



Effect of Protein Levels and Castration Management on Primal Cuts, Meat Quality and Non-Carcass Components of Male Desert Goats

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Abstract

The experiment was conducted in male Desert goats to study the effect of dietary protein levels and castration on primal cuts, meat quality and non-carcass components of male Desert goats. Twenty-four male Desert goats aged 4 - 5 months and weighing 10 Kg were used in this study. The goats were divided into three groups of similar age and weight (8 males), and every group was subdivided into two subgroups; (4 males) one subgroup was castrated (by using burrito) and the other was left intact. Group one was *ad-libitum* fed on the diet (A) (23% crude protein), group two was *ad-libitum* fed on diet (B) (20% crude protein) and the third group was *ad-libitum* fed on diet (C) (18% crude protein) in factorial experiment randomized complete design and the data was analyzed by Statistics 8 program. The results revealed that protein levels, castration and interaction had no significant ($P > 0.05$) effect on primal cuts. Protein levels and castration had no significant ($P > 0.05$) effect on flavor and tenderness except juiciness, protein levels and castration had no significant ($P > 0.05$) effect on non-carcass components. The interaction had no significant effect ($P > 0.05$) on non-carcass components except forefeet and head. It could be concluded that the 20% crude protein had achieved relatively higher forequarter and rack % and had a significant ($P < 0.01$) on meat juiciness score.

Subject Areas

Agricultural Science, Animal Behavior

Keywords

Castration, Protein, Cuts, Non-Carcass Components, Desert Goats

1. Introduction

Goats have numerous breeds which are distributed around the world and reared for their high demanding consumption of meat [1]. In most of these countries, the productivity of goats is below their potential with inefficiency at primary production and post-production systems [2]. The major advantage of goat's meat (chevon) is the lower subcutaneous and intramuscular fat and higher muscle shear force [3]. Compared with beef and mutton meat which makes it attractive and healthier for human consumption [4]. Goats live mostly on grazing poor natural pastures in arid and semi-arid with no supplementary feeding. They live as scavengers in the streets of towns and cities requiring minimum care and attention despite the fact that they play a very important role in the rural economy and provide many poor urban and rural families with milk and meat [5]. Sudan Desert goats are found in arid and semi-arid areas of Sudan, especially in the Kordofan and Darfur regions and they are adapted to survive in adverse conditions of feed limitation and water scarcity. Total annual red meat production in Sudan is estimated at 8830 tons, with goats contributing about 310 tons and annual live goat exports to the Arab world exceed 16,500 head [6]. Protein is an essential nutrient for animal growth and plays an important role in muscle growth and animal development [7]. The protein requirements of animals depend on many factors such as species, breed, age, physiological status and environmental factors. Castration had a significant effect ($P < 0.05$) on total changes in body length and height at wither [8]. The objectives of this research are to study the effect of protein levels and castration on primal cuts, meat quality and non-carcass components of male Sudan Desert goats.

2. Materials and Methods

Materials

Experimental animals.

Twenty-four male Desert goats aged 4 - 5 months and weighing 10 Kg were ear-tagged and injected with viremic (Ivermectin) against external and swallowed Bendazole against internal parasites two doses one week apart and with Terramycin (Oxytetracycline) at a dose of 2 cc/head for three days was administered to all animals as anti-bacterial treatments. The goats were divided randomly into three groups (8 males); each group was subdivided into two subgroups (4 males); one subgroup was castrated (by using burrito) while the other was left intact.

Methods:

Study site

This work was conducted at the farm of Animal Production Department (long30.24037E and lat13.20372N), Faculty of Natural Resources and Environmental Studies, University of Kordofan North Kordofan State, Sudan. North Kordofan State, located in the West of Sudan in arid and semi-arid zone, it characterized by adverse conditions of feed limitation and water scarcity. The cov-

ering plant consists of acacia spp trees and shrubs and annual plant and green grass.

Feed intake.

In group one each animal was provided with individual feed and water troughs, with free access to water and feeding *ad-libitum* fed on (Diet A) which compound from (23% crude protein, 30% ground nut seed cake, 30% Dura grain fetareta, 19% wheat bran, 20% ground nut hay, 1% sodium chloride) given at a rate of 500 g/head/day. Group two each animal was provided with individual feed and water troughs, with free access to water and feeding *ad-libitum* fed on (Diet B) compound from (20% crude protein, 20% ground nut seed cake, 30% Dura grain fetareta, 19% wheat bran, 30% ground nut hay, 1% sodium chloride given at a rate of 500 g/head/day). Group three each animal was provided with individual feed and water troughs, with free access to water and feeding *ad-libitum* fed on (Diet C) consisting of (18% crude protein, 10% ground nut seed cake, 30% Dura grain fetareta, 19% wheat bran, 40% ground nut hay, 1% sodium chloride) given at a rate of 500 g/head/day. Feed samples were dried in an oven at 105°C for dry matter determination and the rest of the samples were dried at 65°C for chemical analysis as outlined by the AOAC [9].

Live weight.

The live weight of each animal was recorded at the start of the experiment, then weekly until the end of the trial, using a spring balance of 50 ± 0 Kg maximum load. The animals were weighed in the morning (before feeding), following an overnight fast except for water [10].

Slaughter, dressing and weighing.

Twelve animals comprised of four individuals from each treatment group were slaughtered at the end of the experiment. Slaughter was done by using a knife to cut the jugular veins and carotid arteries. Each animal was immediately hoisted by the hind legs and allowed to bleed, after removal of the head and the fore and hind feet, skinning and evisceration were carried out. The external and internal offal including gut content were then weighed. The hot carcass weight was recorded. The carcass was then split along the vertebral column. The weight of the carcass halves was recorded. The left halves carcass was cut into forequarter, leg, rack, breast and loin % (wholesale cuts) [11].

Organoleptic properties:

At the end of the experiment, 12 animals were slaughtered 2 animals from each group treatment. The meat was chosen from the longissimus dorsi muscle at the midrib area. The meat was sliced in more or less equal protein and was cooked by boiling in water for 45 minutes with no salt or oil addition, (Kempster *et al.* 1982). Five untrained persons were used as panelists to evaluate the Juiciness, tenderness and flavor according to a 5-point (1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent hedonic scale [12].

Statistical analysis:

Statistically, the data were analyzed according to factorial experiment design as a 3 × 2 (protein levels vs sex). Duncan multiple range tests were used to com-

pare the means between different treatments.

3. Results and Discussion

Effect of protein levels and castration on primal cuts of male Desert goats.

The result exposed that protein levels, castration and interaction had no significant ($P > 0.05$) effect on primal cuts **Table 1**. These results were in line with the findings of [13] who found that increasing the dietary level of methionine by using Smartamine to Merino lambs did not lead to any increase in growth rate, or final body weight and were in line with findings of [14]. Who reported that protein level had not affected the growth rate, and slaughter weight and were in agreement with the finding of [15]. Who found that different levels of protein had no significant ($P > 0.05$) effect on carcass weight and dressing percent and were in line with the findings of the reported ratio with contain more protein ratio [16] [17] [18]. did not results in significant influence on carcass yield. Feeding high protein levels even in the form of undegradable protein did not cause any significant effect on dressing percentage [17] [18] [19]. Castration and interaction had no significant ($P > 0.05$) effect on primal cuts **Table 2**. These results were in line with finding of [20]. who reported that castration had no significant ($P > 0.05$) differences between two age group (3 - 6 months) on economic analysis, growth performance such as final body weight, total weight gain, average daily gain, total dry matter intake and feed conversion ratio and in a agreement with the findings of [8] [21]. who reported that castration had no significant effect on carcass weight and dressing percentage, with the same line with

Table 1. Feed ingredient (% as fed) and chemical composition (% DM-basis).

Type of diet	A diet	B diet	C diet
Ingredients of diet Item	%	%	%
Ground nut seed cake	23	20	18
Dura grain fetareta	30	30	30
Wheat bran	19	19	19
Ground nut hay	20	30	40
Sodium chloride	01	01	01
Chemical composition			
Item	%	%	%
Dry matter (DM)	93.5	93.4	93.2
Organic matter (OM)	87.0	86.5	86.0
Crude protein (CP)	23.7	20.6	18.4
Crude fiber (CF)	12.8	11.5	13.4
Ether extract (EE)	04.2	03.5	04.0
Nitrogen free extractive (NFE)	52.6	57.3	64.7
Ash	06.5	06.9	06.6
Energy density (ME/KgDM)	12.2	13.1	12.1

Energy density calculated as in [26].

Table 2. Effect of protein levels and castration on primal cuts of male Desert goats.

Treatments	No. of animals.	Forequarter (Kg)	Leg (Kg)	Rack (Kg)	Breast (Kg)	Loin (Kg)
Protein levels						
A diet	8	0.9	0.8	0.2	0.2	0.1
B diet	8	1.0	0.8	0.3	0.2	0.1
C diet	8	1.0	0.8	0.2	0.2	0.1
SE		0.09NS	0.04NS	0.3NS	0.04NS	0.02NS
Castration management						
Intact	12	0.9	0.8	0.2	0.2	0.1
Castrate	12	1.0	0.9	0.3	0.2	0.1
SE		0.08NS	0.08NS	0.04NS	0.03NS	0.02NS
Protein levels-castration						
A x intact	4	0.9	0.8	0.2	0.2	0.1
A x castrate	4	1.0	0.8	0.3	0.1	0.1
B x intact	4	1.0	0.8	0.3	0.2	0.1
B x castrate	4	1.1	0.9	0.3	0.2	0.1
C x intact	4	1.0	0.7	0.2	0.2	0.1
C x castrate	4	1.1	0.9	0.3	4.7	0.1
SE		1.0NS	0.14NS	0.07NS	0.05NS	0.03NS

A diet (contain 23% CP), B diet (contain 20 CP %) and C diet (contain 18% CP), NS = non-significant.

findings of [15] they found that castration had no significant effect on carcass weight and dressing percentage and was in line with the present result [22] who reported that castration had no significant ($P > 0.05$) on slaughter weight, hot carcass weight, empty body weight, forequarter %, hindquarter % and dressing percentage. This contradicts with the finding of [23] [24] [25]. They found that castration significantly improved dressing percentage. These differences may be due to the production system, animal breed, growth stage, castration age and feed type used among those studies.

Effect of protein levels and castration on panel tastes.

Protein levels and castration had no significant ($P > 0.05$) effect on tenderness and flavor except juiciness. But protein A had registered relatively highest values compared with protein B and C. On tenderness taste, protein C had recorded relatively highest values compared with protein A and B. On flavor and juiciness, on the other hand, castration had no significant ($P > 0.05$) effect on tenderness and flavor, but castrated males had recorded higher values compared with entire ones on tenderness and flavor. Protein levels had significant ($P < 0.01$) effect on juiciness score, whereas protein A and B registered highest values compared with protein B. Protein levels may increase the intramuscular fat and the intramuscular fat increase the juiciness score, on the other hand, castration had sig-

nificant ($P < 0.01$) on juiciness whereas castrated males recorded higher values compared with entire ones table, 3. Castration increases the intramuscular fat may be the intramuscular fat increase the juiciness score.

Effect of protein levels and castration on non-carcass components of male Desert goats.

Protein levels had no significant ($P > 0.05$) effect on non-carcass components **Table 3**. These results agreed with the finding of [27], who stated that the diet content of crude protein seemed not to affect the empty body, carcass weights, dressing percentage and external component (skin, head and feet) and thoracic organs (lung and heart). However, goats fed medium protein levels had heaviest ($P < 0.05$) liver and gut, and in line with the result of [14] who claimed that protein levels had not affected the growth rate, although slaughter weight, carcass yield and non-carcass components and carcass composition in young sheep from three breeds. However, the weights of some organs were heavier for goats on a medium CP regimen than for kids on other diets. Nutrients produced by fermentation in the case of the medium protein level diet were probably determinants for liver development [28]. This phenomenon may explain the heavier liver, abomasum, and intestines of these animals compared to those fed low or high-CP-level diets. High protein diets (125% of the calculated [29] requirements) resulted in greater weights of liver, small intestine, and kidney compared to normal (100%) protein diets in lambs [30]. The weight of offal components rich in bone and/or with a low metabolic activity (head, feet and lungs) varied slightly with diet. Since these organs are early maturing parts [31]; they are less affected by dietary in growing animals [32]. Castration had no significant effect on non-carcass components **Table 4**. These results were in line with the findings of [33] he reported no significant differences in body components between entire and castrated Nubian goat kids.

Table 3. Effect of protein levels and castration on some organoleptic scores of desert goat meat.

Treatments	No. of animal.	Tenderness	Flavor	Juiciness
Protein levels				
A	8	2.9	2.4	2.9 ^a
B	8	2.5	2.3	2.8 ^a
C	8	2.8	2.7	2.1 ^b
SE		0.3NS	0.3NS	0.3**
Castration management				
Intact	12	2.5	2.3	2.3 ^a
Castrate	12	2.9	2.6	2.9 ^b
SE		0.2NS	0.2NS	0.2**

A diet (contain 23% CP), B diet (contain 20 CP %) and C diet (contain 18% CP), ^{ab}Values in the same rows with different superscripts differ as ** $P < 0.01$ and NS = non-significant.

Table 4. Effect of protein levels and castration on non-carcass components of male Desert goats.

Treatments	No. of animal.	Heart (%)	Mesentery fat (%)	Liver (%)	Lung and trachea (%)	Forefeet (%)	Hind feet (%)
Protein levels							
A diet	8	0.07	0.2	0.2	0.2	0.3	0.3
B diet	8	0.07	0.1	0.2	0.2	0.3	0.2
C diet	8	0.07	0.1	0.2	0.2	0.3	0.2
SE		0.01NS	0.1NS	0.02NS	0.03NS	0.03NS	0.04NS
Castration management							
Intact	12	0.06	0.2	0.2	0.2	0.3	0.2
Castrate	12	0.07	0.1	0.2	0.2	0.3	0.2
SE		0.01NS	0.1NS	0.02NS	0.02NS	0.03NS	0.03NS
Protein levels-castration							
A x intact	4	0.07	0.31	0.2	0.2	0.3 ^a	0.3
A x castrate	4	0.06	0.16	0.3	0.2	0.3 ^{ab}	0.3
B x intact	4	0.06	0.13	0.2	0.2	0.2 ^{ab}	0.2
B x castrate	4	0.07	0.09	0.2	0.2	0.4 ^{ab}	0.3
C x intact	4	0.06	0.06	0.2	0.2	0.3 ^{ab}	0.3
C x castrate	4	0.08	0.04	0.2	0.2	0.3 ^b	0.2
SE		0.02NS	0.2NS	0.03NS	0.04NS	0.05*	0.06NS

^{ab}Values in the same rows with different superscripts differ as *P < 0.05 and NS = non-significant.

Treatments	No. of animal.	Skin (%)	Genitalia (%)	Full four Stomach	Empty four stomachs (%)	Blood (%)	Head (%)
Protein levels							
A	8	0.8	0.08	2.1	0.4	0.4	1.1
B	8	0.7	0.07	1.4	0.4	0.5	1.1
C	8	0.8	0.08	1.7	0.4	0.5	1.0
SE		0.1NS	0.03NS	0.4NS	0.07NS	0.07NS	0.04NS
Castration management							
Intact	12	0.8	0.07	1.7	0.4	0.4	1.1
Castrate	12	0.8	0.08	1.7	0.4	0.5	1.0
SE		0.09NS	0.02NS	0.3NS	0.06NS	0.06NS	0.04NS
Protein levels-castration							
A x intact	4	0.8	0.08	2.2	0.4	0.3	1.2 ^a
A x castrate	4	0.8	0.08	2.0	0.4	0.5	1.0 ^b
B x intact	4	0.8	0.06	1.1	0.4	0.4	1.1 ^{ab}
B x castrate	4	0.7	0.08	1.8	0.4	0.5	1.1 ^{ab}
C x intact	4	0.8	0.1	2.0	0.4	0.	1.1 ^{ab}
C x castrate	4	0.8	0.07	1.5	0.4	0.5	1.0 ^{ab}
SE		0.2NS	0.04NS	0.5NS	0.1NS	0.09NS	0.06*

A diet (contain 23% CP), B diet (contain 20 CP %) and C diet (contain 18% CP), ^{ab}Values in the same rows with different superscripts differ as *P < 0.05, and NS = non-significant.

4. Conclusions

The study could be concluded that:

- The protein levels, castration and interaction had no significant ($P > 0.05$) effect on primal cuts, but 20% crude protein had achieved relatively higher forequarter and rack %.
- Protein levels and castration had significant ($P < 0.01$) effect on juiciness score, on the other hand, protein levels and castration had no significant ($P > 0.05$) effect on tenderness and flavor score.
- The interaction had significant ($P < 0.01$) effect on head and forefeet percentages, while protein levels and castration had no significant ($P > 0.05$) effect on the other non-carcass components.

Conflicts of Interest

The author should clarify that there is no conflict of interest with any financial, personal or other relationships with other people or organizations related to the material discussed in the manuscript.

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