Sudan University of Science and Technology

College of Graduate Studies

Causes and Prevalence of Phytobezoars in Sheep Reared on Natural Pasture in Kordofan

مسببات تكوين الكرات العشبية في الاغنام المرباة علي المراعي الطبيعية في كردفان

A thesis Submitted in Fulfillment for the Requirement of the Master's Degree in Animal Production

By

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College of Natural Resources and Environmental studies

University of Kordofan (2005)

Supervisor: Prof. Intisar Yousif Turki

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الاستهلال

بسم الله الرحمن الرحيم

قال تعالي :

وَالأَنْعَامَ خَلَقَهَا لَكُمْ فِيهَا دِفْءٌ وَمَنَافِعُ وَمِنْهَا تَأْكُلُون **(5)** وَلَكُمْ فِيهَا جَمَالٌ حِينَ تُرِيحُونَ وَحِينَ تَسْرَحُونَ **(6)** وَتَحْمِلُ أَثْقَالَكُمْ إِلَى بَلَدٍ لَّمْ تَكُونُواْ بَالِغِيهِ إِلاَّ بِشِقِّ الأَنفُسِ إِنّ رَبَّكُمْ لَرَؤُوفٌ رَّحِيمٌ **(7)** وَالْخَيْلَ وَالْبِغَالَ وَالْحَمِيرَ لِتَرْكَبُوهَا وَزِينَةً وَيَخْلُقُ مَا لاَ تَعْلَمُون **(8)**

صدق الله العظيم

سورة النحل

DEDICATION

To my mother's soul,

My fathers,

My brothers

And sisters,

all my family.

AKNOWLEDAGMENT

With a great touch of pleasure and gratitude, I would like first to thank my God for giving me health and ability to complete this research, also would like to thank my main Supervisor Prof. Intisar Yousif Turki for the valuable efforts, orientation persistence, and continuous support throughout this research.

I wish to express my sincere thank to Dr Jumaa Bram and Dr. Mohamed El hadi for their great efforts, advice, assistance and constrictive encouragement throughout this research.

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ABSTRACT

This study was carried out in Kordofan region, West Sudan during the period from 2012 to 2014. It aimed to identify the real causes of the herbal balls (phytobezoars) and find out the prevalence of sheep phytobezoariasis in the Greater Kordofan. Husbandry management of this condition was determined in a survey using a questionnaire distributed to breeders in El khuwie, Abu zabad, and El debebat. For chemical characteristics of phytobezoars representative samples of bezoars from slaughtered sheep at abattoirs, and sample from Tabar plant (*Blepharocepala Ipomoea*) that had shown to initiate formation and retention of this ball has been taken. The results of the laboratory analysis showed that the proteins content of phytobezoars and tabar were on an average of (8.73%, 10.38%), respectively. A detected ether extract signed (0.00%, 0.60%) for phytobezoars and tabar, respectively. The plant fiber content (cellulose, hemi cellulose, lignin and tannins) in phytobezoars were determined. The results showed that phytobezoars and tabar plant had higher contents of heteropolysaccharits as cellulose and hemi cellulose of (47.5, 29.11%), (28.6%, 12.16%) in both, respectively. the percentage of lignin was on an average of (28.6%, 14.34%), and tannin recorded values of (2.05%, 0.025%) in phytobezoars and tabar, respectively. After has been identified to bezoars as suspected of causing the most common foreign bodies (35.3%) of respondent confirmed presence of phytobezoars. 23% of breeders indicated this cause due to grazing the animals on special type of (al tabar) (*Merrimia emarginata*). Also 44.6% of respondents recorded the phytobezoars are lethal and caused the death of sheep. For husbandry management of phytobezoars the majority of breeders (81.8%) didn't have knowledge to treat with these cases, only 6.4% said that surgery is the only treatment of the case. For the preventive procedures, 96.3% of breeder answer they had no prevention methods to prevent their animals. The study predicted that the Tabar plant special type (*Merrimia emarginata*) was causing an incidence of phytobezoars in sheep in Kordofan. Results showed that phytobezoars and tabar plant higher fiber content of (cellulose, hemi cellulose, lignin and tannins), that may affect the formation of phtyobezoars. Finally certain recommendations were given in this aspect.

المستخلص

اجريت هذه الدراسة في اقليم كردفان, غرب السودان في الفترة مابين 2012 - 2014 وهدفت الي تحديد المسببات الحقيقية للكرات العشبية (الدرادم) ومعرفة مدي انتشارها وسط الاغنام في منطقة كردفان الكبري. ولتحديد اسباب حدوث وادارة هذه الحالة تم اجراء مسح باستخدام الاستبانة و تم توزيعها علي المربيين في ثلاثة مناطق الخوي، ابوزبد والدبيبات. ولمعرفة الخصائص الكيميائية للكرات العشبية اخذت عينات ممثلة من الكرات العشبية من الاغنام التي ذبحت في المسالخ بموقع الدراسة، وعينات من نباتات التبرالتي اشارت الدلائل في تتسببها بظهور الكرات العشبية والاحتفاظ بهذه الكرة علي هيئة جسم غريب في المجترات. اظهرت نتائج التحليل المعملي ان مكونات الكرات العشبية والتبر من البروتين في المتوسط (8.73% ، 8.37%) علي التوالي. ومحتواها من مستخلص الايثر حوالي (0.00% ، 0.60%) علي التوالي كما تم تحديد محتوي النبات والكرات العشبية من الالياف الخام. حيث اظهرت النتائج ان الكرات العشبية والتبر لها محتوي عالي من المواد الكربوهيدريتية غير الذائبة مثل السليلوز والهيمي سليلوزفي المتوسط (47.5% ، 46.56%) ، (28.6% ، 23.71%) علي التوالي. نسبة اللجنين في المتوسط (28.6 % ، 14.34%), و سجل التانين في المتوسط (2.05 % ، 0.025 %) في الكرات العشبية والتبرعلي التوالي. حسب نتائج المسح الميداني اكد (35.3%) من المربيين حالات حدوث الكرات العشبية في قطعانهم. 23% من المربين اشاروا الي ان هذه الحالات تحدث بسبب الرعي علي نوع خاص من نباتات التبر. كما ان 44.6% من المربين ذكروا ان الكرات قاتلة وتسببت في نفوق الاغنام. عن كيفية السيطرة ومعالجة حدوث حالات الكرات العشبية فان معظم المربين (81.8%) اكدوا ان ليس لديهم معرفة بكيفية علاج هذه الحالات ، فقط 6.4 % قالوا ان الجراحة هي العلاج الوحيد لهذه الحالات. ايضا بالنسبة لاجراءات الوقاية فان 96.3% قالوا لا توجد وقاية. توصلت الدراسة الي ان التبر وتحديدا اللفليف (*Merrimia emarginata*) يعتقد في انه المتسبب في حدوث الكرات العشبية في الاغنام, كما توصلت الدراسة الي ان محتويات الكرات العشبية ونبات التبر من الالياف(السيلوز والهيمي سليلوزواللجنين والتانين) عالية ويعزي لها تشكيل الكرات العشبية. ختاما قدمت توصيات محددة في هذا الصدد.

CHAPTER ONE

1. INTRODUCTION

1.1Back Ground

Sudan is the largest country with an area of 1.88 million square kilometers. It has a human population of 39.27 million people (Central Bureau Statistics - CBS - 2014). Sudan is considered one of the countries with the large livestock in Africa. Its climatic diversity has led to a diversity in livestock with camels in the Northern State , cattle in the Western and Southern States, while sheep is found all over the country, as well as a huge resources of fish and poultry (Ahmed, 2013). (Ministry of Animals Resources and Fishers -MARF - 2010) provided official estimates of the size of Sudan's livestock population currently are of 51.56-52.08 million sheep, 43.27- 43.44 million goats, 41.56-41.76 million cattle and 4.52-4.62 million camels. About 14% of the human populations are involved in livestock production activities on the rangelands (Ministry of Animals Resources and Fishers - MARF- 2005). Kordofan is the homeland for Sudanese Desert sheep that is accounted for 65% of the national herd of the species and the main export ecotype from the country (Jadalla, 2007). In Kordofan region the livestock studies showed that there were 15%, 10%, 21% and 36% of the cattle, sheep, goats and camels respectively and all traditional livestock types are found in Kordofan (Farah, 2006). In North Kordofan, it was estimated that 8 million heads of mostly Desert sheep, Hamari and Kabashi ecotypes were reared. They are well adapted to the harsh environment and often walk long distance search of water and food. Animal production in the State is mainly practiced under traditional extensive system, depending on natural rangeland (Range and Pasture Administration - RPA -

2005). The livestock contribution in the national economy is well recognized, the exported livestock were estimated at 3, 3 million heads sheep, and 3, 3 million heads, goats, and 2, 3 million heads, camels (M A R F, 2010). El hag *et al* (2012) defined the major problem of the rangeland as degradation including over loading and grazing lead to certain ecological disaster. In Sudan, farm animals suffer from serious constraints. The most important is the shortage of feedstuffs, particularly in the dry season. Because the most of Sudanese herds depend on range and pasture, so they will be affected by their conditions when it's poor and nutrients are not enough to cover maintenance and productive requirements of the animal that will decrease the total amount of production. Foreign bodies of plant and\or animal origin as (bezoars) has been reported to cause impaction of the digestive tracts of domestic and wild animals (Bath and Bergh, 1979; Jone and Hunt, 1983). Trichobezoars (Hairballs) are common in cats (Ryan and Wolfer, 1978) and young ruminants (Jubb *et al*, 1985). In young ruminants they result from a deficiency of natural food fibers in artificial diets in dairy claves resulting from persistent suckling of penmates. Those conditions caused hosts to lick themselves excessively and to swallow hair and other indigestible materials and in an attempt to compensate for the deficiency (Drawer, 1978). Although some authors (Ryan and Wolfer, 1978) doubt the pathological importance of bezoars, others (Bath and Bergh, 1979; Schneider and Hugo, 1980; Sharma et *al.*, 1983), indicated that they cause abomasal impaction manifested by anorexia and heavy mortality in young ruminants. In highlands of some African countries many lambs manifest anorexia and die without the cause being established (Njua *et al*, 1988). Degree of incidence cause and mode of formation of those phytobezoars were not yet fully investigated. Though much attention is paid to occurrence of other types of foreign bodies in ruminants that was reported to be a condition of great economic importance and causes severe loss of

production and high mortality rates (Jadalla and Mekki, 2012). In other parts of the tropics phytobezoars together with other foreign bodies are well known causes of losses in small ruminants (Radostitis *et al*, 2000). Phytobezoars in sheep have gained importance recently in Kordofan due to the fact that some plant species have shown to initiate formation and retention of these ball–shaped bodies in ruminants leading to mortality. Among these nutritional constraints was pointed out recently by producers, is the prevalence of phytobezoars that causes high mortality rate and serious losses. Toxic and harmful plants both replaced some plant at range due to over grazing .Recently it was also observed that the change of the flora of the range was associated with harmful cases, such as bloat, diarrhea and increases prevalence of phytozbezoars in small ruminant, which have been speared and prolonged.

Objectives:

- To determine the degree of incidence of phytobezoars in sheep raised on natural pasture in Kordofan.

- To investigate the plants suspected responsible for initiation of phytobezoars formation.

-To study the formation mechanisms and chemical composition of the bezoars.

- To study prevention measurement applied to avoid effects associated with phytobezoars

CHAPTER TWO

2. LITERATURE REVIEW

2.1 Livestock in Sudan

Livestock system plays an important role in the livelihoods in many rural communities in the Sudan. The desert sheep and their crosses make about 80 % of the sheep found in Sudan and mainly predominant north of 12º N(Devendra and Mcleroy, 1982). They are raised mainly under harsh dry land farming conditions for meat production (Khalafalla and Sulieman, 1992). The nutritional limitation, low nutritive value of the range, high ambient temperature, scarcity of feed and water are having great effect on the production of the sheep in semi arid area of Kordofan States as compared to that in temperate regions. The most critical period for grazing sheep in the semi desert zone of Sudan is from February to June, when the ambient temperature becomes hot and range grazing is scanty and depleted of nutrients. Shortage of feed in mating season is the main factor, that affect sheep production in the range land of Kordofan, taking into account that natural pasture by- products are poor in their quality and most of the range are exposed to over grazing, especially near the water recourses. Seasonal nutritional status and husbandry affect sheep production characteristics (El Hag 2011). Nomadic sheep flocks spend the dry season near watering yards. During winter months, when ambient temperature is mild and the range contains some green fodder, herds can extend the watering intervals from 10 to15 days. After winter grazing when climatic conditions becomes harsh, the watering interval is reduced between 3 to 5 days (Mukhtar 1985). Livestock are particularly important for increasing the resilience of vulnerable, poor

people, who are subject to climatic, market and disease shocks, through diversifying risk and assets (Krisna, 2004; Freeman *et al*, 2008). There are many ways in which climate change may affect the livelihood, food security and health of vulnerable people through its effects on livestock and livestock systems, such as changes in water and feed availability, changes in biodiversity and animal health (Thorntan *et al*, 2007, 2009).

2.2 Sheep in the world

In the past sheep were mainlined in the tropic region of Africa and Asia, mainly for production of meat. Subsidiary function was the production of wool, hair, milk and manure. Archeological evidences suggested that they first brought in Africa possibly since 7000 years ago. It is likely that migration from Western Asia, the same people who interdicted Madame cattle mentioned that sheep were domesticated same as a goats and before crop agriculture had fully developed (F.A.O, 1994). World sheep population was estimated 1138.4 million heads. Domestic sheep vary in size shape of the body, nature of coat hair cover, productive ability, reproduction capacity, adaptability to different environmental conditions, and size and shape of product harvested.(F.A.O, 1994).

2 .3 Sheep in Africa

There are two different groups of breeds in Africa, which are the tailed hairy sheep, thin tailed, course wooled, and sheep of course. Not all indigenous breeds can be categorized as belonging to one of these four groups due to environmental differences and enter breeding. Africa sheep population was estimated at about 206 million heads. (F. A .O, 1994).

2.4 Sheep in Sudan

Sudanese sheep are divided into five main groups:

Desert sheep, Western Africa sheep, Nilotic sheep, dry tropics areas sheep and dwarf sheep.

2.4.1 Desert sheep:

The important breed and represent more than 65% of Sudanese sheep population. It has abundance and good meat, wider spread in northern latitudes, line 12 degree north untill latitudes line 18 degree north. It exists around the Nile basin and eastern until Ethiopian boarder and western through the Kordofan and Darfur States untill Western Sudanese borders. Medium weight about 40.6 kg. It is traits different in color according to areas it lived in and usually defined as tribe's names, which live with them and include:

2.4.1.1 Kababich sheep:

The important types of sudanese sheep for export and local consumption, are reared by Kababich tribe's in addition to Elquahla, Elhoawir, ELhamr, Jawamah, Dar Hamid, Elbideria, Buny Carar and ELHassaniya. The desert sheep has big size and long legs, and there is no horns and covered by red brown color, and has best meat ,also a good milk producer, it exists and lives in desert areas from Eastern Nile untill Northern Chad boarder, North Kosti, Neala Rail Way(Elkhawad, 2011).

2.4.1.2 Lining sheep:

Sheep lining or Elchukria desert sheep is bigger in size has humongous color from light brown to dark brown, spread in El butane area and most of them are found in Western part of Gazira. It spreads near the exports ports (Mcleroy, 1961).

2.4.1.3 Elwatish sheep:

Medium sized, and there are no any horns in gens, stand strong as deer, main color is white. Others with bigger size, covered by several colors white, red and mixed. Spread Eastern and Western from Blue Nile Bank in the area extended Southern Gazira (Elkhawad, 2011).

2.4.1.4 Gazira sheep:

Inter fere with desert sheep and spread in eastern Blue Nile and plains lining and desert Sheep Western White Nile, there is special type prevails in Eastern Gazira defined as Eldabasi or Elabraq, also there is another type in Western ElGazira defined as Elashgar. Eldabasi spreads in Eastern Elgazira near Butana plain in area extended from Atbra River to Kassla and Alhlaween area. Dabasi sheep are covered by white color, which coveres all body even black points in back and neck and legs and there is no horns. Dabasi sheep is considerd as good to produce meat, also to have ability for increasing quality production by fattening in early age but the Elashgar sheep spreads in Western Elgazira, raised by Elshukreia tribe in the area between Atbra River and River Nile, covered by bond color, and there is no horns (Mcleroy, 1961).

2.4.1.5 Medob Sheep:

Spreads in El Medob volcanic hill in North Darfur, raised by El Medob tribe. This sheep is bigger and covered by scale of wool beside hair, on a result of living in El Medob colder hill, it has bigger horns and long tail, covered by grey color (Elkhawad, 2011).

2.4.1.6 Baja Sheep:

Spread in the east region on Red Sea shore and hills. Found in winter through rain season in Northern shore and in South area in summer, it has

medium size, no horns and its long tail covered by white color and black points on over head(Mcleroy, 1961).

2.4.1.7 Northern River Sheep for wool:

Spreads on the River Nile in extended region from Abuhamad until Halfa Valley passing to Dongla, raised by farmers with strong agricultural activities; this sheep has small size compared with desert sheep and belongs to wool sheep. There are no horns in two genuses and it has small tail, covered by black and white color (Elkhawad, 2011).

2.4.2 Western Africa Sheep

According to (Mcleroy, 1961) Western Africa sheep are divided into two types: Zaghawa, and the Fulani or Falati

2.4.2.1 Zaghawa sheep:

Involves Western and Middle Darfur and Northern Sudan, represents 1% of the total sheep, spreading in Western Kordofan until the Western River Nile shore valley, raised by El zagawa tribes in Northern Darfur, this sheep has medium size, about 29-36kg. It has long tail covered by black color in all parts of the body, even head and tail.

2.4.2.2 Fulani sheep:

Spreads in Western Southern Sudan and around El Fasheir in Darfur until Arab Sea south, and moving interferes with neighboring countries. It has low percentage less than 1%, compared with total numbers, medium size about 27-36kg, long legs, horns, and covered by white color at end body and another color at chest, famous as resisting diseases and it has ability to thirsty and moving to far distance (Elkhawad, 2011).

2.4.3 Nilotic sheep:

Represents 12% from Sudanese sheep population, spread in southern area in swamps and Mangla, also found in Nuba Mountains and Engasna South Blue Nile. This sheep has more meat and unsteady small horns, covered by White color and white black points. It produces few milk, weight between 23-24kg, named as Nile tribes such as Shoulk, Denka, El Noueer and Bareia (Mcleroy, 1961).

2.4.4 Sheep of dry tropic areas:

Defined as tabosa sheep, spreads in South eastern Sudan in semi- dry areas in East Equatorial, North latitude 4 ° Northern, and longitude 24 degrees Eastern, it has good meat and bigger horns , different from other Sudanese strains in ability instead of long tail, and it has fat in different parts of body, it has black part in front of neck and chest and white color back, represents 1% of sheep population, its weigh 27-36 kg (Elkhawad, 2011).

2.4.5 Dwarf sheep:

Involves the Nuba Mountains sheep in South Kordofan and Engasna Mountains in South Blue Nile, This sheep has smooth hair, and raised for meat production (Mcleroy, 1961).

2.4.6 Sheep Hybrid

According to (Elkhawad, 2011) this a mixture of different types of sheep, are:

2.4.6.1 Desert and nilotic hybrid.

Known as Baggar and Elfung sheep in the border areas between north and south, and represents about 18% of the total Sudanese sheep; its weight between 23-24 kg, and there are horns in Males.

2.4.6.2 Hybrid Desert and Zaghawa

This hybrid exists in border areas south west Sudan, spreads in El medob area.

2.4.6.3 Hybrid Nilotic and Taposa

Represents 1% of Sudanese sheep population, and named El Murly sheep. It has small size and weight about 36kg, it has horns, exists in South Sudan border areas, in South east equatorials, and it has good production.

2.5 Animal production systems in Sudan

2.5.1 According to (Ministry of Finance and National Economy - M F N E - 1997), the major production system may be described as: follows

2.5.1.1 Nomadic: in this system livestock, mainly camels and sheep, with some goats, are raised entirely on natural rangelands. Households move with their animals and have no permanent base on which to grow crops. They spend the rainy season in the northern, semi-desert zone and during the dry season, move further south into the savannah. Income is derived from the sale of animals, meat and milk in the form of white cheese.

2.5.1.2 Transhumant: the transhumant agropastoral system, households depend mainly on livestock, mostly cattle, with some sheep and goats,

although there is some cropping. In western Sudan, households migrate north during the rainy season and return to the savannah during the dry season. In the central and eastern states, migration is towards the Nile during the rainy season and back during the dry season.

2.5.1.3 Sedentary: in this system exists where there is rain fed, arable farming in settled villages. Some livestock, mainly small ruminants, are kept, but the animals are less important than the crops. Sorghum, sesame and cotton are grown on clay soils, and millet and groundnuts on sandy soils.

2.5.1.4 Migratory agro pastoral it found in southern Sudan, where livestock are raised in traditional rain fed agricultural systems in settled villages. Livestock are moved away from the Nile in the period of flooding and back when the floods recede, other system is sedentary irrigated crop–livestock system the permanently settled farmers in the irrigated areas of central Sudan grow cotton, sorghum, groundnuts and wheat, and also raise livestock, especially small ruminants. Livestock, although less important than crops, are a supplementary source of income, which is used to hire labour for agricultural work before the harvest. Productivity is low and animals depend heavily on crop residues, industrial by-products and the grazing of limited areas of fallow and the sides of canals. Intensive cow's milk production is becoming more common within the large irrigation schemes, and these areas are seen as promising for future expansion of livestock production.

2.5.1.5 Other systems: include ranching, feedlot operations and peri-urban backyard livestock production. Ranching is a recent trend in Sudan. Animals

are raised for meat on natural rangelands in western Sudan in Kordofan and Darfur, and in Butana in Kassala State. Poor range management within the ranch is, however, a major constraint. Feedlots have existed for over 30 years. Animals, mainly beef cattle, are brought on the hoof from western Sudan and fattened in Khartoum State on sorghum grain, oilseed cakes and roughages, with gains of up to 1 kg/day in cattle and 0.35 kg in sheep. Near and within urban areas, goats and poultry fed on household waste are kept for domestic supply.

2.5.2 Constraints on production

In spite of the great potential of livestock and Sudan's self-sufficiency in meat and other livestock products, the following important constraints on production may be given as follows according to Fadlalla (1987):

1- Overgrazing in some areas, particularly around settlements, while vast areas are under grazed because of lack of water for the animals.

2- The great distances that animals often have to walk from water points to graze estimated that walking required 30% of the daily energy intake of lactating sheep during the dry season.

3- Expansion of agriculture, particularly mechanized farming, into traditional grazing land, which has led to reduction in grazing areas and in many instances to the blocking of traditional migration routes and water points, causing conflicts between transhumant and settled farmers.

4- Seasonal nutritional deficiencies.

5- Prevalence of diseases, particularly tick-borne diseases, and parasites, leading to early culling of cattle.

6- Poor veterinary services.

7- Poor husbandry.

8- Inefficient utilization of crop residues, including poor integration of livestock in the rotation of acacia (A. Senegal) and arable crops.

9- Lack of processing of feeds and export of by-products.

10- Difficulty of marketing and processing milk from 90% of the milking animals in nomadic and traditional systems, far from the centre's of consumption.

11- Lack of infrastructure such as research, extension, roads, education, health services and livestock markets.

2.6 Sheep Production Systems in Sudan

Sheep are predominately, about 90%, in the hands of traditional producers who mainly depend on natural pasture to raise their animals, in doing so; they convert marginal and unused land for agricultural production into sheep production, despite the expected low cost of the traditional method of sheep production, sheep prices are relatively high compared with international sheep prices, and in addition, prices of Sudanese sheep are constantly fluctuating between seasons and within the year, this could be attributed to remoteness of production areas from consumption centers (Faki *et al*,1991).

Poor integration of traditional sheep producers in the market due to their traditions, beliefs and presence of large numbers of middlemen. (Khalil ,1995). Numerous and high taxes and levies are imposed by different governmental institutions. Knowledge of desert sheep production and marketing is of paramount importance in providing policy makers with the necessary information to formulate the appropriate policies that will improve this sector. (Elrasheed *et al*, 2008*).*

2.7 Kordofan region:

Kordofan is a former province of central Sudan; in 1994 it was divided into three new federal states: North Kordufan, South Kordufan, and West Kordufan, in august 2005, West Kordufan State was abolished and its territory divided between North and South Kordufan States, as part of the implementation of the comprehensive peace agreement between the Government of Sudan and the Sudan people's liberation movement. Kordufan covers an area of about 376,145 km² (146,932 miles²), with an estimated population in 2000 of 3.6 million (3 million in 1983). It is largely an undulating plain, with the Nuba Mountains in the southeast quarter, and during the rainy season from June to September, the area is fertile, but in the dry season, it is virtually deserted, the region's chief town is Al-obeid. Traditionally the area is known for production of gum arabic, other crops include groundnuts, cotton, and millet; the main tribal groups are Arab tribes, such as Dar Hamid, Kawahla, Hamar, Bedairiah, Joamaah, and Rekabeiah. In Northern Kurdufan there are large grazing areas used and inhabited since hundreds of years ago by Arabic-speaking, semi-nomadic Baggara andcamelraising Kababish, Nilotic tribes, Nuba, Shilluk and Din

ka, also inhabit parts of Kordufan, the Kordofanian languages are spoken by a small minority in Southern Kordufan and are unique to the region, as are the Kadu languages, but Arabic is the main and most widely spoken language in the greater Kordufan region(Wikipedia, 2014).

According to Farah, (2006) kordofan region has a wide range of climatic zones which range from north to south as follows:

a- Desert type, with rainfall below 100 mm.

b- Semi-desert, with rainfall varying between 100-225 mm.

c- Arid zone, with annual rainfall ranging from 225-400 mm.

d- Semi-arid zone, with annual rainfall 400-700 mm.

e- Dry wind zone, with annual rainfall ranging between 600-800 mm.

The mean annual rainfall in Kordofan ranges from 50-850 mm, with availability ranging from 18% in the north to 100% in the south; this corresponds to a total amount of rain water of some 150 $X10^6$ m^3/annum. This water falls in three months between July and September. The economy of Kordofan region is predominantly dependent on agricultural production; the leading form of agriculture is rain fed crop forming with the traditional livestock grazing practiced through nomadic systems, The livestock studies showed that there were 15%, 10%, 21% and 36% of the nation cattle, sheep, goats and camels respectively in kordofan region and all traditional livestock types are found in Kordofan, the total wood land area in Kordofan is estimated at 30.7 million feddans and the total area of the preserved forests is 483,876 feddans(Farah, 2006).

2.8 The nutritional constraints affecting the sheep production

Small ruminants are highly selective feeders as compared to cattle and ingest significantly larger amounts of plant materials that are selected irrespective of their quality (Preston and Leng, 1987; Roman *and Hiwot*, 2010). However, the ingestion of indigestible plant materials may occur during period of food scarcity or when certain plant species dominate rangelands (Igbokwe et *al*, 2003). In North Kordofan sheep are herded and left to graze and browse selecting their own feed from the available biomass as the production system is mainly extensive type. The areas available for grazing particularly in the case for animals reared in the rural areas are utilized communally leading to high stocking rates where number of animal units is always greater than the grazing land's carrying capacity (Range and Pasture Administration - R P A - 2002). Under certain conditions plastic and other non plant materials are ingested by ruminants. Reports from cattle and sheep reared within urban and sub-urban environments indicated that impaction of the rumen resulted from the accumulation of foreign bodies, such as plastic bags which causes interference with flow of ingest , leading to the distension of rumen and absence of defecation (Abdullahi *et al*, 1984; Igbokwe *et al*, 2003; Remi-Adewunmi *et al*, 2004). The presence of these foreign materials in the rumen and reticulum also hampers feed intake, digestion and the absorption of volatile fatty acids and consequently reduces the rate of animal fattening (Igbokwe et *al*, 2003). In some countries an estimated loss of 25 million USD in productivity and health associated with plastic impaction has been reported (Hailat *et al*, 1996).

2.9 Phytobezoars in animals

A phytobezoar is known as a fiber ball. They are accumulations of indigestible plant material in the digestive system of ruminants. These occur in areas where fibrous feeds make up a substantial part of the cows diet, initially these fibrous materials accumulate in the rumen, contractions of the rumen then cause these fibres to roll around and form a ball. The balls can be variable in size, from marble size to grapefruit, even football size (AlHindi, 2004). Phytobezoars are commonly seen in cattle grazing large amounts of fibrous weeds such as onion weed or nut grass. Onion weed mostly dominates pastures in the autumn following a dry summer, but obstruction due to phytobezoars occur most commonly in the following spring or summer. This is thought to be associated with lush feed and increased gut activity (Botha and Vorester, 2002). Degree of incidence cause and mode of formation of those phytobezoars were not fully investigated. Among nutritional constraints pointed out recently by producers is the prevalence of phytobezoars that causes high mortality rates and serious losses. Though the phytobezoars were recovered as the most common foreign bodies, other types of foreign bodies retrieved that included plastic, hair ball and bezoars of mixed materials but they were of limited amounts. The overall prevalence of phytobezoars was found to be 15.5 % (Jadalla and Mekki, 2012). The prevalence of ruminal foreign body impaction is also well documented in other parts of Africa (Igbokwe *et al*., 2003; Remi-Adewunmi *et al*, 2004). Phytobezoars were reported in South Africa (Bath *et al*, 1982), and in Syria (AlHindi, 2004).Lambs were the major age category among sheep diagnosed with phytobezoars than other age groups in the

sample. The weight, volume and density of the phytobezoars retrieved were affected by the site of their formation within the digestive system. The degree of incidence was also affected by sheep body condition score where emaciated and thin animals had higher % of phytobezoars than fat and obese sheep. This study indicated that the prevalence of phtytobezoars in sheep that were raised on rangelands was positively associated with high density and frequency of definite species of plants such as *Ipomaea kordofana, I. Merrimia emarginanata* and *I. blepharocephala, eriocarpus*. The likely reason for the incidence would be plant composition change that is brought about by overgrazing that resulted from removal of palatable species and that were replaced by less palatable and in some cases harmful to the animals dependent on it (Jadalla and Mekki 2012).

2.10Types of phytobezoars

According to Al Hindi (2004) Phytobezoars are divided to: Phytobezoars, Lactobezoar, Pharmacobezoars, Diospyrobezoar, Trichobezoar. In another study bezoars are further categorized into five subtypes that include phytobezoars, trichobezoars, lactobezoars, medicinal or pharmacobezoars, and concretions (Anderson and St-Jean, 2002; Kishan 2003; Ku, 1996). However, trichobezoars, phytobezoars, and amixture of both, are named phytotrichobezoars.

2.11 Animals susceptible to Bezoars

The formation of bezoars appears to be most prevalent in ruminants, particularly in small ones, horses (Mealey 1995; Cummings, 1997), cattle (Radostits *et al*, 2000), sheep, and goats (Bath, 1978; Bath *et al* 1992;

Oehme and Prier, 1986). Trichobezoars (Hairballs) are common in cats (Ryan and Wolfer, 1978), and young ruminants (Jubb *et al*, 1985). Gastrointestinal bezoars are prevalent phenomenon in ruminant and most occur in inefficient management conditions, abomasal bezoars are relatively common in young beef calves (Doustar *et al,* 2012*)*. Phytobezoars of varied origin have been reported in bullocks, small ruminants and wild animals, and these could be fatal. But reports on phytobezoars in buffaloes are few. The present communication places on record the fatal complications of phytobezoar in the rumen of a she-buffalo (Veeraiah *et al* 2008).

2.12 Causes and mode of formation of phytobezoars

Nowicki and Miller, (2003), stated that bezoars can be composed of a multitude of materials and can present in a wide variety of ways. Phytobezoars (plant fiber balls) of different shapes and composition including trichphytobezoars (mixed plant- hair balls), have also been reported (Jespen *et al, 1977*; Ryan and Wolfer, 1978).According to (Louw and Steenkamp, (1965) ; Banting (1972), phytobezoars in sheep result from ingesting certain grasses which have seeds that cling together to from balls, while Sigmund (1967) described their formation to poor quality fibrous feeds including certain plants and shrubs covered with fine hair . **(**Bath *et al,* 1992) reported that the ratio of fiber to liquid used was found to be optimal around 1: 7 and milling of material enhanced bezoar formation. Time and pH did not appear to significantly affect the formation of bezoars. Other factors were either standardized or not studied. In a small in vivo trial, 4 groups of one sheep and one goat each were fed 10% of either *C. ciliata, E. ericoides, G. polycephala* seeds and pappus hairs, or a mixture of all 3,

added to a basal diet of milled lucerne fed for up to 31 d, small phytobezoars were formed in the goats but not the sheep receiving *C. ciliata*, and *G. polycephala* material. It was concluded that phytobezoars could form in goats or sheep eating large quantities of mature flowers or seeds of several Karoo bushes**.**

2.13Toxic Principle

Mechanism of formation of bezoars occurs which plant hairs are apparently poorly digested by ruminal micro-organisms and accumulate in especially the abomasums. Here under the influence of abomasal movement, innumerable hairs conglomerate (possibly around a small milk clot as nucleus) and felt together firmly in packed, dense layers to form balls of various shapes and 10 to 150 mm in diameter. Up to 30 balls might be present in the abomasums (Chisholm *et al*., 1992). Syndromes associated with this incidence include intestinal hair balls originating from plants. Systems affected are gastro-intestinal system. Necropsy inculded emaciation, cachexia, fore-stomachs thin-walled, papillae atrophied, and contents watery, foul-smelling. Bezoars in abomasum are manifested in signs of rupture of abomasum or intestine may be seen (Botha and Vorester, 2002).

2.14 Symptoms and Diagnosis

Clinical Signs of phytobezoars in goats are more often affected than sheep and clinical signs and death occur in the age group 3 - 15 months. Slow progressive loss in condition ruminant stasis, distended abdomen (gas, hair balls) faeces - foul smelling and scanty are all sign of incidence of phytobezoars in small ruminants, reported by (Botha and Vorester, 2002).

The signs that indicate a phytobezoar obstruction can also be similar for other gut problems such as *(Left Displaced Abomasum* - LDA), *(Right Displaced Abomasum* – RDA), intestinal torsion, ketosis etc, so if you *a*re concerned about an animal showing signs of gut pain, lowered milk production, off food etc, a vet visit is strongly recommended. (Srivastava *et al*, 2010). The communication reports complications due to a phytobezoar obstructing the reticuloomasal orifice causing ruminitis, regurgitation, aspiration pneumonia and death in a she-buffalo. Examination in the she-buffalo, revealed mild respiratory distress, depression, normal rectal temperature and ruminal fluid was observed at both nostrils. Per rectal examination ruled out intestinal obstruction, hence exploratory rumenotomy was attempted (Veeraiah *et al* 2008). The phytobezoar was fatal as it has obstructed the reticuloomasal orifice leading to excessive ruminal contractions, regurgitation, aspiration pneumonia and death. These are often revealed at postmortem examination as reported by Sastry (1983). This study described the clinical and laboratorial findings of gastrointestinal obstruction by phytobezoar in cattle. Twenty-five cases were analyzed in which the animals received diets composed mainly of cactus forage (*Opuntia sp*), and scarce and low quality roughage. The disease showed acute and subacute evolutions, with state of apathy, dehydration, tachycardia, anorexia, colic, rumen and intestine hypomotility, with the last one being fulfilled with liquid. The feces were rare, there was just mucus in some and phytobezoar palpation was possible in intestinal segments of some animals. Ruminal fluid characteristics were altered. The hematology revealed hyperfibrinogenemia and leukocytosis by neutrophilia (Afonso *et al* 2008).

2.15 Plants that cause the incidence of phytobszoars

The prevalence of phtytobezoars in sheep that were raised on rangelands was positively associated with high density and frequency of definite species of forbs such as *Ipomaea kordofana, I. blepharocephala, Merrimia emarginanata* and *I. eriocarpus* (Jadalla and Mekki, 2012). The ingestion of scarlet pimpernel (*Lysimachia arvensis* L), also known as red chickweed, has been reported as a cause of death of cattle in Uruguay, and as the suspected cause of deaths of sheep in Australia. It has not previously been reported in association with deaths of cattle in Australia. Workers reported the clinical and pathological findings from four cattle in western Victoria that died with a nephrosis suspected to be secondary to intoxication with scarlet pimpernel(Mirza, *et al*, 2009).The clinical and pathological findings of intestinal obstruction caused by phytobezoars in cattle consuming *Stylosanthes sp*, on three farms in Mato Grosso, Brazil were described by Daniel *et al*, (2013). The morbidity varied from 3.3 to 15% and the mortality was 100%. The animals stayed on pastures with predominance of *Stylosanthes sp*. for at least 60 days. The overall clinical picture was apathy followed by episodes of diarrhea or reduced feces and separation from the herd. Individual clinical signs were abdominal colic characterized by anorexia, discomfort, gastrointestinal hypomotility, dehydration, increased abdominal size, sweating, vocalization, sternal or lateral recumbence with the head on the flank. The clinical course lasted from 2 to 7 days. At necropsy, duodenal or pyloric obstruction was caused by ovoid phytobezoars of 2-4cm diameter; in the area of obstruction friable intestinal tissue with intense swelling, congestion, edema, and reddish mucosa was found. The rumen, abomasum and duodenum proximal to the site of obstruction were

filled with greenish liquid, and absence of food contents was observed distally to the phytobezoars. Histologically, at the site of obstruction, the duodenum exhibited diffuse necrosis of the mucosal surface, thickening of the wall by submucosal edema, neutrophilic infiltration, and fibrin deposition, necrosis of smooth muscle fibers, and marked congestion or hemorrhage. Pasture with the predominance of *Stylosanthes sp* is a serious problem due to the possibility of phytobezoar formation, thus leading to intestinal obstruction and high mortality rates in cattle, In a series of in virtro experiments (n = 64) using the mature flowers or seeds and pappus hairs of Karoo bushes *Chrysocoma ciliata*, Dimorphotheca *cuneata, Eriocephalus ericoides, Gazania krebsiana* and *Gnidia polycephala,* small phytobezoars were formed from material of *E. ericoides, G. krebsiana* and *G. polycephala* either alone or in combinations(Daniel *et al*, (2013).

2.16 Problems associated with phytobezoars formation in mongastrics

The most common presenting sign is a sudden and severe decrease in milk production. Occasionally there may be an initial attack of abdominal pain, but this stage usually only lasts for a few hours and may not be seen. In the early stages the amount of faces is reduced and appears pasty. As the obstruction advances faces become more grey-yellow and foul smelling, the cow becomes more lethargic as dehydration progresses and occasionally we see a green discharge from the nose (Michelle et *al*, 2009).For instance (Bath *et al*, 1979; Schneider and Hugo, 1980; Sharma et *al.,* 1983) have indicated that they cause abomasal impaction manifested by anorexia. In Ethiopian, many lambs manifest anorexia (Njua *et al*, 1988).

2.17 Physical Properties and Chemical Composition of the Phytobezoars

The diameters of fibres from phytobezoars varied between 2 and 30 microns, with an average: 58% measuring less than 15 microns, 36% between 15 and 23 microns, and 6% greater than 23 microns. These diameters were very similar to those of the pappus hairs surrounding the seeds of the Karoo bushes *Chrysocoma ciliata, Eriocephalus ericoides* and *Gnidia polycephala* (means of 6.06 microns, 16.67 microns and 22.73 microns respectively). The microscopic structure and ultrastructure of these pappus hairs moreover closely resembled the fibres of bezoars but were quite distinct from that of hair or wool. Of particular interest was the presence of annular thickenings as well as terminal hooks on both bezoar fibres and pappus hairs, both of which structures are believed to be involved in the formation of bezoars. This close similarity between the fibres in bezoars and those of pappus hairs in the 3 plant species studied, leads to the conclusion that the bezoars consisted largely of pappus hairs of these and possibly other species. The chemical composition of bezoars found in goats and sheep, resembled that of pappus hairs and stems of the Karoo bushes *Eriocephalus ericoides* and *Gnidia polycephala* more closely than that of mohair. Ash, nitrogen, phosphorus and zinc concentrations in both bezoars and plant material were similar, but very different to that of mohair; however, the calcium, magnesium, potassium and manganese levels of bezoars were more similar to mohair than plant matter. This may have been due to a leaching effect(Chisholm *et al,* 1992). Phytobezoars consisted of plant materials, polythenes and mineral deposits. The phytobezoar consisted of 8.22%

moisture, 5.58% crude protein, 5.80% crude fiber and 80.40 % total ash on chemical analysis, and it measured 12 cm X 6 cm and weighed185 g. It consisted of plant materials, polythenes and mineral deposits (Veeraiah *et al* 2008).

2.18 Phytobezoars Treatment

Surgery is the only way to treat a phytobezoar obstruction, most animals that are still on their feet at the time of surgery will recover and many are back on their milk within 48 hours. The outlook is very poor for animals that are down and unable to rise. Early treatment has the best outcome (Rippolles *et al*, 2001). Other results were observed by (Doustar *et al,* 2012*)* who stated that surgical interference is routine and can be performed safely with reasonably good prognosis. As reported by (Michelle et *al*, 2009), the only good husbandry practices nutrition and environment can eliminate reproductive loses. Management practices and environment contribute to the presence and kind of foreign bodies present in the ruminal stomach. Again, field diagnosis of the presence of ruminal foreign bodies is naturally a difficult one except where exploratory surgery is involved. According to Botha and Vorster, (2002), purgatives are ineffective and balls are too firm to break manually hence surgery is considered cost effectiveness. Diagnosis is done through palpation of abdomen and slaughter before too much condition is lost. (Yaqub, *et al*, 2012) presented a case where an endoscopic evacuation of an esophageal bezoar was unsuccessful. They treated the bezoar through a nasogastric tube using a cocktail composed of pancreatic enzymes dissolved in Coca-Cola.

2.19 Prevention of incidence of phytobezoar

Botha and Vorster, (2002), reported that avoidance of exposure of lambs to only seradella pastures or camps with causative plants especially during periods when pappus hairs are prevalent could be apreventative measures against phytobezoars.

CHAPTER THREE

3. MATERIALS AND METHODS

3.1The study area

This study was conducted in greater Kordofan (North and South) to investage the cause of incidence of Bezoars and degree of phytobezoars in El Khuwei, Abuzabad and Aldebaibat. All areas are within Kordofan region which located between latitudes 9°:30- and 16°: 30- North and longitudes 24° and 32°: 25- East. The region consists of North and South states forming a total area of 380,000 Km^2 (90 million Faddan). Each of the two states existed independent of one another, while subscripting authority and jurisdiction of the federal government (Farah, 2006). These areas hold the most livestock population in Kordofan.

3.2 Field survey and sampling

The information data of this study was obtained from three areas and markets for sheep in Kordofan: El Khuwei, Abu Zabad and Aldebaibat. One hundred eighty seven 187 questionnaire were randomly distributed to respondents, who are selected among herders and livestock owners from each area of study. Thirty (30) samples of phytobezoars were collected randomly from locality of El Khuwei, Abuzabad and Gebeash for chemical characterization and plant classification. To assess the prevalence of incidence by phytobezoars among animals brought to abattoirs, an examination to diagnose the incidence of phytobezoars was done by palpation before slaughtering the animals.

3.2.1 Collection of phytobezoar samples

After the slaughter, and immediately after removal of the viscera, animal digestive organs were removed carefully to detect the phytobezoars and herbal balls located in digestive system. Samples of phytobezoars and herbal balls were collected from slaughterhouses and classified according to the plants and grasses that the animals ingested.

3.2.2 Questionnaire data

A questionnaire was designed which included: the prevalence of phytobezoars and causes of phytobezoatrs, husbandry management, methods of prevention, treatment of zone and personal characterizations.

3.3 Inventory and Classification of Plants causing phytobezoar.

To identify the species of plants that is believed causing the herbal balls (phytobezoars) , samples were collected covering the three study areas and then subjected to identification and classification, by experts from forests specialist at Ministry of Agriculture and Forestry in Al obeid.

3.4 Chemical analysis of phytobezoars.

Samples of phytobezoars were analyzed by using approximate method to determine the contents of crude protein, crude fiber, dry matter, ether extract, moisture, ash and tannin.

From different families of tabar two species (*Ipomoea cordofana , Merrimia emarginata*) were also analyzed and their physical structure was figured out and the chemical composition was also determined.

3.5 Methods of proximate analysis

According to Abdulrazak and Fujihara (1999), Standard methods used routinely in Animal Nutrition laboratory are described in this manual. The bulk of the manual focuses on the laboratory procedure in a simple step by step approach with more emphasis on methods used in evaluating feed resources

3.5.1 Moisture content

Sample is dried in an oven to obtain a constant weight .The loss in weight is the moisture. Moisture content may be determined in two stages; drying at 6o ^{0}C which yields air dry sample and drying at 105^{0}C overnight, or 135^{0}C for 2h, which yields a total dry sample. The procedure below describes determination of a total dry sample.

3.5.1.1 apparatus

Analytical balance, aluminum dishes, Oven, dessiecator, tongs.

3.5.1.1.1 Reagents: None

3.5.1.1.2 Procedure:

1. Place marked dishes in an oven set at 135^{0}C for 2h. Cool in adessicator (about 20 min) and record the weight (x).
2. Place about 2g of the sample (in duplicate) in the dishes and record the weight of the dish +sample (y).

3. Place the dishes containing samples in an oven set at 135^0C for 2h. Remove and cool in a Dissecator (about 20 min) and record the weight (z). Calculate loss in wt. as water.

Calculation:

Calculate Dry matter % as :(z-x) – (Y-X) x100/wt of sample.

3.5.2. Ash content

Burning sample in a muffle furnace set at 550C gives a total mineral content. As a result, the organic constituent such as protein carbohydrate and lipids disappear.

3.5.2.1 apparatus:

Analytical balance, muffle furnace, porcelain crucibles, oven, dissecator, tongs.

3.5.2.2 Reagents: None

3.5.2.3 Procedure:

1. Place marked porcelain crucibles in an oven set at 135^0C for 2h. Cool in a Dissector and record the weight (x).
2. Place about 2g of the sample (in duplicate) into the crucible and red the weight crucible and sample (Y).
3. Place the crucible with sample into a muffle furnace set at 550^0C for 3h.

4. Set the furnace temperature to 135^0C and let the crucible cool in this temperature, then transfer to Dissector and cool.
5. Weight the crucible immediately and record the weight (z).

Calculation:

Calculate the ash % as(Y-X)-(Z-X)*100/wt of sample.

3.5.3 Nitrogen content (crude protein)

Kjeldahl method is used to determine the total Nitrogen content and then the crude protein by multiplying with the factor 6.25. The sample is digested in H_2SO_4 using $CuSo_4$, as catalyst, converting N to NH_3 which is distilled and titrated. The method described is mainly for analysis of feeds.

3.5.3.1 Reagents:

40% Sodium hydroxide (dilute. 121 .1g of NaOH 6% Assay) to 1 litre of distilled water.

Zinc mossy.

Methyl red indicator (0.2% methyl red: 0.01% broom. cresol green. Ratio of 2:5.

Concentrated sulphuric acid (H_2SO_4).

4% Boric acid (H_3BO_3).

Catalyst k_2SO_4: $CuSO_4$ =9:1(mixture).

3.5.3.2 Apparatus:

Analytical balance, Kjeldahl flasks (500-800ml), Macro Kjeldahl digester and distiller, Measuring cylinder, Pipette, Burette, Washing bottles.

3.5.3.3 Procedure:

1. Weight about 1.2g of air dry sample into Kgeldahl flasks.

2. Add about 5g (2spatula) of $CuSO_4$ and wash down with some distilled water.

3. Carefully add 20 ml of H_2SO_4.

4. Place the flasks on digestion racks and heat. Swirl the flasks gently and continue heating for about 2h.

5. Cool and cautiously add distilled water.

6. Place 25ml of boric acid into Erlenmeyer flasks and add 3-4 drops o methyl red indicator.

7. Open the water tap to the cooling system and switch 0n the heaters of distillation apparatus.

8. Add 2-3pieces of zinc mossy granules followed by 70ml of NaOH into Kjeldahl flasks.

9. Immediately connect flasks to distillation apparatus, mix com. Pletely and distilled for about 20 minutes or until you collect about 100ml distillate. The distillate turns from red/pink to green.

10. Titrate the distillate with (1.1 Na, H_2SO4) turns from green to pink).

Calculation:

Calculate N% as: (titrate 1ml *acid lactor *0.0014*100/wt of sample Dm.

3.5.4 Neutral detergent fiber (NDF)

The total fiber in resources feeds determined using the neutral detergent precedent. The NDF includes cellulose, hemicelluloses and lignin as major component. A sample is boiled in NDS solution for 1 h and later ashing at 550C.

3.5.4.1 Reagents:

Neutral detergent solution (NDS)*, Acetone, Preparation of (NDS, 3 l of water , 13.68g of Disodium hydrogen phosphate, 20.43g Sodium tetraborate decahydrate, 55.83g of Ethy lennedinitrlo tetra acetic acid(EDTA). 2Na, 90g of sodium dodecylulphate, 30ml of 2-Ethoxyeihanol,.

Note: the ph of the solution should be 6.9-7.1. To reduce or increase ph, add Na_2 CO_3 or HCL respectively.

3.5.4.2 Apparatus:

Refluxing apparatus (heaters and cooling system), Filtering apparatus

Berzelius beakers-(600ml). Sintered glass crucibles (course porosity with capacity of about 50 ml)

3.5.4.3 Procedure:

1. Weight 1-2g air-dry sample (duplicate) ground to pass through an 1 imm mesh into a 600ml refluxing beaker.

2. Add 70ml NDS and place the beakers on hot refluxing apparatus and put the condenser in place.

3. Heat to boiling (5-10min) and adjust onset of boiling to about 60C and reflux for 1 h from onest of boiling.

4. Place previously tarred) on the filtering apparatus.

5. Swirl beakers to suspend the solids and fill the crucibles. Filter using low vacuums initially and increases when necessary.

6. Rinse sample in beaker into the crucible with minimum hot water (100^0C), and fill the crucibles twice with hot water and filter-again. Repeat twice with acetone.

7. Dry the crucibles at 135^0C for 2h. Cool in Dessicator and weight (Y).

8. Ash the residue in the crucible for 3h at 550^0C and weight (Z).

Calculation:

Calculate NDF% as(Y-Z)*100/wt of sample

3.5.5 Acid detergent fiber(ADF)

The acid detergent fiber (ADF) is a rapid method for determination of lignocelluloses in feed stuffs. This method is also apreparatory step for lignin determination (section 6.0). Subsequently hemicelluloses and

cellulose may be determined by difference between NDF and ADF: and ADF and ADL respectively.

3.5.5.1 Reagents:

Acid detergent solution (ADS)*, 72% sulphuric acid (H_2SO_4), Cetyl trimethylanmmonium bormide(CTAB), Acetone, Preparation of ADS, Measure 84ml of Conc. H_2SO_4 and add 29-16ml of H_2O. Then weight 60g of CTAB and add into prepared H_2SO_4, solution.

3.5.5.2 Apparatus:

Refluxing apparatus heaters and condensers, Berzelius beakers 600ml, Filtering giass crucibles. Coarse porosity with capacity of about 50ml.

3.5.5.3 Procedure:

1. Weight 1-2g of air dry sample in duplicate, ground to pass through Imm screen into a 600ml refluxing beaker.

2. Add 100ml of acid detergent solution.

3. Place on hot refluxing apparatus and put the condenser in place.

4. Heat to boiling (5-10min) and adjust to gently boiling. Reflux for 1 h at about 60C.

5. Place previously tarred crucible(X) on the filtering apparatus.

6. Swirl beaker to suspend solids and fill the crucible, use low vacuum initially, and gently increase when necessary.

7. Rinse sample into crucible with minimum hot water (100^0C).

8. Fill crucible twice with hot water and filter, and again filter dry twice with acetone.

9. Dry the crucible at 135^0C for 2h.

10. Cool in a Dessicator and weight. (Y).

Calculation:

Calculate ADF as :(Y-X)*100/wt of sample (DM).

Calculate Hemi cellulose % as: NDDF-ADF

3.5.6. Acid detergent lignin(ADL)

3.5.6.1 Procedure

This is a continuation of ADF analysis. After point continue as follows

1. To the sample add 73% H_2SO_4 and stir with glass rode to smooth paste.
2. Leave the past to stand for 4 h while stirring it hourly.
3. Rinse the glass rod with hot water, filter the contents and fill the crucible half way with hot water and filter as completely as possible with vacuum.
4. Dry the content at 135^0C for 2h (Y).
5. Ignite at 550^0C for 3h in a muffle furnace and cool in a Dessicator and record the weight (Z).

Calculation:

Calculate ADL% as: (Y-Z)*100/wt of sample (DM).

Calculate Cellulose % as: ADF-ADL

3.5.7 Total extractable phenolic, tannin extraction

Available tannins condensed tannins methods to determine the total extractable phenolic, tannins and condensed tannins are described. Extraction of tannins is by acetone. Tannins concentrations are determine indirectly by precipitation with (Polyvinypolypynolidone – PVPP). Calorimetric method is described in determination of condensed tannins.

3.5.7.1 Reagents

Acetone (70%): take 700ml acetone + 300ml distilled water and used it as solvent.

Standard tannic acid solution:

Dissolve 25mg tannic acid (TA) in 50ml of distilled water.

Folin Ciocalteu reagent(1N):

Dilute Folin reagent (2N) with an equal (V/V) amount of distilled water. Keep in refrigerator (at 4^0C). Should be golden in colour, if it turns olive Green. Do not use it.

Sodium carbonate (20%):

Dissolve 40g Na_2CO_3in 150ml distilled water and make it up to 200ml with distilled water.

Insoluble polyvinypolypyrroolidone (PVPP): Available from sigms (P6755)

3.5.7.2 Apparatus

Weighing balance, Glass test tubes (10012mm), Vortex, cuvettes

3.6 Statistical Analysis

Obtained will be analyzed SSPS**, (1999).**

CHAPTER FOUR

4.RESULTS AND DISCUSSION

4.1 Incidence of phytobezoars

The prevalence of incidence as showon in table (1) confirmed that 35.3% of breeders insured that their herds have been infected by phytobezoars throughout the sheep's life production. Similar results were observed by Jadalla (2012), who stated that the prevalence of phytobezoars was found 15.5 % in Sudan desert sheep in Kordofan. For instance Igbokwe *et al.*, *(*2003), reported a prevalence rate of 19.3% of foreign bodies in sheep in Nigeria. On the contrary, a much higher prevalence rate (97%) was reported in Nigeria in sheep and goats brought from urban areas for slaughter (Remi-Adewunmi *et al.*, 2004). Hailat *et al* (1996) recorded a prevalence rate of 8.9% in Jordan. Phytobezoars were reported to be 5.1% in sheep and goats in Syria (Hindi, 2004) and was mainly caused due to ingestion of plants that had higher portion of indigestible fibers.

Table (1) Incidence of phytobezoars in Kordofan

Incidence	Frequency	percent%
Yes	66	35.3
No	121	64.7
Total	187	100.0

4.2 Percentages of sheep (male/female) which suffers from phytobezoars in the herd

To study the appointed age that is suffering from Bezoars incidence is shown in table (2). The results confirmed that different ages of sheep were suffering from incidence of phytobezoars, 92.5% male, 96.8% female of lambs at the age less than one year had phytobezoars compared to 85.5% of sheep at one year and 65.7% of sheep at 2 years age. Similar results was stated by Jadalla, (2007) who noticed that breeders insisted that small ruminants especially at younger age suffered from the Bezoars disorder much than animals aged less than one year. Animals in this age group had more phytobezoars than the older ones because of their higher protein requirement for growth and their inclination for selection of forbs higher in protein and at the same time liable to cause phytobezoars such as *M. emarginata*. The herders stated that the symptoms of the incidence are clear and animals can easily be diagnosed for the disorder. Also Nowicki, *et al*. (2003); Botha and Vorster, (2002), stated that, herbal balls infect all ruminant cattle, camels, sheep, goats' horses and cats that grazing large amounts of fibrous weeds. It also spreads more among young animals

Table (2) Percentage of sheep suffers from phytobezoars in herd of Kordofan

Sex	age of sheep	percent %
Male	Less than one year	92.5
	One year	85.5
	2 year	65.7
Female	Less than one year	96.8
	One year	75.8
	2 year	60

4.3 The dominant plant species in natural Pastures in Kordofan

Table 13 showed that the dominant plants in natural pastures in Kordofan region such as *Blepharocepala Ipomoea*, *Blepharis lenariifolia and Merrimia emarginata*.. Also *Zornia glochidiata*, *Cassia tora* and other plants which are suspected to cause phytobezoars. Similar observation stated by (R P A, 2002), who observed that some leguminous herbs such as *Blepharis lenariifolia* and *Zornia glochidiata*, that were dominant in Kordofan rangelands were replaced by *Cassia tora, Ipomea species* and *Merrimia emarginanata*. It was also observed that the change of the flora of the rangelands in the area was associated with harmful cases such as bloat, diarrhea and increased prevalence of phytobezoars in small ruminants especially sheep. Another similar result on the prevalence of phtytobezoars in sheep that were raised on rangelands was positively associated with high density and frequency of definite species of forbs such as *Ipomaea kordofana, I. blepharocephala, Merrimia emarginanata* and *I. eriocarpus was stated by* (Jadalla, 2007).

Table (3) dominant plant species in Kordofan region.

Number	Local name	*Botanical name*
1.	Tabar	*Blepharocepala Ipomoea*
2.	Hantot	*Ipomoea spp*
3.	Huskneet	*Cenchrus biflorus*
4.	Usher	*Calotrophis procera*
5.	Banno	*Eragrostis aspera*
6.	Abossabh	*Dactyloctenium aegyptium*
7.	Al Dhafra	*Echinocloa colonum*
8.	Gaw	*Aristida pallid*
9.	Um Celini	*Zornia glochidiata*
10.	Aldereasa	*Tribulus terrestris*
11.	al humra	*Hyperhenia rufa*
12.	Sharaia	*Tragus perteronianus*
13.	Urgasi	*Chrozophora brochianna*
14.	Gadgad	*Geigeria alata*
15.	tamr al far	*Acanthus spp*
16.	abu agena	*Crotalaria microphylla*
17.	um fula	*Echinocloa frumentacea*
18.	abu furut	*Schoenefoldia gracils*
19.	Liflaf	*Merrimia emarginata*
20.	Naanaa	*Peristrophora bicalyculata*
21.	um shwka	*Argommon xnaxcicana*

Number	Local name	*Botanical name*
22	al rabaa	*Zalya pentandra*
23	Beead	*Commelinia subulata*
24	Sieda	*Cyprus roturdus*
25	Neada	*Sida cordofolia*
26	al begl	*Cynodon dactylon*
27	um cher	*Araghiaria obtusiflora*
28	abu baleela	*Rottboellia exaltata*
29	um banga	*Hyparrhenia bagirmica*
30	um himero	*Hymenocardia acida*
31	um lebeana	*Phyliantjus pentandrus*
32	semsum al gemal	*Sesamum alatum*
33	abu rakhees	*Andropogon gayanus*
34	Shaeer	*Monechma hespidum*
35	um herra	*Achyranthus muricata*
36	water melon	*Cucurmis melo*
37	Cadad	*Dichrostachys glomerata*
38	Adar	*Sorghum halepense*
39	Cawal	*Cassia tora*

Number	Local name	*Botanical name*
40	Mulukheia	*Corchorus olitorius*
41	um negagera	*Alycicarpus glumaceus*
42	al begal	*Blepharis linarifolia*
43	um sakina	*Vetiveria nigritna*
44	Garguob	*Oldenlandia herbacea*
45	Hersha	*Tephrosia sp*
46	abu malih	*Chloris prieurii*
47	um tefa	*Leucas marlinicensis*
48	um gogo	*Cassia nigricans*
49	Danbalb	*Schima ischaemoides*
50	Fresha	*Alysicarpus monilifer*
51	Garen	*Monsonia senegalensis*
52	Sureeb	*Sesbania sesban*
53	Aguwr	*Cucumis sativus*
54	danab al naga	*Ctenium elegans*
55	Creap	*Branghiaris brizautha*
56	Keter	*Acacia mellifera*
57	Haraz	*Acacia albida*
58	Dayara	*Abutilon angolensis*

4.3 Plants Suspected of Causing Incidence of Phytobezoars in Kordofan

List of plants suspected of causing incidence of phytobezoars was shown in table (4). The results showed that 23% of breeders recorded that the plant tabar *Blepharocepala Ipomoea, Merrimia emarginanata and Ipomaea kordofana* was responsible for causing caused the incidence of phytobezoars. Similar result was reported by Jadalla and Mekki (2012) indicated that, the prevalence of phtytobezoars in sheep raised on rangelands positively associated with high density and frequency of definite species of plants such as: *Ipomaea kordofana, Merrimia emarginanata* and *blepharocephala, eriocarpus*. For instance 3.2% of breeders believed that plants tabar and usher were causing the incidence, 1.6% of breeders insured just plant usher was a major cause of these cases, while 63.6% of breeders didn't know the reasons of formation of these phytobezoars. In another study described by Daniel *et al*, (2013) showed that the clinical and pathological findings of intestinal obstruction caused by phytobezoars in cattle consuming *Stylosanthes sp,* on three farms in Mato Grosso, Brazil.

Table (4) plants Suspected of causing phytobezoars

Plants	Frequency	%
Tabar	43	23.0
Usher	3	1.6
Hantoot	2	1.1
Abushareeta	3	1.6
Watermelon	2	1.1
other plants	1	.5
tabar and hantoot	1	.5
Unknown	119	63.6
Tabar and abushreeta	1	.5
Tabar and usher	6	3.2
Tabar , usher and water mellon	1	.5
Tabar ,abushreeta and hantoot	1	.5
Tabar and water melon	1	.5
Tabar and argasi	3	1.6
Total	187	100.0

Table (5) Classification of plant species suspected causing phytobezoars in sheep in kordofan.

local name	***Botanical name***
Tabar	*Ipomoea belepharocepela*
Alhantot	*Ipomoea Cordofana*
Liflaif	*Merrimia emarginata*
Ushar	*Ipomoea spp*
Aerksi	*Calotropis procera*
Water Melon	*Chrozophora brocchiana*
Abanno	*Cucumis melo*
Sorrel	*Citrullus colocynthis*
Heglig	*Balanites aegyptiaca*

4.4 Other non-plants causative agents of phytobezoars in sheep

The other causative agents of non-plant origin that believed to caused phytobezoars in sheep are given in table (6). 92.1% of breeders recorded they do not know other reasons causes phytobezoars. While 2.1% breeders believed that feeding animals on the plants mixed with the soil might be cause the incidence of phytobezoars. Similar Non plant reasons were stated by Abdullahi *et al*, (1984); Igbokwe *et al*, (2003); Remi-Adewunmi *et al*, (2004), who mentioned that, when certain plant species dominate rangelands, under certain conditions plastic and other non plant materials are ingested by ruminants. A large nylon rope and a cloth (rag) with sediments of sand were found in the rumen.

Table (6) Non - plants causative agents of phytobezoars in sheep

Reasons	Frequencies	%
Unknown	173	92.5
Crop residues	1	0.5
Drinking muddy water	2	1.1
City garbage	1	0.5
Air pollution	1	0.5
No salt	2	1.1
Mud	1	0.5
Anti biotic	1	0.5
Crop residues and mud	1	0.5
Total	187	100.0

4.5 The mortality in the herd caused by phytobezoars.

Table (7) shows the mortality in herd's caused by phytobezoars. About (44.9%) of breeders believed that phytobezoars were causing the death of sheep, while 46% don't know the cause of sheep's death. Similar result was reported by Jadalla and Mekki (2012), who stated that the phytobezoars causes severe loss of production and high mortality rates. That phytobezoars cause high mortality rates and serious losses were also reported by Radostitis *et al*, (2000). Moreover, (Preston and Leng, 1987; Roman and *Hiwot*, 2010), stated that Phytobezoars in sheep have assumed economic importance in Kordofan due to the fact that some plant species have shown to initiate formation and retention of these ball–shaped bodies in ruminants leading to mortality. Causes of high mortality were reported also by (Bath *et al*, 1979; Schneider and Hugo, 1980; Sharma et *al.*, 1983), who indicated that it cause abomasal impaction manifested by anorexia and heavy mortality in young ruminants. In Ethiopian highlands around Debra Berhan, many lambs manifest anorexia and die without the cause being established (Najua *et al*, 1988). Furthermore, in many traditional farming systems in Africa high lamb/kid losses occur and in most cases the aeitology has not been identified (Wiener *et al*.; 1983; Wilson *et al*., 1985). Same result about mortality was reported by Botha and Vorster, (2002), who stated that clinical signs of phytobezoars in goats are more often affected than sheep and clinical signs and death occur in the age group 3 - 15 months. Inappetance, slow progressive loss in condition ruminal stasis, distended abdomen (gas, hair balls) feces, foul smelling and scanty are all signs of incidence of phytobezoars in small ruminants. Similar result is a serious problem due to

the possibility of phytobezoar formation, thus leading to intestinal obstruction and high mortality rates in cattle, the morbidity varied from 3.3 to 15% and the mortality was 100% (Daniel *et al*, 2013). Similar result was reported by Sastry, (1983), who stated that the phytobezoar was fatal as it has obstructed the reticuloomasal orifice leading to excessive ruminal contractions, regurgitation, aspiration pneumonia and death. These are often revealed at postmortem examination.

Table (7) The mortality in the herd caused by phytobezoars

Mortality	Frequency	%
Yes	84	44.9
No	17	9.1
Unknown	86	46.0
Total	187	100.0

4.6 The effect of season on degree of phytobezoars incidence

Effect of season on the degree of phytobezoars incidence was shown in table (8). Results showed that (19.3%) of breeders stated that the higher prevalence rate of phytobezoars was observed in winter and wet season (17.6%) because abundance of grasses and plants on pastures are available, which it decreased in summer. This agrees with Botha and Vorster, (2002), who stated that, phytobezoars occur most commonly in the following spring or summer. Same result was reported by (Azizi *et al*, 2010), who mentioned that the higher prevalence of abomasal phytobezoariasis is in winter compared with other seasons and the higher prevalence of affected sheep in autumn compared with spring. This is consistent with the course of abomasal phytobezoar formation in autumn and winter (Nadaliyan, 2002; Oehme and Prier, 1986; Radostits *et al*, 2000).

Table (8) the effect of season on degree of phytobezoars incidence

Season	Frequency	%
Winter	36	19.3
Summer	7	3.7
Rainy season	33	17.6
All the year round	1	0.5
Unknown	106	56.7
Winter and summer	1	0.5
Summer and rainy season	3	1.6
Total	187	100.0

4.7 Treatment of phytobezoars by herders

Table (9) showed treatment ways of phytobezoars by herders.The result showed that 81.1% of breeders do not know how to treat cases of phytobezoars, while 6.4% of breeders stated that the surgery is the only solution to treat phytobezoars. The veterinarian locality of Ghibaish confirmed that existence of phytobezoars during the vaccination were (67 cases) after palpation. Uses of surgery treatment was stated by Rippolles *et al*, (2001),who confirmed surgery is the only way to treat a phytobezoar obstruction, most animals that are still on their feet at the time of surgery will recover and many are back on their milk within 48 hours. The outlook is very poor for animals that are down and unable to rise. Early treatment has the best outcome. The same results were observed by Doustar *et al*, (2012*)*, who stated that surgical treatment is routine and can be performed safely with reasonably good prognosis. Similarly was reported by Michelle *et al*, (2009), who stated that it is concluded that only good husbandry practices nutrition and environment can eliminate reproductive loses. Management practices and environment contribute to the presence and kind of foreign bodies present in the ruminal stomach. Again, field diagnosis of the presence of ruminal foreign bodies is naturally a difficult one except where exploratory surgery is involved.

Table (9) Treatment of phytobezoars

Treatment	Frequency	%
Antibiotics	15	8.0
Sulfa	4	2.1
Unknown	153	81.8
Surgery	12	6.4
Anthrax inoculator	1	0.5
PPR inoculator	2	1.1
Total	187	100.0

4.8 Traditional treatment of phytobezoars.

The traditional treatment of phytobezoars was shown in table (10). The result showed that 61.5 % of the breeders mentioned that they do not know a cure for phytobezoars, 33.2% of breeders confirmed that no treatment and o.5% of breeders mentioned that they used magi (sodium glutamate), oil and *Acacia nilotica* pods as a treatment for phytobezors and this method treated phytobezoars according to their answers.

Table (10) traditional treatment of the phytobezoars

Traditional treatment	Frequency	%
Magi with oil+ acacia nilotica pods	1	0.5
Drinking oil	1	0.5
Branding	1	0.5
Smoke of wood + hetch cook	1	0.5
Traditional heeler	3	1.6
No treatment	62	33.2
Unknown	115	61.5
Ointment with discharged diesel oil	3	1.6
Total	187	100.0

4.9 Prevention of phytobezoars

Table (11) showed that 96.3% of breeders mentioned that no method for prevention of phytobezoars had been used. However, a few of them think that grazing their animals at places free of plants causing phytobezoars, avoidance of drinking muddy water and the fowl pox vaccine may prevent their anima a diseases. Similar result was observed by Botha and Vorster, (2002), who reported that avoidance of exposure of lambs to only seradella pastures or camps with causative plants especially during periods when pappus hairs are prevalent could be preventative measure against phytobezoars.

Table (11) Methods for prevention of phytobezoars

Prevention	Frequency	percent%
No	180	96.3
Prevent grazing at places free of plants causing beazoars	3	1.6
Fowl pox vaccine	3	1.6
Avoidance of drinking muddy water	1	0.5
Total	187	100.0

4.10 Chemical Composition of the phytobezoars

Table (12) showed samples of phytobezoars taken for analysis, from Locality of El khuwi, Abuzabad and Ghebaish, in Kordofan**.** The result indicated that the percentage of ether extracts of 0.00% in all samples of phytobezoars**.** The percentages of the cellulose, hemicelluloses and lignin were of 47.06, 23.96 and 28.97%, respectively. This higher percentage of non digestive heteropolysaccharides may be the main causes of phytobezoars, since their fibrous materials would be accumulate in the rumen and rolling around forming the shape of balls (De Toledo *et al*, 2012). Also, Chisholm *et al*, (1992) stated that a phytobezoar is a type of bezoar, or trapped mass in the stomach, that consists of components of indigestible plant material, such as fibers, skins of seeds. Also the result showed that percentage of crude protein was on an average of 8.73%. Similar result was observed by (AlHindi, 2004), who stated that mainly caused due to ingestion of plants that had higher portion of indigestible fibers, and ash on an average 6.6%, these ratios in phytobezoars and plant (tabar) semi- convergent. Bath and Vorster, (2002), stated that, Phytobezoars are commonly seen in cattle grazing large amounts of fibrous weeds**.** Ash, nitrogen, phosphorus and zinc concentrations in both bezoars and plant material were similar (Chisholm *et al*, 1992). Similar results were reported by (Veeraiah *et al* 2008), who stated that the Phytobezoars consisted of plant materials, polythenes and mineral deposits, the phytobezoar consisted of 8.22% moisture, 5.58% crude protein, 5.80% crude fiber and 80.40 % total ash on chemical analysis. The percentage of tannin also was high on an average 2.05%.Similar result was stated by (Makkar *et al*., 1988; Mueller-Harvey and McAllan, 1992;

McAllister *et al*., 1994b; McSweeney *et al*, 2001) who confirmed that the tannins can react with microbial (both bacterial and fungal) enzymes, inhibiting their activity; similar numerous articles exist on the ability of tannins to reduce the digestibility of the diet. However Kumar and Singh, (1984), stated that tannins mainly exert this effect on proteins, but they also affect other feed components to different degrees. Other result about tannin showed that the main effect on proteins is based on their ability to form hydrogen bonds that are stable between pH 3.5 and 8 approximately. These complexes stable at rumen pH dissociate when the pH falls below 3.5 (such as in the abomasum, pH 2.5-3) or is greater than 8 (for example in the duodenum, pH 8), which explains much about the activity of tannins in the digestive tract (McLeod, 1974; Mangan, 1988; Hagerman *et al*., 1992; Mueller-Harvey and McAllen, 1992).

Table (12) Chemical Composition of phytobezoars

Region	Sample	DM%	C.P	E.E	C.F			Ash	TANIN
					C	H.C	lignin		
El khuwi	1	98.12	8.75	0.00	47.06	23.96	28.97	7.09	2.03
		98.10	8.73	0.00	47.03	23.99	28.97	7.05	2.01
	2	97.7	8.40	0.00	47.93	23.90	28.17	6.14	2.10
		97.5	8.35	0.00	47.90	23.91	28.19	6.12	2.08
	3	97.7	9.10	0.00	47.81	23.87	28.32	6.59	2.08
		97.6	9.07	0.00	47.77	23.88	28.35	6.54	2.06
Abuzabad	4	98.12	8.40	0.00	47.65	23.92	28.43	6.70	1.98
		98.09	8.38	0.00	47.70	23.90	28.40	6.66	1.99
	5	97.52	8.55	0.00	47.38	23.95	28.67	7.38	2.12
		97.4	8.52	0.00	47.33	23.97	28.70	7.34	2.10
	6	97.4	8.67	0.00	47.70	23.90	28.70	6.46	2.09
		97.4	8.60	0.00	47.65	23.92	28.67	6.41	2.06
Ghebaish	7	97.16	8.73	0.00	47.77	23.88	28.35	5.84	2.07
		97.10	8.70	0.00	47.81	23.87	28.32	5.81	2.04
	8	97.6	8.55	0.00	47.03	23.99	28.97	7.01	2.03
		97.5	8.49	0.00	47.06	23.96	28.97	7.00	2.06
	9	97.3	9.05	0.00	47.90	23.91	28.19	7.04	2.07
		97.2	9.01	0.00	47.93	23.90	28.17	7.02	2.05

4.11Chemical composition of the Tabar plants.

Representative samples collected from the areas of study from plant tabar species Elliflaif *(Merrimia emarginata*) (Plate1), and Alhantot (*Ipomoea cordofana*) (Plate 2), were analyzed by proximate analysis methods. Results were shown in table (13). Results showed that the percentage of protein on an average10.37%, ash represents 7.5%. Bath and Vorster, (2002), stated that, phytobezoars are commonly seen in cattle grazing large amounts of fibrous weeds**.** Ash, nitrogen, phosphorus and zinc concentrations in both bezoars and plant material were similar (Chisholm *et al,* 1992). For instance, Jadalla and Mekki (2012), stated that likely reason for the incidence might be plant composition change that is brought about by overgrazing, that resulted from removal of palatable species and were replaced by less palatable and in some cases harmful to the animals dependent on it. The percentages of ether extract on an average of 0.64%. The percentage of the cellulose, hemicelluloses and lignin were of 28.9%, 12.2% and 14.7% respectively. The percentage of tannin is 0.00% in *Ipomoea cordofana* and 0.04% in *Merrimia emarginata.* Similar effects of tannin by outhers whom reported that though tannins mainly exert their effects on proteins, they also have effects on carbohydrates, particularly hemicellulose, cellulose, starch and pectins (Barry and Manley, 1984; Chiquette *et al*., 1988; Leinmüller *et al*., 1991; Schofield *et al*., 2001). For a long time, the effect of tannins on the degradation of fiber was seen as a secondary anti-nutritional effect. However, several studies have shown that fiber degradation in the rumen can be drastically reduced in animals that consume tannin-rich feeds (Barry and McNabb, 1999; McSweeney *et al*., 2001; Hervás *et al*., 2003a). Other study about tannin was reported by (Spier *et al*, 1987) who stated that it is

important to point out that intoxications caused by tannins, which only occur when animals are obliged to eat tannin-rich feed because of the lack of alternative plant resources.

Table (13) Chemical composition of the Tabar plants

Plant	DM%	C.P%	E.E%	C.F%			ASH%	TANNIN %
				C	H .c	Lignin		
Ipomoea cordofana	95.92	10.50	0.64	41.86	13.96	12.98	7.90	0.00
	95.92	10.60	0.61	41.96	13.86	12.90	7.86	0.00
Merrimia emarginata	93.86	10.15	0.57	15.86	10.44	15.05	7.19	0.04
	93.80	10.23	0.63	16.26	10.36	15.07	7.23	0.04

4.12 The structure of the herd

4.12.1Sheep ecotypes of breeds in study area

Table (14) shows that the sheep ecotypes of breed in Kordofan region.The desert breed represented 45% the highest percentage compared with the rest of the breeds in Kordofan and the cross breed (Desert × Garage) recorded 33.2%, while 20.9% was for Garage type. This result convergence of what was given by Preston and leng (1987), who mentioned that, Kordofan is the homeland for Sudanese desert sheep that is accounted for 65% of the national herd of the species.

Table (14) Sheep ecotypes of breeds in study area.

Breeds	Frequency	%
Desert	86	45
Cross(desert and garage)	62	33.2
Garage	39	20.9
Total	187	100

4.12.2 Herders of the animals

Concerning the person responsible for animal herding, the study shows that the 52.9% of breeders tending their sheep themselves and 21.39 % depend on a family member in herding their sheep; this system decreases the problems facing the animals because they look carefully after their animals. While 20.32% herd shepherd the people responsible for grazing their sheep as shown in table (15).

Table (15) Herders of the animals

Person who Herding	Frequencies	Percent%
Hired shepherd	38	20.32
Family member	40	21.39
Owner	99	52.94
Family member and owner	3	1.60
Hired shepherd and family member	3	1.60
Hired shepherd and owner	4	2.14
Total	187	100.0

4 .12 .3 Source of animals and breeding systems

Table (16) showed that 31% of breeders reared their animals in the house, 29.9% of breeders their animals are inherited, whereas 11.8% of breeders their animals mixed between breed at home and inheritance. In this system sheep and other animals depend on pastures, and move long distance for in search of water and food. Similar result was observed by (RPA, 2002) that reported, in North Kordofan sheep are herded and left to graze and browse, selecting their own feed from the available biomass as the production system is mainly extensive type. The areas available for grazing particularly in the case for animals reared in the rural areas are utilized communally leading to high stocking rates where number of animal units is always greater than the grazing land's carrying capacity.

Table (16) Source of animals and breeding systems

Source animals	Frequency	%
Breed at home	58	31.0
From market	8	4.3
As wage	11	5.8
Inherited	56	29.9
Gift	3	1.6
At home and market	14	7.5
At home and inherited	22	11.8
Market and as wage	6	3.21
As wage and gift	3	1.6
Gift and market	6	3.2
Total	187	100.00

4-13Personal characteristics of the respondents:

Table (17) shows the age, Educational level and occupation of breeders. For the age factor 33.5% of breeders their ages were between 31 to 40 year and followed by 40 to 50 years old (21.9%). For the educational level 59.3 % of breeders are illiterate. This indicator and adversely affects the knowledge and the know to take care of sheep. For the occupation 81.3% of respondent are breeders, while just 1.3% are farmers.

Table (17) Personal characteristics of breeders.

Age	20 - 30	31 – 40	41 – 50	51 – 60	61 - 70	Over 70
%	13.8	33.5	21.9	14.9	8.5	6.9
Educational level	illiterate	khalwa	basic	secondary	university	
%	59.3	4.3	23	8.6	4.8	
Occupation	breeder	farmer	Merchant of animals	Breeder /merchant	employees	Breeder/farmer
%	81.3	1.3	1.1	5.9	6.9	3.2

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATION

5.1 Conclusions

This study aims to identify the real causes of the herbal balls (phytobezoars) and find out the prevalence of sheep phytobezoariasis in the Greater Kordofan, it also confirmed that the prevalence of incidence of phytobezoars is causing a real problem in Kordofan States.

Phytobezoars occurs increases mainly in autumn and winter because abundance of grasses and plants in the pasture are available.

The analyses results showed that the bezoars contains high level of undigested fiber which may influence the formation of this herbal ball and also indicated that tabar plant is the major suspected plants that cause incidence of phytobezoars, which is well known to the breeders, but they do not know to deal with it.

5-2 Recommendations

- Intensive campaigns are of vital importance among breeders to aware them about expected hazards in association with phytobezoars .

- Studies of the effect of the diseases caused by phytobezoars on parameters such as milk production, meat quality and others of economical value should be performed.

- More researches and studies about phytobezoars and the Tabar plant should be carried out.

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APPENDICES

Plate (1): *Merrimia emarginata* at growth stag

Plate (2): *Merrimia emarginata* at flowering stage

Plate (3): ***Ipomoea cordofana*** at growth stage

Plate (4): ***Ipomoea cordofana*** at flowering stage

5- Map of kordofan region

Questionnaire:

Number……Social case …….. Occupation……

Age……

State……..Region……. Breed of sheep…… Structure of the herd……..

Age	Male	Female
Less than year		
One year		
Two year		

Incidence of phytobezoars

Yes…….

No……..

If the answer is yes determine animals suffering from phytobezoars

Age	Male	Female
Less than year		
One year		
Two year		

Animals breeding systems……

Person responsible for animal herding:

1- Owner…….. 2- Family member…… 3. Hired shepherd…….

Types of plants in study area……...

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Types of plants suspected cause phytobezoars in sheep…….....

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……

……

Non- plants causative agents of phytobezoars

…….....

……

……

……

If incidence of phytobezoars causes mortality in sheep?

Yes……. No …….....

Incidence of phytobezoars more in:

Autumn……Winter……Summer…….

Treatment of phytobezoars……

……

Traditional treatment of phytobezoars……..

……

……

Prevention methods……..

……

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