BADEGGI JOURNAL OF AGRICULTURAL RESEARCH AND ENVIRONMENT, 2023, 05(02), 58 - 67

NCRI Press

Available online: www.ncribjare.org
ISSN: 2695-2122, e-ISSN: 2695-2114
DOI: https://doi.org/10.35849/BJARE202302/105/006
Journal homepage:www.ncribjare.org

Research Article

Effects of Age on Growth, Compositions and Chevon Quality Attributes of West African Dwarf (Goats) Bucks

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Abstract

Fifty-six growing bucks purchased from different farmers in Oyo and Osun States were used to carry out the study. They were weighed and disinfected against both ecto and endo parasites before the start of the experiment. The average weights at purchase ranged between 7.67 and 9.86kg and the experiment was laid out in a Complete Randomized Design (CRD). The ages of the bucks were identified and determined using the appearance of the incisors and were grouped accordingly. Final Body Weight (FBW), Average Daily Weight gain, (ADWG) and Feed Conversion Ratio, (FCR) were determined using standard procedures. Dressing percentage (DP), Shear Forces (SF), Rib Eye Area, (REA) and Water Holding Capacity, (WHC) were evaluated after three bucks per treatments were sacrificed. Also evaluated were Total Fat Deposits (TFD), Meat to Bone Ratio (MBR) and percentage proportions of lean, bone and fat. Results showed that the average weights at slaughter were 13.47kg, 16.09 and 20.35kg at 12, 18 and 24 months respectively. However the shear forces of 4.97kg/cm^3 and 5.01kg/cm at 18 and 24 months old bucks were similar and significantly higher than that of yearling goats (2.66 kg/cm). The TFD and MBR also varied significantly as the age. The study concluded that older animals produced carcasses with higher total fat deposits, more meat and relatively less percentage GI tract contents compared with others, it however recommended that the cost of managing the animals within the period, feed consumptions including medications to attain the 24 months could be economically evaluated in respect to the meat yield to justify the need for the added time.

Keywords: *Chevon yield, Dressing percentage, Indigenous, WAD goats*

Introduction

Goats are small ruminants commonly found in towns and villages where they have over the years contributed 30% to the total meat consumption in Nigeria (FDL, 2017). Their characteristics feature of being easily converted to cash has helped in raising the living standard of rural farmers. Their management system has generally been free-roaming, tethering, partial and or total confinement, but the profit in managing them in a confinement with adequate food supply outweighs that of free range, (Anurudu 2011). Therefore rearing them in such an atmosphere has been long advocated. Most goats exist today with their locations varying from the Sahel, dry and humid agro-climatic regions of the world (FAO, 2000). Three main breed of goats are indigenous to Nigeria and they include Sahel goats, Maradi also known as Red Sokoto goats and the West African dwarf goats. The Sahel types and Maradi thrive largely in the drier northern part of the country while WAD goats are predominantly common along the south though some pockets are obtainable in some north central states. The WAD goats are tolerant to wide climatic variations and are evenly distributed. The animals fit perfectly into the socio-economy of an average rural farmer and hence deserve greater attention than they are presently receiving. Their ability to convert low quality feeds to meat and milk coupled with high

Received on 28th June, 2023; Revised 4th August 2023; Accepted 18th August and Published on 31st August, 2023

fecundity and short reproductive cycles have helped farmers to better their condition of living, (Anurudu 2011). It is on record that mature bucks command high premiums especially during the Salah festival and other celebrations. A bride price is not complete without the presentation of mature bucks during wedding engagement in most African communities, (Ayanniyi, 2018). They can be easily included in the mixed farming system in a symbiotic relationship where crop residues could be fed to the animals while their waste materials decompose and enrich soil fertility. Left over crops could be harvested, preserved and offered as a basal supplement if well kept. Based on purposeful marketing especially with respect to age, goat is sub divided into Capretto; which is obtained from young animals. They are essentially meat from the old weaners producing carcass weight between 12-14kg. The meat is relatively pink in colour. The other, Chevon is from older goat weighing 15 kg and above. The preference for either chevon or capretto varies from country to country, region to region and more importantly on an ethnic basis. It is based on this preference that this study is anchored. First to establish in terms of the relative nutrient variability across the different ages selected and second to evaluate reasons for the preferences and probable economic gains or losses if management were prolonged unnecessarily.

Materials and Methods

The experiment was conducted at the University of Ibadan, Ibadan in the Small Ruminants Unit. Ibadan is located on Latitudes 7 26^0N and 3 54^0E and is characterized by humid climate with annual rainfall of 1712mm and a mean temperature 18^0-31^0C. The animals were weighed and disinfected against parasites before the start of the experiment. Fifty-six growing bucks were procured in Ejigbo and Iwo LG Areas of Osun State and also from Akinyele LG Area of Oyo State. They were grouped according to their ages and allowed to stabilize for three weeks before the experiment. The animals were managed to attain the respective ages before sacrifice. Theywere fed intensively with isocaloric diets at 5% of their body weight with access to salt-lick and clean water on free-choice basis. Concentrates were fed in between while roughages were offered twice daily. The animals were allowed some minutes to roam around in the pen once a week. Dried *Panicum maximum* together with groundnut haulms were fed as the basal diet. The compositions of the experimental diet are shown in Tables 2 and 3.

Performance characteristics of goats (bucks) according to the age groups

The following parameters were determined during the feeding trial on weekly basis;
Average feed intake, Weight gain, Feed Conversion Ratio and Final body weight.

Slaughtering Procedure

At the end of the trial, 9 bucks per treatment went under knives after a sixteen-hour fasting period. Slaughtering was by severingthe carotid arteries and veins at the base of the neck towards the spinal cord. The bled weight, hot carcass weight and weight of the other non-carcass components were collected and measured. They were evaluated based on the relative percentages to their fasted weights.

Determination of Internal temperature and pH of carcasses

The loin muscle part was cut to 1cm depth and a sensitive digital thermometer was inserted to obtain carcass temperature immediately after skinning. This was done at interval of 30 minutes up following (Okubanjo and Tenni 1997 and Omojola and Adesehinwa, 2006) procedures. A Microcomputer pH meter H18424 model was used for the evaluation of the fresh meat. It involves piecing the loin muscle to a depth of 1-2cm and inserting the instrument in the cut area at 0-hour post mortem and at intervals of 30 minutes in a period of three hours according to the procedure of Omojola and Adeshinwa, 2006.

Dressing percentage

The percentage Dressing was evaluated arithmetically following the procedures described by Aduku and Olukosi, (2000).

$$\text{Dressing percentage (\%)} = \frac{\text{Hot carcass weight}}{\text{Fasted live weight}} \times 100$$

Rib-Eye Area (REA**)**
The REA measures the meatiness of the carcass and is evaluated between the 12^{th} and the 13^{th} ribs towards the lion part. The method, plastic grid mechanism involves placing small cut steak on tracing paper a sheet of Matte fine acetate material which is later read on a graph paper. The acetate paper was placed on the graph paper and boxes were counted as one when filled or more than half part full the other less than half-filled were ignored.

Shear force value of meat
The shear force is determined using the Warner-Bratzler technique. It requires a known weighed meat of 10g wrapped in a thermo-resistant polyethylene nylon and pre-heated in pressure cooking pot for 20 minutes with a hot plate model to 72 ^{0}C (NO ECP 202), Malgorzata*et al.*, (2005). This is followed by allowing it to cool to room temperature of between 25 - 27^{0}c for 15 minutes. The sample meats were thereafter re-weighed, wrapped in polythene bags and chilled for 18 hours at 4^{0}C. They were subsequently subjected to a core of 1.25 cm diameter parallel to muscle fibre orientation with a device (Qiaofen and Da-Wen, 2005). These cores were shared at three different points with the aid of the Warner-Bratzler V-notch blade shearing instrument and read on the scale on the instrument according to the (Honikel, 1997) procedure.

Water holding capacity of meat (WHC)
The force within which meat can retain moisture when external power is exerted is referred to as Water Holding Capacity (WHC) of meat. In determining the moisture content the meat could hold, a principle suggested by (Suzuki *et al*., 1991) was followed. It requires placing a known weight 1-2 g of meat sample in between two 9-cm filter papers and was pressed within a pair of plexi glass of 10.2 x 10.2 cm^2 at a 35.2 kg/cm^3 force for 60-90 seconds in the pressing device. The meat samples were thereafter subjected to oven drying for 24 hours at a temperature of 105^{o}C. The principle is an indirect method where water released on the filter paper is measured and determined.

Cooking loss
This is the reduction in weight of meat during cooking. To evaluate the loss in weight, a known weight of meat is wrapped in an air-tight water proof polythene nylon and subjected to cooking in a pre-heated pot at 75^{o}C for 60-65 minutes. The meat sample was allowed to cool at ambient temperature and reweighed thereafter.

$$\text{Cooking loss \%} = \frac{\text{Initial weight of meat (W1)} - \text{Final weight of meat (W2)}}{\text{Initial weight of meat (W1)}} \times 100$$

Proximate composition and pH of meat
The chemical composition of the meat samples was evaluated in the Meat laboratory following the AOAC (2000) recommendation.

Statistical analysis
The data were collected and the analysis of variance using the SAS (2002)package was employed to separate the means.

RESULTS AND DISCUSSION
From the experiment, the older bucks had better growth rates (114 g/day) and Feed conversion ratio (7.31) than the other two. The daily weight gain observed in this work fell within the range reported by El-khidir *et al*., (1998) who gave values of 121 g/day and 117 g/day weight gain per day for desert sheep fed molasses as urea blocks, oil seed cake and concentrates. However, the findings were comparatively low compared to Suliman and El-Amin (1980) and Allama (1987) reports. Both workers submitted a significantly higher value of 215 g/day and 237 g/day for Sudan goats under intensive care which were two times that obtained from the present study. This wide margin could be as a result of intensive feeding which is one of the limitations in this study. However, the performance of the bucks from this experiment showed a comparatively higher value of 40.03 to 50.54% obtained for the same tropical goats fed grass alone and left extensively (Mahgoub *et al*., 2004).
Further to the above, the submissions of Anjaneyulu *et al*., (2007); El Hag and El Gallad, (1988); Dhanda *et al*., (2003) and Mahgoud *et al*., (2004) who at one time or the other reported effect of age on feed intake, FCR and daily weight gain suggesting older animals consume more and yielded more chevon than the capretto even at the similar management system. The impact of age therefore exerts significant influence on final

bodyweight (FBW) and Daily weight gain (DWG) ($P<0.05$). The range of growth of (71.67-114.38g/d) table 4 were greater than 23 – 63 g/d reported for Tanzania East African goats by both Mtenga and Kitaly (1990) but similar to the value obtained for one and half year(s) old indigenous goats from Ethiopia Valley area with 71.8 g/d (Abule *et al*.,1998). The average DWG from this work was similar to that obtained for Long Ear Somali breeds of tropical goats (Kumar *et al* .,1991; El-Gallad *et al*., 1988), (Kirk *et al*.,1994) of Malawi bucks. The result by Getahun (2001) of semi-intensively managed goats on main concentrate diets was also in tune with the present study of 68.47 g - 91.44 g. The older buck with highest final body weight was able to achieve this feat because of its better utilization of feeds and fast growth.

Effect of age on Dressing Percentage and other slaughter characteristics

Dressing percentage (DP) simply refers to as the percentage of a live animal that becomes carcass after slaughter, (Taylor 1983). Part of his submission is that the reduction is usually due to the loss of blood, removal of hide, skin and intestines then dividing the remaining value by the live weight and multiplying the results by100. Factors such as body weight, sex, age and amount of GIT all contribute to animal dressing percentages, (Tenin, 1994). The older bucks elicited a comparatively higher DP of 48.76% than the other two 34.56% and (45.82%) as observed in this work. Other slaughter characteristics such as the bled and empty body weights were correspondingly lower in the younger bucks. Singh and Senger (1970) on Jampary goats showed the DP ranged between 36.6 to 49.87% when the animals were slaughtered between 9 and 15 months but Bello and Babiker (1998) gave a range of 54.26 to 55.24 for older goats. Though these values obtained from this work were closer among them, they were lower than that of 2 years old bucks. For the bled weight, the 12 and 18 - month old bucks with respective 12.45 kg and 14.42 kg were significantly lower than 19.05 kg of 24months goats. The empty body weight similarly followed this trend with the oldest bucks yielding 12.02 kg which was significantly higher than 6.83 kg and 9.60 kg respectively for the yearlings and the 18-month bucks respectively. The hot carcass weight also revealed that the 24-month bucks elicited superiority over the other two. While the yearlings had a relatively low value of 4.34 kg, that of a year and half produced hot carcass weight of 4.49 kg which was significantly lower than 9.17 kg of the oldest bucks. These findings were reportedly similar to findings from (Ayanniyi, 2018) who studied the effects of breeds on hot carcass weights of indigenous goat breeds in Nigeria. Even though his submission were in percentages, when compared with real values there were found to be comparatively higher than that obtained from this work. The reason was attributable may be because the animals were managed intensively for the period of the experiment and which was so in this work**.**

Relative percentage of primal cuts to hot carcass weight of three goat across the ages

Presented in table 5 were the ratios of primal cuts to hot carcass weight of three goat across the three age groups. The hind legs of 22.82% and 24 00% for the 12 and 18 months old bucks were significantly lower values than that of 24 months old (25.65%) . The younger bucks produced comparatively lower higher values in fore leg, brisket, rack and flank. These findings were not unexpected as increase in age usually lead to growth and in animals they result in to tallness, fatness giving rise to higher weights of the different parts of the body and the overall impact on the body morphology.

Conclusion

The study concluded that age plays a significant role in the carcass yield and in the overall quality attributes of the chevon. However older animals had carcasses with relatively high fat contents which could reduce the quality of meat and also the inherent nutrient value.

Recommendation

The study recommended that the cost of managing the animals within a time frame, feed consumptions including medications to reach the 24 months threshold could be economically evaluated viz as viz the relative meat yields to justify the need for the added time before attaining the target periods as evaluated in this work.

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Table 1: Ingredient Composition of Concentrate Feed on % Dry Matter basis

Ingredients	Percentage (%) g /kg
Dusa*	**30.38**

Brewer's dried grain	**29.38**
Peeled cassava meal	**5.69**
Wheat offal	**19.56**
Palm Kernel Cake	**10.00**
Dicalcium phosphate	**3.00**
Salt	**1.00**
Premix mixture	**1.00**
Total	**100:00**
Calculated value	
Crude Protein	**14.00**
Crude Fiber	**13.71**
Ether Extract	**5.30**
Digestible Energy	**2200**

***By-product of local (gin factory) grain processing**

Table 2: Chemical Composition of the Concentrate Feed and Hay

Components (g/100g)	Concentrate	Hay	
Dry Matter		**88.05**	**91.40**
Crude Protein		**11.95**	**9.15**
Ether Extract		**4.50**	**0.90**
Crude Fiber		**11.75**	**18.65**
Ash		**4.80**	**4.00**
Neutral Detergent Fiber		**53.50**	**68.70**
Acid Detergent Fiber		**35.20**	**49.01**
Acid Detergent Lignin		**9.89**	**15.20**
Hemicellulose		**18.30**	**19.69**
Cellulose		**25.31**	**53.50**
Nitrogen free extract		**56.95**	**58.70**
Digestible Energy (kcal/kgDM)		**3410.30**	**3960.10**

Table 3. Performance characteristics of the bucks across the age groups

	Months				
Parameters	**12**	**18**	**24**	**SEM**	**P-value**
Initial body weight	**7.02^{c}**	**8.14^{b}**	**10.02^{a}**	**0.0997**	**0.7822**
Final body weight	**13.47^{c}**	**16.09^{b}**	**20.35^{a}**	**0.018**	**0.0075**
Average daily feed intake	**427.11^{c}**	**564.22^{b}**	**837.00^{a}**	**0.1238**	**0.0009**
Average daily weight gain	**71.67^{c}**	**88.25^{b}**	**114.38^{a}**	**0.0647**	**0.0225**
Feed conversion ratio	**5.97^{c}**	**6.39^{b}**	**7.32^{a}**	**0.1705**	**0.0001**

^{a,b,c}: means within the same row with different superscripts row differ significantly ($p<0.05$).

Table 4: Slaughter characteristics of the bucks

	Months				
Parameters	**12**	**18**	**24**	**SEM**	**P-value**
Fasted weight (kg)	**13.00^{c}**	**15.21^{b}**	**20.00^{a}**	**0.022**	**0.0087**
Bled weight (kg)	**12.45^{c}**	**14.42^{b}**	**19.05^{a}**	**0.022**	**0.0087**
Empty body weight(kg)	**6.83^{c}**	**9.60^{b}**	**12.02^{a}**	**0.1238**	**0.0009**
Dressing percentage (%)	**34.56^{c}**	**45.82^{b}**	**48.76^{a}**	**1.220**	**0.8435**
Hot carcass weight (%)	**4.33^{c}**	**4.49^{b}**	**9.17^{a}**	**0.330**	**0.0002**

^{a,b,c}: means within the same row with different superscripts row differ significantly ($p<0.05$).

Table 5: Percentage primal cuts to Live weight of the bucks

	Months				
Parameters (%)	**12**	**18**	**24**	**SEM**	**P-value**
Hind leg	**22.82^{a}**	**24.02^{b}**	**25.65^{c}**	**0.0243**	**<0.0001**
Fore leg	**20.46^{a}**	**21.61^{b}**	**22.98^{b}**	**0.0314**	**0.0968**
Brisket	**10.31^{b}**	**11.33^{b}**	**13.30^{a}**	**0.0214**	**0.0043**
Neck	**9.80^{a}**	**10.50^{a}**	**12.64^{b}**	**1.42**	**0.0018**
Flank	**13.74^{c}**	**15.06^{b}**	**15.85^{a}**	**0.0232**	**<0.0001**
Rack	**5.50^{c}**	**6.16^{b}**	**6.99^{a}**	**0.0413**	**0.0009**
Loin	**3.95^{c}**	**4.27^{b}**	**7.09^{a}**	**0.0200**	**<0.0001**

^{a,b,c}: means within the same row with different superscripts row differ significantly ($p<0.05$).

Table 6: Ratio of Lean to bone of the bucks across the age groups

	Months				
Parameters	**12**	**18**	**24**	**SEM**	**P-value**
Hind leg	**1.05^{c}**	**2.20^{a}**	**1.56^{b}**	**1.49**	**0.0001**
Fore leg	**0.84^{c}**	**1.98^{a}**	**1.45^{b}**	**1.52**	**0.0968**
Brisket	**0.79^{b}**	**1.03^{a}**	**1.00^{a}**	**2.18**	**0.0043**
Neck	**0.45^{c}**	**0.93^{b}**	**1.11^{a}**	**1.97**	**0.0015**
Rack	**0.69^{c}**	**1.27^{b}**	**2.25^{a}**	**2.74**	**0.0001**
Loin	**0.29^{c}**	**0.52^{b}**	**0.59^{a}**	**1.06**	**<0.0001**

^{a,b,c}: means within the same row with different superscripts row differ significantly ($p<0.05$).

Table 7: Physical characteristics of chevon of the bucks across the ages

	Months				
Parameters	**12**	**18**	**24**	**SEM**	**P-value**
REA(cm^2)	**3.30^c**	**4.86^b**	**6.37^a**	**1.49**	**0.0001**
Shear force($kgcm^3$)	**2.66^c**	**4.05^b**	**5.76^a**	**2.18**	**0.0043**
Cooking loss (%)	**22.63^c**	**29.71^b**	**32.32^a**	**1.42**	**0.0018**
WHC (%)	**77.30^a**	**70.26^b**	**67.68^c**	**1.97**	**0.0015**

^{a,b,c}: means within the same row with different superscripts row differ significantly (p<0.05).

Table 8: Distribution of tissues in the chevon across the three age groups

	Months				
Parameters	**12**	**18**	**24**	**SEM**	**P-value**
Lean	**61.70^c**	**64.86^b**	**67.07^a**	**0.443**	**0.0001**
Bone	**34.07^c**	**27.65^b**	**23.90^a**	**0.0352**	**0.0024**
Fat	**3.02^b**	**4.48^b**	**5.77^a**	**0.0238**	**0.0003**
Lean : fat	**19.21^c**	**14.51^b**	**14.00^a**	**0.0467**	**0.0031**
Lean : bone	**1.73^a**	**2.25^b**	**2.69^b**	**0.0335**	**0.0013**
Loss	**1.03**	**1.05**	**1.02**	**0.0440**	**0.7051**

^{a,b,c}: means within the same row with different superscripts row differ significantly (p<0.05).

Table 9: Percentage fat depositions across the categories of the bucks

	Months				
Parameters (%)	**12**	**18**	**24**	**SEM**	**P-value**
Abdominal fats	**0.30^c**	**0.62^b**	**0.93^a**	**0.443**	**0.0001**
Kidney fat	**0.09^c**	**0.23^b**	**0.30^a**	**0.0352**	**0.0024**
Pelvic Fat	**0.23^b**	**0.51^b**	**0.77^a**	**0.0238**	**0.0003**
Pectoral fat	**0.20^c**	**0.41^b**	**0.60^a**	**0.0467**	**0.0031**
Intra muscular fat	**0.73^a**	**1.25^b**	**2.00^b**	**0.0335**	**0.0013**
Total	**1.55**	**3.02**	**4.60**	**0.0440**	**0.7051**

^{a,b,c}: means within the same row with different superscripts row differ significantly (p<0.05).

Table: 10 Relative Percentage of body organs to the live weight of the bucks

	Months

Organs (%)	12	18	24	SEM	P-value
Full GIT	**1.05^{c}**	**2.20^{a}**	**1.56^{b}**	**1.49**	**0.0001**
Empty GIT	**1.05^{c}**	**2.20^{a}**	**1.56^{b}**	**1.49**	**0.0001**
Rumen	**0.84^{c}**	**1.98^{a}**	**1.45^{b}**	**1.52**	**0.0968**
Reticulum	**0.79^{c}**	**1.03^{b}**	**1.00^{a}**	**2.18**	**0.0043**
Omasun	**0.84^{c}**	**1.98^{a}**	**1.45^{b}**	**1.52**	**0.0968**
Abomasum	**0.79^{c}**	**1.03^{b}**	**1.00^{a}**	**2.18**	**0.0043**
Bile	**0.84^{c}**	**1.98^{a}**	**1.45^{b}**	**1.52**	**0.0968**
Heart	**0.79^{c}**	**1.03^{b}**	**1.00^{a}**	**2.18**	**0.0043**
Lung	**0.84^{c}**	**1.98^{a}**	**1.45^{b}**	**1.52**	**0.0968**
Liver	**0.84^{c}**	**1.98^{a}**	**1.45^{b}**	**1.52**	**0.0968**
Spleen	**0.79^{c}**	**1.03^{b}**	**1.00^{a}**	**2.18**	**0.0043**
Kidney	**0.79^{c}**	**1.03^{b}**	**1.00^{a}**	**2.18**	**0.0043**
Diaphragm	**0.45^{c}**	**1.11^{b}**	**0.93^{a}**	**1.97**	**0.0015**
Trachea	**0.69^{c}**	**1.27^{b}**	**2.25^{a}**	**2.74**	**0.0001**
Fore shank	**0.45^{c}**	**1.11^{b}**	**0.93^{a}**	**1.97**	**0.0015**
Hind shank	**0.69^{c}**	**1.27^{b}**	**2.25^{a}**	**2.74**	**0.0001**
Gall bladder	**0.45^{c}**	**1.11^{b}**	**0.93^{a}**	**1.97**	**0.0015**
Tail	**0.45^{c}**	**1.11^{b}**	**0.93^{a}**	**1.97**	**0.0015**
Head	**0.69^{c}**	**1.27^{b}**	**2.25^{a}**	**2.74**	**0.0001**
Skin	**0.29^{c}**	**0.52^{b}**	**0.59^{a}**	**1.06**	**<0.0001**

^{a,b,c}: means within the same row with different superscripts row differ significantly ($p<0.05$).