Sudan University of Science and Technology

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Phenotypic Characterization of Some Fulani (*Fallata*) Sheep Subtypes in South Darfur State

التوصيف المظهري لبعض أنواع الضأن الفولاني (الفلاتة) فى ولاية جنوب دارفور

A thesis submitted for fulfillment requirement of Master Science (M.Sc.) in Animal production

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بسم الله الرحمن الرحيم

الإستهلال

ومن الأنعام حمولة وفرشا كلو مما رزقكم الله ولاتتبعوا خطوات الشيطان إنه لكم عدو مبين (142) ثمانية أزواج من الضأن اثنين ومن المعزاثنين قل ءآلذكرين حرم أم الأنثيين أما اشتملت عليه أرحام الأنثيين نبئونى بعلم إن كنتم صادقين (143)

سورة الأنعام الآية (6: 142 –143)

Dedication

To my mother

To my father

To my kid Ramez

To my brother and sister

To my pals and friends

Fatma

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Thanks to Allah the most generous and merciful for giving me health and patience to conduct this work. My deep appreciation and gratitude to My supervisor Dr. Abubakr Sayed Ali and Prof. Dr. Mohamed Tag Eldin Ibrahim for their aiming and end supervision during these study. My deeply thanks to my colleagues Omer Abubakr Mahmoud Abdelrahman Mosa, Osman Sayad, Aboalgasim for their valuable help and support. Special thanks to Yousif Elsmani Elbasher (Fellata Nazer) and Hafeth Eltahir Abdelrhman Ali for their social support.

Abstract

A fitted form of detailed structured questionnaire was used to gather information from 200 Fulani sheep owners in Tullus village and its surrounding villages in South Darfur State, 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.

Two hundred Fulani sheep with average age 3.8 years [38 Umgaba, 37 Alabiad, 25 Abrag, 17 Umkehail, 78 Umsaen and 5 Wadsarari, males (n=64) and females (n=136)] were randomly selected to determine the body measurements using metric tape according to phenotypic characterization of animal genetic resources 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. 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. 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 subtype was the most raised sheep subtype. The results showed that most Fulani subtypes were similar in many morphological features, also it showed that there were local Sudanese names for different Fulani sheep subtypes (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. The result showed that the age at first lambing at one year, three to four months was the most weaning age, furthermore, Fulani sheep owners showed that the production age of ram was equivalent the ewe, moreover, they showed that rams were most preferable and higher price in group market followed by ewes, yearling and Lamb. 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, lack of feed, lack of water and predators.

Sheep sex had significantly affect ($P<0.05$) rump length, head length, head width, and horn length ($P<0.01$). Also sheep subtypes of Fulani had significant effect on height at wither, heart girth, ear length and tail length. The study revealed that Fulani sheep had different colours represented in various subtypes. Fulani sheep subtypes and sex had affected some body measurements.

ملخص الدراسة

أُستخدمت إستبانة مصممة ومفصلة لجمع معلومات من 200 من مُربيي الضأن الفولاني في قرية تُلس وما حولها من قرى في ولاية جنوب دارفور لدراسة بعض الممارسات الحقلية التي يمارسها مربيي وملاك الضأن، ودراسة الوصف المظهري الخصائص لبعض أنواع الضأن الفولاني في أماكن تواجدهم بولاية جنوب دارفور.

تم إختيار 200 رأس من أنواع ضأن الفلانى متوسط العمر (3.8 سنه) عشوائياً [38 أم قبه، 37 الأبيض، 25 الأبرق، 17 أم كحيل، 78 أم سعن و5 ودسرارى) (64 ذكور) و(136 إناث)] لإيجاد قياسات الجسم بإستخدام الشريط المترى، وفقا للتوصيف المظهري الموارد الوراثية الحيوانية الموصى به من منظمة الاغذية الزراعة (2012). شملت دراسة قيسات الجسم: طول الجسم، إرتفاع القارب، محيط الصدر، عمق الصدر، طول العجز، عرض العجز، طول الرأس، وعرض الرأس، طول الأذن، طول الذيل وطول القرون). تم تحليل البيانات المتحصل عليها بإستخدام الجداول الوصفية والرسوم البيانية، تحليل التباين وأختبار أقل فرق معنوى (LSD)، كما أستخدم إختبار ت. للعينات المستقلة. أثبتت النتائج أن أكثر من 68% من مربيي الضأن لهم خبرة أكثر من 15 عام في رعاية حيواناتهم مما إنعكس على مستواهم التعليمي حيث أن 80% منهم أميون أو درسوا حتى مرحلة الأساس أو الخلوة. كما اثبتت النتائج أن المُستبينين يربون الضأن إلي جانب حيوانات المزرعة الأخرى واظهرت النتائج أن أُم سِعِنْ هو الأكثر تواجداً من بين أنواع الضان الفولاني الأخرى. أوضحت النتائج أن أنواع الضأن الفولاني متشابهة في عدد من الصفات المظهرية، كما أوضحت أن هنالك أسماء سودانية محلية لمختلف أنواع الضأن الفولاني (الأبيض – Balami)، (أُم قبه – Uda)، (أُم كحيل – Yankasa). غالب مربو الضأن يتبنوا النظامان شبه المستقر والنظام المفتوح (98.5%) ويطعموا حيوناتهم مختلف المخلفات الزراعية مثل أمباز الفول وردة الدخن. أكثر معايير إختيار النعاج والكباش هي بناءاً على الحجم – الشكل بينما أكثر معايير التخلص من الحيوانات هي الأمراض وتقدم العمر للنعاج والكباش معاً. أظهرت النتائج أن العمر عند أول ولادة فى الغالب سنة، عمر الفطام السائد بين الحملان يتراوح ين ثلاث إلى أربع شهور. أظهر المربيون أن العمر الإنتاجى للكباش مساوى للعمر الإنتاجى للنعاج، بالإضافة إلى أن الكباش أعلى سعرا ومفضلة فى السوق يليها النعاج ثم الحوليات ثم الحملان. 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، قلة الماء، قلة المرعى والإفتراس.

الجنس له أثر على بعض قياسات الجسم معنويا ($P<0.05$) على طول العجز،طول الرأس، عرض الرأس ووجدت معنوية أعلى ($P<0.01$) فى طول القرون، أيضا نوع الضأن له أثر على بعض قياسات الجسم معنوى ($P<0.05$) على إرتفاع القارب و محيط الصدر، كما وجد أثر معنوى أعلى($P<0.01$) على طول الأذن والذيل خلصت الدراسة إلى أن الضأن الفولاني متعدد الألوان يتمثل في مختلف الأنواع، أيضا خلصت الدراسة على نوع وجنس الضأن لهما أثر على بعض قياسات الضأن.

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Chapter one
1. Introduction

Animal resources had important participation in gross national product of Sudan beside the agricultural products, hence it need effort to develop this section to increase the national income. Extensive-open range-system is the dominant in animal production system in Sudan for several livestock species particularly sheep. In this system nomadic people raised their sheep searching for pasture and water but nowadays they reared their animals on agricultural by-products from cultivated schemes (Ockerman and Abdelrahman, 1985), many research studies had been conducted to investigate the sheep production practices, nutrition, health and production handicaps in this system it showed that main constrains in sheep production are lack of water, feed shortage, diseases and less extension services.

The total population of livestock in Sudan is about 106.6 million head. South Darfur State posses about 6.3 million head of livestock, sheep is represented about 42.1% of total livestock numbers in the State and about 5.4% of the total sheep numbers in Sudan (MARFR, 2016).

Fulani sheep found mainly in South Darfur state beside other sheep types, it is one of basic four groups of Sudanese sheep belong to West African breeds and known as (*Fulani* and *M'Bororo*) (McLeroy, 1961) also known as Sahel breed in other western African countries (Devendra and Mcleroy, 1982). Fulani sheep considered to be cross boarder sheep among Sudanese sheep due to spread of the owned tripe in several west African countries such as Chad, Nigeria, Mali, …etc. It consists of several types such as *Uda*, *Macina*, *Samburu* these names come from ethical group that reared this breed, while in Sudan it held local name such as *Umgaba*, *Umsaen, Umkehail*, …etc also few studies had been

done to describe and characterize the Fulani sheep type and the sheep owner's community.

In estimation study of body measurements of Yankasa, Afolayan *et al*., (2006) found that body measurements were affected with different factors including sex, birth type (single or twin) and age, also Sowande and Sobola (2008) found that rams were higher in most studied morphometric measurements than ewes of west African dwarf sheep

The objectives of this study are to:

- Characterize of some different Fulani sheep local subtypes under natural habitat in South Darfur State.
- Describe some field management practices adopted by shepherds' and sheep owners under natural habitat.

Chapter two
2. Literature review

2.1. Sheep population and distribution:

Sudan poses about 40.2 million head of sheep, represent 37.71% of the total of livestock population, in South Darfur the total population of sheep is around 2.2 million head representing 34.3% of the total of livestock in this state (MARFR, 2016). Sudanese sheep bred for meat for local consumption and export, economic contribute and sheep are also reared for their milk production. Fulani sheep ecotype is one of basic five groups of Sudanese sheep it referred to West African Fulani sheep. Suspected half ancestor of the Sudanese desert sheep (Mcleroy, 1961).

2.2. Classification of sheep:

Devendra and Mcleroy, (1987) reported many criteria used in classification of sheep such as tail, coat and purpose of production type.

Based on tail type four basic tail types are found including long, short-tailed, fat tailed and fat rumpled. Crossed sheep of long-thick-tailed and short tailed appear to result from mate between fat-tailed x long-thin-tailed and fat rumpled short-thin-tailed stock, respectively. Coat cover including three main groups: Wool, hair and fur. According to function or primary use, tropical sheep had several purposes as Mutton, wool, fur and milk production.

2.2.1. Classification of sheep according to production type:

Depending on the purpose of production sheep are divided in to four groups (Devendra and Mcleroly, 1987 and EL-Khashab, 1997).

2.2.1.1 Meat sheep type:

It characterizes as meat production type e.g. Oxford and Suffolk which weighing 100-130 kg and 70-90 kg at maturity age for males and females respectively.

2.2.1.2 Milk sheep type:

This type is describing by produce milk such as Italia Lacoune breed, it produces 211 liter of milk in 165 days of lactation (Ibrahim, 1999).

2.2.1.3. Wool Sheep type:

This type is known by producing wool e.g. Merino. This type nearly two centuries adaption to Australia and it is producing excellent quality wool in arid and semi-arid area Carles, (1983).

2.2.1.4. Dual purpose sheep type:

This breed identified by adapting to environmental situations also describing by low production compare to other type such as Caloia and Mondero, both breeds are described by producing meat, milk and wool (Carles, 1983).

2.3. Classification of sheep in Sudanese:

Sheep in Sudan reared mainly for meat production, also it participates in national income trough export. It categorized into three basic types depending on tail size Mason and Maule, (1960).

1- Sudan desert sheep: Including several types, held tribal or areas names (Watish, Kabashi, Butana, Gezira, Hamari, North River wooled sheep, Meidob and Beja).

2- Arid upland sheep: This type belongs to Zaghawa tribe in Darfur.

3-West African Fulani: Reared by (Fallata and *M'Bororo*), McLeroy, (1961).

2.4. Fulani sheep type (*Fellata*):

Devendra and Mcleory (1987) characterized Fulani sheep into different breeds (subtypes) including *Uda*, *Yankasa*, *Macina*, *Samburu*, *Toronke* and *Balami* found in the area from Senegal River basin to the River Nile. (Jahnke, 1982) mentioned that shepherd reared from 100-500 number of Fulani sheep and they are nomadic in nature, moving mainly

during the long months of the dry season searching of feeds. Fulani Sheep includes several subtypes:

- Lake Chad basin sheep: *Balami* and *Uda* (Williamson and Payne, 1965).
- Senegal River basin to the River Nile: *Balami*, *Uda*, *Yankasa*, *Samburu*, *Toronke* and *Macina* (Devendra and Mcleory 1987)
- Sahel sheep type: *Uda*, *Yankasa*, *Macina*, *Samburu*, *Toronke* and *Balami* Devendra and Mcleory (1982).

2.4.1. Balami and Toronke subtype:

Balami sheep subtype known with white color hairy with down ears, long legs and long-thin tail. It found mainly in the Chad lake basin (Williamson and Payne, 1965). Rams have a throat ruff and horn, ewes are normal polled. Another feature makes Balami clear recognizable is its roman and large bulgy nose that differentiates it from Yankasa subtype. (Adu and Ngere, 1979 Haumesser and Gerbaldi, 1980). Balami also found in arid and Sahel region. Balami sheep is bigger compare to Uda and Yankasa apart from tail length (Yakubu and Ibrahim, 2011), in Sudan it called *Alabiad* (White) also, in Mali and Senegal is called *Toronke* sheep its prevalent white colour (Epstein and Mason, 1971).

2.4.2. Uda subtype:

Uda sheep subtype popularly known as the black and white or brown and white found in the Sudan-Sahelian vegetation region. The head and forequarters of Uda sheep are black or faun while the hindquarters are constant white and this is recognizable trait (RIMS, 1992 and Williamson and Payn **(**1965). In Sudan is locally named *Umgaba*. Uda is slightly smallest-body than Balami. It held it name Uda from a Fulºe clan, the Uda'en, tribes who had large flocks of this breed reared in area extend from Niger to northern Nigerian middle belt (Blench, 1999).

Uda sheep had significant highest values for several analyzed body measures traits compare to those of Yankasa sheep. (Yakubu and Ibrahim, 2011).

2.4.3. Yankasa subtype:

Yankasa is white with black patches (spotted black) around eyes and sometimes on the feet, the muzzle and the ears black (Aganga *et al*., 1988, RIMS 1992 and Wamagi *et al*., 2013) it called *Umkehail* as local Sudanese name. Aganga *et al*., 1988) reported that Yankasa rams have curved horns and a hairy white, and ewes are polled. Yankasa sheep do not need daily watering in the wet season and watering once a day sufficed in the dry season. It gives 21 kg of the weight in first estrus at 8 months and 35 kg as the maturing weight of females. ILCA, (1979) reported lower weights in the sub-humid zone refer around 20 kg at 12 months of age and 30 kg as mature weight attained after 4 years.

2.5. Fulani sheep distribution:

Fulani sheep is located within the Sahelo-Sudano ecological belt of Central and West Africa. It has seasonal and continual migrations pressed them to south into the forest Savanna belt of the Guinea savannah Zone. This distribution of Fulani sheep comprises all of Senegal-Niger basin, Chad and Cameroon, the dunk regions of the Niger river, decline basin of the higher Niger which includes the followed sub-Sahara African countries, Niger, Chad, Nigeria, Sudan, Mali, Burkina Faso, Senegal, Ghana, Mali, Mauritania, Northern fringes of Cameroon and Republic of Benin. Draught in the Sudan has pressed this breed up to the Nile River of Egypt. (Epstein and Mason, 1971 and RIMS, 1992). The Yankasa sheep was the most numerous and most large distribute of the Nigerian breeds and is found throughout the Guinea and Sudan Savannah zones. Oni, (2002).

2.6. Sheep production systems:

Sudanese sheep owners locally name *Ghanama* adopted one of three production systems including: pastoral (open – range) system, agricultural system and agro-pastoral system. The most common elements through these systems are environment (climate, nutrients required, vegetation areas, food competition and man) and sheep type. The interaction of these different components participates in made up the production systems and the variation within these components that produce the vast diversity of production systems (Carles, 1983).

Wilson (1991) found two major types of livestock production systems in Africa. The traditional system (pastoral, agro pastoral, agricultural and urban) and the modern system (ranching, feedlot, station and dairy farm) differ basically in that the farmer in the traditional system uses mainly land and labour while the modern system has large capital requirements and generally a lesser requirement for one or other of the remaining factors. Traditional systems are defined as the dependency degree of the household or the family on livestock or livestock products in providing food or for household income. Also, it defined as the relationship between type of agriculture activities and livestock production type. The important sides of management within a system are the distance and movement period of (transhumance) (El Dierani, 1995).

2.6.1. Pastoral system:

In this system livestock participate in more than 50% of total household income or more than 20% of gross household food energy. Including transport value, sales or exchange of manure and revenue from any other major functions. Pastoral are divided into three sub systems, the first is characterized with little or no agriculture activity, also movement for long distances searching for pasture and water. The second pastoral sub system is practiced by Fulani groups of West Africa and cattle

breeder in which livestock production is depend on dry land or cultivated rain land where different livestock species are equal importance. The third pastoral sub system found in South Sudan republic practiced by Nilotic tribes it described with large, irrigated areas (El-Dierani, 1995).

2.6.2. Agricultural system:

In this system 10-50% of revenues are derived from livestock or livestock products. Livestock is almost sedentary or it moved to short and restricted distances. There are three main subsystems connected with the agricultural system: Rain fed subsistence agriculture, rain fed cash cropping and large- scale permanent irrigation of cash crops (El-Dierani, 1995).

2.6.3. Agro-pastoral system:

Is the system in which profit from livestock amounts to less than 10% of the total. In the dry land 70% of small ruminants are found in pure pastoral system and 30% in agro-pastoral system. While it is reverse in semi arid zone the where 70% of small ruminant in the agro-pastoral system. In the extra humid areas a small percentage being found in the agriculture and urban systems while most small ruminants are in the agro pastoral system (El-Dierani, 1995).

2.7. Factors affecting sheep production:

Sheep production is affected by several factors such as lack of water, feed shortage, and diseases.

2.7.1. Management factor:

Most of sheep population is still raised under nomadic conditions using traditional methods of management and natural grazing which are affected by seasonality of rain fall. Sheep husbandry system is mixed between sedentary and nomadic flocks. In sedentary systems, the flocks are kept close to villages with less movement among to the nomadic throughout the year (Eltahir *et al*., 1999 and EL-Hag *et al*, 2001). In

South Darfur no variation among sedentary system and migratory flock in the mortality rate. Lambs born under the nomadic system had higher birth weights, but the growth rate under the sedentary management system tended to be higher (Wilson 1976). Many studies evidenced the mortality rate in dams reared under nomadic system was higher than sedentary ones, while birth weight and weight at 30 days of lambs birth under sedentary system had lower than those of nomadic system, however lambs weight of 60-150 days of age were not differ in the nomadic and sedentary system EL-Hag *et al* (2001).

2.7.2. Nutrition:

Nutrition is one of the environmental factors that influence production and reproduction in different livestock species (Tatman *et al*, 1990). It affects many reproductive performance traits in sheep such as puberty age, fertility, ovulation rate, embryo survival, births to rebreeding period (Robinson, 1996). Flushing feed during mating could improve ovulation and lambing rate of ewes in many breeds is better recognized (O'Callaghan and Boland, 1999), different results might found in ovulation rate if feed intake of animals after mating time is decreased (Rhind *et al*., 1989). Feeding pregnant ewes with balanced energy and protein rations during late pregnancy phase is essential to support embryos growth, maintain of the animal physiological requirement, mammary gland growth, and colostrum and milk yield (Oeak *et al.*, 2005). About eighty percent of embryo growth happens at last 60 days of gestation period leading significant increase in feed requirements of the ewe (Dawson *et al.*, 1999). Lamb survival is related to the feed of the ewe during late pregnancy. (Binns *et al.*, 2002).

Bearden *et al*., (2004) mentioned that nutritional system is one of the management aspects of the animal which must be done in a proper method, good nutrition can increase reproductive efficiency and the

importance of nutrition in maintain reproductive efficiency differs with livestock. Also Njoya *et al*., (2005) reported that protein supplementation to primiparous ewes raising on lower quality pastures improve their body weight, body condition score and reproductive performance. Mufarrih (1991) reported that feeds quantity and quality are connected with seasonal rainfall where serious feed shortages in the dry season affect animal's health and performance, also water deficient is a main problem and animals depend mainly on *Hafeers*.

2.7.3. Animal factor:

2.7.3.1. Breed:

Sulieman *et al*., (1990) mentioned that breeding rams and ewes were separated except at breeding time. Hassen *et al*., (2002) found that birth and body weight were significantly influenced by genotype of birth to 60 days of age, also they reported that genotype and animal breed had affect birth weight and daily weight gain to 90day weight of the animal. Moreover, Boujenane and Kansari, (2002) mentioned that lambs' weight and survival to 70 days differs and depend on genetic composition of lambs, also they found significant influence of breed on fertility, number of lambs born live, litter size at weaning, litter weight weaning per ewe and lamb weight in 60 days.

2.7.3.2. Age of Dam:

Age of dam is an important factor affects suome reproductive traits of such as birth weight, prolificacy, twining rate and litter size (Tauh and Baah, 1985; Ali *et al*., 1999). Age of dam at first service also influences mortality of young animals. (ILCA, 1979). Age of dam between 4-5 years showed higher records of reproductive performance. (Matika *et al*., 2003). Therefore, age of the dam had an important influence on the prolificacy, which is increase 2.0 lambs/ewe for yearlings and 3.3

lambs/ewe for older ewes Sormunen-Cristian and Jauhiainen, (2002) reported an average fertility rate of 0.59 for third lambing and older ewes, 0.45 for second lambing ewes, 0.18 for 19 months old ewes and 0.11 for yearlings' old ewes. Said by Boujenane and Kansari (2002).

2.7.3.3. Type of birth:

Type of birth effects was not important for body measurements. (Ngere and Aboagye (1981) and Atta and EL khidir, 2004). However, many researchers have reported a significant effect of type of birth on lambs birth weight where single born lambs heavier than twins (Donald and Russel, 1970; Alexander, 1974; Sandford *et al*., 1982; Sulieman *et al*., 1990 and Ali 2005). Birth type had obvious effect on birth weight and subsequent live weights as 30, 60 and 90 days Analla *et al*., (1998), in addition growth rate of individual lambs was faster than twins (Macit *et al*., 2001). Also, Wilson, (1989) found higher birth weight and growth rate of single born lambs compared with twins and triplets. Moreover, Nawaz and Meyer, (1991) reported that single lambs had higher daily gain than twins in the per-weaning period and mortality rate of single lambs less than twins.

2.7.3.4. Sex of lamb:

Many research reported that sex of lamb had significant effects on body weight among different age (Bichard and Cooper, 1966; Hohenboken, 1977; Olsson, and Tefrawork, 1990 and Mavrogenis 1996[a,b]). Males and females were not differing in birth weight and among 30 and 90 days of age, but differences could appear in lateness phases, level of significant were increased with age (EL-Hag *et al*., 2001 and Hassen et al., 2002). Both lambs' sexes had no significant effect on lamb weights or growth, males were heavier at birth than females and grow fastest from birth to weaning, but lamb mortality was highest in females

and growth rates were not significantly different EL-Hag *et al*., (2001). Male lambs of Yankasa sheep were heavier at birth than the female Afolayan *et al*, (2006).

2.7.4. Breeding Season:

Lambing seasons affect birth weight and flowing live weights up to 150 days of age. Rainy season records higher lambs' birth weight, weight at 30 days age and growth rate from 90 to 150 days, compare to lambs born late in dry season. However, mortality rate was higher among lambs born in the rainy season (EL-Hag *et al*., 2001).

Lambs born under nomadic system had significantly higher birth weights and body weights at 30 days of age than those born under sedentary system, moreover, 30% of mortality rate was recorded in six months of age while half of the mortality occasion in the first 4 weeks. The reproductive performance and mortality of ewes were better under sedentary production system. Lambs' weights and subsequent growth were affected by husbandry system and lambing season (EL-Hag *et al*., 2001). Also, lambing season had significant influence twin rate, birth weight, live weight and survival age of lambs. Lambing season were significant appear among birth and 30-150 days of age (Hassen et al., 2002).

2.7.5. Climatic factors:

Environmental and genetic factors and the interacting among them influenced birth weight of lambs. Season had significant effect on birth weight where lambs born in rainy season were less than spring born lambs. Ewe pregnant in the summer season could have lower feed intake and increases heat load (Shelton and Huston 1968), which is rise during the hot season and affect the birth weight, also seasonal variation in

pregnant length (Jenkin and Young, 2004) might also be connected with seasonal variation in birth weight.

2.7.6. Diseases factors:

Fulani sheep type is subjected to different diseases. The course of which is affected by several factors such as age, physiological state of the animal (i.e. pregnancy), nutritional status, season and inclement weather (Adamu, 2005). Infectious diseases were divided into three main groups: specific genital diseases, non-specific genital diseases and general infectious diseases Makawi (1999). Mortality is raised by diseases, which are influenced by season Tembely *et al.*, (1976). Higher incidences of gastro-intestinal and respiratory disease problems noted during the dry season for lactating ewes in transhumant sheep comparing to dry open, were probably indication of greater nutritional stress experienced by lactating animal Cook and Fadlalla, (1987). Infective diseases of reproduction are significant reasons of reducing productivity in sheep (Rahaley, 1984).

2.8. Sheep breeding:

2.8.1. Puberty:

Robert and Thomas, (2004) defined puberty as the ability of animal to be fertilized, in ewes it is the sign of the first estrus or it is the time when the estrus cycle start and it is mating capability for rams. Puberty ranged between 5-12 months of age and is influenced by breed, nutrition and lambing date. Ram lambs usually started mating at the age of five months. (Mufarrih, 1991). Early puberty and long productive life of breeding share are very desirable traits, hence all single and most twin ewe lambs reach puberty at the age of 7 months and lamb in 12^{th} month. Adu and Ngere (1979) reported that the age of sheep at first estrus is 7 to 9 months for Yankasa and about 9.5 months for Uda. (Younis *et al.*,

(1978) mentioned that the average length of estrus cycles is more than 16 days and the period of estrus is 30 hours. Moreover, the first estrus signs are differed in numerous breeds due to difference feed that led to different growth rates.

2.8.2. Reproduction:

The breeding season of sheep is differing for many farm animals and occurs initially in the rainy season of the year (Robert and Thomas, 2004). The ratio of ewes to ram is differing based on management if it good it can reach 200:1 (Allison, 1975). Moreover, the common ratio for tropical sheep it should be 10 or 20:1 (Devendra and Mcleory, 1982 and Doney *et al*., 1982).

2.9. Sheep marketing:

The Sudanese sheep provides red meat sources for local consumption in addition to for export to the Arab countries, economic contribute and sheep are also reared for their milk production. About 5.4 million heads of live sheep were exported (MARFR, 2016). Livestock and meat exports from Sudan are channeled through four routes. Animal wealth sector and particularly sheep play very important role in Sudanese people live as source of food, income by providing food, profits beside fertilize soil with natural manure. Also, it is source of hard currencies

There are many factors contribute in determining of sheep price e.g season (ELrasheed *et al*., 2010), taxes (ELrasheed *et al*., 2008), production cost, transferring fee and distance of production to consumption areas of sheep (Faki and Taha, 2007). Although of lack cost of sheep production due to used traditional production procedures, Sudanese sheep prices are high compared to international sheep prices

(ELrasheed *et al*., 2010). Rams are most preferable in the market followed by ewes (Dahab *et al*., 2014).

2.10. Assessment of body measurement:

Mohammad *et al*., (2012) reported that several body measurements are vital to observe the growth of sheep and also can be determine the genetic association between body weight and body measurements. In Yankasa sheep Afolayan, *et al*., (2006) reported that the relationships between body weight and body measurements are affected by sex and type of birth. Also, they found that body weight could be predicted fairly from heart girth than other body measurements body due to high correlations between it.

Several research have used body measurements to estimate animals' live weight. The body measures of Balami sheep showed largest body measurements than Uda and Yankasa breeds except in tail length. Uda sheep also showed significantly higher records for all studied measurements than Yankasa sheep (Yakubu and Ibrahim 2011).

Chapter three
3. Material and methods

3.1: Study area:

The study was carried out in Tullus locality in South Darfur State in western Sudan from September to November 2017. Tullus 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. Tullus 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.

Figure 3. 1. The study area

Source**:** Almalaik *et al*, (2008)

3.2. Questionnaire (survey study):

Two hundred of detailed structured questionnaire was used to collect information form Fulani (*Fellata*) sheep ecotype owners in studied area through interview single visit, the questionnaire was designed to obtain information on general household information, herd formation, production systems and flock feeding, flock management including some productive and reproductive traits adopted by sheep owners and production constrains.

3.3. Studied body measurement:

Two hundred adult Fulani sheep (average age 3.8 years) randomly selected from the study area [38 Umgaba, 37 Alabiad, 25 Abrag, 17 Umkehail, 78 Umsaen and 5 Wadsarari] and according to sex [males (n=64) and females (n=136)]. The body measurement of Fulani sheep subtypes of both sexes was taken after animal weighing during the study period using metric tape according to phenotypic characterization of animal genetic resources recommended by FAO, (2012), the studied measurements include:

Body Length: the described it as the distance among the dorsal tip of scapula and the tip of the ischium.

Height at wither: the height of the highest point of the dorsum above the scapular vertical to the ground surface at the level of the front feet.

Heart girth: This is the circumference to the chest just behind the foreleg.

Chest depth: the distance from the point of couple scapular.

Rump length: the distance between the top of rump to the pin bone

Rump width: the distance between the two cocci.

Head length: the distance between the dorsal surface of the frontal bone to the distal end of the nasal bone.

Head width: the distance between the two lateral surfaces of the temporal bones.

Ear length: the distance from the base of the ear on the parietal bone to the ear tip.

Tail length: the distance from the base of tail (last sacral vertebrate) to the tail tip.

Horn length: the distance from base of horn on the frontal bone to the horn tip.

3.4. 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.

Chapter four
4. Results and discussion

4.1. General household information:

The results of relation between age and experience of work in animal rearing of interviewers (table 1) showed that 69.5% of sheep owners have more than 15 years of experience while 31.5% of them were less than 15 years of experience. It might be that rearing animals is life manner of the interviewers; hence they have good practices. These findings were similar to Ayantunde et al., 2000 Hamed *et al*., (2017), Figure (3) records 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 and years of experience of Fulani sheep owners

	Experience/year						Total	
	Less than 15		15-40		Above 40			
Age group (years)	n	%	n	%	n	%	n	%
Less than 25	36	18.0	0	0.0	0	0.0	36	18.0
25-45	27	13.5	75	37.5	0	0.0	102	51.0
Above 45	0	0.0	26	13.0	36	18.0	62	31.0
Total	63	31.5	101	51.5	36	18.0	200	100.0

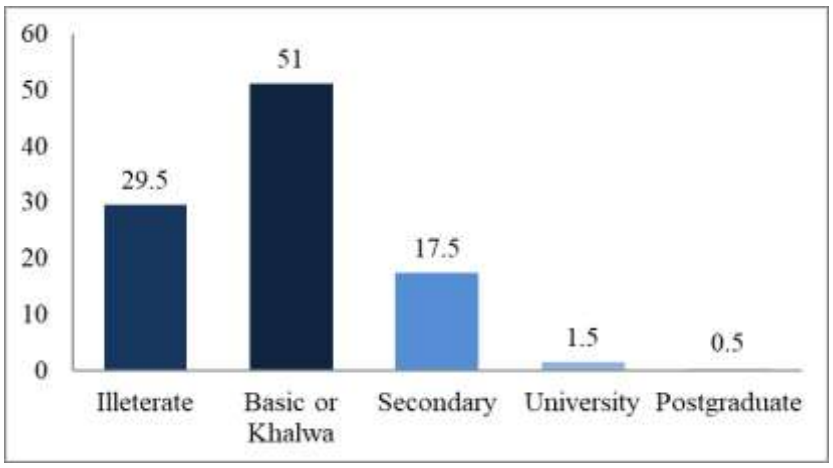


Figure 4.3. Educational level of sheep owners

Table.2.Occupation of sheep owners

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

4.2. 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 (9%). 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 appendix .2) 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 flock composition

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

Table 4. Percentage of different local Fulani sheep subtypes 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

Table.5 Phenotypic descriptions of the Umsaen, White, Umgaba, Wadsarari, Umkehail and Abrag Fulani sheep subtypes in southern Darfur State

	Fulani subtypes					
Characteristics	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

4.3. Management systems and flock feeding:

Figure 4.5, 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-Dierani, 1995), who found that 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 Devendra and McElroy 1982). 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 sorghum 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. The obtained results from the interviewers showed that the majority (91.1%) Fulani sheep owners supply their animals with flushing feed in dry season and beginning of rain followed by those who provide it in just dry season (table.7). The data of the preferable plants for Fulani sheep in study area (appendix 3).

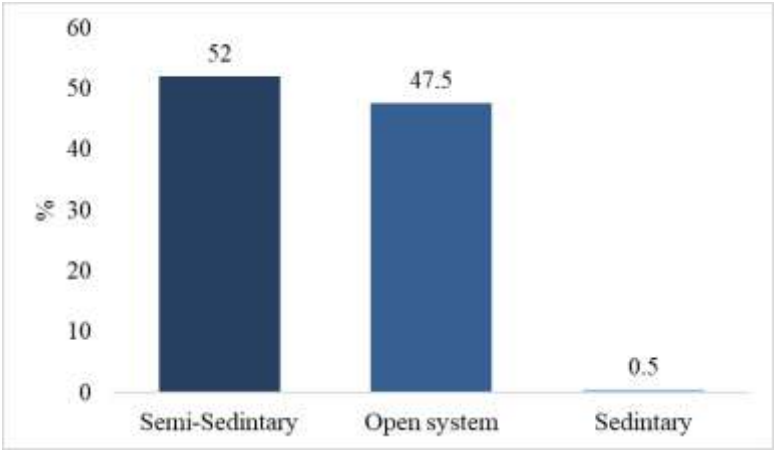


Figure 4.5. Management systems in the study area

Table 6. Feeding systems of Fulani Sheep ecotype

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

Table 7. Time of providing flushing feed

Time of providing feed	N	%
Dry season and beginning of rain	41	91.1
Dry season	4	8.9
Total	45	100.0

4.4. Production and reproduction:

The results of rams and ewes' production age group (table.8) revealed most of Fulani sheep owners kept rams and ewes from 5 to 7 years while few of them kept rams and ewes for ten years, Table 9. Shows the age at first lambing of the Fulani sheep ewes which revealed that 60% of ewes gave their first lamb in twelve months old followed by those ewes gave their first lamb in 13 months of age and fewest percentage (1%) of ewes lambed at first time in 10 months of age. Also the results of numbers of lambs per ewe (table 10) revealed that the

majority of ewes has 10 to 14 lamb followed by those has of 14 to 18 lamb. The results of borrowing ram from other flocks (table.11) showed that 51.5% of Fulani sheep owners doesn't borrow the flock rams to other flock compare 48.5% who borrow their rams to other flock. The results of source of the ram (table .12) showed that 92% of Fulani sheep owners source of the ram from the same flock and outside the flock, then 5% of outside the flock and 3% Fulani sheep owners' source of the ram from the same flock. 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.13), these results were agreed with those of (Carles, 1983, Payne, 1990, and Sulieman *et al*., 1990), who found that weaning age ranged from 2 to 6 months.

Table (8) Rams and ewes production age

	Rams		Ewes	
Age (years)	N	%	N	%
5 – 7	173	86.5	144	72.0
8	20	10.0	44	22.0
9	5	2.5	3	1.5
10	2	1.0	9	4.5
Total	200	100	200	100.0

Table.9. Age at first lambing

Lambing age (months)	N	%
12	120	60.0
13	57	28.5
14	12	6.0
11	9	4.5
10	2	1.0
Total	200	100

Table. 10. Numbers of lambs per ewe

No. of lambs	N	%
10 – 14	169	84.5
14 – 18	29	14.5
7 – 10	2	1
Total	200	100

Table.11. Borrowing ram from other flocks

	N	%
Didn't borrow ram	103	51.5
Borrow ram from other flocks	97	48.5
Total	200	100

Table .12. Source of the ram

Ram source	n	%
From the same flock	6	3.0
Outside the flock	10	5.0
From the same flock+Outside the flock	184	92.0
Total	200	100

Table.13. Weaning age of Fulani sheep

Weaning age (month)	N	%
3-4	174	87
4-5	26	13
Total	200	100

4.5. Marketing of Fulani Sheep:

The results of Fulani sheep different group prices (table 13) revealed that rams record the highest prices (2226.7 SDG) and the lowest group prices were lambs (1204.5 SDG). On the other hand the sheep prices (table 14) were increased in wet summer and winter (72.5%) and the prices were declined in summer (6%) this might be due to availability of good pasture. These results were similar to those of Elrasheed *et al*., (2010) who found that sheep prices affected by several factors including season.

Table.14. Average prices of sheep

	Price (SDG)	
	Min. – Max.	Average
Lamb	750 – 1700	1204.5
Yearling	1000 – 2000	1460
Adult ewe	1200 – 2800	1876.9
Ram	1400-3000	2226.7

1Dollar=29.5 SDG

4.6. 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 (table16) of the ewes followed by the subtype of the ewe (39.3%) as the second rank of the selection criteria, in 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. These results were in line with those of Adamu, (2005) who reported that *Balami* and *Uda* are generally favoured by sheep owners particularly in fattening program. On the other hand, the obtained results of the culling criteria of ewes (table 17) 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 rank. Also, 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.

Table 16. Selection criteria of ewes and ram

Criterion	N		%		Cases %	
	ewes	rams	ewes	Rams	ewes	rams
Size and feature	200	200	39.7	21.2	100.0	100.0
Physical growth		200		221.		100.0
Coat colour	198	199	39.3	121.	99.0	.599
Twining rate	80		15.9		40.0	
Maturity age	26		5.2		13.0	
Adaptation		189		20.1		94.5
Pedigree		154		16.3		77.0
Total	506	942	100.0	100.0	252.0	471.0

Table 15. Time of prices raising

Time	N	%
Wet summer and winter	145	72.5
Wet summer and dry summer	27	13.5
Dry summer and winter	16	8.0
Wet summer	12	6.0
Total	200	100.0

Table 17. Culling criteria of ewes and ram

Criterion	N		%		Cases %	
	ewes	rams	Ewes	rams	ewes	rams
Diseases	200	200	20.6	25.5	100.0	100.0
Overage	200	200	20.6	25.5	100.0	100.0
Weakness	199	200	20.5	25.5	99.5	100.0
Sterility	196		20.2		98.0	
Less sexual capacity	-	183	-	23.4	-	91.5
Low productivity	176	-	18.1	-	88.0	-
Total	971	783	100.0	100.0	485.5	391.5

4.7. Most frequent diseases among adults and lamb of Fulani sheep:

Table 18 shows that bacterial diseases were at first rank of the most frequent diseases among adult sheep followed by external and internal parasites 90.5% These results agreed 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), also 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 relates to many causes including parasitic infestations.

Table 18. Most frequent diseases among adult and lamb Fulani sheep

Disease	N		%		Cases %	
	adult	Lamb	adult	lamb	adult	lamb
Bacterial diseases	200	103	25.9	26.1	100.0	51.8
Un specific diarrhea	178	199	23.0	50.5	89.0	100.0
External and internal parasite	181	1	23.4	0.3	90.5	0.5
Pneumonia	170	67	22.0	17.0	85.0	33.7
Abscess	26		3.4		13.0	
Viral diseases	18	24	2.3	6.1	9.0	12.1
Total	773	394	100.0	100.0	386.5	198.1

4.8. 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 19). 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 19. 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

4.9. Body measurements:

Table 20 shows that sex had significant effect on rump length, head length and width and horn length. These findings agreed with those of Afolayan *et al*., (2006) and Sowande and Sobola, (2008) however partially agreed with those of Ali *et al*., (2017) who found sex of sheep had significant effect on most of body measurements and, Also sheep subtype had significantly influenced height at wither, heart girth, ear length and tail length (table 21), these results were in line with those of Yakubu and Ibrahim, (2011) Ali *et al*., (2017).

Table 20. 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

Table21. 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		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

Chapter five

Conclusion and recommendations

The study concludes that:

- Fulani sheep had different colours represented in various subtypes and it held local Sudanese names such as Umgaba, Alabiad and Umsaen, where Umsaen was most frequent Fulani sheep type.
- Supporting nutrition with additional concentrates or other feed stuffs particularly at dry season could increase litter size and improve general health of the sheep flocks.
- Diseases, feed and water shortage are the most handicaps affect production process of Fulani sheep.
- Sex Fulani sheep subtype had slightly affected many body measurements.

The study recommended that:

- More attention and care should be giving to sheep owners and their animals to improve sheep production conditions including: pasture management, diseases knowledge.
- Further studies and research on production potentiality of Fulani sheep should be done.

References:

Adamu, M. (2005). Sahel type sheep breeds, in: Animal Health and Production Compendium (AHPC), CAB, Oxon, U.K. at: : https://www.researchgate.net/publication/221707467

Adu, I. F. and Ngere, L. O. (1979). The indigenous sheep of Nigeria. World Rev. Anim. Prod. 15 (3): 51-67.

Afolayan, R.A, Adeyinka, I. A. and Lakpini, C.A.M. (2006). The estimation of live weight from body measurements in Yankasa sheep, Czech J. Anim. Sci., 51, (8): 343–348**.**

Aganga, A.A., Umunna, N.N., Oyedipe, E.O. and Okoh, P.N. (1988) Seasonal variations in water requirement and influence of intermittent watering on grazing Yankasa sheep. Small Rum. Res.1: 381–386.

Alexander, C. O. (1974). Birth weight of lambs influences and consequences. In: Elliott, K., Knights, J. (Eds.), Size at Birth. Elsevier, Amsterdam, The Netherlands, pp. 215–245

Ali, T. K., AL-Shukaili, E. S. S., AL-Shamsi, M. S. R, AL-Hanai, S. S.S. and AL-Nabhani, S. A. M. (1999). Productivity of Omani sheep after three years of intensive management and two years of selection. J. Anim. Prod., 12: 59-74.

Ali, A. S., Ibrahim, M. T., Maha M. M., Elobied, A. A. and Salih, M. M (2017). Association between Body Measurements Trait and Live Body Weight of some Sudanese Sheep Ecotypes, Journal of Veterinary Sciences and Agriculture, 18 (1): 71-83.

Ali, M. A. M.Y. (2005). pre-weaning and post-weaning performance of sudan desert sheep under supplementary feeding. Thesis Submitted to the University of Khartoum in Partial Fulfillment of the Requirements for the Digree of Ph. D. in Anim. Prod, (December 2005).

Allison, A. J. (1975). Flock mating in sheep**,** the effect of number of ewes joined per ram on mating behavior and fertility, New Zealand J. of Agric. Res,18:1-18.

Almalaik, A. H. A., Bashar, A. E. and Abakar, A. D. (2008). Prevalence and Dynamics of Some Gastrointestinal Parasites of Sheep and Goats in Tullus Area Based on Post-Mortem Examination**, Asian** J. of Anim. and Vet. Advances**, Vol.3 (6): 390-399.**

Analla, M., Montilla, J.M. And Serradilla, I.M. (1998). Analysis of lamb weight and ewe litter size in various lines of Spanish Merino sheep, Small Rum. Res, 29:255-259.

Atta, M. and El khidir, O.A (2004). Use of heart girth, wither height and scapuloischial length for prediction of liveweight of Nilotic sheep. Small Rum. Res, 55: 233–237.

Ayantunde, A. A., Williams, T. O., Udo, H. M. J., Fernández-Rivera, S., Hiernaux, P. and Van Keulen, H. (2000). Herders' Perceptions, Practice, and Problems of Night Grazing in the Sahel: Case Studies from Niger, Human Ecology, 28: 109–129.

Bale, J. Nuru, S., Addo, P.B. (1982). Serological study of sheep and goats Brucellosis in Northern Nigeria. Bulletin of Anim. Health and prod. in Africa, 30: 73-79.

Bearden, H. J., Fuquany, J. W. and Willard, S.T. (2004). Applied animal reproduction. 6th ed. Upper Saddle River, New Jersey, USA

Bichard, M. and Cooper, M. C.G., (1966). Analysis of production record from cowl and, Sheep Prod. Res, 8:401-410.

Binns, S. H.; Cox, I. J.; Rizvi, S. and Green, I. E. (2002). Risk factors for lamb mortality on UK sheep farms. Prev. Vet. Med., 52: 287-303.

Blench, R. (1999). Traditional livestock breeds: geographical distribution and dynamics in relation to the ecology of West Africa, working paper 127, Overseas Development Institute, London, SW1E 5DP

Boujenane, I. and Kansari, J. (2002). Lamb production and its components from purebred and crossbred mating type, Small Rum. Res, 43:115-120.

Brisibe, F., Nawathe, D. and Bot, C. J. (1996). Sheep and goat brucellosis in Borno and Yobe state of Northeast Nigeria. Small Rum Res, 20:83-88.

Carles, A. B. (1983). Sheep production in the tropics, editor J. P. Maule, Oxford University press.

Cook, R. H. and Fadlalla, B. (1987). Seasonal variation in plasma phosphorus levels of transhumant sheep in Kordofan, Sudan. Trop. Anim. Health and Prod, 19: 57-62.

Dahab, O.A., Ishag, I.A. and Ahmed, M.K.A.(2014). The Hamari sheep production systems in Darfur and Kordofan, Merit Res. J. of Agric. Sci. and Soil Sci, 2:(4) 57-63.

Dawson, L. E. R.; Carson, A. F. and Kilpatrick, D. J. (1999). The effect of digestible undegradable protein concentration of concentrates and protein sources offered to ewes in late pregnancy on colostrum production and lamb performance. Anim. Food Sci. Techno, 82: 21-36.

Devendra, C. and Mcleroy, G.B. (1982). Goat and sheep production in the Tropics. Longman New York. Pp 1-50.

Devendra, C. and Mcleroy, G. B. (1987). Goats and sheep production in the tropics. Intermediate Trop. Agric, Series.

Donald, H. P. and Russel, W.S., 1970. The relationship between liveweight of ewe at mating and weight of new born lamb. Anim. Prod. 2, 273–280.

Doney, J. M., Gunn, R.G. and Horak, F. (1982). Reproduction in Coop, I.E(ed). Sheep and Goat production, Elsevier, Amsterdam, Netherlands, pp.57-80.

El-Dierani, A. H. (1995). Meat production potential of export desert sheep. M.Sc. Thesis. University of Khartoum. Sudan.

El-Hag, F.M., Fadlalla, B. and Mukhtar, H.K., (2001). Some production characteristics of Sudan Desert sheep under range conditions in North Kordofan, Sudan. Trop. Anim. Health and Prod., 33(3), 229-239**.**

El-Khashab, S.H. (1997) Sheep breeding, 1st the Arab house (Ed). Cairo, Eygpt (in Arabic).

Elrasheed, M. M.M., Faki, H. H.M. and Elobied, H.A. (2008). Optimization of Market Supply for Hamari, Desert Sheep in the Sudan, University of Khartoum J. of Agric Sci,16:(1), 153-172.

Elrasheed, M. M.M., Faki, H. H.M. and Elobied, H. A. (2010). Desert Sheep in Kordofan Area –Sudan: production and Marketing, J. of Sci. and Techn., 11(2):17-22.

Eltahir, BA, El Hage FM, Mekki MA (1999). Review of pastoral and Agropastoral system in North Kordofan, Sudan. Special assignment report – sos – sahel Inter UK and El-Ain natural forest management project Elobied Sudan. pp. 30.

Epstein, H. and Mason, I.L (1971). The origin of the Domestic Animals of Africa. Africana Publishing Corporation, New York. Pp. 211-217.

Faki, H. and Taha, A.(2007). Distortions to agricultural incentives in Sudan. Agricultural distortions working paper, 44,World Bank, Washington, DC.

FAO, (2012). Food and Agriculture Organization. Phenotypic characterization of animal genetic resources Animal production and Health Guidelines No.11 Annex.2, P: 95. Italy, Rome.

Hamed, A. H. M., Yagoub, M. Y., Elimam, M. E. (2017). The Characteristics of Sheep Production in Gadarif State, Sudan. J. of Agri. and Life Sci, 4 (1):16-23.

Hassen, Y., Solkner, J., Gizaw, S. and Baumung, R. (2002). Performance of crossbred and indigenous sheep under village condition in the cool highlands of sentaral-northern Ethiopia :growth, birth and body weight , Small Rum Res, 43:195-202.

Haumesser, J.B. and Gerbaldi, P. (1980) Observations surla reproduction et l'élevage du mouton Oudah nigérien. *REMVT* 33,2: 205213.

Hohenboken, W. (1977). Genetic and environmental effect on the pos-weaning growth and carcass merit of crossbred lambs. J. Anim. Sci. 45(6), 1261-1271.

Ibrahim, M. M. (1999). Heredity of the characteristics in Arab and word sheep 2nd the Arab house (Ed). Cairo, Egypt (in Arabic).

ILCA, International Livestock Center for Africa (1979). Small ruminant production in the humid tropics. Systems Study 3, ILCA, Addis Ababa.

Ishag, I. A. and Ahmed, M. K. A. (2011). Characterization of production system of Sudanese camel breeds. Livestock Research for Rural Development. 23:3. Available at www.irrd.org/irrd23/3/ishag23056.htm

Jahnke, H.E. (1982). Livestock production systems and livestock development in tropical Africa. Kieler Wissenschaftsverlag Vauk, Kiel, germany. Pp 253.

Jenkin, G. and Young, I. R. (2004). Mechanism responsible for parturition: the use of experimental models, Anim. Reprod. Sci, 82-83,567-581.

Macit, M., Karaoglu, M., Esenbuga, N., Kopuzlu, S. and Dayiolu, H. (2001). Growth performance and carcass characteristics of Awassi, Morkaraman and Tushin lamb and their crosses under semi-intensive management in Turkey. Small Ruminant Research, 41:171-180.

Maiga, S. (1992). Small Ruminant Morbidity and Mortality in the delta of Niger, Mali. Small-Rum-Res, 9: 181-183.

Maiga, S. and Sarr, J. (1992). Epidemiological Survey of the main respiratory Viruses of small ruminant in Mali. Revue-d' Elevage-et-de-medecine-veterinaire-des-pays-tropicaux.45: 15-17.

Makawi, S.A. (1999). Problems of infertility in sheep. A paper presented at a training workshop on: Use of AI Techniques in sheep Production. Organized by the Arab Organization for Agricultural Development (AOAD), 13-22 February ,1999, Khartoum, Sudan. (in Arabic).

MARFR. (2016). Ministry of Animal Resources, Fisheries and Ranges. Department of Statistic and Information . Khartoum, Sudan. Statistical Bulletin for Anim. Res.-No. 25:p3.

Mason, L.L. and Maule, J.P. (1960). In the indigenous livestock of Estrern and southern Africa Technical communication NO.14.communwealth bureau of animal breeding and genetics, Commonwealth agricultural bureau, Farnham Royal, UK.

Matika, O., van Wyk, J. B., Erasmus, G. J. and Baker, R. L. (2003). A description of growth, carcass and reproductive traits of Sabi sheep in Zimbabwe. Small Rum. Res., 48: 119-126.

Mcleroy, G. B. (1961). The sheep of the Sudan.2. Eco-type and tribal breeds. Sudan J. of Vet. Sci. and Anim. Husb, 2:101-151.

Mohammed, A., Badu, U. A. and Kene, R.V.C. (1996). Lamenes in sheep and goats in relation to hoof conditions in Sahel zone of Nigeria. Bulletin of Anim. Health and prod. In Africa 44: 97-100.

Mohammad, M.T., Rafeeq, M., Bajwa, M.A., Awan, M.A., Abbas, F., Waheed, A., Bukhari, F.A. and Akhtar, P. (2012). Prediction of body weight from body measurement using regression tree (RT) method for indigenous sheep in Balochistan, Pakistan, the J. of Anim and plant Sci, 22(1):20-24.

Mufarrih, M.E.(1991) Sudan desert sheep : their origin ,ecology and production potential ,World Anim. Rev, 66:23-31.

Nawaz, M. and Meyer, H.H. (1991). Effect of genotype and mating weight on ovulation rate, litter size and uterine efficiency on Coopworth, polypay and crossbred ewes, J. of Anim. Sci, 69:3925-3930**.**

Ngere, L.O., Aboagye, G., (1981). Reproductive performance of the West African Dwarf and Nungua Blackhead sheep of Ghana. Anim. Prod. 33, 249–252.

Njoya, A., Awa, N. D. and Chupamom, J. (2005). The effects of a strategic supplementation and prophylaxis on the reproductive performance of primiparous Fulbe ewes in the semi-arid zone of Cameroon. Small Rum. Re, 56 : 21–29.

O'Callaghan, D. and Boland, M. P. (1999). Nutritional effects on ovulation embryo development and establishment of pregnancy in ruminant, Anim Sci, 68(part2):299-314.

Ockerman, H.W. and Abdelrahman, A.M. (1985). World Review of Animal Production vol.12, No.3 July, 1985.

Oeak, N.; Cam, M. A. and Kuran, M. (2005). The effects of high dietary protein levels during late gestation on colostrum yield and lamb survival rate in singleton-bearing ewes. Small Rum. Res., 56: 89-94.

Olaleye, O. D., Tomori, O., Fajumi, J. L. and Shemitz, H. (1996). Experimental infection of three Nigerian breeds of sheep with the zinga strains of the rift valley fever virus. Revue d' Elevage et de medecine veterinaire des pays tropicaux. Vol. 49:6-16.

Olsson, A. and Teferawoek. B., (1990). Performance of indigenous and crossbred sheep in the highland of Ethiopia. In proceedings of the Fourth world congress on Genetics Applied to Livestock production, Vol.XIV, Dairy Cattle Genetics and breeding, adaptation, conservation, Edinburgh, UK, pp.406-409.

Oni, O.O. (2002). Breeds and Genetic Improvement of Small Ruminants. Manual for Small Ruminant Production Training Workshop. Held13 - 18th January, 2002 at NAPRI/ABU Shika, Zaria, Nigeria.

Osman, A. M., Abdelkreim M., Abukashawa, S. M. A. and Ibrahim M. T. (2015). Camel owners and perception towards management practices at Butana area, Gaderif state, Sudan, Inter. J. of Scient. and Techn. Res., 4: 10, 286-289.

Payne, W. J. A. (1990). An introduction to animal husbandry in Trop. The E.L.B.S.Longman groups Ltd.

Radostits, O. M., Blood, D. C. and Gray, C.C (1994). veterinary medicine. A Text book of the Diseases of cattle, sheep, pigs, Goats and Horses, 8th ed. ELBS, Bailliere Tindall, London. PP340-376.

Rahaley, R. S. (1984). Infectious Diseases of Reproduction in Sheep. In: Lindsay, D.R.; Pearce, D.T.(Eds). Reproduction in Sheep. Cambridge University, Press, Cambridge, 345-352.

Rhind, S.M., MsMillen, S.R., McKelvey, W.A.C., Rodriguez-Herrejbn, F.F. and McNeilly, A. S. (1989). Effect of the body condition of ewes on the secretion of LH and the FSH and the pituitary response to gonadortrophin –releasing hormone. Journal of Endocrinology, 120:497-502.

RIMS, (1992). Federal government of Nigeria Livestock Resources Vol. II: Pp184-219.

Robert, E.T. and Thomas, G.F. (2004). Scientific farms animal production (8th ed) Colorado State University, pp562.

Robinson, J. J. (1996). Nutrition and reproduction. Anim. Reprod. Sci., 42: 25-34.

Sandford, J., Wissocq, Y.J., Durkin, J., Trail, J.C.M., 1982. Evaluation of productivities of Djallonke sheep and N'dama cattle at the Center de Recherches Zootechniques, Kolda, Senegal. ILCA Res. Rep. 3: 9–39.

Shehu, L. M., Yusuf, H., Kudi, A. C. and Kalla, D.U. (1999). Seroprevalence 49 of brucellosis in ruminants in Bauchi and environs. Nigerian Vet. J. 20: (1). 67-74.

Shelton, M. and Huston, J.H. (1968). Effect of high temperature stress during gestation on certain aspects of reproduction in the ewe, J. of Anim. Sci, 27:153-158.

Sormunen-Cristian, R. and Jauhiainen, L. (2002). Effect of nutritional flushing on the productivity of Finnish Landrace ewes. Small Rumin. Res., 43: 75-83.

Sowande, O. S., and Sobola, O. S. (2008). Body measurements of west African dwarf sheepas parameters for estimation of live weight, Trop. Anim. Health Prod. 40:433‑439.

Sulieman, A.H., Sayers, A.R. and Wilson, R.T. (1990). Evaluation of Shugar, Dubasi and Watish sub ecotypes of Sudan desert sheep at El Huda National Sheep Research station, Gezira Province, Sudan. ILCA Research report, No. 18, Addis Ababa Ethiopia, P: 30.

Tatman, W. R., Judkins, M.B., Dunn, T.Q. and Moss, T.G. (1990). Luteinizing hormone in nutrient-restricted ovariectomized ewes. J. Anim. Sci., 68, 1097-1102.

Tembely, S.; Lahlou-Kassi, A.; Rege, J. E. O.; Sovani, S.; Diedhiou, M.L. and Baker, R. L. (1976). The epidemiology of nematode infections in sheep in a cool tropical environment. Vet. Parasitol., 70: 129-141.

Tuah, A. K. and Baah, J. (1985). Reproductive Performance, pre-weaning growth rate and the weaning mortality of Njallonke sheep in Ghana, Trop. Anim. Health and prod, 17:107-113.

Wamagi, I.T., Mbap, S. T. and Tahir, I. (2013) Phenotypic distribution of sheep and goats in Southern parts of Kaduna State, Nigeria. World J. of Agri. Sci, Vol. 1(3), pp. 100-105.

Williamson, G. and Payne, W.J.A. (1965). *Animal production in the tropics*. 2nd ed. London, Longmans, Green & Co. Ltd.

Wilson, R.T. (1976). Studies of the livestock of Southern Darfur –Sudan, Trop. Anim. Health and Prod, 8:103-114.

Wilson, R.T., 1989. Reproductive performance of African indigenous small ruminants under various management systems: a review. Anim. Reprod. Sci. 20, 265–286.

Wilson, T. R. (1991). Small ruminant production and small ruminant genetic resource in Tropical Africa, FAO, and Anim. Prod and Health Paper 88, Rome.

Yakubu. A, Ibrahim, I. A. A. (2011). Multivariate analysis of morphostructural characteristics in Nigerian indigenous sheep. Italian J. of Anim. Sci. volume 10: e17.

Younis, A. A., EL-Gaboory, I.A., EL-Tawil, E.A. and Shobokshy, A.S. (1978). Age ay puberty and possibility of early breeding in awassi ewes, J. of Agri. Sci. (UK), 90: 255-260.

Sudan University of Science and Technology

College of Graduate Studies

Questionnaire about some productive and reproductive in Sudanese sheep

Date / / 20 Respondents No……..

(1) Personal information:

1. Owners name:…….....

2. Location:…… State……..

3. age:……...

4. Occupation:

1-Animal breeder( ) 2- Farmer ( ) 3- Govt. sector ( ) 4- private sector ( )

5. Experience in rearing animal (year)

6. Educational level :

1- Illiterate ( ) 2- Khalwa or Basic ( ) 3- Secondary ( ) 4- University ( ) 5-Post graduate

(2) Herd formation:

1.What kind of animals you are reread?

1- Sheep ( ) 2- Goat ( ) 3- Cattle ( ) 4- Donkeys ( ) 5- Poultry ( )

2.What types of sheep you are reread?

1- Umsaen ( ) 2- Umgaba ( ) 3- Alabiad ( ) 4- Wadsarari ( ) 5- Other ( )

3. What the production age /year for ? 1- Ewe ( ) 2- Ram ( )

(3) Management systems and flock feeding:

1. Management system:

1- Intensive system ( ) 2- Semi-intensive system ( ) 3- Extensive system ( )

2.Feeding management:

1/What kind of feed that your animal eat?

1- Natural range ( ) 2- Agricultural residues ( ) 3- Additional feeds ( ) 4- Others …….

2/Which kind of concentrates you provided your animals?.....

3/If you aren't provided the concentrates what is reason? ……

4/ when did you provide the concentrates?

1- Drought ( ) 2- Travelling ( ) 3- Both of them ( ) 4- Other ……

5/ If your animals depend on the natural range, what are the preferable plants that it eat?

1-…… 2- ……

3- …… 4- …….

5- ……... 6- ……

7- …… 8- ……..

(4) productive and reproductive traits:

1. Age at lambing / month ( ) 2. Age at weaning / month ( )

3. Age at puberty / month ( ) 4. The ewe produced single ( )

5. The ewe produced twins ( ) 6. The ewe produced triplets or more ( )

7. Number of lamb to through produced period ( )

8. in which month of the year abound in lambs……

9. The criteria in ewe selection:

1- Size and feature ( ) 2- body color ( ) 3- The twining ( ) 4- Early maturing age ( )

10- The criteria in ram selection:

1- Size and feature ( ) 2- body color ( ) 4- Growth ( )

5- Horn ( ) 6- Stamina and adaptability ( )

(5) Information about the ram:

1.Source of ram 1-outside flock ( ) 2- inside the flock ( )

2. Age you pay the ram to other flock ? 1- yes ( ) 2- No ( )

(6) Marketing sheep in area:

1. Price of marketed sheep (SDG)

1- Lamb ( ) 2- Yearlings ( ) 3- Ewe ( ) 4- Ram ( )

2. When the rise sheep ?.....

(7) Culling and exclusion:

1. Does you cull ewe from the flock ? 1- yes ( ) 2- No ( )

2. What are the reasons?

1- Disease ( ) 2- Over age ( ) 3- general weakness( ) 4- Futility ( )

5- less of production ( ) 6- Other ……

3. Does you cull ram from the flock ? 1- yes ( ) 2- No ( )

2. What are the reasons?

1- Disease ( ) 2- Over age ( ) 3- general weakness( ) 4- weakness sexual capacity 5- Weak or malformation of horn ( ) 6- Other ……

4.What are the ewes selection reasons ?

1- Size and feature (**)** 2- Coat colou ( ) 3- Twining rat ( ) 4- Maturity age ( )

5. **What are the rams selection reasons ?**

1- feature ( ) 2-Physical growth ( ) 3- Coat colou ( ) 4- Adaptation ( ) 5- Pedigree ( )

(8) Flock public health:

1/ public diseases:

Mature sheep diseases	Lamb diseases
1-……	1-……
2-…….....	2- ……
3- ……	3- ……
4- ……	4- ……
5- ……	5- ……

2/ **Curing and protection from diseases by :**

1- Drugs ( ) 2- Drugs + vaccines ( ) 3- Local remedies ( )

3/ What is most infected age?

1- Lamb less than 5months ( ) 2- lamb more than 5 months ( ) 3- Mature males

4- Mature female ( )

4/ What is most mortality age?

1- Lamb less than 5months ( ) 2- lamb more than 5 months ( ) 3- Mature males

4- Mature female ( ).

5/ Did you receive any vaccination services? 1- yes ( ) 2- No ( )

6/ When did you receive the vaccination services?

1- in outbreak ( ) 2- Any time in the year ( ) 3- Others ( )

7/ **What is the source of drugs and vaccines?**

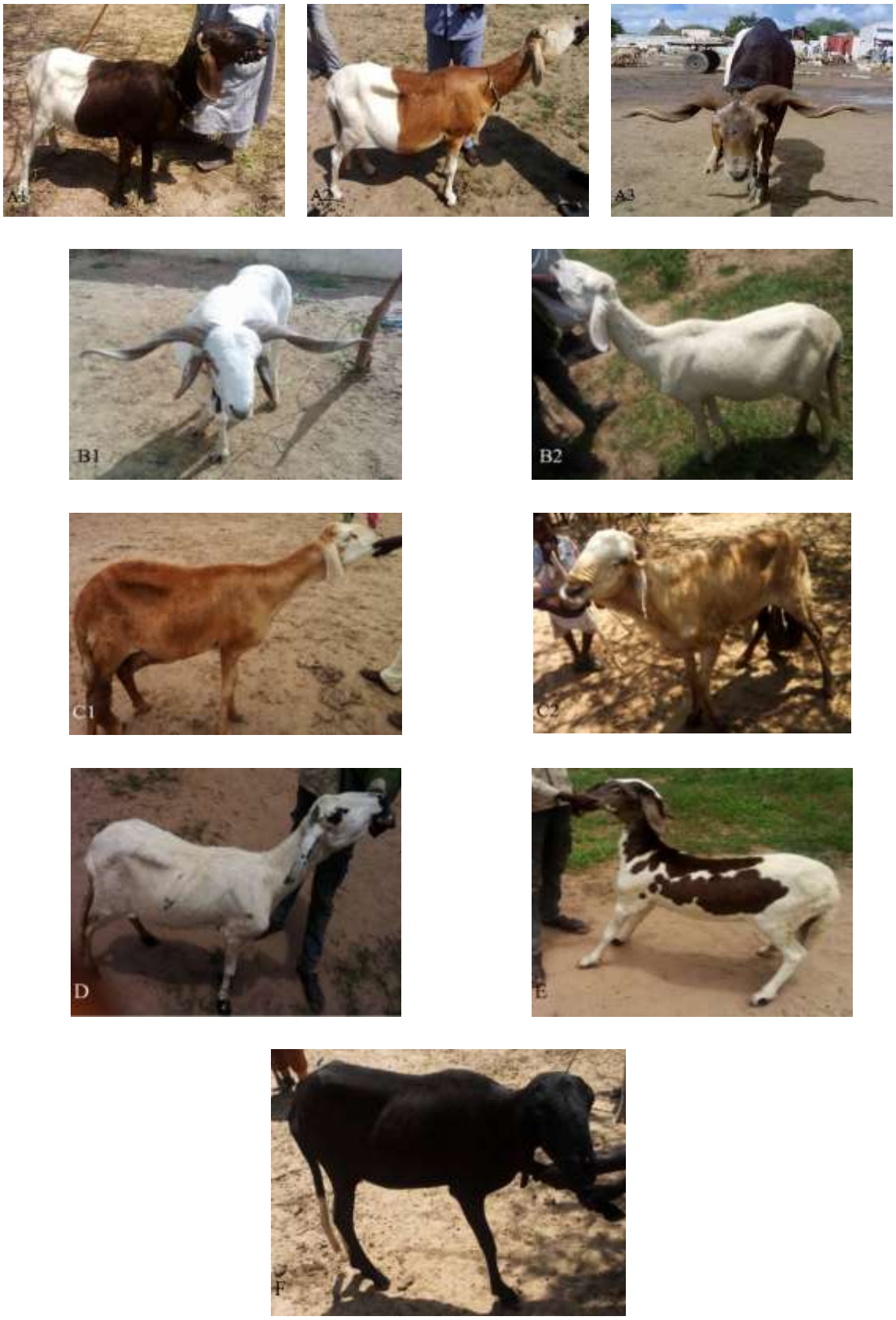
1- Governmental ( ) 2- Nongovernmental organization ( ) 3- private veterinary sector ( )

(9) Production constrains:

1- Diseases ( ) 4- Lack of labor ( ) 5- Predators ( )

2- Lack of feed and range ( ) 6- Lack of extension services ( )

3- Lack of water ( ) 7- Lack of security ( )



Appendix 2. Fulani sheep subtypes in the study area: (A1-A3) Umgaba; (B1,B2) Alabiad; (C1,C2) Umsaen; D) Umkehail; E) Abrag; F) Wadsarari

Appendix 3. Preferable plants (ranks) by sheep in the study area

Plants	Mean	%	
Abgigree (Dafari)	5.41	17.63	*Cotalaria senegalensis*
Aboasabee	6.02	20.88	*Dactylooctenium aegyptium*
Garad	2.76	0.92	*Acacia nilotica*
Different bushes	4.14	14.19	Different bushes
Draisa	2.30	4.31	*Tribulusterrestris*
Kawal	2.93	5.03	*Cassia obtusifolia*
Neela	2.82	2.09	
Hemaid fruit	2.05	1.75	*Sclerocaya birrea*
Taleh	3.18	4.58	*Acacia seyal*
Different trees fruit	4.44	3.37	Different trees fruit
Kraib	4.55	13.14	
Lesaig	1.68	1.54	*Xanthium brasilicum*
Khodara (Molukhya)	2.85	1.50	*Corchorus olitorius*
Sidir	2.00	0.12	*Ziziphus spina _christi*
Daggamanna	3.74	2.26	
Hantoot	2.39	3.08	*Ipomea cordofanum*
Shahat	2.13	0.33	
Laot	3.00	0.06	*Acacia nubica*
Gedaim	.00	0.04	*Tinnas grewia*
Teco	1.00	0.04	
Babanos	2.00	0.04	*Dalbergir melanoxylon*
Hilegeg	2.14	0.29	*Balanites aegyptiaca*
Ketir	6.00	0.23	*Acacia mellifera*
Melaiha	7.00	0.41	*Chloris prieeueii*
Hashab	5.00	0.10	*Acacia Senegal*
Shaalob	3.31	2.07	*Merrmia aegyptia*
Total		100.00	