

A Study on Goat Meat Production in Sudan

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Abstract

The total population of goats in the world is about 738.2 million heads, while the population of goat in Africa is approximately 218.6 million heads. The goat population in Sudan is estimated to be 42.526 million heads. The total meat production from the goat in the world is about 3.8 million tones, while in Africa the total production of meat from goats is about 851,000 tones. The Sudanese goats produce about 118,000 tones of meat per year. The goat population is mainly in developing countries where little is done to raise the awareness of the potential of this small ruminant to stimulate its introduction into animal research and economic development programmes. Population in Sudan can be classified into four major groups: Nubian, Desert, Nilotic and dwarf (or tagger) goats. The latter three groups are very excellent meat producers, however the first is famous for milk production, but the males are reported to produce good carasses. Goat meat is most important product from goats in the tropics and it is widely consumed. The colour of goat meat is usually dark red and it is some-what coarse in texture. The fat content is usually sparse and the fat is white in colour. The sparse covering of fat on the meat and the tendency of the fat to be concentrated more in the viscera is a characteristic of the species. There is often strong odour especially in the meat of the uncastrated old male goats. There is an emerging demand for goat meat as a gourmet item. In addition, health concerns regarding red meat do not apply to goat meat which compares favourably with chicken in terms of calories and protein, but is lower in total and saturated fat. Nowadays strategy in Sudan is focusing towards increase the awareness and culture of utilizing goat meat, to spare beef and mutton for export.

Keywords

Goat Meat, Production, In Sudan

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1. Introduction

The goat population in Sudan is estimated to be 42.6 million heads (Ministry of Animal Resources, 2005). The herd animal growth rate is 2.5%. Little is done to raise the awareness of the potential of this small ruminant to stimulate its introduction into animal research and economic development programmes.

Goat meat is famous for its low fat content and high processing properties as water holding capacity and colour. In addition to that the ratio of polyunsaturated to saturated

fatty acids is high. These properties make goat meat a healthy food commodity.

The objective of this study is to focus on meat characteristics and production potentials of Sudanese goats.

Socio-economic importance of goats: Of all domestic animals of value to man, goats have a particular socio-economic importance. This value goes back several centuries, and is consistent with the fact that next to the dog, goats were the first animals to have been domesticated by man (Zeuner,

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1963). There are two aspects to their importance; firstly, to meet man's social, cultural and also recreational needs, and secondly, to provide a supply of meat, milk, fibre and skins. Because of small farm size, however, small animals (sheep, goats and poultry) fit better into production systems than cattle which are more demanding of resources (Devendra, 1979). Rearing goats is a source of investment and income with low risk and minimum management attention (Devendra, 1979). Nomadism and transhumance involve migration of camels, cattle, sheep and goats which is dominant feature of livestock management especially in the near east region.

Goats provide small but significant supply of animal protein and goats due to their small size, are available to the poor people in rural areas (Devendra, 1981). This small contribution of animal proteins is especially important for poor farmers and land less, the undernourished pregnant and nursing mothers and for children.

Goat population: At present the total population of goats in the world is about 738.2 million (FAO, 2003) with approximately 54% being found in the tropics, the largest concentration are in Africa and India subcontinent. The population of goats in Africa is approximately 218.6 million (FAO, 2003) which represent 32% of the world total. The Eastern Africa region contains the highest concentration of goats. It is estimated that the arid zone of the world contains about 39% of the goat population, inspite of low grazing potential, while the semiarid zone has the greatest concentration of goats.

The goat population in the Sudan is estimated to be 42.6 million (Ministry of Animal Resources, 2005).

Goat production systems in Sudan: Goats in Sudan are generally managed extensively on unfenced range, sometimes herded by men or children but often left grazing alone. It is this management system which has led to accuse goats of damageing vegetation in areas of their grazing. The main reason for uncontrolled grazing is the marginal socio-economic situation of the people keeping goats. They depend on goats for milk and meat and to the low productivity of pasture and animals they were not able to apply better methods of management; and consequently productivity cannot be increased. As a result goat owners tend to keep large numbers of animals, to ensure a minimum supply of their products.

With few exceptions, goats are kept virtually without management. Animal graze free on communal range, which excludes any possibility of rational management and range improvement. Females and males graze together, so that controlled mating and a breed improvement programme through selective breeding are impossible. By the same

token, young female goats are mated at a very young age which impairs growth and future productivity.

Intensive goat rearing: This is mainly indoor kept goat at very small numbers. Nowadays large herds of goats owned by few rich individuals are found around big cities. Goats kept under such intensive system is costly and high producing individuals mainly foreign or cross bred goats are kept. This system offer some control over animals and pastures and would meet the minimum requirements for extending technical assistance.

Goat breeds in Sudan: Goats are preset in most parts of Sudan in innumerable crosses, however fourmain local types exist, these are: Nubian, Desert, Nilotic and dwarf (Tagger) goats.

1. Nubian goats: They are reverian found particularly in Northern Region and Khartoum state, they are also found in East Africa and Madagascar. They are unique African milk breeds producing 1-2Kg of milk per day. They are large, long legged, with pendulous ears and Roman nose especially in males. They are black or brown, have long silky coat and it has typical loop ears like those of the Damascus breed. Their adult weight ranges between 27–60 Kg. Because of their size surplus kids would be suitable for meat production (Mason and Maule, 1960; Devendra and Burns, 1970).

2. Desert goats: These goats belong to the arid areas. Both sexes are horned, in males being longer, twisted and projecting laterally. Ears are pendulous and moderate size. The goat are long legged and had short fine coat which usually gray (adaptation to heat and sparse grazing of desert condition). Beards are common in male and females. Average mature body weight is 33 Kg and 66 cm in wither height in adult female. While in male live weight ranges from 40–48 Kg and wither height ranges from 69–83 cm. These goats are primarily producer of meat and skin (Devendra and Burns, 1983). Kidding is non-seasonal and kidding interval is less than 12 months. The breed is very prolific and produces high proportion of twins and triplets with an average kidding rate above 200% and a lifetime production of 9–10 kids (Wilson and Clark, 1975).

3. Dwarf (Tagger) goats: They are found in the mountains and hills of the sudan in Nuba and Angessana mountains. Tagger is small sized animals with short legs and ears, horned and have mane and wattles. Males have beards. Colour is creamy to brown and sometimes black. They are active and well adapted to mountain climate. Kid average birth weight is 1.62 kg for males and 1.27 kg for females. Mature weight ranges from 13.0 to 23.3 kg for males and 16.3 to 21.3 for females. Young Tagger goats slaughtered at light weights 12-13 kg and they yield a carcass of 5.5 kg. While adult slaughtered at 20-22 kg yield a carcass of 8.5 kg.

4. Nilotic goats: They are reverian found in southern Sudan. Thebreed is of small size with an average weight of 11 kg and wither height of 40- 50 cm. They are kept for meat production (Mason and Maule, 1960).

Goat meat: Goat meat is the most important product from goats. The colour of goat meat is usually dark red and it is some-what coarse in texture. The fat content is usually sparse and the fat is white in colour. The sparse covering of fat on the meat and the tendency the fat to be concentrated more in the viscera is the characteristics of the species. There is often strong odour especially in the meat of the uncastrated old male goats. The meat is consumed where it is produced or sold in the markets by butchers for immediate consumption.

There are three types of goat meat:-

1. Meat from kids (8–12 weeks).
2. Meat from young goats (1–2 years).
3. Meat from old goats (2–6 years).

Acceptability of goat meat: While some countries and communities discriminate against goat meat, other communities even prefer goat meat to meat of cattle and sheep (Devendra and Burns, 1970). Acceptability of meat is so much influenced by local custom and preference that it is almost impossible to apply a universally acceptable standard. However, the question might be put if goat meat has some intrinsic peculiarities, which makes it unacceptable. As far as amino acid composition is concerned it closely resembles that of beef and mutton, although it is higher in arginine and leucine and isoleucine.

A few studies have been carried out to assess the acceptability of goat meat in Sudan. Gaili *et al.* (1972) in their study of desert sheep and goats in the Sudan, found that the taste panels found a tendency for mutton to be more tender than goat's meat, while no flavour differences could be detected. They also commented on the absence of strong flavoured meat in adult goats; which was contradictory to the current concept of goats meat.

The meat of older goat kids was regarded as being more juicy, with a more favourable aroma than that of younger kids, which was however a more tender and to a lesser degree some what less palatable. Meat from very young kids (3–5 months of age) was tough and that from aged goats was decidedly inferior in palatability. Goat meat, like mutton and beef, can be tenderized by means of electrical stimulation of the carcass (Savell *et al.*, 1977) or by processing at high ambient temperature (Babiker and Below, 1986). El Khidir *et al.* (1998) showed that the panalist score for juiciness, tenderness and overall accetability of goat meat was lower but not significantly so,

than that of the desert sheep.

Babiker *et al.* (1990) studied the chemical composition and quality attributes of goat meat and lamb and found that goat muscles were found to have significantly ($P < 0.001$) superior water holding capacity and lower cooking loss and the connective tissue strength was greater but not significantly so in goat meat than lamb. Also they found that flavour was significantly ($P < 0.05$) lower and juiciness was lower in goat meat than in lamb. Meat tenderness and overall acceptability were rated similarly between the two species.

It can be concluded that goat meat can hardly be distinguished from mutton or lamb, as far as flavour is concerned provided that it is obtained from relatively young animals. The long-held idea that goat meat is strongly flavoured is not well founded. However, goat meat seems to be definitely less tender than lamb. Muscle cold shortening of the poorly fat covered kid and goat carcasses in comparison to lamb and sheep carcasses seems to have had a toughening effect on goat meat.

The effect of sex on meat production from goats: The effect of sex on live weight growth is two folds. Firstly there is direct effect of sex on growth resulting presumably from genetic differences between males and females; and secondly there is an indirect effect of sex due to the influence of the sex hormones.

Castration of either sex reduces sex differences. Males castrated at a young age do not develop secondary sexual characters; the bones do not develop to the same extent in thickness although their growth in length is not retarded. They do not attain the broad head and thick and heavy neck and forequarters in general, typical in the entire male.

Babiker *et al.* (1985) reported a weekly rate of live weight gain in Sudan desert goats of 0.5 Kg for entire and 0.38 Kg for castrated goat kids.

Islam *et al.* (1991) found that thefemale goats were lighter, had lower gut content, but had a higher dressed yield (%) than the males. Elmoula *et al.* (1999) found that male desert goat kids consumed more dry matter, had significantly greater live weight gain and had heavier slaughter weight and superior feed conversion efficiency than females. Carcass weight was significantly greater in males than females but females dressed out heavier than males. Males carcasses had more muscles and bone while females carcasses had more fat and trimming. Bello and Babiker (1988) found that the average weekly rate of gain was 0.8 Kg in the desert X temperate crossbred kids and 0.6 Kg in the local male desert goat kids. The local desert kids ate 8.4 Kg dry matter of feed to gain 1 Kg live weight, while the crossbred kids ate 7.7 Kg of dry matter per 1 Kg of live weight gain.

The effect of castration on meat production from Nubian goats had been studied by Mohammed (1994) who concluded that the entire kids consumed more amount of feed and converted feed more efficiently than castrated kids. Also the slaughter weight was significantly ($P < 0.001$) higher for the entire than for castrates, but the dressing out percentages were not significantly different although castrates tended to have slightly higher dressing percentage values. The meat composition showed that castrated kids had significantly ($P < 0.05$) higher fat percentage and significantly ($P < 0.01$) lower muscle percentage while bone percentage was not significantly different between the two sex groups, as this tissue is an early maturing. The quality attributes evaluated objectively and subjectively indicated that entire kids had significantly ($P < 0.01$) more red coloured meat while castrates meat was significantly ($P < 0.01$) lighter in colour. Water holding capacity and cooking loss, though not significant were slightly higher in the meat from castrates than that from entire goat kids. Castration resulted in a significant ($P < 0.05$) reduction in shear force which coincided with the rating of the taste panel. The meat of castrates was also rated as more juicy than that of entire.

Performance characteristics of Sudanese goats: Osman (1984) intensively fed Sudan desert goats on different levels of feed and reported an average F.C.R. of 10.76 to 22.52 Kg dry matter per Kg weight gain. Babiker *et al.* (1985) reported a weekly weight gain for Sudan desert goats of 0.5 Kg for entire and 0.38 Kg for castrates, intensively fed from weaning to 7.5 months of age. They also reported that an average F.C.R. of Sudan desert goats of 5.06 and 6.56 Kg D.M/Kg gain for entire and castrated kids intensively fed for 126 days from weaning to slaughter at 30 Kg live weight. Bello (1985) fed entire Sudan desert goats and their temperature crosses with a diet of 12.75 MJ/Kg DM and reported a rate of weekly weight gain of 0.55 Kg and 0.7 Kg for entire desert male kids and their temperature crosses respectively. He also reported a respective F.C.R. of 8.39 and 7.06 for his tested kids. El Amin *et al.* (1990) conducted a study to detect the effect of the proportion of concentrate to roughage in the performance of Sudan desert goats. Their experimental diets consisted of high (H), medium (M) and low (L) concentrates. They observed no significant difference on the daily gain of the animals. They also reported F.C.R. of 8.3, 9.0 and 11.8 respectively.

2. Carcass Characteristics of Sudanese Goats

1. Dressing out percentage: Gaili (1976) found that the dressing percentage of unfattened desert goat ranged from 40.36 to 43.01, while with fattening it increased from 49.01

to 54.08 for young yearling and mature goats.

Babiker *et al.* (1985) reported a dressing- out percentage in 7.5 month old Sudan desert goats in the range of 45 – 52% for entire and 47-56% for castrates. Bello (1985) calculated the dressing- out percentage on a hot carcass basis for local desert goat kids and their temperate cross and found it as 54.14% and 54.84% respectively. The difference was not significant but tended to be higher in the crossbred kids. However, when dressing percentage was calculated on cold carcass basis, the dressing out percentages were 50.09 and 52.62% in the local desert goats and their temperate crossbred respectively. The value was significantly ($P < 0.05$) higher for the crossbred kids. Bello and Babiker (1985) reported dressing percentages of Sudan desert goat's kids and their temperature crosses as 54.1 and 54.84 when fed on diet containing 12.75 MJ.

El Khidir (1989) found that the desert goats had significantly heavier carcass weight (both hot and cold) and superior dressing out percentage than sheep possibly due to the heavier skin, head and visceral content in sheep. Elmoula *et al.* (1999) studied the effect of sex on goat meat production and found that the worm and cold dressing percentages on slaughter body weight basis were not significantly different but they were greater in females. While on empty body weight basis the worm dressing percentage was greater in males, but the cold dressing percentage was greater in females and also the difference was not significant.

2. Carcass composition: El Khidir *et al.* (1998) found that carcasses of goats have more muscles than that of sheep and they also found that, except for its slow growth rate, desert goats could yield heavier carcasses which were leaner than desert sheep.

3. Non carcass components: Bello (1985) reported that the head percentage was significantly ($P < 0.05$) greater in local desert goats than in their temperate crosses. El Khidir (1989) reported significant differences in non-carcasses component except for heart and testicles when desert goats were compared with desert sheep. Also El Khidir (1989) found that the head, skin, kidneys and alimentary tract (empty) were significantly heavier in the desert sheep than in the desert goats. Four feet, omentum, mesenteric fat and kidney knob channel fat were significantly heavier in desert goats than in sheep. Heart and testicles were also heavier, but not significantly so, in desert goats than in sheep. Elmoula *et al.* (1999) studied the effect of sex on goat meat production and found that, the head, skin, reproductive organs and four feet were heavier in male than in female goats, but the differences were not significant, except for the skin, liver, lung, diaphragm, trachea spleen and alimentary tract (empty) which were heavier in females than males. Omental fat, mesenteric

fat and kidney knob and channel fat were significantly ($P < 0.05$) heavier in females goats compared with males. The heart was also significantly ($P < 0.01$) heavier in females.

4. Muscle: bone ratio: Osman (1984) reported muscle: bone ratio of 2.05:1 in desert goat. Bello (1985) found that the muscle: bone ratio was 2.81 and 3.00 in the local desert goat kids and their temperate cross respectively. El Khidir (1989) reported that the muscle: bone ratio was higher in desert goat 3.00 than sheep 2.7. Elmoula *et al.* (1999) found that there was significant ($P < 0.05$) difference in the carcass total muscle, which was higher in male than female goats, but there was no significant difference in the total carcass bone tissue which was greater in males than females.

3. Meat Quality Attributes

1. Colour: Babiker *et al.* (1990) compared muscle colour of desert goat with that of sheep and reported respective values of 34.8 and 36.2 for lightness (L) 13.1 and 19.6 for redness (a) and 4.9 and 5.7 for yellowness (b) which indicated dark red colouration of goat muscles. Elmoula *et al.* (1999) studied the effect of sex on goat meat production and found that hunter lightness (L) value was not significantly different in male and female goat meat, but redness (a) and yellowness (b) values were greater in the meat of male than females.

2. Water holding capacity (WHC): El Khidir (1988) compared some quality attributes of muscles of desert sheep and goats and reported WHC values of 2.14 and 2.84 and cooking loss percentage of 34.2 and 36.6 for goat and sheep, respectively. Elmoula *et al.* (1999) in his study about the effect of sex on goat meat production found that WHC of muscles was significantly ($P < 0.01$) lower in male muscles than in females, but the cooking loss was significantly ($P < 0.05$) greater in male muscles. Babiker *et al.* (1990) compared muscles of goat meat and lamb and found that goat meat had significantly ($P < 0.001$) superior WHC and less cooking losses than lamb.

3. Meat tenderness: Babiker *et al.* (1990) on their study on chemical composition and quality attributes of goat meat and lamb, found that the shear force measured across muscle fibres and the connective tissue strength were greater, but not significantly so, in goat meat than in lamb meat. Ibrahim (1996) found that shear force was significantly ($P < 0.001$) lower in muscles obtained from kids given high energy level compared with those given medium or low energy levels, but the connective tissue strength of the same muscles showed no significant difference.

Effect of goat sex on meat shear force was reported by Elmoula *et al.* (1999) who found that shear force was not significantly different between the two sexes, but tended to

be slightly greater in male muscles than in females.

4. Conclusions

Due to its low fat content, high water-holding capacity and darker red colour goat meat has been recommended as healthy food commodity for those concerned with arteriovascular diseases and a good raw material for comminuted meat commodities.

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