

Intake , digestibility and growth performance of Nilotic type lambs fed on concentrate diet containing graded levels of mesquite (*Prosopis juliflora*) pods

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SUMMARY

Studies were conducted to determine the effect of replacing concentrate diets by graded levels of mesquite pods powder upon intake . digestibility and growth performance of Sudanese indigenous lambs . Three dietary treatments were compared (four lambs per treatments) . The control group received a basal concentrate conventional diet (sorghum grain 25 % . groundnut cake 32 % , wheat bran 40 % , limestone 2 % and common salt 1 %) The other treatment groups : ground *Prosopis juliflora* pods replaced 15 % and 30 % of the conventional diet respectively . Intake and digestibility experiment (4 weeks) were measured using twelve lambs (23.4 ± 2.76 kg body weight) , while growth performance trial (14 weeks) was conducted using another twelve local lambs (15.1 ± 5.18 kg) . The daily dry matter intake (g / kg metabolic weight : 1.) was not affected ($p > 0.05$) by inclusion of ground *P. j.* pods in lambs concentrate diets (792-853g nor was the digestibility coefficient . A similar trend in growth of lambs fed the experimental diets and recorded a daily growth rate of 1013-139.3 g The inclusion of ground *P. j.* pods in local lambs concentrate diet up to 30 % exerts no negative action on lambs on term of feed intake , digestibility and growth . Using ground *P. j.* pods in lamb feed is beneficial towards reducing feed cost and controlling the spread of mesquite through seedlings.

INTRODUCTION

The major constraint for the development of sheep production in Sudan is the shortage of feeds in dry season namely protein sources . Mesquite (*Prosopis juliflora*) tree was introduced to Sudan since 1917 from South Africa and Egypt and planted in Khartoum (Brown and Massey , 1929) . The establishment of this tree in Sudan was because of its unique abilities to tolerate drought and salty soil making it suitable to various ecological zones throughout the country with emphasis on dry areas . *Prosopis* spp are fast growing and nitrogen fixing and often colonize eroded , overgrazed or drought - affected lands . In Sudan *Prosopis* spp became invasive weed and invading agricultural lands along irrigation channels and water courses . The most invaded areas (90 %) in Sudan are in Eastern Sudan namely in Gash delta from Kassala northwards passing Wager and southwards up to the borders with Eritrea , in Atbara river , along Khor Baraka , extending from the delta up to 130 km upstream and in water collection pits along Kassala Gadarif and Port Sudan highway In most invaded areas . mesquite impenetrable thickets smothered and exclude native vegetation Talking about *Prosopis* eradication is no more relevant , instead control and management programs developed . Programs of uprooting of *Prosopis* spp was initiated by El Tayeb al al (2001) . These programs were not successful due to lack of sustainability and follow up . *Prosopis* spp are native in the Americas , there is long history of using all parts of the tree for trading wood , food and fodder . However , when introduced to Africa , Asia and Australia , the indigenous knowledge rarely followed and *Prosopis* remained under - utilized and hard to manage . The crude protein contents of pods are 16 % suggesting it as a good source of protein for livestock . Studies in Brazil and Mexico , Habit and Saavedra (1988) showed that *iflora* pods flour could replace up to 60 % of wheat flour in rations for lactating cows and that dry matter intake , weight gain and milk production increased with increased live weight gain up to 45 % inclusion rate .

In dry season ruminant animals may eat *P. juliflora* pods , Furthermore most of its seeds shed in their feces intact resulting in the spread and invading of the tree . However , the ground pods may be an appropriate alternative feeding form , that minimized the seed dispersal The objective

of this study was to elucidate the effect of feeding graded level (15 % and 30 %) ground *P. juliflora* pods on dry matter intake digestibility and growth performance of lambs .

MATERIALS AND METHODS

Feeds :

Feeds used in this study were concentrate diet and a roughage source . *P. juliflora* pods were collected manually from mesquite trees growing around the Kuku research centre - Khartoum North , were ground in a hammer mill and became ready to be included in concentrate diet . The experimental concentrate diets consisted of sorghum grain , groundnut cake . wheat bran , ground *P. juliflora* pods , lime stone and common salt shown in table (1) , Barseem (*Medicago sativa*) hay was fed as roughage source

Animals:

Twenty four sheep of local type Nilotic dwarf sheep (Williamson and Payne , 1978) were used . Animals were housed had free excess to clean water and mineral blocks . They were treated against internal and external parasites using Ivomec (Mark Sharp and Dohme) .

Experiment 1 :

Intake and digestibility study Twelve sheep (23.4 ± 2.76 kg body weight) were arranged in randomized block design where animals were individually penned and divided into three groups fed the experimental diets as four animals diet . The experimental diets were divided according to *P. fulfiora* pods inclusion rate into 0 % 15 % and *P. juliflora* diets . Dried barseem (*Medicago sativa*) was offered ad libitum to the experimental animals as a source of fibre . The concentrate diet was offered once daily at 8:00 AM as 100g (94 g dry matter basis) for each animal . The total dry matter intake was recorded every day for a week after adaptation period of ten days . Animals were weighed before and after intake period . After the end of intake period . labs were equipped with harnesses and bags for faecal collection
Collection period

continued for 7 days . The feed intake of each lamb was recorded every day with fecal output . The collected faecal samples were dried in a forced air drying oven (60 ° c) for 48 hrs grinding to become ready for analysis .

Experiment 2 :

Growth performance trial : Twelve post - weaned lambs of local Nilotic type sheep were used with an average initial body weight of 15.15.18 kg . They were divided into three dietary treatment groups (0 % , 15 % and 30 % P. juliflora) as four animals group . Animals were group - housed . group - fed and each weighed weekly The experimental period continued for twelve weeks . The first two weeks were adaptation period and the rest ten weeks were the measurement period .

Chemical analysis :

Feed and fecal samples were analyzed to their proximate components according to AOAC (1990) into dry matter (DM) , ash , crude protein (CPL ether extract (EE) and crude fibre (CF) .

Statistical analysis : Data of intake , digestibility and performance trial were analyzed by analysis of variance for randomized design (stat Soft , 2001) . The difference between means was separated using Duncan multiple range test .

RESULTS AND DISCUSSION

Experimental diets composition , nutrient intake and digestion :

Feed ingrediants of experimental diets and chemical composition are shown in Table 1 .

Table 1. Feed ingredients (fresh basis) and chemical composition of the experimental diets (dry matter basis).

Item	<i>P. juliflora</i> ¹ pods inclusion rate			Barseem	<i>P. juliflora</i> pods ¹
	0 %	15 %	30 %		
Sorghum grain	25	30	25		
Groundnut cake	32	30	30		
Wheat bran	40	22	12		
<i>P. j.</i> ¹ pods	0	15	30		
Lime stone	2	2	2		
salt	1	1	1		
Total	100	100	100		
Chemical composition (%)					
DM	95.0	93.6	93.2	93.7	95.3
Ash	7.5	7.1	7.4	12.7	6.2
CP	26.5	25.7	24.8	17.1	16.5
OM	92.5	92.9	92.6	87.3	93.8
CF	10.8	11.4	13.2	32	21.8
EE	5.6	4.8	4.0	1.6	2.0
NFE	49.6	51.0	50.6	36.6	53.5
ME (calculated)	12.40 ¹	12.28 ¹	11.96 ¹	8.8 ³	11.17 ¹
MJ/kg DM					

It can be seen that the three diets were almost isonitrogenous (CP = 256 g / kg) , and isocaloreic (12.2 MJ / kg) . It can also be noticed that *Prosopis juliflora* had higher CP and ash than these reported by Ravikala et al . , (1995) , and Mahgoub et al . (2005) and also higher than indigenous sample collected by Sulieman and Mabrouk (1999) ; containing 13.8 ; 4.97 , 12 ; 4 and 7.85 ; 5.22 % respectively . However , the inclusion of *Prosopis juliflora* at 15 % and 30 % in the concentrate portion and when fed in conjunction with Barseem forge hay did not affect ($P > 0.05$) intake and digestibility coefficient of nutrients (DM , OM and CP) . although these values tended to be higher for the higher inclusion rate (30 %) .

Generally dietary intake and apparent digestibility values obtained in this study (Table 2) were lower than those reported by Obeidat et al . , (2008) for diets including 100 and 200 g / kg *P. j.* pods where they obtained the

coefficients ; 0.73 , 0.74 , 0.72 and 0.71 , 0.74 , 0.75 for DM , OM , and CP respectively for both inclusion rates .

Table 2. Intake and digestibility of *P. juliflora* pods containing diets by lambs.

Item	<i>P. juliflora</i> pods inclusion rate			SE	SL
	0 %	15 %	30 %		
No. of lambs	4	4	4	-	-
Average live weight (kg)	26.8	22.8	23.4	-	-
Daily feed intake (g DM)					
Concentrate	94	94	94	-	-
Barseem	837.7	790.4	768.2	28.39	NS
Total	931.7	884.4	862.2	28.9	NS
% live weight	3.4	3.9	3.7	0.06	NS
g/kg Wt ^{0.75}	79.2	85.3	80.9	3.30	NS
Crude protein (CP)	154.7	159.3	168.2	4.86	NS
Metabolizable energy (MJ)	7.4 ^a	7.2 ^a	8.1 ^b	0.24	*
Digestibility coefficient (g/kg)					
DM	0.618	0.609	0.664	0.00604	NS
OM	0.640	0.623	0.675	0.00577	NS
CP	0.718	0.582	0.658	0.00589	NS

SE, standard error of the difference between any two means.

SL, significance level.

NS, not significant.

* significance at ($P > 0.05$).

It appears that the lower values obtained in the present study could possibly be due to the higher amounts of diets ingested by experimental animal (3.5 % live bodyweight) rather than an effect of P. J. pods consumed . High amounts of feed consumption promotes faster rate of passage of digesta in the rumen , lowering digestion .

High roughage concentrate ratio (8 : 1) in feed consumed may possibly be another factor contributing factor to low digestibility . It should be noted that lower digestibility values were non - differently ($P > 0.05$) obtained from both P. J. pod - containing as well as P. J. non - containing control) , diets (Obeidat et al . (2008) ; Mahgoub et al . (2005) and Ravikala (1995)

. On the other hand , the smaller amounts (1.6 and 3.3 ud . Table 3) of P. J. diet ingested were unlikely to be such a suppressant to diet intake and digestion due to an effect of tannins or trypsin - inhibitor content which would be moderated by high CP intake (Table 2) from the experimental diets fed , primarily originating from forage (Barseem) fraction (82 % CP) consumed (Table 1 & Table 2) .

Table 3. Contribution of *Prosopis juliflora* to dry matter (DM), crude protein (CP) and metabolizable energy (ME) intake of concentrate fraction and the experimental diets containing the pods, in experiment 1.

Nutrient intake	<i>Prosopis juliflora</i> inclusion rate			
	Concentrate ration		Whole diet	
	15%	30%	15%	30%
Dry matter (g)	14.1	28.2	1.6	3.3
Crude protein (g)	2.34	4.65	0.026	0.053
Metabolizable energy (KJ)	0.58	0.315	0.018	0.036

Growth rate : The daily growth rate of lambs in the second experiment was not significantly different ($P < 0.05$) between different treatments .

Table 4. Growth performance of indigenous lambs fed P. Juliflora pods containing diets.

Item	P. j. pods inclusion rate			SE	SL
	0 %	15 %	30 %		
No. of lambs	4	4	4	-	-
Period (Weeks)	10	10	10	-	-
Initial live weight (kg)	19.4	16.9	18.5	3.95	NS
Final live weight (kg)	26.5	26.6	27.0	0.37	NS
Total gain (kg)	7.1	9.8	8.5	2.29	NS
Daily gain g	101.8	139.3	121.4	32.72	NS

SE, standard error of the difference between any two means.

SL, significance level.

NS, not significant.

Generally there was a tendency for increased daily gain as the proportion of P. j . pods increased in the concentrate diet . The growth rate reported in this study was in agreement with the results reported by Atta (2001) raised the same type of sheep used in this study . Atta (2001) reported a growth rate of 112-141 g / day for post - weaned lambs while Mason (1988) recorded a growth rate of less than 100 g / day under good feed conditions . However , the growth rate reported in this study was high when compared with other studies using the same type of sheep . Gabore et al . (2006) reported a growth rate of West African dwarf sheep in Nigeria ranging from 97.98 to 180.72 g per week . Also in another study done by Aye and Adegun (2010 in Nigeria were reported a growth rate of 28.6 to 57.1 g per day . The elevated growth rate of Nilotic sheep reported in this study may attributed to the higher dietary crude protein intake of the tested ration evidenced by Njwe and Kona (2004) in Cameron . Those scientists observed that as the dietary crude protein level increased from 34.49 to 63.73 73.55 g per day , corresponding growth rate of 9 , 60 and 78 g per day were obtained for West African dwarf sheep fed a basal diet of elephant grass supplemented by stylo hay or concentrate as protein supplement . Also in most recent work Fasaie et al . (2011) reported a lower growth rate of 38.8 to 47.9 g per day for the same type of sheep but fed on maize hay and cassava hay without any concentrate supplement . The relative growth rate reported in this study (3.8 0 5.2 g gain per kg body weight) lies within the normal range of Nilotic sheep and even desert sheep (Atta and El Khidir . 2010) . From the previous study it could be concluded that ground Prosopis juliflora pods could be used to replace concentrate sheep diet up to 30 without any negative effect of feed digestibility or lamb performance . However , more studies are required to elucidate the effect of those inclusion rates and its effect on meat quality of lambs fed on such diets . Also higher inclusion rates are to be tested for lambs on performance and meat quality .

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العلف المأكول ، معدل الهضم و معدل النمو للأغنام المحلية المغذاة على علف مركز
يحتوي على كميات متدرجة من ثمار المسكيت

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ملخص البحث

تم إجراء دراسات عدة لتحديد از مديل جزء من العطيفة المركزة بكميات عربية مس ما المسكيت المطحون على كمية الغذاء المتداول ، معدل الهضم ومحل النمو في الأغنام السودانية المطية . تم تحضير ثلاثة مركبات غذائية للحصول على ثلاث معاملات الاربعة الام لكل معاملة (، المعاملة 0 % تم تغذيتها على أساس عليقة مركزة فلينية (غرة فترة 25 % ، أساز فول 32 % ، زنة قمح 40 % ، حجر جيرى 3 % وملح طعام 1 %) ، أما المعاستار 15 % و 30 % فقد تم استبدال 15 % و 30 % من العليقة المركزة التقليدية بثمار المسكيت المطحونة على التوالي تجربة كمية الطعام المأكول ومعامل الهضم (4 أسابيع) تم إجراؤها باستخدام 12 من الأعلام المحلية (23,4 = 2.76 كجم وزن حي) ، أما تجربة معدل النمو (12 أسبوعا) فقد تمت باستخدام 12 من الأغنام المحلية ليضا (15.1 + 5.18 كجم وزن حي) . كانت كمية الطعام الماكونه يوميا أجد اكجم 75) لم تتأثر باستخدام ثمار المسكيت المطحونة في العلائق المركزة (85.3-792 ، بالإضافة لذلك فإن النسبة المئوية لمعامل الهضم للمعاملات المختلفة لم تتأثر

مطلقا بإدخال ثمار المسكيت المطحونة في العلائق المركزة . وكل النتائج السابقة انعكست على تجربة معدل النمو ، حيث إن معدل النمو كذلك لم يتراجع نتيجة لاستخدام ثمار المسكيت للعلائق المختلفة . وقد كان معدل النمو في المدى من 101.3-139.3 جم / اليوم لكل فرد من الأغنام . بصورة عامة إن استخدام ثمار المسكيت المطحونة في علائق الأغنام المحلية حتى 30 % من العلف المركز لا يسبب أي آثار سلبية على كمية الطعام المأكول ، أو معامل الهضم للمواد الغذائية او معدل النمو . استخدام ثمار المسكيت المطحونة في علائق الأغنام المحلية أيضا مفيد من حيث تقليل تكلفة الغذاء والحد من انتشار شجيرة المسكيت عن طريق البذور ،