



**Sudan University of Science and Technology**  
**College of Graduate Studies**



**Study on Some Field Practices of Breeders towards Management  
and Rearing of Sheep in Khartoum State**

**دراسة عن بعض الممارسات الحقلية للمربين تجاه إدارة ورعاية الضأن  
بولاية الخرطوم**

A dissertation submitted for partial requirement for the degree of Master  
of Science (M.Sc.) in Animal Production in Tropics

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## الاستهلال

قَالَ تَعَالَى:

﴿أَوَلَمْ يَرَوْا أَنَّا خَلَقْنَا لَهُمْ مِمَّا عَمِلَتْ أَيْدِينَا أَنْعَامًا فَهُمْ لَهَا مَالِكُونَ ﴿٧١﴾ وَذَلَّلْنَاهَا لَهُمْ  
فَمِنْهَا رَكُوبُهُمْ وَمِنْهَا يَأْكُلُونَ ﴿٧٢﴾ وَلَهُمْ فِيهَا مِنْفَعٌ وَمَشَارِبٌ ۖ أَفَلَا يَشْكُرُونَ ﴿٧٣﴾﴾

سورة يس الآيات (71 - 73)

صدق الله العظيم

# **Dedication**

To my Family

Brothers, sisters, daughter and wife greatly a appreciated.

Finally I would like to dedicate this thesis to my loving parents whom paid imminence sacrifice for the success of my academic career.

# Acknowledgments

Thanks to Allah the most generous and merciful for giving me power and patience to conduct this work. Also, thanks for the effort of many who supported my graduates' studies in general and the research in particular first I wish to extreme sincere thanks and gratitude to my supervisor Dr. **Ameer Ahmed Elobied**.

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## **Abstract**

The study was conducted in Khartoum State, and (75) individuals who were sheep raising owners have been surveyed in the markets, and a detailed questionnaire was distributed to each of them, including the care of the herds in the markets. This study aimed at identifying the sheep quality importing to Khartoum State, regions and sheep raising owners in terms of their education and experiences in sheep raising and marketing, the information were summarized in the form of tables and graphs descriptive for the study, revealing that 27.3 of them have more than 20 years of experience in sheep raising, and 60% of them are illiterate, or rather have obtained basic education or Khalwa "Quarnic Schools".

The study shows that the rainy season is the season with the most increase in prices, and that the criterion of priority for selecting Kabashi ewes and rams in the market is by size, while the ewes are distinguished by the number of births.

The sheep raising owners made it clear that the milk will increase in age, and the rainy season is the appropriate season in which prices reach their peak. The study clarifies that structure in the mentioned markets consists of sheep which constitutes 69,1% and goats and camels, and the study showed that there are diseases inflict the aged sheep which are diarrhea, swelling, ticks and respiratory diseases, also there are diseases that infects the young animals such as diarrhea 39% and other respiratory diarrhea 23,8%.

The study reveals that production constraints which are represented in diseases, security and water shortage.

## الخلاصة

أجريت الدراسة في ولاية الخرطوم وتم سؤال حوالي 75 فرد من مالكي الخراف في الأسواق وتم تقديم استبيان مفصل لكل فرد منهم يتضمن الرعاية بالقطيع في الأسواق، تهدف الدراسة إلى معرفة نوعية الضأن الداخل ولاية الخرطوم والمناطق التي يأتي منها ومالكي الخراف من تعليمهم وخبرتهم في التربية والتسويق وتم تلخيص المعلومات في شكل جداول ورسوم بيانية وصفية للدراسة تظهر أن 27,3 خبراتهم أكثر من 20 عام في رعاية الخراف و60% منهم أميون أو بالأحرى نالوا التعليم الأساسي أو الخلو.

الدراسة تتوضح أن فصل الخريف هو أكثر الفصول زيادة في الأسعار وأن معيار أولوية اختيار النعاج والكباشي في السوق بالحجم بينما يتم تميز النعاج تحدد أولوية بعدد الودادات.

وأوضح مالكي الخراف أن الأسعار ترتفع بزيادة الأعمار ويعتبر الخريف هو الفصل المناسب الذي تصل فيها الأسعار ذروتها.

توضح الدراسة أن تركيب القطيع في الأسواق المذكورة يتكون من الضأن وهي تمثل 69,1% والماعز والجمال، وأوضحت الدراسة أن هناك أمراض تصيب الحيوانات الكبيرة وهي الإسهال والنفخ والقراد والأمراض التنفسية، وكما أن هناك أمراض تصيب الحيوانات الصغيرة مثل الإسهال 39% والأمراض التنفسية 23,8%.

توضح الدراسة معوقات الإنتاج وهي الأمراض والأمن وشح المياه.

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# Chapter one

## 1. Introduction

The demand for livestock products is increasing because of increased human population and relative growth in income. Hence, sustainability of livestock production is important to ensure continuous and sufficient availability of livestock products for the current and future generations. Sudan owns large numbers of livestock and agricultural products where it is the backbone of its economy, so this sector needs more development to increase the national income. The total population of livestock in Sudan is about 108.2 million head, sheep population represented about 37.7%. Although total percentage of sheep in Khartoum State was 1.13% but it is considered as the main market of all types of sheep and other livestock animals in the Sudan (MAR, 2018). The livestock markets are distributed in the three main cities of Khartoum State (Khartoum, Khartoum north and Omdurman) each one of these cities is characterized by certain sheep type than other as we can find Kordofan and Darfur sheep *Hamari* and *Kabashi* type in Omdurman city.

Lands in Sudan are characterized by several plant species due to various reasons such as the action and interaction of soil, climate, topography and prevalent human activities. Despite degradation due to

overgrazing, drought, fire and desertification, they still provide 82.6% of the livestock feed (Daragge and Fadl ELMula, 1994). Several research studies reported that extensive-open range-system was the dominant animal production system. Also, it was pointed to many constrains faced sheep production such as lack of water, feed shortage, diseases and less extension services. The objective of this study was to study the productive and reproductive practices that adopted by shepherds and sheep owners in Khartoum State.

## **Chapter Two**

### **2. Literature Review**

#### **2.1 Sheep in Africa**

The present-day, sub-Saharan African domestic sheep (*Ovis aries*) genetic resources are extensive, with an estimated 170 breeds. Eighty percent of the sheep are classified as indigenous populations maintained under traditional farming systems. They are divided into two main groups with a largely non-overlapping distribution: thin-tailed and fat-tailed (including fat-rump) sheep (Wilson, 1991). The thin-tailed sheep are found mainly in North Africa from Morocco to Egypt, in Sudan and in West Africa from Sénégal to Nigeria.

#### **2.2 Classifications of Sheep:**

Devendra and Mcleroy, (1987) and EL-Khashab, (1997) mentioned that there are many criteria to classify sheep such as tail, coat and purpose of production type, according to the production type sheep are classified into four groups Carles, 1983).

##### **2.2.1. Wool sheep type:**

This type is characterized by producing good quality of wool such as Merino. This breed has been adapted to Australia for nearly two centuries. Merino sheep is well favorable to produce excellent quality of wool in semi-arid areas (Carles, 1983).

##### **2.2.2. Milk sheep type:**

This type is categorized by producing milk as Italian Lacoune breed, it remarkable for its milking capacity with average yield of 211 Litters in 165 days of lactation Carles, 1983).

##### **2.2.3. Meat sheep type:**

This breed is known by meat production such as Oxford and Suffolk with mature males weighing (100-130) kg, whereas female weigh (70 -90 kg) (Ibrahim, 1999).

#### **2.2.4. Dual purpose sheep:**

This type is adapted to different environmental conditions, also it is described with such a breed has low productivity compared with the other type. Caloia and Mondero is representative of this type, both are characterized by producing meat, milk and wool (Carles, 1983).

#### **2.3. Classification of Sudanese sheep**

Mainly sheep reared for providing meat for local consumption in addition to their share in national income through the export. Sheep are also reared for milk production. The breeds of sheep in the Sudan and South Sudan were classified into five basic types and three mixed ecotypes according to tail size the basic types including:

- 1- Sudan desert sheep which include (Butana Gezira, Watish, Hamari, Kababish, Meidob, North River woolled, and Beja).
- 2- Sudan Nilotic sheep which include (Dinka, Shilluk, Nuba mountains and Mangala). Belong to South Sudan.
- 3- Arid upland and this are the Zaghawa sheep.
- 4- Arid Equatorial sheep which is the Taposa. Belong to South Sudan.
- 5- Western African Fulani (fellata and M'Bororo), (Mcleroy, 1961).

##### **2.3.1 Sudanese desert sheep origin**

Sudan desert sheep is the most common type in the country, Sudan Desert sheep and its hybrids comprise more than 80% of the national sheep flock. Sudan Desert sheep and its crosses are supposed to be a progeny of a sheep of Egyptian origin (Devendra and Mcleroy, 1982). Also, they stated that Sudan Desert sheep are spread north of latitude 12°N, extending into Eritrea and westward into Chad. Mufarrih (1991) had another assumption supposed that Desert sheep have probably an origin from cross breeding between sheep of Arab tribes that have arrived in Sudan through western boarder and the sheep of northern Fulani tribes, (*Balani* and *Ouda*), in the Lake Chad basin. This assumption was supported by the fact that Fulani sheep are long-legged and long-tailed

sheep. Also, Williamson and Payne, (1965) reported that it has been forced out of Egypt by the entry of fat-tailed and cross wool sheep (Mufarrih, 1991). The similarity of management practices, environmental habitat and many body features such as the shape of the head and face, body length, coat texture, thicker tail and fuller rump between Sudan Desert sheep and Fulani sheep could support the hypotheses that said that Sudan Desert sheep might be attributed to partial inheritance from their Arab ancestors Mufarrih, (1991).

#### **2.4. 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).



#### **2.4.1. 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).

#### **2.4.2. 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).

#### **2.4.3. 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).

## **2.5. Factors affecting sheep production**

### **2.5.1. Management factors**

The management system has many effects on the production features of the Sudan Desert sheep El-Hag *et al.*, (2001). Many researchers reported that mortality rates in breeding dams were significantly higher in nomadic one than sedentary flock, while ewes lambed under sedentary system had lower lambs birth weights than those lambed in nomadic system (3.38 vs.4.08 kg) and lambs body weight at 30 days of age (8.05 vs. 9.42 kg), whereas lambs weights from 60-150 days of age were not different in the two systems. In contrast, in other study, Wilson (1976) reported that death rates between sedentary and migratory flocks of Southern Darfur were not differing. The mortality rate was almost same in both systems.

### **2.5.2. Nutrition**

Enhancing live weight at mating influenced ovulation and litter size (West *et al.*, 1991; Nawaz and Meyer 1991). Moreover, Njoya *et al.* (2005) noted that, protein complementary additions to ewes browsing low quality pasture improved their body weight, body condition score and reproductive performance. Also Muskasa-Mugerwa and Lalhoul-Kassi (1995) reported that sufficient nutrition is important on the reproductive trait in ewes in Ethiopia furthermore, Stephenson and Bird (1992) pointing out a valuable response in productivity of supplemented ewes eating low quality grass in Australia.

During the late gestation period pregnant ewes received feed supplementation with balanced and adequate energy and protein to support developing of embryonic and fetal growth, maintain physiological requirements of the animal, mammary gland growth, colostrum and milk production (Oeak *et al.*, 2005). Eighty percent of fetal growth arises through the last 60 days of pregnancy and it is due to 35% significant increase in nutrient requirements of the ewes (Dawson *et al.*,

1999). Thus, lamb survival is related to nutrition of ewes during late gestation (60 days) (Binns *et al.*, 2002).

The capability of nutrition during mating time to change ovulation and lambing rates of ewes in several breeds is well recognised (O'Callaghan and Boland, 1999). In a study on some British breeds, Rhind *et al.*, (1989) mentioned that decreasing in ovulation rate prior mating time resulted from low animals feed intake, in addition, ova wastage rate occurs due to lower feed intake after mating time. On the other hand, Landau and Molle (1997) stated that numerous Mediterranean breeds of sheep, a short period of feed flushing before mating definitely affected ovulation. In the same issue Lassoued *et al.*, (2004) reported that higher rates of feeding before and through mating time were related to improve reproductive performance in accordance with the literature reported for several sheep breeds. Lambing rates were affected by the dietary treatment. Emam and Malik, (2009) reported that the most additional feeds were cotton seed cake, groundnut hulls and sorghum grains.

### **2.5.3. Animal factors**

#### **2.5.3.1. Breed**

Animal breed and genotype had significantly affected the birth weight, daily weight gain and 90 day weights of the animal (Cochran *et al.*, 1984 and Hassen *et al.*, 2002.), besides, Boujenane and kansari, (2002) mentioned that lamb weight and survival to 70 days differed depending on genetic composition of lamb. They also found that effects of breed were significant for fecundity, number of lambs born alive, litter size at weaning, litter weight weaning per ewe joined and lamb weight at 60 days.

#### **2.5.3.2. Age of dam**

Age of dam had significant effects on many reproductive traits such as birth weight, prolificacy, twinning rate and litter size (Tauh and

Baah, 1985; Ali *et al.*, 1999). In more details Al-Shorepy and Notter (1996) noted average fertility 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. Likewise, Boujenane (2002) reported that dam age had significant effect on birth weight and 90 days.

#### **2.5.3.3. Type of birth**

Analla *et al.*, (1998) reported that birth type had noticeable effect on birth weight and consequent live weights as 30, 60 and 90 days, so that, single lambs were heavier than twin lambs, additionally, growth rate of single lambs was faster than twins (Macit *et al.*, 2001). Moreover Tuah and Baah, (1985) found that weaning weight, pre-weaning growth rate were influenced by birth type, similar findings were obtained by Cloete *et al.* (2007) in crossing Dorper ewes with Ile de France, Merino Land sheep and SA Mutton Merino rams. Also Dimsoski *et al.*, (1999) noted that single lambs had higher daily gain than twins in the pre-weaning period. Mortality rate of single born lambs was lower than twins (Nawaz and Meyer, 1991).

#### **2.5.3.4. Sex of lamb**

Both sexes of lambs almost had the same weights at birth, 30 and 90 days of age, but it differ in late stages (El-Hag *et al.*, 2001 and Hassen *et al.*, 2002). These results are in contrast to Analla *et al.*, (1998) and Boujenane, (2002) who found that male birth weights were heavier than those of the female and these results are applicable for 30 and 90 days. Also Cloete *et al.* (2007) mentioned that birth weight of male was higher than female lambs. Several researchers have found significant differences in body weight between male and female lambs at entirely ages (Bichard and Cooper, 1966; Gjerdem, 1967 and Mavrogenis 1996<sup>a,b</sup>). Moreover Ali *et al.*, (1999) stated that male lambs were heavier than females at birth, weaning and 6 months of age. However, (Rastogi 2001; Boujenane

and Kansari 2002) noted that sex of lamb was not an important source of variation.

#### **2.5.4. Breeding season**

Lambing season significantly affected the prolificacy and twinning rate, birth weight and on consequent live weights and survival age of lambs (El-Hag *et al.*, 2001; Rastogi, 2001; Hassen *et al.*, 2002; Boujenane and Kansari 2002; Tuah and Baah, (1985). Lambs born in rainy season had the highest birth weight (3.83 kg), while those born in the early dry season (3.52 kg) were higher than those born in late dry season (3.17 kg), hence the lamb weight at 30 days of age and growth from 90-150 days were higher in lamb born in the rainy season. Moreover, El-Hag *et al.*, (2001) reported that breeding season had significant effects on desert sheep reproductive performance. The rainy season recorded higher lambing and mortality rates numbers of serviced ewes than in the late dry season.

El-Hag *et al.*, (2001) Reported that the weights and mortality rate of lambs born under the nomadic system and those born during the rainy season were higher comparing to other rearing system and season. Mortality rate of lambs are an essential constituent of total flock Death (Wilson, 1976). About 30 % of mortality rate was to the age of six months, while half of the deaths lambs happening in the first four weeks and deaths were rare during the late dry season., moreover, higher records of serviced ewes were noted in the late dry season however, higher lambing and mortality rates occurred during the rainy season (El-Hag *et al.*, 2001).

In study of seasonal effects on birth weight (BWT) on prolific Assaf flock kept under intensive management, BWT of born lambs on April (4.6 kg) was significantly differs from BWT of born lambs on September (3.8 kg). BWT was inversely affected by day length among

the early stage of gestation, while it was directly related with rate of changes in day length during the latter stages of gestation (Gootwine and Rozov, 2006).

#### **2.5.5. Climatic factors**

Both genetic and environmental factors and the interaction between them could affect birth weight of lambs. Along with the environmental factors, season was also found to influence birth weight with lambs born in the rainy season being smaller than spring-born lambs. Ewes pregnant in the summer season could have lower food intake, and increase heat load (Shelton and Huston, 1968) which is high during the hot season then it influences the birth weight. Furthermore, seasonal variation in gestation length (Jenkin and Young, 2004) may also be related to seasonal variation in BWT.

#### **2.5.6. Disease factors**

Makawi, (1999) stated that infectious diseases were divided into three main groups; specific genital diseases, non-specific genital, and general infectious diseases. The main reasons of reduced productivity in sheep are the infectious reproduction diseases, and it is generally categorized into these mainly affecting the venereal tract of rams and those mainly affecting ewes causing abortion and pre-natal lamb mortality (Rahaley, 1984). Higher rate of gastro-intestinal and respiratory disease problems noted during the dry season for lactating ewes in transhumant sheep comparing to dry open, were probably a reflection of the greater nutritional stress experienced by lactating animal (Cook and Fadlalla, 1987).

#### **2.5.7. Sheep marketing**

Sudanese sheep is considered as one of red meat sources for local consumption and export, about 5.5 million heads of live sheep were exported in 2015 (MAR, 2018). Animal resources sector and especially

sheep play a vital role in Sudanese people live as source of food, income by providing food, profits and supply soil with natural manure. Also, it provides the country with hard currencies. Many factors participate in determination of sheep price such as season (Elrasheed *et al.*, 2010), taxes (Elrasheed *et al.*, 2008), transportation fees, production cost beside distance from production to consumption areas of sheep and veterinary charge (Faki and Taha, 2007). in spite of low cost of sheep production due to use of traditional production system, the prices of Sudanese sheep are high compare to international prices (Elrasheed *et al.*, 2010). Rams are the most preferred group in the market followed by ewes (Dahab *et al.*, 2014).

## Chapter three

### 3. Materials and Methods

#### 3.1. Study Area

The study was conducted in the period from March to May 2021 in the Khartoum State in central Sudan. Khartoum State is located in desert zone between the latitude 15 - 16° North and longitude 31.5 - 34° East with total area of 22,142 km<sup>2</sup> as smallest state in Sudan. It consists of three large cities Omdurman, Khartoum and Khartoum north cities; also it has seven localities including Omdurman, Khartoum, Khartoum north, Sharq an-Nil, Jabal Awliya, Om badda and Karari. It surrounded by River Nile State in the north-east and Northern State in the north-west, in the east and southeast by states of Kassala, Gadarif, Gezira and White Nile State and in the west by North Kordofan. The weather in Khartoum State is rainy in autumn and winter and dry in winter. Average rainfall reaches 100-200mm in north eastern areas and 200-300mm in the northwestern areas. The temperature in dry summer (April – June) ranges from 25 to 40°C, and 20-35°C in wet summer (July – October) while it declines gradually from 25°C to 15°C in winter (November – March).

#### 3.2. Study Design

A cross-sectional survey was conducted to obtain data from a simple random sample consisting of seventy-five sheep owners and shepherds from four local sheep markets (*Kandahar, Alshabie, Jebel Awalia* and *Aldroshab*) in Khartoum State. The sample size was based on equation of (Thompson, 1987), A fitted structured questionnaire were filled in single interviewed for each sheep owner, each interview was lasted about 15 minutes, it focuses on personal household data, herd composition, rearing systems and flock feeding, flock management including practiced productive and traits and production constrains.



### **3.3. Statistical Analysis**

Collected data was categorized and summarized in Microsoft<sup>®</sup> Excel sheet then analyzed using SPSS for Windows program, Version 25 and the results were presented in form of descriptive statistics tables, graphs as multiple responses. Also, Chi-square test was used at  $\leq 0.05$  level of significant.

## Chapter Four

### 4. Results and Discussion

#### 4.1. Studied Market and Locations

The study was conducted in four markets showed that 66.7% of shepherd were from Omdurman locality distributed in market 1 and 2 locates and 26.7% of them were from market three locates in Khartoum locality while 6.7% of sheep owners were from market three locates in Khartoum north.

**Table 4.1.No of interviewers in the study area**

	n	%
Omdurman	50	66.7
Khartoum	20	26.7
Khartoum north	5	6.7
Total	75	100.0

**Table 4.2 surveyed market in the study area**

Market	n	%
<i>Kandahar</i> Omdurman	20	26.7
<i>Alshabie</i> Omdurman	30	40.0
<i>Jebel Awalia</i> Khartoum	20	26.7
<i>Aldroshab</i> Khartoum north	5	6.7
Total	75	100.0

## 4.2. Personal Information of Sheep Owners:

The results of association between age groups and years of experience of sheep owners (table 3) showed that more than 61% sheep owners were above 35 years old and with more than 13 years of experience. Mainly sheep owners with experience above 13 years old comprise more than 73%, it seems to be that rearing sheep is a part of their life. These findings were in line with those of to Hamed *et al.*, (2017), Fatima *et al.*, (2019) and Ali *et al.*, (2020). Table (4) records that 60% sheep owners were either illiterate or had a basic or “Khalwa” education whereas 16% of them had higher educational level, the educational level could be due to less important of education to sheep owners.

**Table 4. 3 Association between age and years of experience of sheep owners**

Age (years)	Experience/year						Total	
	Less than 13		13 – 20		More than 20			
	n	%	n	%	n	%	n	%
Less than 35	10	56.6	7	36.8	2	10.5	19	25.3
35 – 45	9	20.0	33	73.3	3	6.7	45	60.0
More than 45	1	9.1	7	36.6	3	27.3	11	14.7
Total	20	26.7	47	62.6	8	10.7	75	100.0

Chi-square value=13.188, P. value=0.010

**Table 4.4 Educational level of the sheep owners**

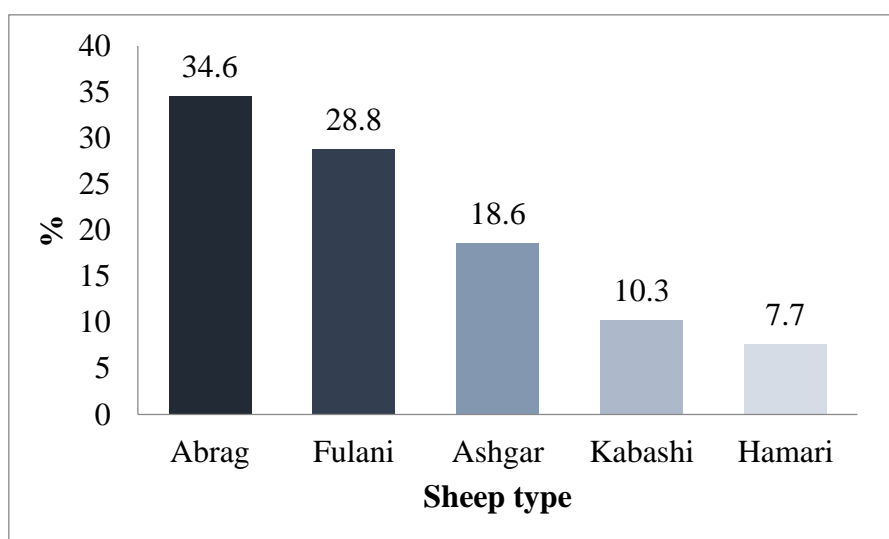
Level of education	n	%
Illiterate	1	1.3
Basic or Khalwa	44	58.7
Secondary	18	24.0
Graduate	12	16.0
Total	75	100.0

### 4.3. Herd formation and sheep subtypes in the study area:

The questionnaire survey revealed that the respondents reared mainly sheep in addition to other livestock species (table.5) particularly goat which ranked at the second level (45.3%). These could be attributed to similarity between sheep and goat and there were the most abundant in the studied markets. These findings are agreed to Ishag and Ahmed (2011), Hamed *et al.*, (2017) and Ali *et al.*, (2020). But slightly varied than those of Fatima *et al.*, (2019) due to differences in study area and markets. From figure 1. Abrag followed by Fulani sheep types were the most abundant sheep subtype in the study market while Ashgar subtype comes in the third rank.

**Table 4.5. Types of rearing livestock by interviewers**

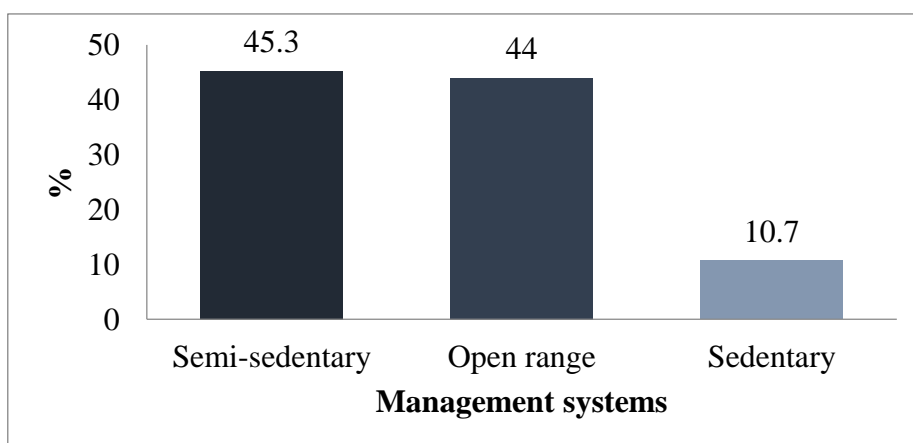
Herd	n	%	Together %
Sheep	75	64.1	100.0
Goat	41	35.0	54.7
Camel	1	0.9	1.3
Total	117	100.0	156



**Figure 4.1. Proportion of sheep type in the study area**

#### 4.4. Rearing systems and flock feeding:

Figure 3, showed that most sheep (89.3 %) comes to the studied markets were reared and bred under semi sedentary and open range systems whereas 10.7% of the sheep depend on sedentary system, these could be due to that sheep comes from different production areas and states and most of these sources depend on semi-sedentary and open range systems. Similar finding was found by El Hassan (1994); Osman *et al.*, (2015<sup>a</sup>); Elobied, (2015) and Fatima *et al.*, (2019). These results are parallel with that the interviewers depend basically on the natural range followed by different feedstuffs such as Sorghum hulls (*Semaima*), *Shara*, sorghum grain and groundnut cake on feeding their animals, (Table 4.6). These findings were agreed with those of Osman *et al.*, (2015<sup>b</sup>), Hamed *et al.*, (2017), Elobied, (2015),



**Figure 4.2. Practiced management systems by sheep owners**

**Table 4.6. Most used feedstuffs in the study area**

Feedstuffs	n	%	Together
Natural range	74	25.5	98.7
Sorghum hulls ( <i>Semaima</i> )	70	24.1	93.3
Shara (type of grasses fodder)	68	23.4	90.7
Sorghum grain ( <i>Feterita</i> )	45	15.5	60.0
Groundnut cake	33	11.4	44.0
Total	290	100.0	386.7

#### 4.5. Marketing of Sheep:

The results of studied sheep showed different physiological age group prices (table 7), the highest price recorded by ram *stallion* (37493 SDG) followed by more than one year ram (30840 SDG) while lam showed the lowest price (23307 SDG) among the physiological groups. Furthermore the sheep price (table 8) were increased in autumn (75%) and the price were decrease in summer (24.2%) this might be due to availability of good pasture and feed in Autumn. These results were agreed with those of Elrasheed *et al.*, (2010) who found the sheep prices affected by several factors including season.

**Table 4.7. Average prices of sheep at different physiological age**

Physiological age	Price (SDG)	
	Average	Min. – Max.
Lamb	23307	22000 – 25000
Yearling	26160	21000 – 30000
Ram	30840	22000 – 35000
Ewe	24392	22000–26000
Ram (stallion)	37493	34000 – 40000

One Sudanese pound (SDG)=0.0024 US dollar

**Table 4.8. Time of raise of animals' price**

	n	%	Together
Autumn	69	75.8	92.0
Summer	22	24.2	29.3
Total	91	100.0	121.3

#### 4.6. Most frequent diseases among adults and lambs as found by sheep owners

Table 9 shows that unspecific diarrhea comes at first rank of the most frequent diseases in adult sheep followed by bloat disorder. While, general weakness comes in the last rank. Similar results in table 10 found that unspecific diarrhea is more frequent (70.4%) in lambs followed by tick borne diseases (64.8%). These results were in accordance with those of Bale *et al.*, (1982), Aradaib and Abbas (1985), Brisibe *et al.*, (1996), Shehu *et al.*, (1999) and Maiga, (1992), who found several respiratory diseases and lameness.

**Table 4.9. Most frequent diseases in adult sheep**

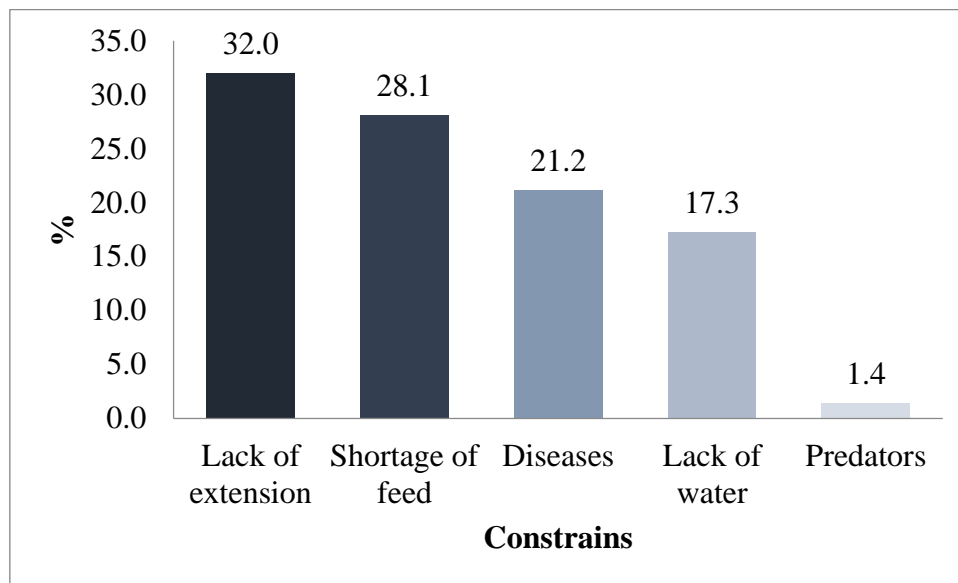
Disease	n	%	Together
Unspecific diarrhea	66	39.8%	89.2%
Bloat	33	19.9%	44.6%
Tick borne diseases	20	12.0%	27.0%
Respiratory symptoms	33	19.9%	44.6%
General weakness	14	8.4%	18.9%
Total	166	100	224.3

**Table 4.10. Most frequent diseases in lambs**

Disease	n	%	Together
Unspecific diarrhea	50	39.7%	70.4%
Tick borne diseases	46	36.5%	64.8%
Respiratory symptoms	30	23.8%	42.3%
Total	126	100.0%	177.5%

#### 4.7. Production constraints:

The questionnaire survey revealed that lack of extension, shortage of feed and diseases respectively were the most frequent among production constrains of sheep flowed by lack of water comes (Figure 4). These results were 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.



**Figure 4.3 Different types of constrains faced the sheep production in the study area**



## **Conclusion and recommendations**

This study concludes that:

- Sheep owners rearing their animals as a part of their life.
- Both open and semi-sedentary systems were the most adopted systems by sheep owners in the production areas.
- Lack of extension, shortage of feed, diseases were the main production constraints of sheep production in the study area.

The study recommended that:

- More attention and care efforts should give to sheep owners and their animals to improve sheep production conditions including range management, extension and veterinary services, diseases awareness.

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