بسم الله الرحمن الرحيم

EFFECT OF DIETARY LEVELS OF PELLETED GROUNDNUT HAUMS ON PERFORMANCE OF DESERT LAMBS

By

Abeer Saad Elnour Abdallteef Abdalla

B.Sc. (Honours) Animal Production
University of Al Neelain, 2006

Supervisor

Prof. Amir Mohamed Saleh

A dissertation submitted in partial Fulfillment of the requirements for the degree of M.Sc. in Nutrition Science

University of Khartoum
Faculty of Animal Production
Department of Animal Production

July, 2010

DEDICATION

TO MY DEAR MOTHER, AND TO MY DEAR FATHER,

WITHLOVE AND RESPECT

TO MY SISTERS AND BROTHERS

TO

MY RELATIVES

AND

FRIENDS

ABEER

ACKNOWLEDGEMENTS

First of all my thanks and praise are due to almighty Allah, the beneficent, the merciful for giving me the health and strength to accomplish this work.

Deep gratitude and indebtedness to my supervisor Professor Amir Mohammed Saleh, for keen interest, valuable advice, helpful and patient guidance during the course of this study.

Thanks are extended to my friends, especially to Dr. Omer Ahmed Abd Elmageed and generous help at any time.

Finally, Thanks to all members of Faculty of Animal Production, and warm thanks and appreciations to my family for their continuous support and encouragement.

LIST OF CONTENTS

LIST OF TABLES

ABSTRACT

Twelve entire male Sudan desert lambs ranging in age between 4-5 months and their live weight 14-18 Kg were used to study the effect of dietary levels of pelleted groundnut haulms on weight gain, feed intake, feed conversion efficiency and the cost of groundnut haulms as feed for ruminants.

They were divided into four groups. Each group was subdivided into three animals. Each lamb was fed separately. Varying levels of groundnut haulms was added to the ration. Four isocaloric diets were formulated.

Diet A(control) 0% groundnut haulms, diet B 20% groundnut haulms, diet C 14% groundnut haulms and diet D 7% groundnut haulms. All ingredients of the rations were mixed and made into the form of pellets in a factory in Khartoum. Data were collected on weekly feed intake, weight gain and feed conversion ratio.

The ingredients were mixed and fed adlibitum for 56 days. The results showed that the levels of groundnut haulms had significant ($P<0.05$) effect on the Performance of the experimental lambs. The final weight, average daily gain, daily feed intake and feed conversion ratio showed significant ($p<0.05$) differences among the dietary treatments.

The average daily gain was 264 g/day with a feed conversion ratio of 3.1 compared with the control (Ration A) of daily gain was 134 g/day with 5.8 feed conversion ratio.

Average daily gain of lambs and feed conversion ratio decreased as the level of groundnut haulms was decreased in the ration.

Ration B was the cheapest in cost and gave the best daily gain and feed conversion ratio.

خلاصة البحث

أُستخدم فى هذه الدراسة 12 حمل من ذكور الضأن الصحراوى التى تتـراوح أعمارها بين 4 و5 أشهر وأوزانها بين 14 و18 كجم. لمعرفة تأثير مستويات مختلفـة من مكعبات تبن الفول السودانى على الوزن المكتسب، الغذاء المتنـاول، كفـاءة تحويـل الغذاء وتكلفة تبن الفول السودانى كغذاء للمجترات.

قُسمت إلى 4 مجموعات من الذكور، وزعت كل مجموعة إلى ثلاثة حيوانـات وغذي كل حمل بمنفرده.

أُستخدمت مستويات مختلفة من تبن الفول السودانى فى العلائق التـى كونـت. العليقة الضابطة (0%)، العليقة B 20% تبن فول السودانى، العليقة C 14 % تبن فول سودانى والعليقة D 7% تبن فول سودانى.

خُلطت كل مكونات العلائق تماماً وصنعت فى شكل مكعبات بمصنع (الأعـلاف المركزى) بالخرطوم.

جمعت البيانات أُسبوعياً للغذاء المتناول, الوزن الحى المكتسب ومعـدل تحويـل الغذاء. تمت التغذية لمدة 8 أسابيع.

أظهرت النتائج أن مستويات تبن الفول السودانى ذات تـأثير معنـوى (مسـتوى المعنوية 5%) على أداء الحملان التجريبية. الوزن النهائى، متوسـط الـوزن المكتسـب اليومى، الغذاء المتناول ومعدل تحويل الغذاء، أظهرت إختلافات معنوية بين المعاملات.

متوسط الوزن المكتسب اليومى 264جرام/يوم وكفاءة تحولية 3.1، مقارنة بالوزن المكتسب اليومى للعليقة الضابطة (A) 134 جرام/يوم و كفاءة تحويلية 508.

متوسط الوزن اليومى المكتسب للحملان وكفاءة تحويل الغذاء تقل بانخفـاض مستوى تبن الفول السودانى فى العليقة.

العليقة B كانت أقل تكلفة وأعطت أفضل وزن يومى مكتسـب وكفـاءة تحويـل الغذاء.

CHAPTER ONE
INTRODUCTION

Livestock industry is of great importance to Sudanese economy as it is one of main sources of feed employment and foreign currency. Livestock population is estimated at 138965 million heads (Ministry of Animal Resources, 2007).

In Sudan the main sources of animal roughages for animal feeds are range natural pastures, irrigated fodders, Crop residues and agro-industrial byproducts. The total range area in Sudan is 279 million feddan the productively of this area is estimated at 78 million tons dry matter (DM) and constitutes about 87% of the animal feed resources (AOAD, 2001).

The agro industrial residues represent important sources of animal feeds in such developing countries as Sudan. In the developed countries they depend on the improved pastures and good quality feeds for feeding their animals.

In Sudan the decrease of the productivity of range lands and the limited forage production beside the increase of sorghum straw prices; all these factors increased the importance of byproducts for ruminant feeding (Abu Swar and Darag, 2002).

The Sudan depends on animal production, as one of the main pillars of its economy; particularly the country has a large number of animal resources. Therefore it is important to look for alternative cheap resources of animal feed; beside improvement of the existing feed resources such as crop residues and agro industrial byproducts. Ruminants have the ability to digest low cost feedstuff that is not

utilized by other livestock. Ruminants in Sudan are good users of agro-industrial by product such as sugar tops, bagass, molasses and Sugar industry in Sudan is very huge and producing a lot of agro-industrial by products.

The objective of this study is the uses of groundnut haulms in sheep rations, weight gain, feed intake and feed conversion efficiency in lambs fed different levels of groundnut haulms will be considered.

In addition the cost of groundnut haulms as feed for ruminant will be considered.

CHTPER TWO
LITERATURE REVIEW

2.1 Animal production in Sudan

Animal production in Sudan depends mainly on natural grazing because it is the cheapest way of raising animals. In addition natural grass lands can accommodate large number of animals. This is due to the wide areas reserved for this purpose.

Sudan has one of the largest livestock populations in Africa. Cattle, Sheep, goats and camels were estimated at 45 million heads in the mid 1970s (Watson *et al*.**,** 1997**)** and over 116 million two decades later (MOAAR, 1998). During the same period, the numbers of sheep have grown from 16 to more than 42 million heads with an estimated annual growth rate of 3.1%. However, the proportion of sheep in the Sudan's livestock population has remained constant at 36%.

Table (2.1): Estimations of Animals Numbers (1000/ head)

Year	Cattle	Sheep	Goats	Camels	Total
2002	39479	48136	41485	3342	132442
2003	39669	48440	42030	3503	133642
2004	39760	48910	42179	3724	134573
2005	40468	49797	42526	3908	136699
2006	40994	50390	42756	4078	138218
2007	41138	50651	42938	4238	138965

Source: Ministry of livestock and livestock Information Centre (2007).

2.2 Sudanese Sheep Breed and Types

The Sudanese sheep are descendants from two major breeds, Ovidonges which come from Southern Sudan or Nilotic and Oviplatre which come from the Northern Sudan Sheep. Both breeds are described as Asiatic horned species and classified as hairy thin tailed (Mohamed, 2008).

2.3 Type of sheep

Mohamed (1996) classified sheep of the Sudan into 5 groups. Desert, Nilotic, Zaghawa, Taposa and Fellata. These groups were designated as ecotypes

2.3.1 Ecotype Sudan desert sheep

The Sudan desert sheep constitute 80% of sheep population in Sudan (Mohamed, 2008). They provide the bulk of mutton in the Northern part of the country. The desert sheep is a large, long legged animal with hairy coat. Most of desert sheep are biscuit brown in colour (e.g. Butana sheep) with occasional black and white marking (e.g. Gezira sheep) Dubasi. Desert sheep, come from two sources:

1. Nomadic flock

In the semi desert and savannah zones (10-16N) we find Kababish and Butana sheep.

2. Village flocks

These are kept in the irrigated Gezira scheme grazing crops residues and some fodder crops.

Kababish tribal breeds of sheep are to be considered the prototype or model from which we discuss and compare all other

related tribal breeds. They include not only the sheep of the Kababish tribe proper, but also the animal in full or part of such Arab tribe, such as Hamar, Kawahla, Beni Garar, Hawawir, Bediriaya, Dar Hamid, Hassaniya and other.

They collectively occupy the area between the Nile and the upland of Darfur and roughly north of Kosti - Nyala railway line (Mc Leroy, 1961).

Meidob type of sheep are tribal breeds of sheep localized in the Meidob hills situated in northeastern Darfur. These are actually similar to ecotype in arid upland.

Beja tribal breed sheep are principally localized in Eastern Sudan i.e. the Red Sea coast. Butana tribal breeds (Shugar) are found in Butana plains. This area stretches from River Nile on south and Kasala, Gedaref railway line on the east Butana sheep have been called Shukriya tribal breeds, which are divided into eastern and western sections with a number of associated and sub-sections e.g. Shugar.

Gezira Dubasi and Watish are found in the south of Khartoum, between the White and Blue Niles as well as along the lower reaches of Dinder River. They are relatively pure bred animals.

2.3.2 Ecotype nilotic sheep

These are found in southern Sudan and are owned by the Nilotic tribes. They are characterized by very small twisted horns. They are white in colour, with brown dots throughout the skin with a mature weight of 8-10 Kg.

2.3.3 Ecotype Zaghawa sheep

There are hardy animals, resistant to climate changes, but relatively poor in productive traits. The ram may reach 36 Kg live weight. They are black in colour with white at the head, legs and tail end. They are characterized by having no pendulous penile sheath.

2.3.4 Ecotype Taposa sheep

These are owned by Taposa tribe in Equatoria region. Manson and Maule (1960) classified them with fat tailed sheep. They have short rough hair, short ears, white colour with black head, neck and may be Shoulders. They resemble black headed Persian sheep. Probably they were introduced to Sudan through Somalia.

2.3.5 Ecotype Fellata sheep

These belong to the West Africa types. They are found in North and South Darfur (Mohamed, 2008). They have long legs, long tail, short hair and many colours with dominating white colour at caudal region. The adult ram any reach 36 Kg body weight.

2.4 Fattening of lambs

Lamb is a meat animal. Fattening lambs has the following advantages.

- Lambs can adapt to a range of environments;
- There is a relatively small investment;
- The lambs offer a form of savings in case of emergency needs;
- Manure production;
- Protein supply.

2.4.1 Fattening by concentrated ration

Concentrated rations are suitable for fattening animals under the intensive system. Concentrate feeding has been studied by many researchers in Sudan.

The ingredients used in this rations are sorghum grain, wheat bran, oil seed cakes, oat, maize and molasses in different rations (Elkhidir and *et al*., 1988; El Amin *et al*., 1990).

Addition of concentrates at 2.5% DM of body weight increased the daily gain and feed conversion efficiency.

Concentrated rations have a good impact on intake of some hays such as wheat straw (Climp *et al*., 1988).

Supplementing wheat straw with concentrated rations increased wheat straw intake significantly ($P<0.05$) in both sheep and goats.

The concentrated rations ingredients that should receive greater attention are different oil seed cakes.

2.4.2 Groundnut cake

Groundnut cake is a residue remaining after oil is removed from oil seed. It is rich in protein and valuable foods for animal, contains approximate mainly 45-50% crude protein and quite deficient in lysine. It has been important on protein supplement peanut in Europe and Africa.

It has several advantages in feeding, as it increases the organic matter intake, organic matter digestibility, intake of crude fiber and intake of digestibility of nitrogen free extract (Bhatia and Pantayak, 1988).

2.4.3 Cereal grain

Maize, wheat grains and sorghum are the main source of concentrate rations. Sorghum grains are one of the essential cereal grains, which were fed for the livestock.

Sorghum is the main food in Africa and parts of India and China. There are different types of sorghum and, as they vary in grain size, typical analyses can be misleading when applied to individual samples. It generally contain rather more protein and less oil. Whole sorghum grains can be given to sheep and poultry but are usually ground for other animals (Mc Donald, 2002).

The feeding of processed grains to lambs increased the live weight gain and feed efficiency ratio compared to lambs fed on whole grains (Economides, 1990).

2.4.4 Wheat bran

Wheat bran is byproduct produced from wheat milling. It represents about 13% of the wheat grain. The wheat bran of 93.5% DM contains 116.83% CP, 7.91M/J/Kg metabolizable (ME) (Bulletin, 1981).

It is quite palatable and is well known for its ability to prevent constipation and water holding capacities. It has an amino acid balance, good source of water soluble vitamin except niacin (Cheeke, 2005).

Wheat bran should not be used in high quantities in the ration because rations containing 50% wheat bran cause a decrease in feed intake and increase in rumen lactate concentration (Varner and Wood, 1975).

2.4.5 Molasses

Molasses is a product of the sugar refining industry, functions primarily as an energy source and can be fed at levels up to 30% of the diet high mineral content. Molasses is often included in manufactured feed at level 2 to 5% to increase palatability. It reduces dustiness and fines and acts of pellet binder to improve pellet quality. It is suitable for use as liquid feeding for ruminants. In many developing countries, abundant supplies of molasses are available, at provides the major fermentable carbohydrates. These may be used as energy source in ruminant feeding practices, also in the production of ethanol and bakery yeast (Cheeke, 2005).

In addition to that it is used in fermentation of rumen and beer (Smagakki guoted by Tag Eldin, 2009).

Molasses contain 75% DM, 12.7MJ/kg ME and CP 4.1g/kgDM (Maff, 1975).

2.4.6 Concentrates to roughages proportion in fattening diets

The use of roughage in feeding usually depends on it^{s} nutritive value. Groundnut hay and Sorghum Bicolor (Abu 70) are used in suitable proportion with concentrated ration because of lower nutritive value. This fact was stated by (Khalafalla and Mohammed, 1988) who replaced sorghum grains with cotton gintrash and found that live weight gain of animals decreased.

2.4.7 Fattening lambs with roughages

Roughages of some sort are essential for fattening lambs. The roughage may consist of the legume hays, such as alfalfa, clover, soybean and straw such as oat.

Fattening ruminants with legumes such as Breseem (***Mediacgo sativa***) is of great value because it is available and has a high feeding value and economically suitable. Some studies indicated that Breseem (***Medicago sativa***) could satisfy animals nutrient requirement without causing an adverse effect (Abdel-Mutalib, 1977).

2.4.8 Sorghum straw

Straw mainly from cereals are of low nutritional value but are important foods for ruminants especially in developing countries it uses with supplement.

The sorghum byproduct is represented by sorghum straw, which is a part of sorghum plant remaining after removing the grain. It is either left in the field to be ploughed later in the soil or be grazed by animals. Sudan produces about 64% of all the amount of sorghum straw in the Arab world, but the high cost for transportation from collection areas increases its utilization cost as feed for animal (Abd El Rahman *et al.,* 1981).

2.4.9. Groundnut haulms

Legumes have a higher N content and therefore higher nutrient value than the cereal crops.

Groundnut haulms at harvest and after extraction of the oil are major source of nutrients for animals especially as supplements for lactating cow and animal fattening (Larbi *et al*., 1999). Alternatively, groundnut haulms could be ploughed in after groundnut harvesting,

Alternatively, groundnut haulms could be ploughed in after groundnut harvesting, reducing ammonia and erosion losses and

providing more potential for stabilization of organic residues within the soil matrix.

In addition, the sale of groundnut haulms is major source of household income (Williams *et al*., 1997).

Incorporation of groundnut residues led to increases in economic yield.

Haulms are of equal or higher value as a feed source for livestock during the long dry season.

2.5 Feeding of sheep

It is important to consider which feeds are to be given during fattening, because they consist of 70% of the production cost. The feed should consist of water and dry materials. Dry materials consist of organic and inorganic materials, including fodder and concentrates. Fodder can include green leaves, cut grass, legumes, etc., while concentrates can be made.

2.6 Voluntary feed intake

Feed intake is weight of food eaten by an animal or group of animal during a given period of time in which they have free access to food (Forbes, 1986).

Feed intake in ruminants fed a high energy diet is controlled metabolically, but in those fed on forages it is limited by the rate at which feed can be digested in the rumen. Intake related to metabolic body weight ($w^{.75}$).

Feed intake in ruminants fed in high energy diet is controlled metabolically (Mc Donald *et al*., 2002).

2.6.1 Animal factors

There are a number of feed back regulators such as rumen distention, protein, energy and behavioral aspect that influence voluntary feed intake. Ruminant can learn to identify particular feed and alter the intake on basis of the past experiences (Fisher, 2002).

2.6.2 Distention or fill feedback

Distention or fill is an intuitive feedback but it is not without some controversy, tension receptors are present in ruminant animals; however distention should not be considered separately from other possible feedbacks when predicting the impact on feed intake (Fisher, 2002).

Voluntary feed intake of roughages was limited by the capacity of the reticluo-rumen and fill-in effect of the food at the end of the meal when digestibility of food ranged between 50-70 %; over this range of digestibility a linear relationship was found between voluntary intake quality of roughages (Khalifa, 1971).

Physical capacity of reticulo-rumen is an important factor controlling feed intake in ruminants (Mc Donald *et al*., 1985).

2.6.3 Physical state of the animal

Ruminants would adjust voluntary feed intake in relation to physiological demand for energy if full gut or rumen load does limit consumption (Mc Donald *et al.*, 2002). Others relate increased feed intake in pregnant animal to fetal needs for nutrients and growth. However in late pregnancy the intake will be decreased due to the increased uterus size, resulting in little space left for rumen expansion.

In ruminants, blood concentration of volatile fatty acid (VFA) (blood metabolites) initiates neural activity to produce sensation of hunger, stimulating feed intake. The control of intake by effects of blood metabolites on the appetite center is known as chemostatic regulation of intake (Cheeke, 2005).

2.6.4 Type of feed

The Factors affecting feed intake are; nutritive value of a diet and physiological state of the animal. The nutritive value includes the energy and protein content and their relationship with blood metabolite (Preston *et al*., 1974).

2.6.5 Palatability

Palatability is the summation of the taste, olfactory and textural characteristics of feed stuff that determine its degree of acceptance.

The taste is major component of palatability; its responses are sweet, salt, bitter and acid. Factors influencing palatability are nutrient, fiber, or secondary components.

Soluble carbohydrates in plant are main nutrients involved. High soluble carbohydrates correlated with high leaf protein concentration (Cheeke, 2005). Palatability of is not a major determinant of intake in farm animals.

Voluntary feed intake by ruminant may be limited by the palatability of the diet, the time available for eating, the rumintating activity, type of production, the amount of digesta accumulated in the rumen, the rate of removal of diagesta from the rumen and the animal size (Gheradi and Black,1988).

2.6.6 Pelleting

Pelleting of feed is accomplished by forcing the mixture. It increases the bulk density of feed, which reduces the volume of forage and transportation space needed, and may increase feed intake. Pelleting prevent animals from sorting ingredient. They must consume the entire mixed feed. Many animals prefer pelleted feed over same mixture feed in mash form. Pelleting reduce dustiness, improving the feed's acceptability to animals (Cheeke, 2005).

The normal size of pellets is 3.9 mm though the maximum used pellets diameter is 6.25 to 9.4 mm, with cylindrical shape. Pellets should be hard and not crumbly (Sundstol *et al*., 1984).

Feeding pelleted forage to cattle and sheep increased feed intake, daily gain and feed conversion ratio (Beardsley, 1964).

2.6.7 Effect of sex on feed intake

The study effect of sex on feed intake, growth and nutrients digestibility done on in Blackhead sheep fed complete mash rations of crop residues, that sex had no effect on feed intake of any sheep (Aregheore, 1997).

The daily dry matter intake was similar between the entire lambs and their castrates (Eldow, 2001).

2.7 Growth rate

Growth is an important biological phenomenon involving interaction between hormonal, genetic, nutritional and metabolic factors. The partitioning of nutrients to different tissues varies during the growth of the animal. The efficiency of conversion of feed into lean meat varies, also with the stage of growth being higher in the young animal and lower in mature animal (Roche and Quirke, 1984).

2.7.1 Effect of sex on growth rate

The effect of sex on live weight growth is two fold. First there is a direct effect of sex on growth resulting presumably from genetic difference between males and females. Secondly there is an indirect effect on sex due to the influence of the sex hormones. Thus, most previous studies on cattle, sheep, goats and pig have conclusively shown that males grow faster than females.

The sex of lamb had a highly significant ($P<0.01$) effect on daily average weight gain. Male lambs were heavier ($P<0.01$) than female lambs, and they also grew faster than females (Macit, 2001).

The different growth rate for male and female of Sudan desert sheep fed on same ration composed of sesame cake, molasses and salt. Values were 106 g/day for females and 150 g/day for males (Ahmed and Pollot, 1978).

The growth rate of Sudan desert sheep ecotype watish was 148 g/day for male and 105 g/day for female respectively (Ahmed *et al*., 1988).

2.7.2 Effect of breed on growth rate

The average daily gain of Marino was 250 g/day which was less than the average daily gain of 200 g/day for Marino crossed with Romney Marsh 280 for Marino crossed with Ile-de France fattened from 20- 38 Kg live weight (Malik, 1974). In the Sudan the ecotype of the same breed showed different growth rates. Average daily gain for Sudan desert sheep ecotype Shugor was 191.0 ± 5.81 g/daily gain for ecotype watish was 160 ± 5.81 g/day (El Karim and Owen, 1987).

2.8 Feed conversion efficiency

Feed conversion efficiency is the amount of feed required by the animal to produce on unit of live weight. It is affected by many factors which include plane nutrition, breed, sex and live weight.

2.8.1 Live weight on F.C.R

Feed conversion efficiency is affected by the live weight of the animal through its effect on maintenance requirements and production needs. The heavier the animal the greater its maintenance requirements and lower feed conversion ratio (Morris, 2003).

2.8.2 Effect of Nutrition on Feed Conversion Efficiency

The feed conversion ratio of 5.4 for Gezira weaned lambs fed for 60 days on a ration composed of Dura grain 25% Dura grain, 2.5% cotton seed cake, 49% roughages (wheat bran and ***Medicago sativa*** hay) and 1% salt (Sulieman, 1970).

Different values of feed conversion efficiency for Sudan desert sheep 6.8, 9.3 and 6.1 when fed on the different rations namely 50% sorghum grain and 50% cotton seed cake, 50% sorghum grain, 50% Berseem and 25 Dura, 12.5 cotton seed cake and 62.5% Berseem respectively (Hassan and Mukktar, 1970). Productive trait in Sudanese desert sheep obtained feed conversion efficiency was in the range 4.88 to 5.16 for three treatments of flushing versus non-flushing (A llama, 1987). Feed conversion ratio values for Sudan desert lambs of 8.5, 7.6, 8.0 and 11.5 when fed on rations containing different levels of cotton gin trash 0%, 25%, 40% and 55%respectively (Kalafalla and Mohammed, 1988). FCR for Sudan desert sheep fed on rations containing different levels of blood meal 0.1% and 15% as 7.3, 5.8 and 6.5 respectively (Mansour *et al.*, 1988).

FCR of 6.71 and 5.76 for Sudan desert lambs when fed on rations containing cotton seed cakes or blood meal respectively (Ahmed and Sulieman, 1988).

Thus from all these researches reports variations in feeding resulted in different feed conversion values in same sheep breeds.

2.8.3 Effect of breed on F.C.R

Feed conversion ratio of Merino and Merino crossed with Marsh Ile-de France 6.3, 5.9 and 5.5 respectively, when fed on the same ration (Malik, 1974).

Sheep breed effect on FCR and found that cross breed had better FCR than pure breed, 8.3 FCR for pure breed and 3.7 FCR for cross breed. Sudan sheep (Shugor) had better FCR than watish (Makarechain *et al.*, 1978).

CHAPTER THREE
MATERIALS AND METHODS

3.1 Experimental Methods

Twelve entire male Sudan desert lambs ranging in age between 4-5 months and live weight between 14.3 to18.5 Kg were used in experiment. Animal were dewormed with bendazol and Ivermectin.

3.2 Experimental Period

Adaptation period lasted for two weeks. During the adaptation period animals were fed on the assigned experimental diet.

At the beginning of the adaptation period animal were tagged, weighed and distributed randomly into 4 groups A, B, C and D of three animals in each group. The experiment started on 28 July 2009 and ended on 15 September 2009.

3.3 Location of experiment and housing

The experiment was conducted in the Faculty of Agricultural Technology and Fish Sciences at Jebel Awlia. Animal were housed in open pens roofed by iron bar and metal about two meters high to allow good ventilation. Every experimental unit was provided with water and fed separately.

3.4 Experimental rations

Experimental mixture rations were formulated with agro industrial byproducts and crop residues.

Four rations A, B, C and D were manufactured in central feeds factory. The four rations contained groundnut haulms at rates of 0%,

7%, 14% and 20% for groups A, D and C, respectively. All feed ingredients were mixed very thorough as pellet.

3.5 Feeding of experimental rations

The animals were fed daily separately the assigned diet adilibtum at 9: 00 Am for 56 day.

Table (3.1): Formulation of the ration fed (Calculated)

Ingredients %	A	B	C	D
Sorghum (Feterita)	30	30	30	30
Groundnut haulm	0	20	14	7
Sorghum straw	20	0	6	13
Groundnut cake	22	22	22	22
Wheat bran	10	10	10	10
Molasses	15	15	15	15
Limestone	1.5	1.5	1.5	1.5
Mineral premix	0.5	0.5	0.5	0.5
Salt	1	1	1	1
Total	100	100	100	100

3.6 Data records

3.6.1 Feed intake

Feed was offered adilibtum and residual for each pen were recorded daily.

3.6.2 Live weight gain

Animal were weighed weekly by using spring balance in the first three weeks and box balance till the end of the experiment. The animals were fasted over night except for water before weighing to reduce the error due to variation in gut full.

The average weekly weight gain of each animal and feed conversion efficiency was calculated.

3.7 Statistical analysis

All experimental data were analyzed by the simple complete randomized design and Duncan Multiple Range Test was used to detect difference between means (Snedecor and Cochran, 1980) by SPSS program.

Table (3.2): Chemical analyses of Groundnut Haulms (Determine)

Item	Percentage (%)
Moisture	6.27
Dry matter	93.73
Crude protein	10.20
Ether extract	1.16
Crude fiber	11.97
Ash	18.00
Nitrogen free extract	52.4
Total	100

Table (3.3): Chemical composition of the rations (Determine)

Ingredients %	A	B	C	D
Moisture	7.1	5.6	6.4	6.7
Dry matter	92.9	94.1	93.6	93.3
Crude protein	20.6	23.3	23.1	20.5
Ether extract	4.9	3.8	3.9	5.6
Crude fiber	12.1	14.5	16.1	13.8
Ash	14.1	13.2	13.4	15.1
Nitrogen free extract	41.2	39.3	37.1	38.3
Total	100	100	100	100

CHAPTER FOUR
RESULTS AND DISCUSION

4.1 The proximate analysis of the rations

The proximate analysis of the ration fed in this experiment is presented in table (3.3). The proximate analysis indicated that the ingredients constituting ration B and C showed high in crude protein and low in fats. Ration B and C were better than A (control) and, while ration A (control) was the lowest in crude protein and crude fiber.

4.2 Feed intake

The average daily feed intake is represented in table (4.1). Animal fed ration Band D showed high feed intake than rations A (control) and C. However, statistical analysis of the feed intake data detected significant difference ($P<0.05$) between dietary treatment groups.

It is evident from performance data (Table 4.1) that feed intake tended to increase significantly ($P<0.05$) with the increase of groundnut Stover dietary levels. This might be due to increased crude fiber content of the diet (table 3.3).

Table (4.2) shows the effect of dietary treatments on the average weekly feed intake.

There was non- significant effect on dietary treatments on feed intake during first, third and seventh week.

Lambs given diet D consumed the highest amount of feed, while, those given diet A expressed the lowest average daily feed intake in table (4.1).

Table (4.1): Total Performance of lambs fed experimental diets for 8 weeks

Item	A	B	C	D	Level of significant
Number of animal	3	3	3	3	-
Feedlot period	56	56	56	56	-
Initial body weight (kg)	17.6	14.3	16.2	18.5	*
Final body weight	25.1	29.1	28.3	29.2	*
Total body weight gain (kg)	7.5	14.8	12.1	10.7	*
Average daily gain (g)	134	264	216	191	*
Average daily feed intake (Kg/head/day)	0.78	0.83	0.82	0.85	*
Feed conversion efficiency	5.80	3.10	3.80	5.40	*

* Significant ($P<0.05$).

Table (4.2): Effect of varying level of groundnut haulms on average weekly feed intake of Sudanese desert lambs/gm

Week	A	B	C	D	SE
1	3.900	3.633	3.717	3.9767	0.212
2	4.567	4.517	4.667	4.000	0.284
3	5.150	5.267	5.283	5.667	0.166
4	5.267^{b}	5.550^{ab}	5.567^{ab}	6.117^{a}	0.183
5	5.217	5.483	5.350	5.9	0.217
6	5.717^{b}	6.200^{ab}	6.350^{ab}	6.683^{a}	0.197
7	6.467	7.333	7.017	6.950	0.320
8	7.467^{b}	8.433^{a}	7.900^{ab}	8.133^{ab}	0.219

1. Values are means of 4 replicates of lambs each.
2. a and b: means not sharing common superscript letter are significantly different ($P<0.05$).
3. SEM: Standard error of the means from ANOVA d.f.12.

Results indicated that there was significant different ($P<0.05$) on feed intake during the fourth, sixth and eighth week.

The feed intake on dry matter basis of the rations A, B, C and D was lower than that recommended by (N.R.C., 1965) which stated the intake of sheep range between 3.3% -4.4% of their live weight.

The results from group B and C were in agreement with results of Mohamed (1998) who evaluated cotton seed cake, sesame cake, groundnut cake and sunflower seed cake as nitrogen sources for fattening Sudan desert sheep.

Daily feed intakes were 1.12 Kg, 1.09 Kg, 1.09 Kg and 1.11 Kg respectively. This also in line with Karalazos *et al*. (1988). They studied the growth performance and carcass characteristics of lambs fed soybean meal, corn seed and sunflower seed cake.

3.3 Live weight gain

Data for body weight are summarized in table (4.1).

Average daily live weight gain was significantly different ($P<0.05$) among the treatment groups. The average daily gain increased as groundnut haulms proportion increased in the diet. Group B showed the highest daily gain (264g) while group A (control) showed the least daily gain (134g). The difference in the initial live weight and finally weight, between four groups selected in this experiment showed significant difference ($P<0.05$).

The rate of daily live weight gain was significantly different ($P<0.05$). Total body weight gain and the final body weight were also significantly different ($P<0.05$). The results showed that ration (B and C) had greater gain than other two groups (A and D).

Table (4.3): Effect of varying level of groundnut haulms on average body weight on Sudanese desert lambs

Week	A	B	C	D	SE
1	1.500	1.000	1.000	1.167	0.264
2	1.000^{b}	1.000^{b}	1.833^{a}	1.333^{ab}	0.236
3	1.133	1.333	1.500	1.833	0.319
4	1.167	2.167	1.667	1.500	0.29
5	1.033^{b}	2.167^{a}	1.667^{ab}	1.500^{ab}	0.301
6	1.000^{b}	2.733^{a}	1.833^{ab}	1.900^{ab}	0.278
7	1.300	2.633	1.833	0.767	0.208
8	0.800^{b}	2.767^{a}	2.100^{ab}	1.867^{ab}	0.327

1. Values are means of 4 replicates of lambs each.
2. a and b: means not sharing common superscript letter are significantly different ($P<0.05$).
3. SEM: Standard error of the means from ANOVA d.f.12.

There was non-significant effect of dietary treatments in the first, third, fifth and seventh week on body weight gain.

Throughout the second, fourth, sixth, and eighths week feeding different dietary treatments have significant effect on body weight ($P<0.05$, lambs fed the diet B had the highest body weight gain, where as lambs fed on A tended to have the lowest body weight gain.

The average of daily gain of Sudan desert lambs in this study was superior to that reported in literature by different workers who used oil cakes in formulating their diets. El Khidir *et al*. (1989) reported an average daily gain of 121and 117 g/day for desert sheep fed molasses urea block plus oil seed cake and concentrate respectively. Sulieman (1976) and Allama (1987) reported daily gain for Sudan desert sheep of 237 and 215 g/day which was superior to that reported in this study. The results obtained agreed with that reported by (El Khidir *et al*, 1988). Who fed three groups of Sudan desert lambs with high molasses (%), low molasses and high sorghum diets. The mean daily live weight was 161, 196 and 179g respectively.

Results obtained were superior to those reported by (Gaili and Ali, 1985). They reported average daily gain of Sudan male sheep as 125g/day when fed on diet containing sorghum 35%, wheat bran 15%, cotton seed cake 20%, groundnut hulls 29% and salt1%.

4.4 Feed conversion efficiency

Feed conversion efficiency (F.C.E) is also shown in table (4.1). The feed conversion efficiency was significantly different ($P<0.05$) among the treatment groups. However, lambs fed diet B had better feed efficiency (3.1) followed by lambs on group C (3.8), group D (4.5) and then group A which had the least F.C.E (5.8).

Results showed that there was non significant effect of dietary treatments on feed conversion ratio during first, third, fourth and fifth week ($P<0.05$).

The influence of treatments or feed conversion efficiency was significant ($P<0.05$), in second, sixth, seventh and eighth week. Lambs given diet B showed the best performance compared to the other groups.

(Gaili and Ali, 1985) reported a feed conversion efficiency of 5.9 for Sudan desert sheep which were higher than group A and D and similar to B and lower than group C.

A higher feed conversion efficiency (2.2 – 2.3) was reported by (Qrskov *et al*, 1971) for Scottish-half bred ewes on diet contained 85%Barely, 13% fish meal and 2% calcium carbonate. Also higher feed efficiency values of (3.2-3.0) were reported by (Fraser *et al*, 1974), for Suffolk lambs which were offered a diet composed of 80% fish meal, 15% lime stone, 4% molasses and 1% mineral and vitamin supplement which was superior to that reported in this study.

Ration B and C showed an improved efficiency of feed utilization than rations A and D, while ration D was intermediate between C and A rations.

4.5 Economic Benefit

Lambs fed diets B and C had given the highest live weight gain, while, those given diet A expressed the lowest average daily gain in table (4.1).

The results obtained agreed with those reported by (MFEP, 2000) who reported economic value of sheep.

Table (4.4): Effect of varying level of groundnut haulms on Feed conversion efficiency

Week	A	B	C	D	SE
1	2.917	4.444	4.528	3.506	1.138
2	5.167[a]	4.517[ab]	2.680[b]	3.411[ab]	0.599
3	5.651	4.050	3.861	3.582	1.222
4	4.793	2.583	3.394	4.887	0.779
5	7.346	2.565	3.492	4.281	1.84
6	7.089[a]	2.278[b]	3.624[ab]	3.672[ab]	1.258
7	5.338[b]	2.815[b]	3.939[b]	9.867[a]	1.196
8	10.935[a]	3.186[b]	3.844[b]	4.889[b]	1.145

1. Values are means of 4 replicates of lambs each.
2. a and b and d: means not sharing common superscript letter are significantly different ($P<0.05$).
3. SEM: Standard error of the means from ANOVA d.f.12.

Sheep play important social and economic roles in the economy of the country and valuable strategic resource for both local and export purposes. More than 65% of the sheep is of the Sudan desert breed.

Compared with other types, Desert sheep has remarkable productive and marketing features, and in recent years, its use as an export commodity has increased. Annual off take rate has increased from 500.000 heads in 1992/93 to nearly one million in 1998 (MFEP, 2000).

Results showed that returns were very few. This might be due to the fact that sorghum grain and groundnut cake were most expensive during experimental period.

CONLUSION AND RECOMMENDATIONS

Crop residues and agro- industrial byproduct can be used, as a source of feed for ruminant animals.

Many of these can be used as a source of protein and minerals for ruminant animals, especially in the dry season when the natural pasture and crop residues used are devoid of such nutrients.

Groundnut haulms moved to be on economic practical process which could help in feeding.

Another alternative would be to use groundnut haulms as livestock feed and apply the resulting manure to the field.

In addition it may quiet effectively be used in Fattening Sudanese lambs up to 20%.

Ration B was the cheapest in cost and gave the best daily gain and feed conversion ratio.

REFERENCES

Abd El-Rahaman, K.M. and Ahmed, B.M. (1981). The Use Treated Poor Quality Roughages in Growing Animal's Ration. V1 Conf. Egypt, Soc. Anim. Prod. Sep. 11-18.

Abel-Mutalib, H. (1977). Source of Nutrition for meat production in the Sudan (Arabic). In the processing of the English veterinary conference. (Mustafa, A. A. and El Sanosi, S.M-eds). P. 23-29, Printed by Eltamadon P.P. Ltd, Khartoum Sudan.

Abu Swar, A.O. (2005a). Pastures and Forages (In Arabic). Publisher Sudan Open University. PP. 6-16.

Abu Swar, O.A., Drag, A.A. (2002). Study on the Possibility of Cooperation in the Production and Industry of Fodders in the Arabian Region (in Arabic) in Sudan.

Ahmed, F. A; Pollott, G.E. and Mohamed, O.M. (1979). The growth and carcass weight of young watish (Sudan desert type) When fed concentrate supplements to breseem (*Mediicgo sativa*) grazing. The Sudan J. of Vet. Sci. 20: 27- 35.

Ahmed, H. E. and Sulieman, A.H. (1988). The effect substitution of cotton seed cake by blood meal as a source of protein in a ration of fattening lambs. The Sudan J. Anim. Prod., vol. 1(1): 50-55.

Allama, H.A. (1987). Some productive and Reproductive Traits in Sudan desert sheep. M.V. Sc. Thesis, University of Khartoum, Sudan.

AOAD (2001). The Yearbook for Agriculture Statistics Arab Organization for Agricultural Development.

Aregheore, E.M. (1997). Effect of sex on feed intake, growth and nutrients digestibility in Blackhead sheep fed complete mash ration of crop residues. Journal Animal – and feed – Sciences. 6(1): 71-79.

Beardsley, D. W. (1964). Symposium of Forage Utilization: Nutritive value of Forages as Affected by Physical Form Part 2, Beef Cattle and Sheep Studies J. Animal Sci.23, 239.

Bhatia, D.R. and Patnayak, B.C. (1988). Replacement of sesame cake by cotton seed cake in diet of growing lambs. India. J. of Anim. Sci. 58, 4: 514-516.

Cheeke, R. Peter (2005). Applied Animal Nutrition Third Edition. Pearson. New Jersey.

Economides, S.; Koumas, A.; Georghiades, E. and Hadjipanayiotou, M. (1990). The effect of barely sorghum grain processing and from of concentrate mixture on performance of lambs, kids and calves. Amin. Feed. Sci. and Teach. 13(1-2): 105-116.

El Amin, A.M.; Ibrahim, M.T. and El Tayeb, A.E. (1990). Effect of concentrates to forage proportion on performance and carcass characteristics of Sudan desert Gents. Sudan J. Vet. Sci. and Anim. Husb. 29, 1: 47-50.

El khidir, A.O.; Badr Nadya, A.M. and Murgos, F.I. (1989). Molasses diet containing oil concentrate supplement in a basal hay diet for feeding Sudan desert lambs. The Sudan J. Amin. Prod. 2(2): 79-88.

El khidir, O.A. And Ibrahim, S.F. (1999). The effect of Season of Year and Initial Live Weight Gan and Feeding Efficiency of Western Baggara Cattle. Indian, J. Anim. Sci. 69(6): 430-452.

El khidir, O.A. Khalfalla, A.M., Gumaa, A.Y. And Osman, O.K. (1984). High Levels of Molasses and Peanut Hulls in Urea Supplement Diet for Sheep. World Review Anim. Prod. 20: 73-78.

El Khidir, O.A.; Khalafalla, A.M; Mansour, M.E. and Shadya, A.O. (1988). The effect of feeding diet variable energy concentration in growth and carcass composition of Sudan desert lambs. The Sudan J. Amin. Prod., 1(2): 81-88.

Eldow, G.E. (2001). Effect of castration of Sudan desert lambs on feedlots performance, carcass characteristics and meat quality. M.Sc. Thesis. Faculty of Animal Production. University of Khartoum, Sudan.

Elkarim, A. I. A. and Owen, J. B. (1987). Post weaning growth performance, carcass characteristics and preliminary heritability for some estimates carcass traits of two types Sudan desert sheep on intensive feeding. J. Agric. Sci., 109(3): 531-538.

Fisher, S.D. (2002). A Review of A Few Key Factors regulating Voluntary Feed Intake A in Ruminants. Crop. Sci. 42: 165-1655.

Forbes, M. J. (1986). The voluntary Food intake of Farm Animals. Butter Worth and Co. publisher Ltd.

Fraser, C. and Qrskov, E.R. (974). Cereal processing and food utilization by sheep. I- The effect by processing on utilization of barley by early weaned lambs. Amin. Prod. 18: 75-83.

Gaili, E.S.E. and Ali, A.E. (1985). Meat from Sudan desert sheep and goats part 1. Carcass yield of fats and distribution of carcass tissues. Meat Sci., 13: 217-227.

Gheradi, S.G. and Black, G.L. (1988). Influence of Post Rumen Supply of Nutrition on Rumen digesta Load and Voluntary Intake of Roughages by Sheep Bri, J. Nut. 62: 589-599.

Glimp, A.A.; Hart, S.P. and Vanlugela, D. (1988). Effect of altering nutrient density (concentrate to roughage ratio) and restricting energy intake on rate efficiency and composition of growing lambs. J. Amin. Sci. 67(4): 865-671.

Hassan, A.M. and Mukhtar, A.M.S. (1970). Feed lot performance of Sudan desert sheep. Trop. Agric.Trinided, 47(4):325-330.

Kalafalla, A.M. and Mohammed, T.A. (1988). Effect of partial replacement of conventional concentrate diet with cotton gin trash on nutrients utilization and feed lot performance of lambs. Sudan J. Amin, Prod., Vol. (2): 95-101.

Karalozos, A.; Haljminaoglour, J, and Spinapis, E. (1988). The performance of lambs to diets supplemented soybean meal, cotton seed meal and sunflower meal. World Rev. Animal Prod., Vol. 24(3): P: 51-54.

Khalifa, H. A. A. (1971). Voluntary Intake of Food in Requirements Review. The Sudan J. Vet. Sci. and Anim. Hus., 12(1): 40-60.

Larbi, A., Dung, D.D., Olorunju, P.E., Smith,J.W., Tanko, R. J., Muhammad, I. R and Adekunle, I.O.(1999). Groundnut (Arachis hypogaea) for food and fooder in crop- livestock system. Forage and seed yields., Chemical Composition and rumen degradation of and stem fractions of 38cultivars. Animal feed science and technology, 77: 33-47.

Macit, M; Sahin, S; Esenbuga, N; and Karaoglu, M. (2001). Growth and carcass characteristics of three fat- tailed pure breeds under grazing with concentrate supplementation. Truk. J. Vet. Anim. Sci. 27: 331-337.

MAFF (1975). Energy Allowances and feeding Systems of Ruminants. Ministry of Agricultural Fisher and Food Technical Bulletin 33 London, U.K.

Makarechain, M.J.V.; Whiteman, L.E. Walter and Muson, A.W. (1978). Relationship between growth rate, dressing percentage and carcass composition in lambs. J. Anim. Sci. 46: 1610-1617.

Malik, J. (1974). Fattening performance of cross bred lambs. Anim. Breeding Abstr, 42(11): 557.

Manson, I.L. and Maule J.P. (1960). The ingredenous livestock of Eastern and Southern Africa (AB) Animal Breed Genet. Tech., No. 14 Commonwealth Agricultural Bureaux Royal, U.K.

Mansour, N.E.; Sulieman, A.H. and Abdula, S.A. (1988). The effect of feeding complete rations comprising different levels of groundnut hay on performance and carcass characteristics of Sudan desert lambs. Sudan J. Vet. Sci. and Anim. Hush. 1(2): 89- 94.

Mc Donald p, Edward RA, Green halgh J, F and Morgan C,A 2002 , Animal Nutrition 6th ed Prentice Hall.

Mc Donald, P., Edward, R.A. and Greenhalgh, J.F.D. (1985). Animal Nutrition. Longman Group Limited Longman House, Burnt Mill, Harlow, Essex CM, 202JE England.

MC Leroy, G.B. (1961). The sheep of the Sudan. 2: Ecotypes and tribal breeds. Sudan J. Vet. Sci. Anim. Husb., 2: 101.

McDonagh, J.F., Toomsan, B., Limpinuntana, V. and Giller, K.E. (1993). Estimates of the residual nitrogen benefit of groundnut to maize in Northeast Thailand. Plant Soil 154: 267–277.

MFEP (2000). Annual Report (1999- 2000). Ministry of Finance and Economic Planning (MFEP), Khartoum, Sudan.

Ministry of Animal Resources (2002). General Administration for Planning and Animal Resources Economics, Khartoum, Sudan.

MOAAR (1998). Ministry of Agriculture and Animal Resources (MOAAR). Annual Report (1997-1998), Khartoum, Sudan.

Mohamed, A. Madani. (1996). Animal Resources and Animal Production in Sudan (Arabic). First Edition. Sudan, Khartoum.

Mohamed, M. Selieman. (2008). Animal Resources in Sudan and Issues Development (Arabic). First Edition. Sudan, Khartoum.

Mohammed, H.A. (1998). Effect of varying protein sources with molasses based diets on fattening Sudanese desert sheep. M.Sc. Thesis (Animal Prod.), University of Khartoum, Sudan.

Morris, S. T. (2003). Feed Conversion Efficiency in Beef Production system. Paper for Angus cattle Breeders. Canterbury 16 May 2003 pp: 1-5, Institute of Veterinary, Animal and Biological Sciences (IVABS), Massey University Beef New Zealand. Http:// beef.org.nz/research/newsletters/feedconveff.asp

N.R.C. (1965). The Nutrient Requirement of Farm Livestock. No. 2, Ruminants. Summary of estimated requirements. Agricultural Research Council, London.

Pollot, G.E. and Ahmed, F.A. (1979). The Effect of Diets Containing 15, 30, 45 and 60% Molasses on Performance of Watish Lambs. Umbenin Livestock Research Bulletin.

Preston, T. R. (1987). Conference Summary and Overview. Symposium proceeding feed Intake of Beef Animals, pp 387-391.

Qrskov, E.R., Fraser, C.; Gill, J.C. And Elizabeth, L.C. (1971). The effect in an intensive production system of type of cereal and time of weaning on the performance of lambs. Amin. Prod., 13: 485-492.

Roche, J.F. and Quirke, J.F. (1984). The effect of Steroid hormones and xenobiotics on growth of farm animals. Ir. Vet. J., 38: 126-131.

Smagakki quoted by Tag Eldin. (2009). Feedlot Performance and Carcass Characteristics of Ruminants Fed Pellets with Varying Energy Levels. PhD thesis Sudan Academy of Sciences (SAS).

Snedecor, G.W. and Cochran, W.G. 1980. Statistical Methods, Iowa State University Press. Ames, Iowa, U.S.A.

Sulieman, A.H. (1976). Some production traits of Sudan indigenous sheep under irrigated Gezira condition in Sudan M.V.Sc. Thesis, University of Khartoum.

Sundestol, F. and Coxworth. E, M. (1984). "Ammonia Treatment" Straw and other Fiberous By-products as feed, (Sundestol, F, Owen, E, Eds), Elsevier. Amsterdam. Pp 196-247.

Varner, L.W. and Wood, W. (1975). Influence of wheat variety upon *in vivo* and in vitro lactate levels. J. Amin. Sci. 41: 900-908.

Waston, R.M.; Tippett, C.I.; Rizk, Jolly, F.; Beckett, J.; Scholes, V. and Casbon, F. (1997). Sudan National Livestock Census and Resources Inventory. Vol.31. The results of an aerial centsus and recourses in Sudan from August 1975 to January 1977. Sudan Vet. Res. Admin., Ministry of Agriculture, Food and Natural Resources, Khartoum, Sudan. 34 pp.

Williams, T.O., Fernandez-Rivera, S. and Kelley, T.G., (1997).The influence of socio-economic factor on availability and utilization of crop residues as animal feed. In. C. Renard (ed.). Crop residues Sustainable mixed crop/ livestock farming systems, (CAB, International, Wallingford), 25-39

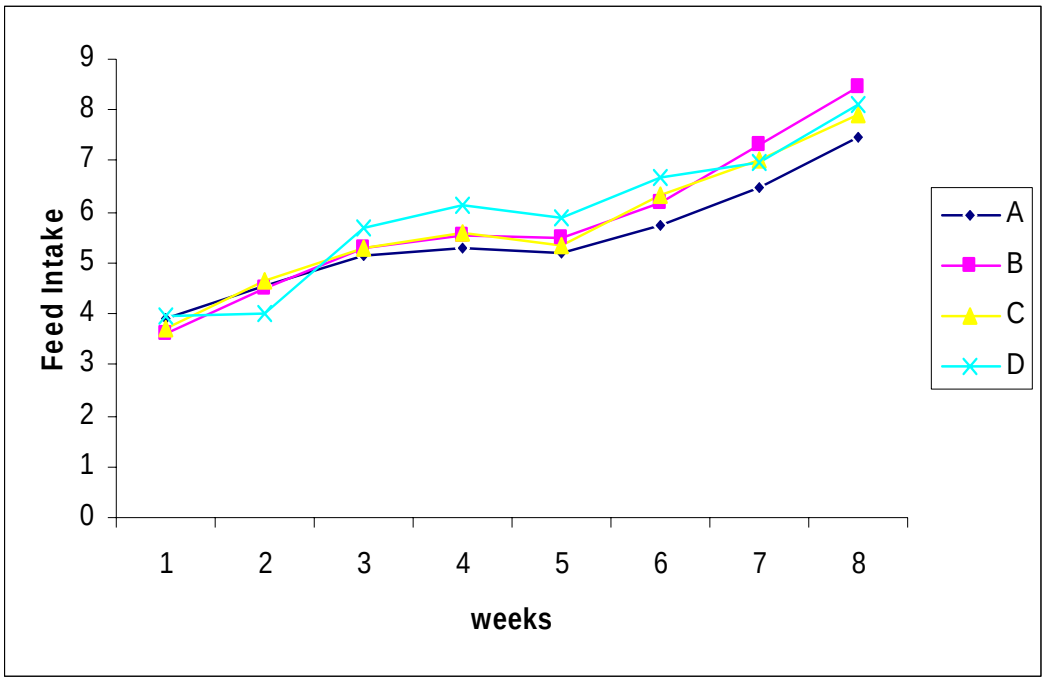
APPENDICES

Appendix (1)

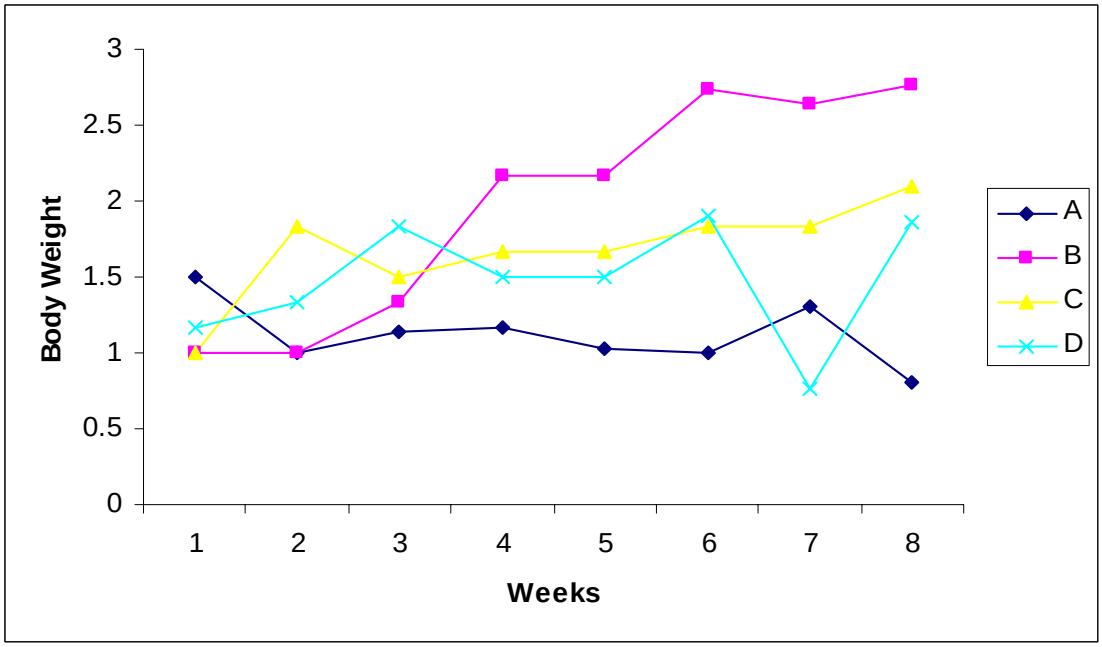
Economic values

Item	A	B	C	D
Sorghum (grain)	112.5	112.5	112.5	112.5
Groundnut cake	82.5	82.5	82.5	82.5
Wheat bran	37.5	37.5	37.5	37.5
Molasses	56.5	56.5	56.5	56.5
Limestone	5.626	5.626	5.626	5.626
Mineral Premix	1.875	1.875	1.875	1.875
Salt	3.75	3.75	3.75	3.75
Sorghum Straw	_	22.5	48.75	75
Groundnut Haulms	75	52.5	26.2	-
Total	375	375	375	375
Diets manufacture	33.75	33.75	33.75	33.75
Experimental lambs	225	225	225	225
Ear tag	4.5	4.5	4.5	4.5
Ivermectin	3.75	`3.75	3.75	3.75
Bendazol	3.75	3.75	3.75	3.75
Oxytetracyclin	20	_	_	_
Bloatzol	5	_	_	_
Transportation	39.75	39.75	39.75	39.75
Employments	45	45	45	45
Total of inputs	741.25	757.5	7187.15	753.75
Total of outputs	750	950	890	
Quotation	8.75	192.5	171.85	166.75

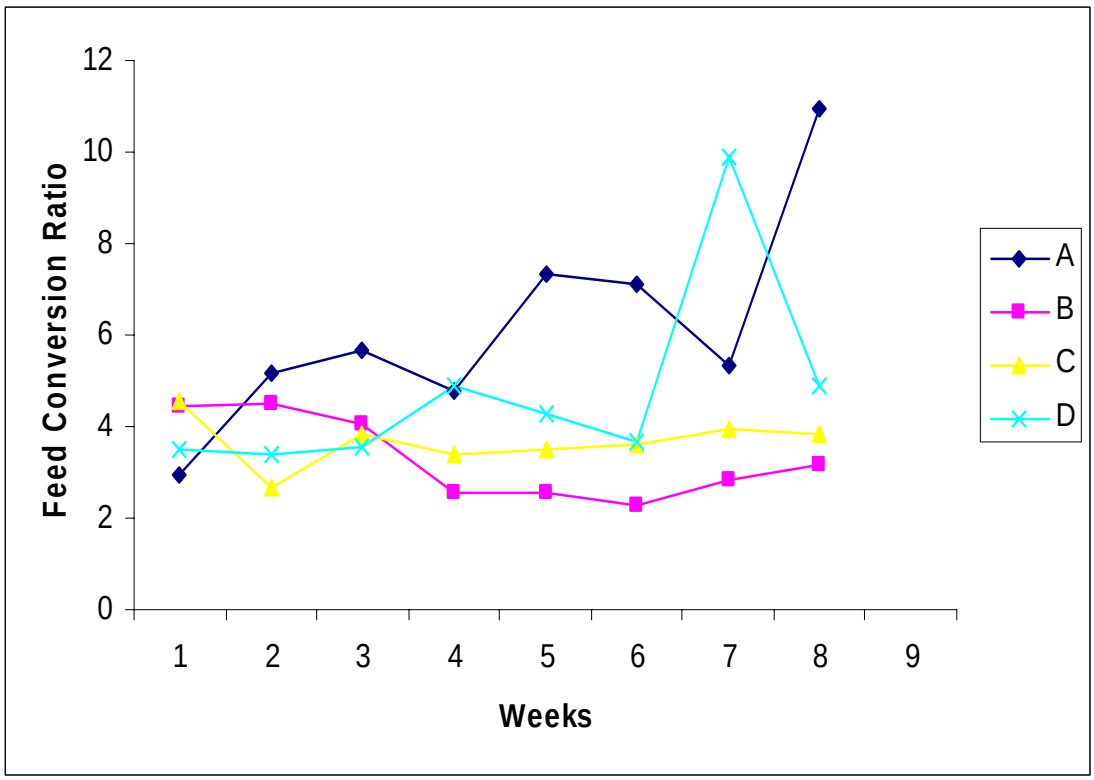
Quotation = Total of outputs - Total of inputs.



Appendix (2)
Effect of varying levels of Groundnut haulms on Feed intake of Sudan Desert Lambs



Appendix (3)
Effect of Varying Level of Groundnut haulms on Body Weight of Sudan Desert Lambs



Appendix (4)
Effect of Varying Level of Groundnut haulms on Feed Conversion Ration of Sudan Desert Lambs

Appendix (5)
Sudan Desert Lamb group (A)

Appendix (6)
Sudan Desert Lamb group (B)

Appendix (7)
Sudan Desert Lamb group (C)

Appendix (8)
Sudan Desert Lamb group (D)

Appendix (9)
Experimental Diet A

Appendix (10)
Experimental Diet B

Appendix (11)
Experimental Diet C

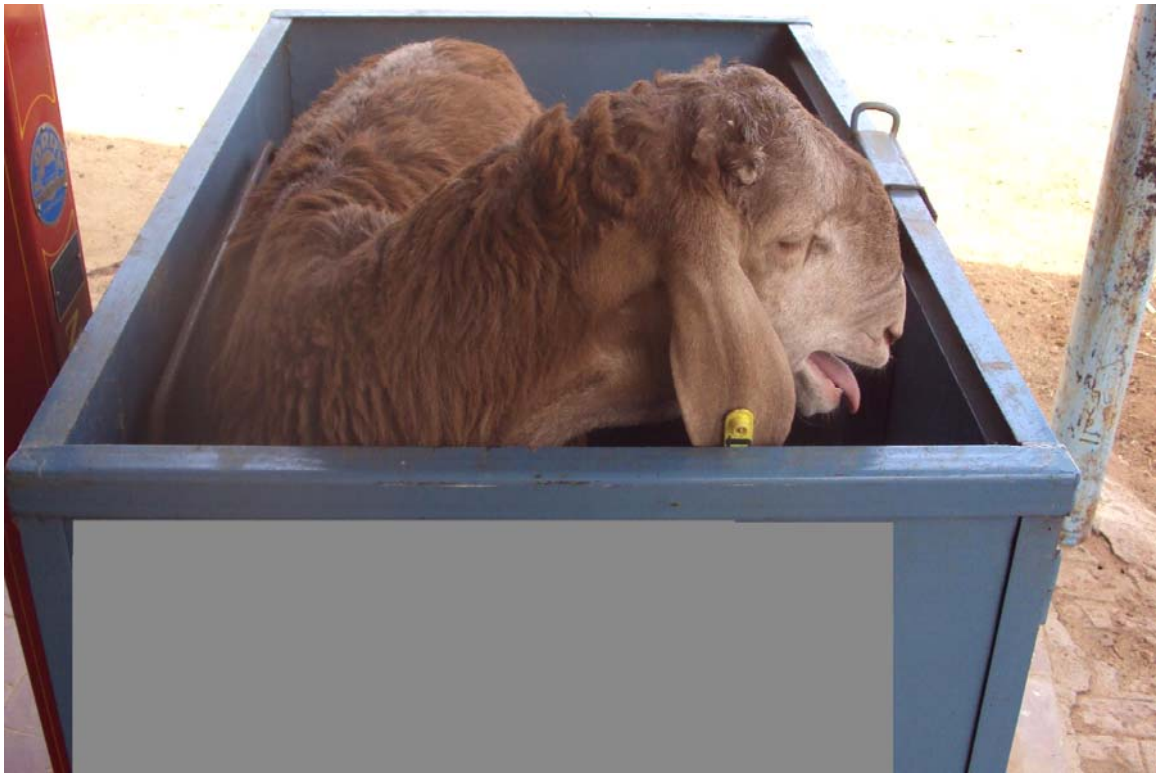
Appendix (12)
Experimental Diet D

Appendix (13)
Groundnut Haulms

Appendix (14)
Sorghum Straw

Appendix (15)
Spring Balance

Appendix (16)
Box balance



Appendix (17)

Animal weighed