

**FEEDLOT PERFORMANCE AND CARCASS
CHARACTERISTICS OF KUNANNED AND INTACT
SUDANESE DESERT SHEEP**

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CHAPTER ONE

INTRODUCTION

Sudan is a big country with a great number of livestock. These flocks are raised under a wide variety of ecological zones. In the Sudan there are about (46.09) millions heads of sheep in the year 2000 (Ministry of animal resources, Sudan ,2001) , which comprise a greater proportion of the total wealth of the poor families and are the primary source of meat and meat products .These flocks are able to survive and produce in harsh environmental conditions , and are scattered all over the country .

They are classified into five basic ecotypes , in addition to three fused ecotypes . Sudan is considered as one of the most important countries leading production and exportation of livestock (A.O.A.D., 2000) .The desert sheep dominates the local and export market of the live sheep and meat.

Sudan has also tremendous agricultural resources . There are large quantities of agricultural by-products . Even with these huge amounts of by-products , the livestock still suffers severe feed shortage, because the bulk of the herds are in the hands of nomads ,the livestock were not introduced into irrigated schemes and inefficient use of by-products . (Maglad and Lutfi 1984) .

Shortage of forage resources as a result of expansion in farming cash and food crops, increased feed costs and declined of the natural vegetation which are factors that justify the use of by-products as animal feed . (Bird,1991and McAllan,1991).

There are several methods used to obtain certain characteristics, and benefit the animals over all , Such as dehorning ,disbudding ,tail-docking, deodorization and castration.(Harold,2000).

Lamb castration is commonly practiced to control breeding and to get fat lambs . Kunan which is a local applicable method , used mainly to control breeding in Sudan. (Mohammed,1997).

The objective of this study is to conduct research on the effect of kunan on feedlot performance and carcass characteristics of Sudanese desert sheep.

CHAPTER TWO **LITERATURE REVIEW**

2.1 Live stock population in Sudan :-

Livestock in Sudan are mostly raised under nomadic conditions with traditional methods of management and natural grazing (Mcleroy, 1961) . Now they are raised as source of income through local and export trade . (Eldaw , 2001) . The livestock population in Sudan estimated as 59.8 million heads in the year 1990 and grew to 124.8 million in the year 2000 . (Ministry of Animal Resources ,Sudan 2001) .

2.2 Types of Sudanese sheep :-

Mcleroy (1961)classified sheep of Sudan into eight distinct ecotypes according to locality , tribe and origin . Of these ecotypes is Sudan desert sheep which constitute 65% of the sheep population in the country .(Jack, 1955) stated that Sudan desert sheep is the best type in the country .

They are large legged animals carrying a fine hair coat , the colour is commonly light brown , often becomes white on the belly and legs. A combination of black and white is the typical colour of Gezira sheep.

The face is convex , the ears are long and pendulous and the tail is long, fleshy and often reaching the ground . A good desert sheep stands nearly three feet at the shoulder and may weigh as much as 70 Kg .

Mcleroy (1961) indicated that Sudan desert sheep include seven tribal breeds namely ; Watish, Meidob ,Northreverine wooled , Beja , Butana , Gezira and Kababish which is considered as the prototype to which all other types are compared . Other ecotypes classified with the desert sheep as basic ecotypes were ; Sudan nilotic , Arid up land , Arid equatorial and West Africa Fulani . In addition to three fused Ecotypes include ; Sudan desert crossed with nilotic , Sudan desert crossed with Arid up land and Sudan nilotic crossed with Arid equatorial. (Mcleroy , 1961).

2 .3 Male genital organs :-

2 .3 .1 Scrotum :

The scrotal sac is dependent to the inguinal region through which the testes descend . The scrotum has a thermo-regulatory function for the most part . (Mohammed , 1997).

2 . 3. 2 Testicles:

The testis is the site of production of male's sex hormone testosterone. This hormone belongs to the class known as androgens and is produced by the leyding cells of the testis and is transported by blood plasma (Cole

and Cupps ,1959).

2 . 3.3 Epididymis :

This is a series of convoluted tubules and ductules which emerge from the rete testis . Its functions are the transportation , maturation , storage and nutrition of spermatozoa .The epididymis is composed of three parts ; Head which is composed of about 15-19 efferent ductules in the ram which decrease in number progressively towards the ductus epididymis. (Ashdown ,1967) , Body which extends between the head and the tail which is situated at the ventral extremity of the testis . Whereas the ductus epididymis is highly convoluted in the head and body , it is less coiled in the tail where it finally connects with the vas deferens .

2 .3 .4 Vas deferens :

It transports the spermatozoa forming part of the spermatic cord and ends at the ampulla of the ductus deferens in which spermatozoa are stored before ejaculation .

2 .3 .5 Urethra :

It is tubular tract composed of two parts , pelvic and penile , both having the role of conveying the semen on ejaculation to the exterior.The urethra is also a part of the urinary system .

2 .3 .6 Penis :

This is the copulatory organ which has a specialized feature in rams ; the end is formed by the urethral process which deposits semen directly into or around the females cervical os . Erection of the penis is achieved through erectile structures , the two corpora cavernosa penis and the corpus cavernosum urethra . The origin of an erection is from stimulation to parasympathetic branches of the sacral nerves.(Cole and Cupps,1959 ; Sisson and Grossman , 1959 and Chemineau *et al.*, 1991).

2 .3 .7 Accessory genital glands :

These secondary sexual glands include the vesicular , bulbo-urethral and prostate glands . The latter is a disseminated gland in the ram (Blom, 1968) . Their secretions are added to the sperm rich fraction of the semen at the time of ejaculation .

2 .4 Castration :

The history of castration is properly almost as the history of domestication of animals by man to fulfill his requirements for meat , animal products and draft power . (Turton , 1969) .

Castration is traditionally carried out for management reasons to prevent unintended mating . Castrated lambs are known as wethers. Castration may not be necessary in ram lambs that are to be slaughtered before six months of age , as there is no ram taint in the meat of prepubertal lambs (Kent *et al.* , 1991) . If lambs are to be castrated the

procedure should be carried out after maternal bonding has been established (after 24 hours of age) and preferably before six weeks old.

(King *etal.*,1991 and Robertson *etal.* 1994).

To prevent mating Sudanese sheep owners practise castration at any time from six months to two years of age by crushing the spermatic cords or forcing the testicle upwards and tying the scrotum below . However, the main control on indiscriminate mating is exercised through the application of kunan (a cord with two slip knots , one which is looped up around of the neck of scrotum while the other is slipped over the prepuce) the rams wear the kunan except during the breeding season to have the lambs coming during the season of rains (kharif). (Mcleroy, 1961).

2 .5 Method of castration :

There are several methods used to castrate ram lambs .(Battaglia and Mayrose,1981).

2 .5 .1The open technique :

In this method all the tissues of the scrotum are incised and the testicle and spermatic cord are removed without their coverings .This method is easily carried out under field conditions , and may be used in the standing colt or bull , under local analgesia.The main disadvantage is

that it opens the tunica vaginalis and thus makes a potential connection between the peritoneal cavity and the outside. This means that if an undetected weakness exists in the form of an incipient hernia there is a danger of intestine escaping through the inguinal canal causing an intestinal prolapse. (Oehme and Prier, 1974).

2 . 5 . 2 The closed technique :

This technique involves cutting through scrotal skin and exposing the testicle, complete in the unopened tunica vaginalis. The neck of tunica vaginalis is then either ligated and served, or removed by means of an emasculator, this technique involves blunt dissection, and under field conditions, potential contamination of the scrotal area. It does not involve opening the tunica vaginalis and thus avoids the very real danger of intestinal prolapse. It is the method that is used to castrate any animal with an actual or suspected scrotal hernia. (Oehme and Prier, 1974).

2 . 5 . 3 Bloodless castration :

This method is suitable for use in the ox and sheep, both of which have pendulous scrotums. It involves the use of an instrument which will crush the spermatic cord without opening the scrotum, and this eliminates, to a very great extent, the dangers of post-operative sepsis. In cattle and sheep, the Burdizzo bloodless castrator is used, whereas in young lambs, it has become increasingly popular to apply a tight elastic

band around the neck of the scrotum ,using an Elastrator.The pressure of the elastic band causes an eschaemic necrosis of the neck of the scrotum and its contents , all of which separate and drop off after 10-14 days.

The best way of lambs castration is the application of rubber ring to the neck of scrotum using an elastrator . (Harold , 2000) .

2 . 6 Kunan method :

In Sudan , desert sheep are bred in certain periods of the year and lambs are dropped when range fodder is at its best , so to control mating to suit these conditions , a double looped cord is applied around the neck of the scrotum and the pendulous part of the ram's prepucial sheath . This is termed the kunan method for contraception . It is well known in north and west Africa as well as Sudan, as a means of mating control (Wilson, 1991) . The same method is applied in India (Mittal , 1980) .

The desert type of sheep in Sudan in which kunan is routinely practised have particularly pendulous penile sheaths so attachment of the anterior noose of the cord is simple . Contraception is effected by the narrowing of the prepucial orifice by the noose and should the penis protrude when erect there is the safe guard of the cord tied caudally to the neck of the scrotum which would serve to deflect the penis ventrally away from the females' vulva .

2.7 Effect of kunan :

Nothing has been found in the literature about the effect of kunan on the external genitalia of rams during or after its application nor on the possible effect on spermatogenesis or sperm maturation . The kunan noose might restrict withdrawal or relaxation of testes in such away that the thermo-regulatory mechanism is altered . (George , 1969) . Recent findings indicated certain pathological changes in pampiniform plexus, cermaster muscle and appendage . (Mohammed , 1997) . There was no substantial difference in spermatogenesis and development of spermatozoa between those rams with kunan noose applied and those without , either in the longer or short term , although some thickness of spermatic cord and around the head of testis was observed . (Mohammed *et al* ,2000) .

Nothing has been found in the literature about the effect of kunan on weight gain or carcass performance of Sudanese desert sheep.

2.8 Some other methods practiced to benefit the animals overall:

2.8.1 Dehorning and desbuding :

Horns of cattle , sheep and goats have no useful function in a domestic species . Indications for horn removal are economic considerations , fracture , abnormal growth and to reduce injuries from fighting . Dehorning and destruction of the horn buds in young animal

kids is widely practiced all over the world . (Greenough and Johnson , 1974) .

2.8.2 Tail docking :

Tail docking is practiced routinely in sheep to keep the rear parts cleaner drier and to improve ease of entry for the rams penis during breeding . The most satisfactory time to remove the tail is when the lamb is 1- 2 weeks old . (Johnson *et al* ,1974) .

2 . 9 Agricultural products and by-products in Sudan :

Agricultural crop residues become a useful by-products when a profitable use is made of them , if this is not the case the residue becomes a waste which has to be disposed off . (Barreveld , 1982) .

In Sudan a variety of cash crops are grown , some of their products and processing by-products can be used in animal feeding . They include cotton , ground nuts , sesame , dura , wheat , millet , sorghum and sugar cane . Planted area of groundnuts in Sudan in the year 1993/1994 was over 2.4 million acres and the production was estimated to be 428000 tonnes . (Elminshawi , 1996) .

2.10 Molasses as livestock feed :

Molasses is used widely in compounded feeds , in the industrialized countries , where it is used to improve the palatability and binding

properties of pelleted feed , as well as reducing dustiness . Only low concentrations (5-10%) are for this purpose , higher levels make mixing and pelleting difficult . Because the molasses comprises such a small proportion of the diet,no nutrient imbalance is apparent(Elminshawi,1996).

In tropical countries the quantities of molasses available are large relative to other potential feed ingredients . In these situations molasses can be used as a fermentable carbohydrate providing the basis of the diet for ruminants , as a palatable carrier for other essential nutrients and as a source of trace minerals and some macroelements (eg. Sulphur, calcium and potassium) . Many studies on the utilization of sugar cane as animal feed , especially for cattle , have been done in many countries. (Preston and Leng,1976 ; Preston ,1995) .

2 . 11 Agro-industrial by-products in animal feed :

Elshafie and Mcleroy, (1964) have used a ration composed of agricultural by-products Viz 26% cotton seed hulls , 20% cotton seed meal , 20 % wheat bran , 20 % dura grain , 13 % molasses and 1 % salt/mineral mix in a fattening experiment using 29 heads of Westen baggara cattle . They found that the average daily gain was 2.45pounds. James , (1973) had used sugar cane comfith and sugar cane tops in the ratio of 3:1 in rations supplemented with protein, minerals,vitamine and urea , to level adequate for good feedlot performance . Fresian male

calves and Barbados black belly sheep were fed on the rations for periods varying from 45-250 days. They found that the average daily gain for animals fed on comfith sugar cane tops based rations was 0.9 Kg . In sheep trials the comfith sugar cane tops rations , resulted in up 0.11 Kg average daily gain . Elkhider *etal* (1989) reported that the average daily gain of adult withers of Sudan desert sheep fed on ration containing 60 % molasses urea blocks and 40 % roughage and a control ration containing 60 % concentrate and 40 % roughage , the average daily gains was 130 and 140 g/day respectively . Merino *etal* (1965) found that sheep fed molasses at level of 10-20 % had given high daily weight gain than these fed rations containing 30-40 % molasses .

CHAPTER THREE **MATERIALS AND METHOD**

3 . 1 Experimental animals :

Fourteen male lambs of Sudanese desert sheep(balady),were brought from local market of (Sidon),located in River Nile State , they were of an average age of seven month.On arrival at the experimental shed in Atbara town , they were treated with FASMIN (Levamisole + Oxytoclozanide) against enteric parasites , and VAPCOTOX for control of external parasites , and given a prophylactic dose of long acting Tetracycline 1.5cc for each animal.

3 . 2 Pre-experimental feeding :

The experimental animals were allowed an adaptation period of two weeks , during which they were fed on groundnut hulls .

3 . 3 Experimental procedure :

At the end of the adaptation period , lambs were individually weighed after an over night fast except for water . Animals were randomly divided into two groups A , and B (7 animals / group),with an average induction weight of 14.50 Kg ,and 14.43 Kg for A and B respectively .Group B was kuaned ,while group A was left intact, on 11th. of May 2001.

3 . 4 Kunan procedure :

Kunan method applied by using a cotton tape of double looped cord , around the neck of scrotum , and the pendulous part of the ram's prepuceal sheath .

3 .5 Feed and feeding :

The ingredients of the experimental diet were , groundnut hulls 30%, molasses 25 % ,wheat bran 18 % ,groundnut cake 15 % , dura grain 10%, salt 1 % and lime stone powder 1 % .

The percentage of ingredients and chemical composition of the experimental ration were shown in table (1) .

3 . 6 Experimental feeding :

Through out the feeding period , which extended for 100 days , daily food allowances were given to each group ad libitum (10 % weigh back), in one meal at 6.0 pm .Unconsumed feed were collected before providing the daily meal . Fresh Berseem (*Medicago sativa*) was given to each group weekly at a rate of 1 Kg / head to avoid vitamin A deficiency. Clean water was available throughout the experimental period .

3 .7 Live weight and growth :

The induction live weight was recorded for each animal at the beginning of the trial. Then the animals were individually weighed every week at 10 o'clock a.m after an over night fast except for water , to minimize error due to variations in gut fill . A spring balance (100 Kg) was used.

Table (1) .Percentage of ingredients and chemical composition of the experimental ration .

Item	Percentage
Groundnut hulls	30
Molasses	25
Wheat bran	18
Groundnut cake	15
Dura grain	10

Lime stone powder	01
Sodium chloride	01
Calculated dry matter	88.07
Calculated crude protein	15.24
Calculated metabolizable energy(Mj/Kg)	10.48
Chemical analysis of the ration:	
Dry matter analysis	88.36
Crude protein	10.97
Crude fiber	12.43
Ether extract	3.23
Ash	10.47
Nitrogen free extract	51.26
Metabolizable energy(Mj/Kg)	15.70

3 . 8 Feed intake :

The feed intake of each group was recorded daily as the difference between amount offered and the refusals , the dry matter values were used to calculate the dry matter intake . Group feed intake and individual feed conversion efficiency were calculated weekly .

3 . 9 Health care :

Medical examination of all animals was done before their arrival and

throughout the study period . Signs of mineral deficiency were observed during the adaptation period (swallowing hair) , and treated with multi-minerals powder Vapco , added to water . Individual cases of diarrhea treated with anti-diarrheal .

3 . 10 Slaughter procedure and slaughter data :

At the end of the feedlot period , three lambs from each group were randomly selected for slaughter . The six animals were slaughtered after an overnight fast except for water .

The lambs were slaughtered according to the local Muslim practices, i.e. by severing the jugular veins , carotid arteries and esophagus by a sharp knife without stunning .

After a complete bleeding , the head was removed at the atlanto-occipital joint and skin was removed manually . The feet were cut at the knee and hock joint. All visceral and thoracic organs were then removed. These non-carcass components were weighed separately. Warm carcasses were weighed too . Gut-fill was computed by the difference in weight between the full and empty alimentary tract . The tail , kidneys and kidney knob and channel fats were left attached to the carcass . The carcasses were transferred to the chiller and chilled at 5 °C for 24hours.

Following chilling ,the cold carcasses were weighed.The tail, kidneys and kidney knob and channel fat were then removed and weighed

separately . Each carcass was split along the vertebral column into left and right sides . The left side was weighed and broken into whole sale cuts according to M.L.C. procedure (1976) .These included : head, neck, breast , leg and chump , single short forequarter , loin and tail . Each cut was weighed and dissected into muscle , bone and fat . Each tissue was then weighed separately .The weight of each tissue was determined and recorded .

3 . 11 Samples for chemical analysis and quality

determination : -

The dissected muscle was minced and two samples were taken, one for chemical analysis and the other for quality determination .The part for chemical analysis was analyzed for total proteins , total moisture, ether extract (fat) and ash according to AOAC (1980) . Protein fractionation was also preformed . Chemical analysis and quality determination were done in the lab. of meat , faculty of Animal Production , University of Khartoum .

3 . 11 . 1 Protein fraction :

Protein fraction procedure was as described by Babiker and Lawrie (1983) . All fraction procedures were carried out 4 °C and in duplicates.

A sample weighing 5 gm was put into a micro blinder jar maintained in an ice bath and 50 ml of 0.03 M potassium phosphate buffer (PH 7.4) were added . The contents of the micro jar were blended at low speed for 6 minutes . After homogenization , the homogenate was transferred to a centrifuge tube and centrifuged for 20 minutes at 3000 krpm. The supernatant was retained and the residue was resuspended in another 50 ml of the same potassium phosphate buffer ,homogenized and centrifuged as before . The supernatant was kept and the two solutions obtained were filtered through filter paper (What man No. 4) to remove fat and other particulate materials not removed by centrifugation .

The combined filtrate contained sarcoplasmic proteins , which were determined in 1 ml sample using Biuret method (Gomal *et al* , 1949).A 30 ml sample of the above filtrate was mixed with 10 ml of trichloroacetic acid 20 % (w/v) for 15 minutes and filtered through filter paper (What man No. 1) to obtain non-protein nitrogen (N.P.N.) . Kjeldahal semi-micro method was used to determine the nitrogen content of this fraction , which was expressed as percentage of fresh sample weight .

The residue remaining from the extraction with phosphate buffer was extracted one with 50 ml of 1.1 M.K.I. in 0.1 M potassium phosphate buffer (P H. 7.4) using the same method followed above . After centrifugation at 3000 R.P.M. for 20 minutes ,the supernatant was filtered through glass wool and the filtrate was used for myofibrillar protein

determination by Biuret method .

Bovine serum albumen was expressed as percentage of fresh sample weight .

3 . 12 Water holding capacity :

Samples of about 0.5 g from the minced muscles were used . Each sample was placed on humidified filter paper and pressed between two plexi glass plates for 3 minutes at 25 Kg load . The meat film area was traced and the filter paper was allowed to dry . Meat and moisture areas were measured with a compensatory planometer . The resulting area covered by moisture was divided by meat area to give a ratio expressed as water holding capacity of meat . A larger ratio indicates an increase in the watery condition of the muscles or a decrease in water holding capacity (Babiker and Lawrie , 1983) .

$$\text{Water holding capacity (W.H.C.)} = \frac{\text{Loose water area - meat film area}}{\text{Meat film area}}$$

3 . 13 Statistical procedure :

Data were analyzed for a completely randomized design(Steel and Torrie , 1980) , mean separation was done according to Gomez and

Gomez test.Means were seperated using Least Significant Difference.(L. S. D).

CHAPTER FOUR **RESULT**

4.1 Feed lot performance :-

Feed lot performance data of experimental animals are shown in table (2).The average initial body weight was not significantly different

between the two groups, group (A) the entire and group (B) the kunanned. The average final body weight was not significantly different between group (A) and (B).

As seen in table (2), the average daily live weight gain was not significantly different between the two groups. Group (B) had slightly more daily live weight gain, than group (A).

4.2 Feed intake and feed conversion efficiency :-

Feed intake is also given in table (2). The average daily dry matter intake was significantly different ($P < 0.01$) between group (A) and (B). Group (B) ate 0.92 (Kg/head/day) dry matter, while group (A) ate 0.87(Kg/head/day).

Daily feed intake was 0.98 (Kg /head/day) and 1.04 (Kg / head / day) for groups (A) and (B) respectively, it was significantly different ($P < 0.01$) between group (A) and (B). As seen in table (2), the feed conversion efficiency was not significantly different between the treatment groups, while group (B) had better feed conversion ratio than group (A).

Table (2). Feedlot performance of experimental sheep.

Item	Group(A)	Group(B)	L.S.D	Level of significance
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Number of animals	7	7	-	-
Feedlot period (Days)	100	100	-	-
Average initial weight (Kg)	14.50	14.43	2.6	N.S
Average final weight (Kg)	29.29	30.71	5.7	N.S
Average total weight gain (Kg/head)	14.79	16.29	3.82	N.S
Average daily weight gain (gm/head/day)	147.86	162.86	15.30	N.S
Average total feed intake (Kg/head)	98.14	104.39	2.81	**
Average daily feed intake (Kg/head/day)	0.98	1.04	0.02	**
Average daily dry matter intake (KgDM/head/day)	0.87	0.92	0.03	**
Feed conversion ratio (KgDM/Kg gain)	5.86	5.65	0.56	N.S

N.S and ** :Not significant and significant at $P < 0.01$, respectively.

Table(3).Slaughter weight of experimental animals.

Item	Group(A)	Group(B)	L.S.D	Level of significance
Slaughter weight (Kg)	31.5	32.7	3.03	N.S
Hot carcass weight (Kg)	15.7	15.5	3.49	N.S
Cold carcass weight (Kg)	15.3	15.3	2.70	N.S
Shrinkage %	1.63	1.66	4.57	N.S
Dressing out % :-				
Hot carcass wt./live wt.	49.6	47.4	6.17	N.S
Cold carcass wt./live wt.	48.6	46.6	4.08	N.S

N.S :Not significant .

Table (4).Yield of whole sale cuts (as % of cold side wt.) of experimental animals.

Item	Group(A)	Group(B)	L.S.D	Level of significance
Neck	5.39	6.72	3.83	N.S
Shoulder	14.49	12.18	9.43	N.S
Ribs	19.99	21.13	4.16	N.S
Foreshank	11.23	12.40	6.48	N.S
Loin	15.35	16.48	2.25	N.S
Plate	3.51	5.12	2.21	N.S
Hindshank	27.88	27.54	4.63	N.S
Tail	4.84	4.21	0.90	N.S

N.S :Not significant .

Table (5). Carcass performance of experimental animals.

Item	Group(A)	Group(B)	L.S.D	Level of significance
Total muscle %	57.44	58.49	2.66	N.S
Total bone %	19.05	21.77	0.46	**
Total fat %	23.51	19.74	2.91	*
Muscle bone ratio	3.02	2.69	0.15	*
Muscle fat ratio	2.44	2.96	0.56	N.S
Gut fill %	14.38	13.72	6.57	N.S

N.S , * and ** : Not significant and significant at $P < 0.05$ and $P < 0.01$, respectively .

Table (6). Body components (as % of empty body weight.) of experimental animals.

Item	Group(A)		Group(B)		L.S.D	Level of significance
	%	wt.kg	%	wt.kg		
Head	9.34	2.39	9.14	2.45	1.78	N.S
Skin	9.64	2.50	6.24	1.67	2.44	*
Four feet	2.76	0.71	2.71	0.73	1.07	N.S
Genital organs	1.26	0.33	1.49	0.40	0.63	N.S
Rumen empty	3.92	1.01	4.20	1.14	0.96	N.S
Intestine empty	3.13	0.80	3.42	0.92	1.54	N.S
Heart	0.55	0.14	0.87	0.23	0.28	*
Liver	1.55	0.40	1.77	0.47	0.57	N.S
Lungs and trachea	2.11	0.54	1.64	0.44	0.39	*
Spleen	0.21	0.06	0.38	0.10	0.20	N.S
Omentum fat	2.32	0.61	2.33	0.63	1.58	N.S

N.S and * :Not significant and significant at $P < 0.05$ respectively.

Table (7). Chemical composition ,water holding capacity and pH values of meat of experimental animals.

Item	Group(A)	Group(B)	L.S.D	Level of significance
Crude protein CP %	20.06	20.61	0.74	N.S
Moisture %	71.32	71.63	0.89	N.S
Ether extraction EE %	7.19	6.29	0.44	**
Ash %	1.01	1.02	0.03	N.S
Non protein nitrogen NPN %	0.45	0.46	0.02	N.S
Sacroplasmic proteins%	6.35	6.55	0.11	**
Myofibrillar proteins%	11.84	12.69	0.24	**
Water holding capacity W.H.C	2.90	2.16	0.27	**
pH value	5.40	5.60	0.10	**

N.S and ** :Not significant and significant at $P < 0.01$ respectively .

Table (8) .Body measurement of experimental animals.

Item(in cm.)	Group(A)	Group(B)	L.S.D	Level of significance
Heart girth	76.1	78.7	6.69	N.S
Barrel circumference	83.3	88.1	7.69	N.S
Animal height	71.0	71.6	4.61	N.S
Back length	46.3	47.3	3.38	N.S
Body length	65.4	64.7	7.42	N.S

N.S: Not significant.

4.3Gut fill :-

Gut fill percentage was not significantly different between kunanned and entire lambs, group (A) was 14.38 and group (B) was 13.72 as shown in table (5).

4.4 Carcass yield and carcass performance :-

The data of carcass yield and carcass performance of experimental animals are shown in table (3), and table (5). There was no significant differences between the two groups for slaughter weight, hot carcass weight and cold carcass weight as shown in table (3).

Hot carcass dressing percent on live weight base between the two groups were not significantly different, and cold carcass dressing percent on live weight base between the two groups were not significantly different table(3). Muscle percentage was not significantly different. It was slightly greater in kunanned than in entire lambs as shown in table (5). Bone percent values were significantly different ($P < 0.01$) between group (A) and (B), kunanned had higher bone percentage. Fat percentage was significantly different ($P < 0.05$) between kunanned and entire lambs. It was less in kunanned than in entire. As shown in table (5), significant difference in muscle : bone ratio was observed between the two groups ($P < 0.05$), kunanned had lower value. While muscle : fat ratio was not significantly different. Percentage of carcass shrinkage values on table (3)

were not significantly different .

4.5 Body components of experimental animals :-

Body components of experimental animals expressed as percentage of empty body weight shown in table (6). No significant differences were observed between the two groups except for ; the skin , heart and lungs and trachea .The skin was significantly ($P < 0.05$) heavier in group (A) and heart weight was significantly different ($P < 0.05$) , it was heavier in group (B) than in group (A) .The lungs and trachea were significantly ($P < 0.05$) heavier in (A) .Group (B) had slightly higher percentages for genital organs , spleen ,rumen empty ,intestine empty and liver .While group (A)had higher percentages for head and four feet .

4.6 Whole sale cuts yield :-

The whole sale cuts of experimental animals from chilled carcasses were shown in table (4) . The proportion of various whole sale cuts obtained from the left carcass sides of experimental lambs as ;neck, shoulder , ribs , fore shank , loin , plate , hind shank , and tail were not significantly different between the two groups .

4.7 Meat chemical composition :-

The chemical composition of the total lean from experimental sheep , showed significant difference ($P < 0.01$) between the two groups for fat percentage , sarcoplasmic proteins percentage and myofibrillar

proteins percentage as seen in table (7) . Group (A) had significantly more percentage fat ($P < 0.01$), but less myofibrillar and sacroplasmic proteins percentages ($P < 0.01$) . Group (B) had significantly ($P < 0.01$) higher sacroplasmic and myofibrillar proteins percentage , but less fat percentage .Group (B) had a higher crude protein and moisture percentages than group(A) although the difference was not significant.

4.8 Meat quality attributes :-

There was significant difference ($P < 0.01$) between the two groups for water holding capacity (W.H.C),group (A) had higher (W.H.C.) than group (B) , while group (B) had significantly higher pH value ($P < 0.01$), than group (A) ,table (7) .

4.9 Body measurement :-

The body measurements of experimental sheep shown in table (8). There were no significant differences for heart girth,barrel circumference, height , back length and body length .

CHAPTER FIVE

DISCUSSION

5.1 Feedlot performance :-

5.1.1 Live weight growth :

Live weight growth performance for both entire and castrated lambs in the present study showed no significant differences on growth rate between the two groups (Table 2). This is in line with the findings of Elshafie (1965), he obtained almost the same growth rate for castrates and entire Butana calves. Also this agrees with Fisher *et al.* (2001), in calves - from 9 months old to day 56 period - during which, surgically castrates were not differing from either entire male bulls or banded castrates, but banded were lighter. And in line with Nsoso (2004) in goats concluded no significant difference in the live weight between castrated Tswan goats using burdizzo, rubber ring, short scrotum and entire males. And in line with the findings of Chacón *et al.* (1969) in sheep. Also Field *et al.* (1993) reported that after 56 days on feed there were no significant differences between wethers and intact rams in average daily gain.

Mackenzie (1970), working with British Toggenburg goats reported

faster growth rate and heavier castrates than entire male goats, in corroboration with this view Kyomo (1978), found that, castrated East African goats were heavier than intact males from weaning to 72 weeks of age. Whilst Louca *et al.* (1977), Schanbacher *et al.* (1980) and Nold *et al.* (1992) concluded that, entire male animals grow faster than castrates. This attributed mainly to sex hormones (Turton, 1969; Field, 1971 and Carragher *et al.* 1997). In the present study this reason is not considered because kunan has no effect on sex hormones.

5.1.2 Feed intake:-

In the current study, there was a significant ($p < 0.01$) reduction in feed intake for entire male lambs. This is comparable with the findings of Muhikambele *et al.* (1994), who observed a significant ($p < 0.05$) reduction in feed intake for entire male of Saanen goats, in the 24.5kg to 36.5 kg liveweight period which attributed to breeding season effect and sexual behaviour of intact males. Because as males approached sexual maturity, there could be excessive mounting which resulted in decreased feed consumption. (Bonneau and Squires, 2000). Also agree with (Walstra and Kroeske 1968; Fowler *et al.* 1981 and Andersson *et al.* 1997) in pigs.

On the other hand Manal (1994) stated that, castrated kids had a decreased feed consumption. While Eldaw (2001), revealed that there

were no significant differences between entire and castrated lambs in feed consumption .

5.1.3 Feed conversion ratio :-

Feed conversion ratio in the current study represented that there were no significant differences between intact male lambs and castrated lambs in feed conversion efficiency ,(Table 2).This coincided with Elshafie (1965) ; Schoonmaker *et al.* (1999) and Schoonmaker *et al.* (2002). And also coincided with Chacón *et al.* (1969) , who studied the capacity for fattening in castrated and intact sheep male of three tropical breeds in addition to castrated sheep of two crossbreeds, presented no significant differences were observed for feed conversion ratio among treatments groups .This agree with Mahgoub *et al.*(1998), working with Omani local sheep reported the same result . And agree with Thys *et al.* (1989) observed that , for partially castrated rams (short scrotum) feed conversion efficiency remained normal . Also coincided with Muhikambele *et al.* (1994) , in Saanen goats -from 24.5 to 36.5kg liveweight- reporting 5.94 and5.51 for entire and castrated animals,respectively compared with5.86 and5.65 for entire and castrated sheep in the present study.

On the other hand , Klosterman *et al.* (1954)in cattle;Nitter(1975)in goats and Kiyama *et al.* (2000) in sheep , concluded a reduction effect of

castration on feed conversion ratio.

5.2 Slaughter and carcass characteristics :

5.2.1 Slaughter and carcass weight :

No significant differences were observed between kunnanned and intact lambs in slaughter weight. (Table3). This was in agreement with the findings of Elshafie , (1965) ; Chopra (1988) ; Phad *et al.* (1995) ; Singh *et al.*(1996) ; Nsoso *et al.*(2004) in goats and Kiyima *et al.*(2000) in sheep.

There were no significant differences between the two groups in hot and cold carcass weight which coincided with Abdula *et al.*, (1994) they reported that , hot and chilled carcass weights were similar for rams , wethers and cryptorchids, also Hanrahan(1999) in sheep reported the same weight. And coincided with the findings of Schoonmaker *et al.* (1999) during their overall trial concluded similar hot carcass weights between male bulls and implanted steers .

On the other hand Klosterman *et al.*,(1954) ; Shelton *et al.*,(1984) and Eldaw (2001), in cattle , goat and sheep respectively indicated that intact males had heavier carcasses than castrates . This may be explained by the obvious difference between kunnan method of temporary contraception and other methods of permanent castration , the latter had a complete suppression of testicular function resulting in marked reduction of serum

testosterone -Kiyama *etal.*(2000)- which is considered as a muscle builder and plays a key role in the growth , body configuration and behavioral characteristics of the male animal .Zarrow (1968) ; Schanbacher (1980) ; D'Occhio and Brooks (1982) , but kunan lacks the effect on testicular function .

5.2.2 Dressing out percentage :

There were no significant differences between the treatments of the present study on hot and cold dressing out percentage on slaughter base (Table 3) . These results are in agreement with the results reported by Elshafie (1965) , and Shelton *et al.* (1984) ; Babiker *et al.* (1985) ; Nsoso *et al.*(2004)-at14 months of age- in goats ; Chacõn *et al.*(1969) ; Manfredini *et al.*(1978) ; Eldaw (2001) in sheep .

The findings are , however,at variance with those of(Seideman *et al.* (1982) in cattle ; Owen *et al.*(1978) ; Singh *et al.*(1996) in goat ; Crouse *et al.*(1981) ; Dawa *et al.*(1996) in sheep) ,establishing that intact males have significantly decreased dressing percentage compared with male castrates .

Factors such as age and weight at slaughter , breed and method of castration singly or in combination may cause these disparity of results between workers .

5.2.3 Body components :

No significant differences were observed between the two treatment groups in the percentage of most body components (Table 5). However, the skin was significantly ($P < 0.05$) heavier in entire lambs than kunanned which coincided with the findings of Field *et al.* (1993); Koohmaraie *et al.* (1996) in sheep reporting that intact rams had significantly ($P < 0.05$) heavier pelt than wethers . Also in agreement with Shelton *et al.* (1984) in goat.

Lungs and trachea were significantly ($P < 0.05$) heavier in entire than in kunanned lambs. Koohmaraie *et al.* (1996) ; and Eldaw (2001) reported heavier lungs in entire lambs than wethers although the difference was not significant.

Kunanned lambs had significantly ($P < 0.05$) heavier heart than intact lambs this result is in agreement with the findings of Schoonmaker *et al.* (1999) and recently Schoonmaker *et al.* (2002) in cattle reporting significantly heavier heart in steers than in male bulls . In contrast, Koohmaraie *et al.* (1996) established significantly heavier heart ($P < 0.05$) in ram than wethers .

5.2.4 Carcass characteristics:

There were no significant differences existed between kunanned and intact lambs for total muscle percentage , muscle-fat ratio , shrinkage percentage and gut fill .(Tables 5 & 3). The total muscle percentage did not

differ ($P > 0.05$) between kunanned and intact lambs which is in line with the findings of Koohmaraie *et al.* (1996) in sheep concluded that there was no significant difference between wethers and intact rams with respect to total muscle weight . Also the findings of Schoonmaker *et al.* (2001) in cattle concluded no significant difference between bulls and steers for yield grade is in line with the present study . While Kiyama *et al.* (2000) reported that , carcasses of castrated lambs received less desirable yield grade than carcasses of intact lambs .

The carcasses of kunanned lambs had significantly ($P < 0.01$) higher bone percentage compared with entire lambs , while the latter had significantly ($P < 0.05$) higher fat percentage than the former which is an interesting and important aspect in the present study. The reports of many studies that when the animals reach their mature body size they can continue accrete fat , but protein accretion declines to zero (Owens *et al.* 1995) might explain this , and the lower percentage of fat for kunanned lambs may indicate that they did not reach their mature body size yet , in other words entire male rams approach their mature body size sooner .

5.3 Meat chemical composition:

There were no significant differences ($P > 0.05$) between the two treatment groups in the percentages of protein , moisture and ash . (Table

7). Which coincided with the findings of Hunt *et al.*(1991) ;Schoonmaker *et al.*(2002) in cattle ;Koochmaraie *et al.*(1996) in sheep.

With regard to fat , entire rams had significantly higher ($P < 0.01$) fat percentage than kunanned . In contrast Kiyama *et al.*(2000) concluded higher ($P < 0.05$) fat for wethers than in intact lambs .While Koochmaraie *et al.* (1996) rported that wethers did not differ from intact lambs .

The less estimated rates of fat with no difference of protein accretion in kunanned lambs compared to intact lambs in the present study may attributed to less lipid deposition in early age of kunanned lambs rather than greater lean tissue accumulation and/or due to more fat deposition in intact lambs.

The sacroplasmic and myofibrillar protein percentages were significantly affected by kunan application method, where kunanned had significantly ($P < 0.01$) higher percentage of sacroplasmic and myofibrillar protein percentages than entire lambs (Table 5) . Morgan *et al.* (1993) reported that , in normal animals myofibrillar protein is lower in intact males than in castrated males , supported the present results . While Koochmaraie *et al.* (1996) reported that myofibrillar protein was lower in wethers than in intact males . The increase of myofibrillar protein in kunanned lambs might be due to their slightly higher muscle percentage.

5.4 Meat quality:

5.4.1 Water holding capacity (WHC):

Water-holding capacity was affected by kulan , intact male rams had significantly ($P < 0.01$) greater water-holding capacity than kulaned lambs might be attributed to the significant increase in both myofibrillar and sarcoplasmic proteins in the meat of kulaned animals .

5.4.2 pH value:

In the present study kulaned had significantly ($P < 0.01$) greater ultimate pH meat than intact lambs. Which in agreement with the findings of Fisher *et al.* (2001) stated that meat from steers is often of a more consistent quality than that from bulls , due to less dark-cutting and high pH meat .

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