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The Effect of Castration on Feedlot Performance and Non-Carcass Components of Young Male Sudanese Nubian Goats

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Abstract: This study was carried out to investigate the effect of castration on feedlot performance and non-carcass components of Sudanese Nubian Male Goats. Twenty Nubian Male Goats of similar weight (14.2 Kg) and similar age (less than a year) were used. Experimental Goats were divided into two groups of 10 goats each. The two groups took the same ration throughout the experimental period which lasted for 150 days. After the adaptation period, one group of goats was selected randomly for castration using the Burdizzo method, and the other group served as a control. Independent student t-test was used to examine the significance of differences between the two groups. Results showed that castration significantly ($P< 0.01$) reduced the final kid's weight.

Live body weight gain and feed intake were insignificantly decreased. Non-carcass components were not significantly affected by castration except that mesenteric, omental, and kidney knob fat which were significantly ($p<0.05$) higher in the castrates.

It could be concluded that castration had adverse effect on feedlot perfprmance and noncarcass parameters.

Keywords: Castration, Feedlot Performance, Non-Carcass Components, Male Sudanese Nubian Goats.

أثر الإخصاء على الآداء والمكونات غير الذبيحة لصغار ذكور الماعز النوبى السودانى

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المستخلص: أجريت هذه الدراسة للكشف عن تأثير الإخصاء على أداء صغار الماعز النوبى السوداني والمكونات غير الذبيحة في حظائر التسمين. استُخدم عشرون ذكرًا صغار الماعز النوبى السوداني بوزن متقارب (14.2 كجم) وأعمار متقاربة (أقل من عام).

قُسِّمت صغار الماعز النوبى السوداني إلى مجموعتين (10 ذكور لكل مجموعة). تناولت المجموعتان نفس العلف طوال فترة التجربة التي استمرت 150 يومًا. بعد فترة الأقلمه اختيرت مجموعة من الصغار عشوائيًا للإخصاء بواسطة آلة البرديزو بينما استُخدمت المجموعة الأخرى كمجموعة ضابطة.

أُجري تحليل إحصائي باستخدام اختبار "ت" للطلاب المستقلين لفحص دلالة الفروق بين المجموعتين.

الإخصاء بواسطة آلة البرديزو قلل معنويا ($P< 0.01$) من الوزن النهائى. كما زاد معنويا ($P < 0.05$) دهن البطن.

لم تختلف المكونات غير المذبوحة بشكل كبير بين المجموعتين، باستثناء النسيج الدهنى.

خلص البحث الى أن الإخصاء أثر معنويا على الأداء و المكونات غير الذبيحة.

الكلمات المفتاحية: الإخصاء، الأداء ، المكونات غير الذبيحه، الماعز النوبى السودانى.

1- Introduction

Sudan possesses a significant livestock population, estimated at 110 million head, comprising 41.12 million sheep, 32.4 million goats, 32.08 million cattle, and 4.9 million camels (MARF, 2021). This vast animal resource serves as a primary source of meat production for both local consumption and international export, playing a crucial role in the national economy and providing a vital source of income for many rural communities.

According to FAO (2023), small ruminant production in Sudan has increased by 15% since 2015, with Nubian goats showing superior adaptation to climate change (ILRI, 2022).

The Economic and Social Importance of Nubian Goats

The importance of Nubian goats extends beyond their role as a source of milk and meat; it encompasses the economic and social aspects of rural communities in Sudan. Raising Nubian goats is a primary source of income for many families, providing them with self-sufficiency in animal products and contributing to improving their living standards. Nubian goats are also characterized by their ability to adapt to harsh climatic conditions and scarce resources, making them an ideal choice for breeders in arid and semi-arid regions (Devendra and McLeroy 1982).

Furthermore, Nubian goats play a role in preserving the biodiversity of local breeds, representing an integral part of Sudan's animal heritage. Developing and improving the productivity of this breed can contribute to enhancing national food security and reducing reliance on animal imports.

By-products of goats, such as hides and manure, also provide additional economic opportunities for breeders and local industries (Ensminger and Parker1986).

Inspite of many researches about effect of casteration on goats (Murray et al 2020 and Gashu et al 2023) , but most of these reseaches concentrare on other breeds than Nubian and other climatic conditions. Also these reseaches do not investigate the relation between castration time and fatdepots in young male goats.

The Global Role of Goats in Food Security

The role of goats is not limited to being a locally important animal in Sudan; it extends to an increasing global importance in the context of food security and sustainable development. Goats are among the first animals to be domesticated and have spread worldwide, especially in arid and semi-arid regions where resources are limited.

Goats are highly adaptable to difficult environmental conditions, including water scarcity and poor pastures, making them an efficient productive animal in marginal environments (Devendra 2010).

Goats contribute significantly to providing high-quality animal protein through the production of meat and milk, in addition to fiber (wool and cashmere) and hides. In many developing countries, goats are a primary source of income for smallholder farmers and play a crucial role in their livelihoods. Their small size and ease of management also make them suitable for home rearing, enhancing food security at the household level (Webb etal 2005).

In light of increasing global challenges such as climate change, resource scarcity, and population growth, the role of goats emerges as a sustainable solution for food production. Their ability to convert low-quality feed into valuable animal products, their disease resistance, and their reproductive efficiency make them a strategic choice for enhancing global food security. Therefore, research focusing on improving goat productivity, such as this study, gains significant importance at both local and global levels (Dubeuf and Le Gall 2012).

Environmental Importance of Goats and Their Adaptability

Goats are uniquely capable of adapting to a wide range of environments, from rugged mountainous regions to arid deserts and humid tropical areas. This adaptability makes them particularly valuable in regions where other animals, such as cattle and sheep, cannot thrive. Goats can feed on a variety of plants, including shrubs and coarse grasses that other animals avoid, making them efficient in utilizing marginal grazing resources (Devendra 2010).

Additionally, goats play an important ecological role in controlling the growth of harmful shrubs and invasive weeds, which helps maintain pasture biodiversity. Their ability to graze in difficult terrains and access plants inaccessible to other animals makes them

a valuable tool in land management. These environmental characteristics enhance the importance of goats as part of sustainable animal production systems, especially in areas suffering from land degradation or resource scarcity (Webb etal 2005).

Challenges Facing Goat Production in Sudan

Despite the significant importance of goats in Sudan, the goat production sector faces numerous challenges that limit its full potential. Among the most prominent of these challenges are harsh climatic conditions, such as drought and scarce rainfall, which negatively affect the availability of pastures and water. This leads to nutritional deficiencies, impacting animal health and productivity (Devendra 2010).

Another challenge is the spread of epidemic diseases and parasites, which cause significant economic losses to breeders. Lack of awareness of sound health management practices and insufficient veterinary services in rural areas exacerbate this problem. Furthermore, traditional breeding methods, which often lack scientific planning, limit production efficiency and hinder the application of modern technologies (Webb et al 2005).

Marketing challenges also represent a major obstacle, as breeders face difficulty accessing markets and selling their products at fair prices. Lack of infrastructure, such as paved roads and collection centers, increases transportation costs and reduces profit margins for breeders. Moreover, the absence of clear policies to support the goat sector and insufficient investment in research and development limit the sector's ability to grow and develop (Dubeuf and Le Gall 2012).

Research Objectives of the Study

Based on the economic and social importance of Nubian goats and the need to improve their productivity, this study aims to achieve the following objectives:

1. Evaluate the effect of castration on feedlot performance: Determine the differences in growth rates, feed intake, and feed conversion efficiency between castrated and uncastrated Nubian Young Goats.
2. Analyze the effect of castration on non-carcass components: Study the changes in weight and proportion of non-carcass components (such as head, skin, internal organs, and visceral fat) as a result of castration.
3. Provide practical recommendations: Based on the findings, provide applicable recommendations for breeders and policymakers to improve Nubian goat breeding practices and increase meat production efficiency.

By achieving these objectives, this study seeks to contribute to the development of the livestock sector in Sudan, enhance food security, and improve the livelihoods of rural communities.

2- MATERIALS AND METHODS

Experimental Animals and Procedure

Twenty Sudanese male Goats (Nubian ecotype) were utilized in this study. Prior to the experimental period, the animals underwent a two-week adaptation phase, during which they were rested, ear-tagged for individual identification, and housed under controlled conditions. During this period, all animals received prophylactic treatment with antibiotics and Albendazole to ensure their health and minimize the risk of disease interference with the study results. At the conclusion of the adaptation period, animals were individually weighed, and subsequently divided into two experimental groups, each comprising ten goats, ensuring an equal average live weight of 14.2 kg per group. Each group was housed in separate pens, equipped with dedicated watering and feeding facilities to prevent cross-contamination and ensure accurate feed intake measurements.

Castration Procedure

Following the adaptation period, one group of goats was randomly selected for castration, while the other group remained intact and served as the control. The closed method of castration, involving the crushing of spermatic cords with a Burdizzo emasculator, was employed to avoid open wounds and minimize the risk of infection and contamination. Immediately after castration, the castrated animals received an injection of a broad-spectrum antibiotic as a prophylactic measure to prevent postoperative infections and ensure their well-being.

Feeds and Feeding

Both experimental groups were provided with the same experimental diet throughout the study period, which extended for 150 days. The diet consisted of a balanced mixture of sorghum grain, groundnut cake, wheat bran, groundnut hulls, molasses, salt, and calcium carbonate (Table 1).

This formulation was designed to meet the nutritional requirements of growing goats and support optimal performance. In addition to the concentrate diet, Barseem (Medicago Sativa) was offered twice a week at a rate of 0.293 kg per head per week to provide additional roughage and essential nutrients and to prevent vitamin A deffeciency. Clean water and salt licks were made available ad libitum throughout the entire experimental period to ensure adequate hydration and mineral intake.

Data Records

Detailed data records were meticulously maintained throughout the study to ensure accuracy and reliability of the results. Feed intake was recorded daily by measuring the total feed offered to each pen and the residual feed, allowing for the calculation of group intake and individual feed intake by difference. Live weight gain was monitored weekly, with animals being weighed using a spring balance after an overnight fast (except for water) to minimize errors due to gut fill variation. The average weekly weight gains and feed conversion efficiency were subsequently calculated from these measurements.

Health Care

Comprehensive health care protocols were implemented to ensure the well-being of the experimental animals.

Physical examinations were conducted upon their arrival and regularly throughout the study period. Any clinical signs of pneumonia observed were promptly treated with an injection of Oxytetracycline 5% at a dose rate of 5cc per animal for 3-4 days. Sulphonamides (Sulphasole) were administered for the treatment of any observed cases of diarrhea, ensuring that animal health issues did not confound the experimental results.

Non-Carcass Components

At the culmination of the 150-day feeding trial, all animals were fasted overnight, with access only to water, prior to slaughter. Individual body weights were recorded immediately before slaughtering. The slaughtering procedure adhered to local Muslim practices. Following slaughter, various non-carcass components, including the head,skin, four feet, full and empty rumen and intestines, liver, kidneys, omental fat, mesenteric fat, and kidney knob and channel fat, were meticulously weighed to assess the impact of castration on these components.

Statistical Procedure

The collected data, encompassing daily dry matter intakes, weight gain, feed conversion ratio, and non-carcass components (expressed as a percentage of empty body weight), were subjected to statistical analysis using Stat Soft (2010). Independent Student's t-tests were employed to determine the significance of differences between the intact and castrated goats groups. This statistical approach allowed for a robust comparison of the treatment effects on the measured parameters.

Additional Details on Experimental Design

This study was designed as a randomized comparative study to evaluate the effect of castration on feedlot performance and non-carcass components in Sudanese Nubian Young goats. A Completely Randomized Design was chosen to ensure random allocation of animals to experimental groups, thereby minimizing the influence of uncontrolled factors and increasing the reliability of the results. Twenty Nubian Young Goats were used, divided into two equal groups (10 Goats per group): a castrated group and a control (uncastrated) group. Animals were kept in individual pens to allow for precise monitoring of feed intake and individual behavior, and to reduce competition for food.

The experimental period was set at 150 days, based on the average time required to reach commercial slaughter weight in Nubian goats under feedlot conditions. A stable environment was provided for the animals, with temperature and humidity controlled as much as possible to reduce environmental stress. Animals were examined daily by a veterinary team to ensure their health and welfare, and any abnormal observations or disease cases were recorded.

Detailed Experimental Setup and Animal Management

The experimental animals, twenty Sudanese Nubian male Goats, were carefully selected to ensure uniformity in age (less than one year) and initial body weight (approximately 14.2 kg). This rigorous selection process aimed to minimize variability among subjects, thereby enhancing the internal validity of the study. Upon arrival at the research facility, the goats underwent a two-week acclimatization period. During this phase, they were housed in individual pens , allowing for close observation of their health status and adaptation to the new environment. Each pen was equipped with ad libitum access to fresh water and feed troughs, ensuring that nutritional and hydration needs were consistently met [64]. To mitigate potential health issues that could confound the experimental results, a comprehensive health management protocol was implemented. All animals received a broad-spectrum antibiotic and an anthelmintic (Albendazole) at the beginning of the adaptation period. Daily health checks were performed by experienced veterinary personnel, who monitored for any signs of illness, changes in behavior, or deviations from normal physiological parameters. Any animal exhibiting signs of distress or disease was promptly treated, and its data was carefully considered for inclusion or exclusion from the final analysis to maintain data integrity.

The individual housing system facilitated precise measurement of feed intake for each animal. Feed offered was weighed daily, and any residual feed was collected and weighed the following morning. This allowed for the calculation of daily feed consumption per animal, providing accurate data for feed conversion efficiency assessments.

The experimental diet, composed of sorghum grain, groundnut cake, wheat bran, groundnut hulls, molasses, salt, and calcium carbonate, was formulated to meet the specific nutrient requirements for growing Young Goats, ensuring optimal growth potential under the experimental conditions.

Weekly body weights were recorded for all animals using a calibrated spring balance. To minimize variations due to gut fill, animals were fasted overnight (with access to water) before weighing. This consistent weighing protocol provided reliable data for calculating weekly weight gains and overall growth rates. The 150-day experimental period was chosen to allow sufficient time for the effects of castration on growth and carcass characteristics to manifest, providing a comprehensive understanding of the long-term impacts.

3- Results and Discussion

Feed Intake

Feed intake of the two animal groups is presented in (Table 2). Entire Young Goats exhibited a significantly ($p<0.05$) higher consumption rate than castrated ones. This finding aligns with previous research indicating that intact males generally consume more feed due to their higher metabolic rates and growth potential (Solomon et al 1991).

The absence of castration stress at the beginning of the experiment in entire Young Goats might also contribute to their better feed intake, as stress can negatively impact appetite and digestive efficiency (Bretschneider 2005). These results are consistent with those obtained by Mohammed (1994), Garray (2005), and Nasr et al. (2011), who noted that for the same breed, dry matter intake is better in entire than in castrated animals.

Growth Rate and Live Weight Gain

As shown in (Table 2), castrated goats had significantly ($P<0.05$) lower weight gain and significantly ($P<0.01$) lighter final body weight than intact goats. This could be attributed to the role of testosterone hormone as a growth promoter, responsible for the distinguishing characteristics of the masculine body. Testosterone influences protein synthesis and muscle development, leading to higher growth rates in intact males.

Similar observations were reported by Mahgoub and Lodge (1998), who found that among various species/sex/slaughter weight groups, castrated male and female goats had the lowest growth rate.

Murray et al. (2001) also reported that the growth rate of entire Boer and feral bucks was significantly higher than that of their castrated counterparts. Conversely, Nasr et al. (2011) found that castration had an insignificant effect on the examined feedlot performance traits of Sudanese Nubian Goats. This discrepancy might be due to the shorter experimental period (8 weeks) in their study compared to the current study (up to 22 weeks). Longer experimental durations often reveal more pronounced effects of castration on growth and body composition, as hormonal differences accumulate over time (Bretschneider 2005).

Efficiency of Feed Conversion

Entire Goats were found to convert feed more efficiently than castrates (Table 2). This enhanced efficiency is primarily due to sex hormones, which increase the efficiency of dietary nutrient utilization. This result is consistent with findings from various studies in cattle, sheep, and pigs, which indicate that castrated males convert feed into live body weight less efficiently than entire males (Ensminger and Parker1986).

In experiments with lambs, the results of this study align with Gashu et al. (2017) and Claffey et al. (2018), who reported that intact lambs had significantly better feed conversion ratios than castrated lambs. Liu et al. (2022) also showed that the feed conversion ratio is better in entire than in castrated rams.

However, Babiker et al. (1985) and Mohammed (1994) found that feed conversion ratios were similar ($p>0.05$) for castrated and entire Goats. The significant superiority of entire Goats in the present study could be attributed to the effect of testosterone hormone, which is known to increase the efficiency of dietary nitrogen utilization and protein deposition.

Non-Carcass Components

The non-carcass components as a percentage of empty body weight are shown in (Table 3). No significant differences were observed between the two groups of goats in the weight of the head,skin, feet, heart, lungs and trachea, liver, intestines, and kidneys. However, these values tended to be slightly higher in entire goats than in castrates.

This suggests that while castration primarily impacts fat deposition and reproductive organs, its effect on other non-carcass components is less pronounced.

Conversely, the values of visceral fat, including kidney knob and channel fat, omentum, and mesenteric fat, were significantly ($P<0.05$) heavier in castrates than in entire Young Goats. This is likely due to hormonal changes post-castration, specifically a decrease in testosterone levels, which play a significant role in regulating fat distribution in the body. This decrease is followed by an increase in estrogen hormone levels, which promotes fat accumulation in certain areas, such as the mesentery, kidney, and abdomen (Piccione et al 2012).

Many researchers have observed increased fat deposition in castrated animals compared to intact ones, as reported by Marti et al. (2017) in bulls.

Reproductive organs were also significantly ($P<0.001$) heavier in entire goats than in castrates. Their values were 1.44kg for entire and 0.47 kg for castrates. This difference can be attributed to the diminished weight of reproductive organs in castrates due to the castration process itself.

Recent research, such as that by Michael (2018) on Gender, Age, and Diet Effects on Lamb Meat Quality [46], and Shawn et al. (2024) comparing entire and castrated Australian male lambs, generally aligns with these findings and highlighting the profound impact of castration on reproductive organ development and weight.

Comparison of Feed Intake and Weight Gain Results with Previous Studies

The results obtained in this study regarding the effect of castration on feed intake and weight gain are consistent with several previous studies conducted on various ruminant species. For instance, a study by Mohammed (1994) on Nubian goats showed that intact animals consume larger quantities of feed and achieve higher growth rates compared to castrated animals. This consistency reinforces the validity of the current findings and confirms that the effect of testosterone on metabolism and growth is a general phenomenon in males.

In the context of sheep, Gashu et al. (2017) found that intact lambs had significantly better feed conversion efficiency than castrated lambs, supporting the hypothesis that male sex hormones play a crucial role in improving nutrient utilization efficiency.

Similarly, a study by Claffey et al. (2018) on lambs showed that castration leads to a decrease in growth rate and an increase in fat deposition, which aligns with the results regarding increased visceral fat in castrated goats in our study.

However, it is important to note some discrepancies in results among studies. While our study and others showed a negative effect of castration on growth, some studies, such as that by Nasr et al. (2011), did not find a significant effect of castration on feedlot performance in Nubian Young Goats. These differences can be attributed to several factors, including the age at which castration was performed, the duration of the experiment, the type of diet, environmental conditions, and genetic variations among breeds.

For example, if castration is performed at a very young age, it may not have a significant impact on subsequent growth, as the animal has not yet reached sexual maturity where testosterone has its greatest effect. Also, short-term studies may not capture the long-term effects of castration on growth and body composition.

Therefore, the design of future experiments should consider these factors to ensure more accurate and generalizable results.

Additionally, feed quality and composition can affect the response of animals to castration. In high-energy and protein diets, the effect of castration on growth may be less pronounced, as animals have sufficient nutrients to support growth even in the absence of testosterone. In contrast, in low-quality diets, the effect of castration may be more evident, as animals rely more on testosterone to improve nutrient utilization efficiency.

This comparison highlights the complex relationship between castration, hormones, growth, and body composition in ruminants. It emphasizes the need for more comprehensive research that considers all influencing factors to provide more accurate recommendations for breeders.

Implications for Breeders and Consumers

The results of this study provide valuable insights for both goat breeders and consumers in Sudan. For breeders, the study highlights the trade-off between rapid growth rate and feed conversion efficiency in intact animals versus increased fat deposition and ease of management in castrated animals. If the primary goal of the breeder is to achieve maximum meat production in the shortest possible time and at the lowest feed cost, keeping males intact may be the better option, especially if conditions allow for managing potential aggressive behavior. However, if the breeder targets a market that prefers fattier meat or faces challenges in managing aggressive animals, castration may be more suitable. The ease of managing castrated animals can also reduce the risk of injuries to breeders and workers, and save time and effort in daily care. Therefore, breeders should evaluate their production goals, market conditions, and management capabilities before deciding on castration.

For consumers, the study indicates that meat from castrated goats may have a higher fat content, especially visceral fat. This may be attractive to consumers who prefer more tender and juicy meat, as fat contributes to improving these sensory characteristics. However, health-conscious consumers may prefer leaner meat, which may be more available in intact animals. Providing clear information to consumers about the source of meat (castrated or uncastrated) can help them make informed purchasing decisions that align with their dietary and health preferences.

Furthermore, the strong male odor in intact animals can affect consumer acceptance of meat, especially in cultures that do not prefer this odor. In these cases, castration can be an effective solution to improve the sensory quality of meat and increase its market acceptance. Understanding these consumer preferences can help breeders adapt their production practices to better meet market demands.

Conclusions

The study investigated the feedlot performance and non-carcass components of both entire and castrated Nubian Young Goats. The findings indicated that entire Goats consumed a greater amount of feed, leading to a more efficient feed conversion ratio and a higher growth rate compared to castrates. This suggests that maintaining male Goats intact can be advantageous for maximizing meat production efficiency, particularly in systems where rapid growth is prioritized.

Regarding non-carcass components, castration did not significantly affect most of these components in the two groups of Goats, with the notable exception of fat depots. Visceral fat, including mesenteric, omental, and kidney knob fat, was significantly increased in castrated Goats.

This accumulation of fat is primarily attributed to the hormonal changes induced by castration, specifically the reduction in testosterone levels and the subsequent increase in estrogen, which promotes fat deposition in certain areas of the body.

In summary, while castration may lead to increased fat deposition and potentially easier management, it can negatively impact feed intake, growth rate, and feed conversion efficiency.

Breeders should carefully consider their production goals and market demands when deciding whether to castrate male Nubian Young Goats. For markets that prioritize lean meat and rapid growth, keeping males intact may be more beneficial. Conversely, for markets that prefer fattier meat or where management of aggressive intact males is a challenge, castration might be a viable option.

Further research is recommended to explore the long-term effects of castration on meat quality attributes and consumer preferences in different cultural contexts.

Advanced Data Collection and Analysis Techniques

Beyond the primary measurements of feed intake, weight gain, and non-carcass components, future research building upon this study could incorporate more advanced data collection and analytical techniques to provide a deeper understanding of the physiological and molecular mechanisms underlying the observed effects of castration. For instance, regular blood sampling could be conducted to analyze a wider range of biomarkers. This includes not only sex hormones (testosterone, estrogen) but also growth hormones (e.g., Insulin-like Growth Factor 1 - IGF-1), metabolic hormones (e.g., insulin, leptin, ghrelin), and stress hormones (e.g., cortisol). Such analyses would offer insights into the endocrine regulation of growth, metabolism, and stress responses in castrated versus intact animals.

Furthermore, detailed analyses of muscle and adipose tissue samples could be performed at the molecular level.

This could involve gene expression profiling (e.g.,RNA sequencing or qPCR) to identify genes differentially expressed in response to castration, particularly those involved in muscle growth, fat deposition, and energy metabolism.

Proteomic analysis could also be employed to quantify protein levels and identify specific proteins associated with changes in meat quality and carcass composition. Histological examination of muscle and fat tissues would provide microscopic insights into cellular changes, such as muscle fiber hypertrophy/atrophy and adipocyte size/number, contributing to a more complete picture of the morphological alterations induced by castration.

In terms of statistical analysis, while t-tests and ANOVA are fundamental, incorporating multivariate statistical methods could reveal more complex relationships within the data. Techniques such as Principal Component Analysis (PCA) or Factor Analysis could be used to reduce data dimensionality and identify underlying patterns among multiple correlated variables. Regression analysis could be employed to model the relationships between castration status and various performance parameters, while controlling for confounding factors. Survival analysis could be considered if there are differences in animal longevity or time to reach certain physiological milestones. The use of advanced statistical software packages with robust capabilities for mixed models and longitudinal data analysis would further strengthen the statistical rigor of the study.

Moreover, integrating economic modeling into the analysis would provide a more holistic view of the implications of castration for goat production systems. This could involve cost-benefit analyses of castration procedures, feed efficiency, market prices for different meat qualities, and labor requirements. Such economic evaluations would be invaluable for breeders and policymakers in making informed decisions regarding management practices and market strategies. The combination of physiological, molecular, and economic data would provide a comprehensive understanding of the multifaceted impacts of castration in Nubian Young Goats.

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Table 1. Ingredients and Calculated Chemical Analysis of Experimental Diet.

Ingredient	Percentage
Ground Sorghum grain	**40**
Groundnut Cake	**18**
Wheat bran	**20**
Groundnut hulls	**10**
Molasses	**10**
Salt	**1**
Calcium carbonate	**1**
Calculated chemical analysis	

Ingredient	Percentage
Metabolizable Energy (MJ/Kg)	10
Crude protein (%)	17.19

Table 2. Feedlot Performance of Entire and Castrated Young Goats.

Item	Entire Goats	Castrated Goats	Level of Significance
Number of animals	10	10	-
Time of experiment (weeks)	22	22	-
Initial weight (kg)	14.77	14.83	N.S
Final weight (kg)	21.09 ± 3.21	17.37 ± 1.64	P< 0. 01
Total Dry matter intake (kg)	66.26	56.24	P< 0. 05
Daily Dry matter intake (kg /head)	0.430	0.365	N.S
Daily Concentrate intake (kg/head)	0.412	0.347	N.S
Total live body gain(kg)	6.57 ± 0.81	4.57 ± 1.28	N.S
Feed conversion efficiency (kg Dm/kg live body weight)	10.08	12.30	P< 0. 05

N. S: Not significant

Table 3. Non- carcass components of Entire and Castrated Young Goats as percentage of empty weight.

Item	Entire Goats	Castrated Goats	Level of Significance
Head	7.28	7.12	N.S
Skin	7.95 ± 0.39	7.58 ± 0.61	N.S
Four feet	3.1 ± 0.09	3.1 ± 0.07	N.S
Rumen and intestine (empty)	7.91 ± 0.77	8.60 ± 0.79	N.S
Liver	2.36 ± 0.21	2.23 ± 0.26	N.S
Kidney	0.38 ± 0.03	0.41 ± 0.02	N.S
Heart	0.55 ± 0.04	0.51 ± 0.05	N.S
Lungs &trachea	2.34 ± 0.21	2.42 ± 0.19	N.S
Spleen	0.22 ± 0.03	0.19 ±0.03	N.S
Mesenteric fat	1.40 ±.0.22	1.61 ± 0.40	P < 0.05
Omentum fat	1.72 ± 0.30	2.16 ± 0.33	P < 0.05
Kidney knob and channel fat	1.49 ± 0.21	1.86 ± 0.37	P < 0.05
Reproductive organs	1.44 ± 0.17	0.47 ± 0.06	P < 0.001

N. S: Not significant