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Effects of dried sugar beet root based concentrates level on wholesale cuts and eye muscle characteristics in Nubian goat male kids

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ABSTRACT

High meat demand and prices in the Sudan highlighted the needs to improve goat exploitation due to high population and meat high nutritive value and health attributes. However, goats are mainly raised in traditional systems with low inputs and outputs. Nubian is the main goat dairy breed and culled males are used for meat production. Nutrition is among the main constraints for goat production and concentrates are not commonly fed. Sugar beet is introduced into the Gezira State and is a valuable feed. There is no information on the effects of dried sugar beet roots (DSBR) based concentrates level on Nubian goat male kids performance and carcass characteristics. Twelve Nubian goat male kids at 6 month old were housed individually, divided into 3 groups and allocated at random to feeds in 2016. They were fed upgraded *Seewa* (UPS) *ad lib.* at 8 am and 4 pm. They were fed DSBR based concentrates (70% DSBR, 15% groundnut cakes and 15% sunflower cakes) at 0 (control), 250 g and 500 g in two meals before UPS. They were fed for 8 weeks in addition to a two week preliminary period. They were slaughtered and the left side was divided into wholesale cuts, weighed and dissected. The rib section (10th – 12th) was removed and characteristics and meat composition were determined. All wholesale cuts weight increased with concentrates level. Supplementing upgraded *Seewa* improved Nubian male kids performance and carcass characteristics. Eye muscle characteristics were affected with concentrates level, but not significantly different. Concentrates level significantly ($P < 0.05$) affected meat DM, CP and ash. Animals fed 500 g had the highest DM, EE and ash. Animals fed 250 g concentrates had the highest CP. It was concluded that DSBR based concentrates level had improved wholesale cuts weight and meat composition. It was recommended to use DSBR based concentrates and upgraded *Seewa* in fattening Nubian goat male kids.

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INTRODUCTION

In the last decades meat demand and prices increased substantially in the Sudan due to increased human population, urbanization and improved education, living standards, nutritional awareness and sheep meat exports (Ahmed, 2014). Consequently, it is above the ability of a high sector of the population leading to adverse nutritional consequences on the poor, especially children. It is, therefore, critical to produce high quality and cheap meat *via* better exploitation of neglected animal species. Sheep meat is the most preferred followed by beef and then goat meat which is mainly used as kids meat in rural areas. Goat meat is preferred in many areas including Africa, Asia, Arabia and south Europe (Devendra and Mc Leroy, 1992). It is reputed for high muscles and nutritive value and low fat and cholesterol (Casey, 1992). In addition goat meat demand increased due to disputed relations between saturated fatty acids, cholesterol and cardiovascular diseases (Wikipedia, 2016).

Goats are important in the Sudan due to high population, wide distribution and production of high quality milk, meat and skin. In addition they require less investment and easily integrated in agricultural systems. Sudan ranked 6th in world goat population and meat production (FAOSTAT, 2008), but their contribution is less than expected as goat meat production is mainly traditional with low inputs and outputs. Improving goat meat production makes it competitive and increases demands, exports and national income. Sudan has many goat breeds and Nubian is the main dairy breed while Desert, *Taggar*, *Baggara*, Nilotic and *Ingessana* are meat breeds. Nubian males are usually culled at early ages and used for meat production.

Nutrition is among the main obstacles for goat production in the Gezira State due to many factors including rangeland deterioration (Abusuwar and Darrag, 2002), seasonal variations in feeds quantity and quality and serious shortages in the dry season with adverse effects on animals health and performance (Hamed, 2007). Crop residues are exploited to fill the nutritional gap with generally low nutritive value depressing dry matter intake and animals performance. *Seewa* is sorghum cob residue, abundant, cheap and has low nutritive value. Dried sugar beet roots (DSBPR) based concentrates were used in feeding *Tagger* males (Elimam *et al.*, 2017a and b). However, there is no information on using upgraded *Seewa* and DSBR based concentrates in Nubian males.

Therefore, this study was conducted to study the effects of different levels of DSBR based concentrates on the performance and carcass characteristics of Nubian males fed upgraded *Seewa ad lib* in the Gezira State. This article reports the effects of DSBR based concentrates on wholesale cuts and eye muscle characteristics in Nubian goat male kids.

MATERIALS AND METHODS

The experiment was conducted in the Goat Research Centre, Faculty of Agricultural Sciences, University of Gezira in Wad Medani, Gezira State, Sudan in 2016.

Animals

Twelve Nubian goat male kids at 5-6 month old were used in this experiment. They were injected with Ivermectin (Interchemie Werken, Harjumaa, Estonia) against internal and external parasites, weighed, ranked and divided into three groups each with four animals. The groups were allocated at random to treatments. They were weighed weekly for 8 weeks including a two weeks preliminary period.

Housing

They were housed in individual wire pens (1.5x2 m) shaded with corrugated iron sheets and the pens had roughages, concentrates and water buckets.

Feeds and feeding

Seewa was mixed in a ration containing 80% *Seewa*, 10% groundnut cakes, 5% molasses, 2% urea, 2% lime stone and 1% salt (UGS). Sun dried SBR were ground and formed a

concentrate with 70% DSBR, 15% groundnut cakes and 15% sunflower cakes. The animals were fed UGS *ad lib.* in two equal meals at 8 am and 4 pm and the refusals were collected and weighed. The animals were fed DSBR based concentrates at 0 (control), 250 g and 500 g in two equal parts before UGS meals. Drinking water was offered at all time.

Slaughter

At the end of the feeding period, the animals were fasted overnight, weighed before being slaughtered according to Islamic rituals (Elimam and Ombabi, 2007). They were skinned, eviscerated and carcasses were weighed with kidneys and renal fat (hot carcass weight, HCW).

Wholesale cuts

Hot carcasses were divided into left and right sides along the vertebral column using a saw and the left one was divided into six wholesale cuts as described by MLC (1977). Each cut was weighed and dissected into muscle, fat and bone and were weighed separately.

Rib section characteristics

The rib section (10th–12th) was removed from each carcass and weighed. Eye muscle (*Longissimus dorsi*) at the 12th rib surface area was measured using a tracing paper. Rib sections were dissected into muscle, fat and bone and were weighed separately. Eye muscles were minced and used for laboratory analysis.

Laboratory analysis

Eye muscle meat samples were analyzed in triplicates for DM, EE, CP and ash (AOAC, 1990).

Wholesale cuts weight was calculated as percentages of live body weight (LBW) and empty body weight (EBW).

RESULTS

Table 1 shows the effects of DSBR based concentrates level on wholesale cuts weight in male kids. All cuts weight increased with concentrates level and this effect was significant ($P \leq 0.05$) for single short forequarter and leg and chump.

Table 1. Effects of dried sugar beet root based concentrates level on wholesale cuts weight (kg) in Nubian goat male kids, Gezira State, Sudan.

Wholesale Cuts	Concentrates level (g/ day)		
	0	250	500
Neck	0.27±0.04	0.32±0.03	0.39±0.09
Single short forequarter	1.02±0.35	1.34±0.12	1.36±0.30
Best end of neck breast	0.38±0.06	0.49±0.09	0.51±0.11
Loin	0.25±0.03	0.32±0.05	0.40±0.16
Leg and chump	0.86±0.08	1.08±0.08	1.11±0.19

Table 2 shows the effects of DSBR based concentrates level on wholesale cuts percentages in male kids. All cuts percentages increased with concentrates level up to 250 g and decreased at 500 g concentrates. Best end of neck and breast and loin percentages were not significantly ($P \geq 0.05$) affected with concentrates level. Neck and single short forequarter and leg and chump percentages were significantly ($p \leq 0.05$) highest in animals

fed 250 g concentrates and were not significantly ($P \geq 0.05$) different in animals fed 0 and 500 g concentrates. They were significantly ($P \leq 0.05$) highest in animals fed 250 g.

Table 2. Effects of dried sugar beet roots based concentrates level on wholesale cuts percentages in Nubian goat male kids, Gezira State, Sudan.

Wholesale cuts	Concentrates level (g/ day)		
	0	250	500
Neck	10.12 ± 0.80	11.76 ± 0.85	10.52 ± 0.55
Single short forequarter	37.72 ± 3.13	39.79 ± 1.83	35.90 ± 0.76
Best end of neck & breast	14.13 ± 2.77	16.37 ± 1.52	13.72 ± 0.81
Loin	9.29 ± 1.04	11.47 ± 1.03	10.39 ± 2.09
Leg and chump	30.88 ± 1.51	32.66 ± 1.18	29.47 ± 2.11

Table 3 shows the effects of DSBR based concentrates level on eye muscle characteristics in male kids. All eye muscle characteristics were affected by concentrates level, but not significantly different ($P \geq 0.05$). Eye muscle area increased with concentrates level. Eye muscle weight generally decreased with concentrates level and was least in animals fed 500 g concentrates. Muscle percentage decreased and bone percentage increased with concentrates level. Fat percentage generally decreased with concentrates level and was least in animals fed 250 g concentrates.

Table 3. Effects of dried sugar beet roots based concentrates level on eye muscle characteristics in Nubian goat male kids, Gezira State, Sudan.

Parameters	Concentrates (g)		
	0	250	500
Weight (kg)	00.12 ± 0.05	00.12 ± 0.01	00.11 ± 0.02
Area (cm)	08.69 ± 2.10	09.25 ± 1.85	10.81 ± 3.09
Composition(%):Muscle	66.90 ± 9.53	65.38 ± 1.58	64.18 ± 2.05
Bone	23.71 ± 7.96	26.88 ± 2.20	27.18 ± 2.00
Fat	09.39 ± 4.43	07.70 ± 2.47	08.64 ± 0.80

Table 4 shows the effects of DSBR based concentrates level on meat chemical composition in male kids. Concentrates level affected meat composition. It significantly ($P \leq 0.05$) affected moisture, CP and ash and had no significant ($p \geq 0.05$) effect on EE. Animals fed 500 g concentrates had the highest moisture, EE and ash and animals fed 250g concentrates had the highest CP. Moisture was significantly ($P \leq 0.05$) highest in animals fed 0 and 500 g concentrates. Crude protein was significantly ($P \leq 0.05$) highest in animals fed

250 g concentrates and least in the control. Ash was significantly ($P \leq 0.05$) highest in animals fed 500g concentrates and least in the control.

Table 4. Effects of dried sugar beet roots based concentrates level (g/day) on meat chemical composition (%) in Nubian goat male kids, Gezira State, Sudan.

Conc.	level	CP	EE	Ash
Moisture				
0		18.09±0.	9.23±0.	0.73±0.
71.41±0.12		25	18	07
250	68.45±0.	20.15±	9.05±0.	0.83±0.
	31	0.25	14	25
500	71.59±0.	18.44±0.	9.29±0.	1.09±0.
	68	33	22	25
Over	70.48±1.	18.89±0.	9.19±0.	0.88±0.
all	57	98	19	16
mean				

DISCUSSION

Wholesale cuts

The increased wholesale cuts weight with DSBR based concentrates level was similar to that in *Tagger* males (Elimam *et al.*, 2018). But, this effect was not significant in the two studies. The increased wholesale cuts weight with concentrates level was mainly due to increased body weight (Elimam *et al.*, 2017a) and carcass weight (Elimam *et al.*, 2017b) with concentrates level. Concentrates level improved nutrients supply, rumen microbial fermentation, digestibility and weight gain. All wholesale cuts were lower in Nubian males compared to *Tagger* males (Elimam *et al.*, 2018). This was mainly genetical and *Tagger* is considered a meat breed.

The non-significant increase in wholesale cuts weight with concentrates level and their percentages increase up to 250 g concentrates followed by a decrease at 500g concentrates with significant effects on some cuts highlighted the needs to express results in the two forms for better understanding. The significantly different effects on some cuts including neck, single short forequarter and leg and chump indicated differential growth. Concentrates level had no significant effect on wholesale cuts percentages in *Tagger* males (Elimam *et al.*, 2018).

The effects of DSBR based concentrates level on wholesale cuts percentages varied between Nubian and *Tagger* males (Elimam *et al.*, 2018). The percentages of best end of neck and breast and leg and chump increased with concentrates level and percentages of neck and loin increased at 150 g and then declined in *Tagger* male kids. The percentages of neck, best end of neck and breast and loin were higher in Nubian males than *Tagger* males. Leg and chump percentage was similar and single short forequarter percentage was close in Nubian and *Tagger* males fed DSBR based concentrates.

Eye muscle characteristics

The increased eye muscle area and bones with concentrates level were mainly due to improved nutrients supply, rumen fermentation, digestibility, total DMI, weight gain, slaughter weight, carcass weight and composition with concentrates level. The generally decreased eye muscle weight and muscle percentages with concentrates level were not desired and the decreased fat with concentrates level was advantageous due to the increasing demand for low fat meat. Dried SBR based concentrates level increased eye muscle weight,

area and muscles and generally decreased bone percentage with concentrates level in *Tagger* males (Elimam *et al.*, 2018). The variations between Nubian and *Tagger* males in response to increasing concentrates level suggested variations in growth and energy partition between the two breeds. Nubian males eye muscle weight and area were within the range for *Tagger* males fed DSBP based concentrates (Elimam *et al.*, 2018). Muscle and fat percentages were lower and bone percentage was higher in Nubian males.

Meat chemical composition

The effects of concentrates level on meat composition were mainly due to improved animals nutrition, performance and differential growth. Effects of DSBP based concentrates level varied in Nubian and *Tagger* males (Elimam *et al.*, 2018) due to genetic and nutritional factors associated with concentrates amounts. The highest EE in animals fed 500 g concentrates was mainly due to the high energy and fat. The highest ash in animals fed 500 g concentrates was mainly due to high ash in *Seewa*. Meat mean CP was close in Nubian and *Tagger* male kids fed different levels of DSBP based concentrates (Elimam *et al.*, 2018). Nubian male kids had higher EE and lower ash than *Tagger* male kids. The variations in meat composition between Nubian and *Tagger* males kids fed different levels of DSBP based concentrates were mainly genetic and affected nutrition. Nubian males meat CP and ash were lower and moisture was close to that in goats in Tanzania (Shija *et al.*, 2013).

CONCLUSIONS

Wholesale cuts weight and percentages generally increased with SBR based concentrates level. Eye muscle area increased and weight generally decreased with concentrates level. Concentrates level significantly ($p \leq 0.05$) affected meat DM, CP and ash and had no significant ($p > 0.05$) effect on EE.

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أثر المستويات المختلفة لعلف مركز يحتوي على بنجر السكر المجفف على صفات القطع الاجمالية والعضلة العينية في ذكور الماعز النوبي

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الخلاصة

تمثل الماعز النوبي سلالة الألبان الرئيسية وتستخدم الذكور المستبعدة من القطيع لإنتاج اللحوم. تعتبر التغذية معوقاً رئيسياً لإنتاج الماعز ولا تستخدم عادة علائقاً مركزة. تم مؤخراً إدخال زراعة بنجر السكر في ولاية الجزيرة وهو مصدر علفي قيم. ولا تتوفر معلومات عن استخدام عليقة تتركز على جذور بنجر السكر المجففة على الأداء وصفات الذبيحة في جديان ذكور للماعز النوبي. وضع 12 ذكراً من الماعز النوبي بعمر ستة أشهر في حظائر مفردة ووزعت لثلاثة مجموعات ووزعت المجموعات لثلاثة أعلاف بصورة عشوائية كاملة في عام 2016م. غذيت الحيوانات على مخلفات قناديل الذرة المحسنة حسب الرغبة عند الساعة الثامنة صباحاً والرابعة مساءً. كما غذيت الحيوانات على عليقة مركزة تتركز على جذور بنجر السكر المجفف (70% جذور بنجر السكر المجفف، 15% أمباز الفول السوداني و15% أمباز بذرة زهرة الشمس) عند صفر (الشاهد) 250 جرام و500 جرام في وجبتين قبل مخلفات قناديل الذرة المحسنة. غذيت الحيوانات لمدة ثمانية أسابيع مع أسبوعين كفترة تمهيدية. تم ذبح الحيوانات وقسم الجانب الأيسر للقطع الاجماليه ووزنت وشُرحت. اخذ جزء الأضلع (من العاشرة الى الثانية عشر) وقيست صفات العضلة العينية وتركيب اللحم. جميع القطع الاجماليه زاد وزنها مع مستوي العليقة المركزة وزادت نسبتهم المثوية مع مستوي العليقة المركزة حتى 250 جراماً ثم انخفضت عند 500 جرام عليقة مركزة. تأثرت صفات العضلة العينية بمستوي العليقة المركزة بشكل غير معنوي. أثر مستوي العليقة المركزة بشكل معنوي على المادة الجافة ونسبة البروتين الخام والرماد في اللحم. كانت نسب المادة الجافة والمستخلص الأثيري والرماد أعلى في الحيوانات التي غذيت على 500 جرام عليقة مركزة. كانت نسبة البروتين الخام أعلى في الحيوانات التي غذيت على 250 جرام من العليقة المركزة. كانت الخلاصة من الدراسة ان استخدام مستويات مختلفة من عليقة مركزة تتركز على جذور بنجر السكر المجففة حسن وزن القطع الاجمالية للذبيحة وتركيب اللحوم. لذلك يوصي باستخدام جذور بنجر السكر المجفف بمستويات مختلفة مع قناديل الذرة المحسنة في تسمين ذكور الماعز النوبي .