^a	57.20±16.93 ^{abc}	**
Horn length	16.25±8.50	13.00±2.00	6.00±0.00	11.00±1.41	18.17±9.72	polled	NS

Different super script letters within the same row mean significant differences at P<0.05

*=significant differences at P<0.05, **= significant differences at P<0.01, NS=No significant differences

Conclusions

Fulani sheep had different colours represented in various subtypes and it held local Sudanese names, Umsaen was most frequent Fulani sheep type.

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التوصيف المظهري لأنواع الضأن الفولاني

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المستخلص

الهدف من هذه الدراسة هو محاولة دراسة بعض العمليات الحقلية التي يمارسها مربِّي وملاك الضأن والوصف المظهري لأنواع الضأن الفولاني المحلية بولاية جنوب دارفور. أُستخدِمت إستبانة مصممة ومفصلة لجمع معلومات من مُتتئين من مُربِّي الضأن الفولاني في قرية تُلَس وما حولها من قرى في ولاية جنوب دارفور. أثبتت النتائج أن أكثر من 68% من مربِّي الضأن لهم خبرة أكثر من 15 عام في رعاية حيواناتهم مما إنعكس على مستواهم التعليمي حيث أن 80% منهم إما أميون أو درسوا حتى مرحلة الأساس أو الخلوة. كما اثبتت النتائج أن المُستبينين يربون الضأن إلي جانب حيوانات المزرعة الأخرى واثبتت النتائج أن أم سِعْن هو الأكثر تواجداً من بين أنواع الضأن الفولاني الأخرى. أوضحت النتائج أن أنواع الضأن الفولاني متشابهة في عدد من الصفات المظهرية، كما أوضحت أن هنالك أسماء سودنية محلية لمختلف أنواع الضأن الفولاني (الأبيض – Balami)، (أم قبه – Uda)، (أم كحيل – Yankasa). غالب مربِّي الضأن يتبنوا النظامان شبه المستقر والنظام المفتوح (98.5%) ويطعموا حيواناتهم مختلف المخلفات الزراعية مثل أمبار الفول وردة الدخن. أكثر معايير إختيار النعاج والكباش هي بناءً على الحجم – الشكل بينما أكثر معايير التخلص من الحيوانات هي الأمراض وتقدم العمر للنعاج والكباش معاً. عمر الفطام السائد بين الحملان يتراوح بين ثلاث إلى أربع شهور. أكثر الأمراض شيوعاً في الضأن الفولاني هي الأمراض البكتيرية وأعراض الإسهال في الحيوانات البالغة والحملان علي التوالي، كذلك أظهرت النتائج أن أكثر المعوقات في إنتاج الضأن الفولاني هي الأمراض . خلصت الدراسة إلى أن الضأن الفولاني متعدد الألوان يتمثل في مختلف الأنواع، كما أن الجنس ونوع الضأن لهم أثر على بعض قياسات الجسم.