



Assessment of impact of Supplementing Lactating Desert Goats with kuk (*Acacia sieberana*) and Kadad (*Dichrostacys cinerea*) on Weight Changes and Body Measures of Kids

Adam Jumaa Hamid Hamdoun¹, Musa Ahmed Musa Tibin¹, Salah Abdelgabar Salah Bukhari¹, Sallam Abdulfadil Bakheit Sabil² and Jumaa Barram Jadalla^{*2}

1 Department of Animal Production and Range, Faculty of Natural Resources and Environmental Studies, Alsalam University Alfula, Sudan. hamdonadam@gmail.com, musatibin2015@gmail.com and bukharisalah1968@gmail.com.

2* Departments of Animal Production, Faculty of Natural Resources and Environmental Studies, University of Kordofan, Sudan, corresponding Author jumaaaringola2000@gmail.com.

2 Departments of Animal Production, Faculty of Natural Resources and Environmental Studies, University of Kordofan, Sudan.

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*Corresponding Author

Jumaa B. Jadalla

E-mail: jumaaaringola2000@gmail.com

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ABSTRACT

This study was conducted in Kadam village, West Kordofan State, Sudan with the objective of investigating the effects of supplementation of Desert goats on natural grazing with Kuk (*Acacia sieberana*) and Kadad (*Dichrostacys cinerea*) pods on body measurements and weight change of kids and their dams. Twenty-four lactating Desert goats at different parity were divided into four similar groups, each with six animals. The groups were fed on four diets I, II, III, and IV. Group I was fed a diet of 50% Kadad pods, 25% groundnut cake, 24% sorghum grains and 1% salt. Group II was given a ration that contained 25% kadad pods, 25% kuk, 24%, sorghum grains and 25%, groundnut cake and 1% salt. Group III was fed with a ration consisting of 50% kuk pods, 0% kadad pods, 24% sorghum grain, 25% groundnut cake and 1% salt. The last group of goats (IV) depended on natural pasture alone. The supplements were offered at a rate of 750 g per head per day, and the natural pasture was supplied ad libitum. Body weight measurements were recorded from the start of the experiment until the end of the lactation season that was observed for two years. Data were analyzed using analysis of variance (ANOVA). The results of the body measurements showed significant differences ($P < 0.05$) in the height at wither / cm / month for kids before weaning period in the two seasons, and among the four groups, group (I) recorded significant increase in chest circumference / cm / month in the first and second seasons (48.5 and 48.7 cm / month) respectively, and group (II) 47.3 and 48.0 cm / month) for the two seasons respectively, and group (III) 47.6 and 48.5 cm / month) respectively, while group (IV) had significantly lower values for chest circumference, reaching to 45.8 and 45.8 cm / month, respectively. The results showed no significant differences ($P > 0.05$) in the body length of the goats in two seasons. The three groups (I, II and III) recorded the highest body length / cm / month in the first season and the second season (43, 42.4 and 41.1 cm / month). As for group IV, it was shorter (38.4 cm / month). The results showed no significant differences ($P < 0.05$) in the body weight of dams during the milk period in two seasons for groups (I, II and III). The weights of the three groups were (31.0, 30.7 and 29.6 kg) and were significantly ($P < 0.05$) lower, respectively, while the fourth group (IV) was lighter. By weight, it was 24.1Kg. The study concluded that the use of Kuk and Kadad pods in rations resulted in an increase in the rate of kids' weight and body measurements as well as the weight of dairy goats during the season. It recommends that more research be conducted in the field of using tree pods in feeding various types of animals raised on natural pastures.

INTRODUCTION

Goat population in the Sudan was estimated to be 37.5 million heads with 3% annual growth rate (FAO 1999). Sudanese Desert goats are mainly found in western region of the Sudan which includes Darfur and Kordofan states. Desert goats are mainly raised for meat production especially in rural areas, and they also provide milk for family needs. Body weight gain expresses how the animal utilizes its feed in term of growth rate. Itidal (1989) reported 0.1 kg body gain per a day for desert goat. Mustaffa (1992) reported 87.9 grams average daily body weight gain for Sudanese desert goats from one day old up to 13 weeks of age; while he reported an average daily gain of 65 and 75 grams for the first and seventh months of age respectively in Sudanese Nubian goat kids. Adult body weight showed great variation among different goat breeds and environments. Wilson (1982) reported an average adult body weight of Sudanese desert goat breed of 38 and 33 Kg for males and females respectively, whereas, Mustaffa (1992) reported 22.3 kg at 12 month for Nubian goats. Ibrahim and Tibin (2003) found an average body weight of 27 Kg for adult Sudanese Nubian goats at three years of age. Mohamed and Elimam (2007) conducted a study that included 330 females and 46 male desert goats in Elobied area- North Kordofan State, reported body weights ranged from 15.8 and 35kg for males and 14.4 and 19.2kg for females at 1 and 4 years of age respectively. Elimam and Amir (2007) in another study calculated a body weight of 23.1 for male and 21.9kg for female Taggar goat at one year of age. El imam and Amir (2007) studied the characteristics of Ingessana goats in Blue Nile State- Sudan, and found average body weights ranging from 9.6 to 28.3kg in goats of age of less than one year up to more than four years.

MATERIALS AND METHODS

Study area

This study was conducted in **Kaddam** village, which located at west Kordofan state, Sudan, within latitudes 11° 15' - 16° 30' N and longitudes 27°-32° E, about 850 Km west of Khartoum. (Ministry of Agriculture west Kordofan state, 2019).

Climate

Kaddam district lies within the low rainfall zone that is characterized by wet autumn and hot dry summer. The rainy season extends from July to October with a peak in August. Average annual rainfall is 350mm in the north and about 650mm in the southern parts. The temperatures are modified by rain, the highest annual temperatures (42° C) were recorded within a period extending from April to July, while the lowest values (14° C) were recorded during December and January (Meteorology Authorize west Kordofan state, 2019).

Topography and Vegetation

The soil is generally of smoothly undulating clay muddy plain dissected by patches of loamy sands (Gardud) in the southern parts (Personal observations). The most common tree and shrub species are *Combretium cordofanum* (Habeli), *Adansonia digitata* (Tebeldi), *Acacia Senegal* (Hashab), *Acacia mellifera* (Kitr), *Acacia nubica* (Laout), *Acacia albida* (Haraz), *Albizzia amara* (Arad), *Acacia sieberana* (Kuk), *Dichrostachys cinerea* (Kadad), *Acacia nilotica* (Sunot) and *Boscia senegalensis* (Mokhait). Grasses are mostly annual including, *Dactyloctenium aegyptium* (Abu Asabei), *Cenchrus biflorus* (Hascheent), *Echinochloa colonum* (Difra), *Eragrostis aspera* (Banu), *Andropogon gayanus* (Abu-Rakhies). Herbaceous species are *Zorniglo chidiata* (Shilini) and *Ipomea cordiosphilla* (Tabar). Heavily grazed areas are predominantly covered with unpalatable invaders plants such as *Cassia tora* (Kawl), *Cassia occidentales* (Soreib), *Abutilon spp* (El Neiada) and *Cassia senna* (Sanamuka) (Harrison and Jackson, 1958).

The Experimental Animals

Twenty four lactating Sudanese Desert does were used in this study. The animals were divided into four similar groups. Prior to commencement of the trials, the goats were weighed, drenched with a broad spectrum anthelmintic, ear tagged and individually penned. The animals were also vaccinated against diseases endemic to the study area. Watering and feeding troughs were provided in each pen. The feed supplement was offered twice a day after estimating the amount consumed at 7:00 am by subtracting the residual amount from the quantity offered. Water was provided continuously. The animals were at early pregnancy stage and the kids were weighed at birth and once every week to 16 weeks. For season two the goats were mated at the same time and their kids were also weighed similarly. The does were milked twice a day after allowing kids to suckle one teat. The amount of milk was recorded to the end of the lactating period. Body Measurements of length, chest circumference, height at wither and body weight of kids was recorded.

The Experimental Feed

Four rations were formulated. The percent ingredients used in the rations formulation are presented Chemical composition of the ingredients is presented in table (3.2) while chemical composition of the rations used in feeding the four groups is presented in table (3.3). The experiments was conducted to study the effect of feeding locally available tree pods; **kadad** *Dichrostachys cinerea* and **kuk** *Acacia sieberiana* added to groundnut cake, sorghum grains and salt on milk production, body weight and various body measurements of the Desert goats and their kids for two lactation periods. The concentrates were offered at 750 g / head/ day as supplementary ration and natural grazing as basal feed that was offered ad libitum. The

experimental animals in Group four (IV) were kept depending on natural pasture only as control group.

The feeding trials were carried out during the lactation period through early 120 days of lactation.

Table (1) percent Ingredients used in formulation of the of experimental rations percentage

Feed	Rations			
	I	II	III	IV
Kadad pods	50	25	0	0
Sorghum grain	24	24	24	0
ground nut cake	25	25	25	0
Kuk pods	0	25	50	0
Common salt	1	1	1	0
Total	100	100	100	0

Table (2) Chemical composition of the ingredients used in formulation of experimental rations

Feed	DM	OM	CP	CF	EE	NFE	ASH
Kada pods	93.65	86.95	6.93	29.23	2.20	48.64	6.70
Kuk pods	92.2	87.5	4.4	39.10	1.20	42.83	4.70
Sorghum grains	92.5	85.4	13.48	11.77	5.30	54.85	7.10
Groundnut cake	93.4	89.0	42.18	17.68	7.60	21.54	4.40
Salt							

Table (3) Chemical composition of the rations used feeding the experimental groups

Ration	DM	OM	CP	CF	EE	NFE	ASH
I	92.3	86.22	17.25	21.86	4.27	42.87	6.15
II	91.98	86.36	16.62	24.33	4.02	41.42	5.65
III	91.65	86.50	15.98	26.80	3.77	39.96	5.15
IV	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Salt							

Body weight and management:

Every goat body weight was recorded at the beginning of the trial, then monthly until the end of experimental period which lasted for 120 day.

Height at withers (HW) was measured from the highest point on the dorsum of the animal to ground surface at the level of back feet.

Body length (BL) was measured from the tip of the scapular to the pin bone.

Heart girth (HG) was measured around the circumference of the chest just behind the fore legs and along xiphoid depression.

RESULTS AND DISCUSSION

Effect of Supplementation on body weight of kids before weaning

The effects of supplementation of Desert kids from does on natural grazing with rations formulated using kadad (*Dichrostachys cinerea*) and Kuk (*Acacia sieberiana*) or a mixture of the two pods on body weight is presented in table (1) The result revealed that body weight was higher in group (I) that was fed a ration formulated with kadad at 50% and followed by the group on a ration with 25% kadad and 25% Kuk (II) as well as the group that consumed a ration with 50% kuk(III). The lowest body weight/kg was recorded from the group that was on the natural grazing alone (IV) for the two seasons. The body weight season one was 9.11, 8.61, 8.46 and 6.40 kg/month for group I, II, III and IV respectively.

In season two body weights were 10.40, 9.67, 9.38 and 8.00 kg/month for group I, II, III and IV respectively. The results revealed that there was significant differences ($P < 0.05$) on the fourth groups.

Table: (1) Effect of Supplementation on body measurement on kids during lactation period (body weight/kg/month)

Treatments	Lactation period (days)				Overall mean
	30	60	90	120	
I ¹	4.83 ^{ab}	9.00 ^{ab}	10.50 ^{abc}	12.10 ^d	9.11
I ²	5.50 ^a	9.75 ^a	11.50 ^a	14.83 ^a	10.40
II ¹	4.67 ^{ab}	7.83 ^b	9.50 ^{bc}	12.42 ^b	8.61
II ²	5.00 ^{ab}	9.50 ^{ab}	10.83 ^{ab}	13.33 ^{ab}	9.67
III ¹	4.25 ^{bc}	8.58 ^{ab}	9.42 ^{bc}	11.58 ^b	8.46
III ²	4.58 ^{ab}	9.25 ^{ab}	10.67 ^{ab}	13.00 ^{ab}	9.38
IV ¹	3.50 ^c	6.00 ^c	7.42 ^d	8.67 ^c	6.40
IV ²	4.10 ^{bc}	7.83 ^b	8.91 ^{cd}	11.25 ^b	8.00

I II III IV treatments 1, 2 seasons

Effect of Supplementation on body measurement (body length) of kids during lactation period

The effects of supplementation of Desert kids from does on natural grazing with rations formulated using kadad (*Dichrostachys cinerea*) and Kuk (*Acacia sieberiana*) or a mixture of the two pods on body measurement is presented in table (2) The result showed that body length was higher in group (I) that was fed a ration formulated with kadad at 50% and followed by the group on a ration with 25% kadad and

25% Kuk (II) as well as the group that consumed a ration with 50% kuk(III). The lowest body length cm/month was recorded from the group that was on the natural grazing alone (IV) for the two seasons. The body length in season one was 41.8, 40.9, 41.22 and 38.38cm/month for group I, II, III and IV respectively.

In season two, body weight was 42.8, 43.1, 43.21 and 39.6cm/month for group I, II, III and IV respectively. The results revealed that there was significant differences ($P<0.05$) on the fourth groups

Table: (2) Effect of Supplementation on body measurement on kids during lactation period (body length /cm/month)

Treatments/seasons	Lactation period (days)				Overall mean
	30	60	90	120	
I ¹	35.83 ^{ab}	42.50 ^a	44.00 ^{abc}	44.83 ^{abc}	41.80
I ²	36.67 ^a	41.00 ^{ab}	46.50 ^{ab}	47.00 ^a	42.80
II ¹	34.20 ^{abc}	40.33 ^{ab}	43.83 ^{bcd}	44.33 ^{bc}	40.90
II ²	35.67 ^{abc}	43.20 ^a	46.20 ^{ab}	47.33 ^a	43.10
III ¹	35.33 ^{abc}	42.20 ^a	43.00 ^{bcd}	44.33 ^{bc}	41.22
III ²	35.83 ^{abc}	42.50 ^a	47.50 ^a	47.00 ^{ab}	43.21
IV ¹	33.50 ^{bc}	38.50 ^b	40.33 ^d	41.20 ^d	38.38
IV ²	33.20 ^c	39.20 ^b	42.50 ^{cd}	43.50 ^{cd}	39.6

I II III IV treatments 1, 2 seasons

Effect of Supplementation on Body Measurement on Kids during Lactation Period (Heart Girth/cm/month)

The effects of supplementation of Desert kids from does on natural grazing with rations formulated using kadad (*Dichrostachys cinerea*) and Kuk (*Acacia sieberiana*) or a mixture of the two pods on body measurement is presented in table (3) The result revealed that heart girth was higher in group (I) that was fed a ration formulated with kadad at 50% and

followed by the group on a ration with 25% kadad and 25% Kuk (II) as well as the group that consumed a ration with 50% kuk(III). The lowest heart girth cm/month was recorded from the group that was on the natural grazing alone (IV) for the two seasons. The heart girth in season one was 48.49, 47.33, 47.96 and 45.38cm/month for group I, II, III and IV respectively.

In season two, the body weight was 48.5, 48.85, 48.33 and 45.67cm/ month for group I, II, III and IV respectively. The results revealed that there were no significant differences ($P<0.05$) on the fourth group.

Table: (3) Effect of Supplementation on body measurement of kids before weaning (heart girth/cm/month).

Treatments	Lactation period(days)				Overall mean
	30	60	90	120	
I ¹	42.33 ^a	47.33 ^a	50.50 ^{abc}	53.83 ^a	48.49
I ²	41.00 ^{ab}	47.50 ^a	51.50 ^{abc}	54.00 ^a	48.50
II ¹	39.50 ^{ab}	46.83 ^a	49.50 ^{abcd}	53.20 ^{ab}	47.33
II ²	39.20 ^b	48.67 ^a	52.20 ^a	55.33 ^a	48.85
III ¹	40.67 ^{ab}	48.67 ^a	48.83 ^{bcd}	53.67 ^a	47.96
III ²	39.67 ^{ab}	48.50 ^a	51.67 ^{ab}	53.50 ^a	48.33
IV ¹	38.20 ^b	45.67 ^{ab}	46.83 ^d	49.83 ^b	45.38
IV ²	38.33 ^b	43.50 ^b	48.33 ^{cd}	52.50 ^{ab}	45.67

I II III IV treatments 1, 2 seasons

Effect of Supplementation on body measurement on kids during lactation period (height at wither /cm/month).

The effects of supplementation of Desert kids from does on the natural grazing with rations formulated using kadam (*Dichrostachys cinerea*) and Kuk (*Acacia sieberiana*) or a mixture of the two pods on body measurement is presented in table (4) The result revealed that height at wither was higher in group (I) that was fed a ration formulated with kadam at 50% and followed by the group on a ration with 25% kadam

and 25% Kuk (II) as well as the group that consumed a ration with 50% kuk(III). The lowest height at wither cm/month was recorded from the group that was on the natural grazing alone (IV) for the two seasons. The height at wither season one was 37.18, 36.17, 36.88 and 34.30cm/month for group I, II, III and IV respectively.

In season two, body weight was 37.88, 38.10, 37.10 and 35.46cm/month for group I, II, III and IV respectively. The results revealed that there was significant differences ($P<0.05$) on the fourth groups

Table: (4) Effect of Supplementation on body measurement on kids during lactation period (height at wither /cm/month).

Treatments	Lactation period (days)				Overall mean
	30	60	90	120	
I ¹	32.20 ^{ns}	37.50 ^{abc}	39.20 ^{ab}	39.83 ^{ab}	37.18
I ²	32.50 ^{ns}	38.00 ^{ab}	39.83 ^{ab}	41.20 ^{ab}	37.88
II ¹	32.00 ^{ns}	35.50 ^{bcd}	37.50 ^{bc}	39.67 ^{ab}	36.17
II ²	32.33 ^{ns}	38.20 ^a	40.20 ^a	41.67 ^a	38.10
III ¹	31.83 ^{ns}	37.67 ^{ab}	39.20 ^{ab}	38.83 ^b	36.88
III ²	31.67 ^{ns}	37.20 ^{abcd}	39.33 ^{ab}	40.00 ^{ab}	37.10
IV ¹	30.33 ^{ns}	34.83 ^d	36.20 ^c	35.83 ^c	34.30
IV ²	30.50 ^{ns}	35.00 ^{cd}	37.50 ^{bc}	38.83 ^b	35.46

I II III IV treatments 1, 2 seasons

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