



Original Article

Effects of Feeding Lactating Desert Goats with *Moringaolifeira* Meal on Milk Yield and Composition in North Kordofan, Sudan

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ABSTRACT

This study was conducted in North Kordofan State, Sudan with the objective of studying effects of feeding *Moringaoleifeira* meal (MOM) on feed intake, milk production, composition and weight changes of Sudanese Desert goats and their kids. Four goats group at their second parity, weighing 25 kg \pm 0.750kg each with a single kid were used (total 16goats plus kids). The animals were vaccinated against diseases endemic in North Kordofan, drenched with antihelmentic for the control of internal and external parasites and individually penned with feeding and drinking troughs. Natural grazing was given ad libitum. The first group was left on the natural grazing (NG) only. The second group was supplemented with 300g MOM; the third with 400g MOM while the forth group was given 250g concentrate supplement. The supplements were provided at 7:30 am and consumed completely before providing the natural grazing. The daily feed intake was estimated and water was provided continuously. The goats were milked and milk quantity was measured at 8:00 am before allowing kids to suckle their dams then being separated at 6:00 pm and penned separately. Goats and kids were weighed at the beginning and end of the trial. The data was considered as complete randomized design and analyzed via analysis of variance. Least significant difference was applied to detect differences among means. The results indicated significant ($P < 0.01$) increase of feed intake upon supplementation with MOM. The animal groups consumed 1100, 1250, 1260 and 1000g DM when the goats were offered NG only, supplemented with 300g, 400g MOM and 250g CS, respectively. Milk yield also increased upon supplementation with MOM. Daily production was 0.500, 1.775, 2.012 liter for the group of goats consuming NG only, supplemented with 300 g MOM, 400 g MOM and 250g CS, respectively. Milk had higher fat when goats were fed CS while high milk protein was

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recorded for the group on the NG only and offering MOM resulted in higher lactose content while non-fat solids content was similar in milk of different groups. Live body weight was higher in the group that was supplemented with 400g MOM followed by those on 300g MOM, 250 g CS and finally those on the natural grazing meal only. The respective daily weight gain was 152.6, 145, 130 and 10g. Weight gain of kids was 23.24g for those who belonged to dams on the natural grazing, 55 for goats on 400g MOM, 95.5g for those on CS. It was concluded that supplementation with *Moringaolifeira* meal increased milk production and its constituents also differed. Weight gain of goats and their kids also differed by supplementation with MOM. It was recommended that more studies be carried out to determine best levels of supplementation with MOM to get highest yield and best levels of fat and protein content.

Keywords: lactating goats, nutrition, *Moringaolifeira*, weight change.

INTRODUCTION

North Kordofan state lies within the savanna zone of Sudan and covers about 185,302 square Kilometers. It is the major Gum Arabic and livestock production area in Sudan (Fadl *et al.*, 2009). Integration of trees in farm land proved to have positive effects on soil physical and chemical properties, protecting the farm against soil erosion, improve the microclimate and satisfying farmer's needs from fuel wood and fencing materials (Fadl and Gebauer, 2004). Studies on alleviation of draught effects and environmental preservation have shown that the rationale in resources utilization entails shifting from traditional crop production that involves illicit tree cutting and burning grasses and herbs to livestock production (El Sammani,1986; Hemidan, 2008; El Hag *et al* 2001 and mahmoud,2003). Small ruminants were recommended as most suitable Livestock species. Goats were reported being the most adapted species to the harsh environmental conditions of North Kordofan. Because the species mainly depend on trees for feed, it entails integration of forestation with livestock production and introduction of new tree species specially those known for their large biomass production and high nutritive value. Recently, *Moringaolifeira* was introduced and used for different uses in Sudan. Empirical observations have shown that the tree fodder is palatable to goats and there are reports of increased milk production of does fed *M. olifeira*. No studies were taken to examine effects of feeding Moringa to goats in Sudan in general and Kordofan in particular.

Objectives: The overall objective of the study is to improve the local Desert goats' production in Northern Kordofan State through improving and providing green fodder alternatives. The specific objective is to test the effects of feeding *M. olifeira* tree meal on milk yield and composition, body weight and on general health of the Desert goats and their kids compared to other fodders and natural grazing in the study area.

MATERIALS AND METHODS

Study Area: This study was carried out in North Kordofan State, (Latitudes 11.15⁰ and 16.45⁰N and longitudes 27.05⁰ to 32⁰E) coverings an area of about 185.302., km², representing two thirds of Kordofan region (Wikipedia,2015). The state has a population of about 3,340,000 million according to 2011 census (70 % of the population of Kordofan region (Khatir, 2012). The state is divided into four ecological zones according to isohyets and soil types: arid, semi arid and low rainfall savanna on sand and low rain fall savanna on clay (Harrison and Jackson,1958).

The soils in North Kordofan are predominantly sandy interspaced by silt depressions in the northern parts, with stabilized and disturbed sand dunes known as "goz" or silt depression and clay pockets known as "gardud". Most crops are grown on gardud while sands are used as rangeland with some cropping (FAO, 2008). Rain water is harvested into hafirs, earth

dams, seasonal pools and water yards for irrigation, human and livestock consumption. Boreholes, hand pumps and open wells are drilled to use up underground water.

Bara locality, the study site, is situated within semi arid zone (latitudes 14°00 and 16°40 N) with annual rainfall ranging from 150 to 300 mm. The inhabitants usually raise camels, goats and sheep and practice farming. Millet, watermelon and horticultural crops are the main crops produced.

The experimental animals were penned at Shag Alnom village, 5 kilometers from Bara. The soil is extremely sandy characterized by sand dunes. Villagers depend on animal husbandry keeping sheep and Desert goats and camels. Rain fed agriculture is practiced on Goz slopes and depressions *Acacia senegal* is conserved for Gum Arabic production. The climate change mitigation innovations project, a state and UN sponsored activity, provides many services including agricultural extension, animal husbandry, water harvesting, health and education.

The experimental Animals

Sixteen lactating Desert goats at their second parity, with single kids, were used in this study. The does were 2-2.5 years of age and their initial weight was 25 kg \pm 0.750. The animals were divided into four similar groups each with four animals. The does were individually penned, equipped with feeding and drinking troughs. Prior to commencement of treatments the goats were ear-tagged, vaccinated against diseases endemic to the area such as anthrax and Hemorrhagic septicemia and drenched with broad spectrum anthelmintic (Ivomic). Ten days were allowed for goats to be adapted for feed and treatments. The adaptation period was also necessary for removal of the effects of the feed previously taken. Goats and their kids were weighed at the beginning of the trial, after 30 days and at the end of the trial to monitor their weight changes as affected by type of ration. The does were milked twice a day; at 8:00 am and 6:00 pm. The kids were allowed to suckle their dams after milking one teat and leaving the other to the kid. Milk quantity of each does was daily recorded using a measured graduated cylinder. Milk samples were taken at mid trial time for chemical analysis.

The Experimental Feed: The lactating goats were fed four rations. Natural grazing (NG) comprising of Adan elfar and Huskaneet alone, NG and concentrate supplement, NG and 300 g and 400g of *Moringaolifeira* meal MOM.

Moringa meal was prepared as a mixture of leaves, twigs and capsules. Parts of *M. olifeira* were collected and dried under shade. Twigs and capsules were grinded and mixed to the dry leaves at 60% leaves, 25% twigs and 15% capsules.

The natural grazing (hay) was collected from the experimental site and consisted mainly of Adan elfar (*Requinaobcordata*) and Huskaneet (*Cenchrusbiflorus*). Concentrate supplement was prepared using sorghum grains (35%), groundnut cake (30%), wheat bran (30%), limestone (4%) calcium salt (0.5%) and sodium chloride (0.5%). The concentrated supplement and *M.olifeira* meal were offered at 7:00 in the morning and consumed completely before offering the basal feed (the natural grazing hay) ad libitum. The quantity of feed consumed was determined at 6:30 am every morning before offering supplements. The experimental feed presented in table (1).

Table 1: Fodder amount and daily consumption kg/day

Fodder type	Daily consumption(kg)	No. of days	Total amount (Kgs)
<i>Morigaolifeira</i>	4.6	50	230
<i>Requinaobcordata</i>	20	50	1000
<i>Cenchrusbiflorus</i>	5	50	250
Concentrate supplement	1	50	50

Table 2: Experiment treatments distribution and daily consumption g/ head Treatments

Feed	I	II	III	IV
<i>Moringaolifeira</i> meal	-	300	400	-
<i>Requinaobcordata</i>	1000	1000	1000	1000
<i>Cenchrusbiflorus</i>	250	250	250	250
Concentrate supplement	-	-	-	250

Chemical Analysis: The ingredients used in concentrated ration formulation, the *Moringa olifeira* meal and the natural grazing were analyzed using the proximate analysis methods according to procedures described by the Association of the Official Analytical Chemists, AOAC, (2000). Dry matter and organic matter digestibility coefficients were determined according to Telly and Terrie (1980) procedures.

Milk samples were analyzed via the methods described by AOAC, (2000). Protein and total solids of milk samples taken from different groups of does were analysis according to the methods described by Willit,(1951) while milk ash was determined according to Baily, (1937) and lactose was assessed according to procedures described by AOAC,(2000).The digestible energy (DE) was calculated as follows according to McDonald *et al.*,(2000):

$$1 \quad \text{kg DOM} = 1.05\text{TDN and ME (Mj/ Kg DM)} = \text{DOM} \times 4.4 \times 0.82 \times 4.184$$

Table 3: Chemical composition of feed ingredients used in the experiment

Feed	DM	OM	CP	CF	EE	NFE	ASH
<i>Requina obcordata</i> (Adan Far)	97.7	77.35	17.1	37.4	4.0	71.9	19.6
<i>Moringa olifeira</i> (Rawag)	96.5	86.9	27.5	24.7	6.0	29.9	9.6
<i>Cenchrusbiflorus</i> Haskaneet	96.8	83.5	9.2	37.9	5.0	37.3	13.38
Concentrate supplement	95.4	89.8	22.2	26.1	3.0	29.9	15.6

The Statistical Analysis: The duration of the experiment was seven weeks. Data collected during the study was considered a complete randomized design (CRD) with four replications, and was analyzed via analysis of variance according to Steel and Torrie (1998). Where there was significance among treatment means, Duncan multiple range tests was used to separate difference among means. The analysis was carried out using MSTAT-C statistical package (Fiscer, 1990).

RESULTS

Effects of ingestion of *Moringa olifeira* Meal on feed intake of does: The natural grazing (NG) intake as basal feed and intake of *Moringa olifeira*, concentrates and total dry matter intake of the lactating Desert goats is presented in table (4). Goats on NG and 400g*Moringaolifeira*meal (MOM) consumed significantly ($P < 0.01$) higher amount of feed than those on NG plus 300g MOM, NG and CS plus natural grazing Daily feed intakes of the groups were 1100, 1250, 1260 and 1000 g/d/head for the group on natural grazing only, natural grazing supplemented with 300g MOM, natural grazing with 400 g MOM, natural grazing supplemented with 250g concentrate, respectively.

Effects of Ingestion of *Moringa olifeira* Meal on nutrients' digestibility and energy intake of the lactating goats: Effects of supplementation of lactating goats with *Moringa olifeira* meal on *in vitro* nutrients' digestibility and energy intake is presented in table (5). *In vitro* dry matter digestibility coefficients were 51, 55,61,23,65,62 and 66,45 % for the group of goats that consumed natural grazing only, NG supplemented with 300g MOM, NG and 400g MOM and NG with 250g/d CS, respectively. The organic matter digestibility coefficients were 52,45.63,23,67,45 and 67,68% for I, II, III and IV, respectively. Energy intake (M cal /d)

was 765,823,845, and 805 for goats that were on natural grazing alone, the group on natural grazing and 300 MOM, natural grazing and 400 g MOM and NG supplemented with 250 CS, respectively.

Table 4: Feed intake of lactating goats as affected by the level of *Moringa Olifeira* meal consumed

Parameters studies	Treatments				
	I	II	III	IV	SE
Moringaolifeira meal	-	300	400	-	-
Natural grazing	1100	950	860	750	±25
Concentrate supplement	-	-	-	250	-
dry matter intake g/d	1100	1250	1260	1000	±100
Total dry matter intake kg	55.00	62.50	63.00	53.5	±11.23

Table 5: Feed intake and *In Vitro* dry matter and organic matter digestibility of nutrients as affected by level of *Moringa olifeira* meal consumed by does

Parameters studies	Treatments				
	I	II	III	IV	SE
Feed intake(g/ day/head)	1100	1250	1260	1250	±100
IV DMD %	51.55	61.23	65.62	66.45	±13.25
IVOMD %	52.45	63.23	67.45	67.78	±15.16
Energy intake ME/Kg DM	765	823	845	805	±25

Effect of feeding *Moringa Olifeira* Meal on live bodyweight of lactating goats

Effects of supplementation of lactating goats with *Moringa olifeira* meal on live body weight changes is presented in table (6). The daily weight gains for the lactating goat groups were 10, 145, 152.6 and 130 g for those offered natural grazing alone, NG plus 300g MOM, NG plus 400g MOM and those consumed natural grazing supplemented with 250g of concentrate. There were significant differences ($P<0.01$) in weight gain between the groups that were supplemented with MOM and those on the natural grazing. The differences between the two supplemented groups with MOM were insignificant ($P>0.05$).

Kids weight gain also was similar to those of their dams. Kids with dams on the natural grazing supplemented with MOM or concentrate supplement gained greater daily weight than those on the natural grazing alone. The kids of dam groups that were supplemented with MOM or natural grazing and concentrate supplement showed also significant ($P<0.01$) weight gains. Their daily weight gains were 67.9, 55 and 95.5 g/d for kids of dam on NG+ 300, NG and 400g MOM and 250g concentrate, respectively. While those belonged to dams on the natural grazing alone gained only 23.24 g/d .

Effects of supplementation of lactating goats with MOM on milk yield: Effects of supplementing lactating Desert goats with *Moringa olifeira* meal (MOM) on milk yield is presented in table (7). Dams on the natural grazing produced smaller amounts of milk compared with those on the natural grazing supplemented with 300 or 400g *Moringaolifeira* meal. Animals on natural grazing supplemented with concentrate were superior in milk production for the groups that were on natural grazing alone or supplemented with MOM. Average milk production of a goat in the four groups produced 25, 88.750. 100.600 and 72.500 liters milk per the total experimental period and on daily bases average production of a in a group was 0.500 , 1.775, 2.012 and 1.450 liters for those on the natural grazing alone , on NG and supplemented with MOM at 300 and 400 g and those on NG and 250 concentrate supplement.

Table 6: live body weight change, kids' weight as affected by level of *Moringaolifeira* meal consumed by does

Parameters studies	Treatments				
	I	II	III	IV	SE
Number of animals	4	4	4	4	-
Days on trial	50	50	50	50	-
Initial weight of goats (kg)	23.75	23.75	23.75	23.75	-
Final weight of goats	24.25	31.00	31.38	30.250	-
Daily feed intake (g)	1100	1250	1260	1000	11.13
total weight gain of goats (kg)	0.500	7.250	7.630	6.500	3.343
Daily weight gain of goats (g)	10	145	152.6	130	±15.3
Initial weight of kids(kg)	3.275	3.250	3.050	3.838	-
Final weight of kids (kg)	6.250	6.000	6.445	5.000	±11.13
Total weight gain of kids (g)	2.975	2.750	3.395	1.162	25.33
daily weight gain of kids (g)	95.5	55	67.9	23.24	15.13

Table 7: Weekly average milk production of goats as affected by Level of Moringa meal in the ration

Weeks	NG	Rations		
		NG+300g MOM	G+400g MOM	NG+CS
1	0.548	0.850	0.887	0.677
2	0.480	1.105	0.972	0.805
3	0.832	1.402	1.100	1.582
4	.500	1.365	1.605	0.947
5	0.952	1.675	1.227	1.195
6	0.500	1.383	1.947	1.222
7	0.513	1.783	2.095	1.282

NG= natural grazing, MOM = moringa meal

Chemical composition of Goats' Milk as affected by the level of *Moringaolifeira* meal in the ration: Chemical composition of the milk produced by goats on NG supplemented with MOM at different levels is presented in table (8). Total solids % was 12.86, 13.53, 12.70 and 13.01 for goats on NG alone, NG supplemented with 300 g MOM, NG supplemented with 400g MOM and NG with CS, respectively. Milk fat percentage was 3.70 for those group of goats on NG alone, and 3.65 on the two levels of MOM, and 3.65 % for the group on CS. Milk protein was 3.80, 3.60, 3.64 and 3.68 % for those on NG alone, NG supplemented with 300gMOM, 400 g MOM and 250g CS, respectively. Lactose was 4.57, 5.04, 4.81 and 3.96% for the group on NG alone, NG plus 300 g MOM, NG plus 400 g MOM and NG supplemented with 250g CS, respectively.

Table 8: Mean percentages of milk chemical composition of lactating goats

Parameters studies	Milk components (%)				
	TSS	Ash	Fat	C.P	Lactose
Control	12.86	0.77	3.70	3.80	4.57
NG + 300 MOM	13.53	0.90	3.65	3.60	5.04
NG + 400 MOM	12.70	0.68	3.65	3.64	4.81
NG+ concentrate	12.86	0.97	4.65	3.68	3.69

DISCUSSION

Moringaolifeira Meal and Feed Intake of Does: The lactating goats consumed *Moringaolifeira* meal without being subjected to adaptation though moringa leaves were reported containing saponins, which may impair palatability (Amaglo *et al.*, 2010). This could be attributed to its high protein content and good palatability. Similar observations were reported by Heuzé *et al.*, (2014) who found that all *Moringaolifeira* was eaten by goats immediately. It was also observed that total dry matter intake of goats was significantly ($P < 0.01$) increased upon supplementation with MOM meal. The group on NG and MOM consumed greater amount of total dry matter and that was attributed to effects of supplementation with good quality roughage that improved rumen ecosystem and increased micro flora population leading to higher digestibility, faster movement of the digesta from the gut and eventually increasing total feed intake (McDonald *et al.*, 2010). Similar results were also reported by Asaolu *et al.*, (2012) who fed West African Dwarf goats on *Moringa* Multi Nutrient Block (MMNB) supplementation and had assessed its nutritive value relative to cassava peels (CPL) and corn starch residues (CSR). The authors found that feed intake increased significantly ($P < 0.01$) upon supplementation with *Moringa* blocks.

Baba *et al.*, (2000) studied the effects of inclusion of tree leaves on performance of lactating goats and found that goats on low quality roughage supplemented with *Leuceana leucocephala*, *Artocarpus heterophyllus* and *Melastromum arabathricum* (NCB) increased average dry matter and water intakes by 32, 25 and 20%, respectively. Effects of Feeding *Moringaolifeira* Meal on nutrient digestibility: Nutrients digestibility of the rations increased with supplementation of does with MOM compared with NG alone. This might be attributed to increased nutrients needed by the cellulolytic bacteria that digested more dry matter. Organic matter digestibility was also similar to that of the dry matter for the same reasons and due to high protein content of MOM. The results of this study are similar to those reported by McDonald *et al.*, (2010) who found that feeding legume supplements could improve dry matter and organic matter digestibility in goats. Butterworth and Mosi (1985) reported that legume good quality hay might increase dry matter and organic matter digestibility. Protein and organic matter of *Moringaolifeira* were reported being readily digestible in the rumen and/or in the intestine (Makkar *et al.*, 1997; Makkar *et al.*, 1997 and Kakengi *et al.*, 2005). The available data on digestibility of *Moringaolifeira* parts are highly variable, and *in vitro* and *in vivo* OM digestibility reported in the literature range from 40 to 80%, possibly due to the large variability in fiber content (Heuzé *et al.*, 2014).

Kandyliis *et al.*, (2008) studied the effects of supplementation of the low quality roughage with tree leaves and demonstrated that feeding of mulberry leaves with 12 % crude protein and low fiber content, resulted in a high apparent digestibility of the feed when fed to sheep on a mixed forage and concentrate diet.

Effects of feeding goats with *Moringaolifeira* Meal on milk production: Milk production increased significantly ($P < 0.01$) upon supplementation of Desert goats with MOM. That might be attributed to the nutrients supplied by the high quality roughage that was shown to contain 27.1% compared with 11.2 % for the natural grazing and minerals. The concentrated ration though had high protein and energy had cereal grains that usually produce lower volatile fatty acids that are necessary for inducing lactating animals to produce more milk (McDonald *et al.*, 2010). Nevertheless, giving concentrated diets induced goats to produce more milk than offering natural grazing alone. The results reported here are similar to those reported by Sultana *et al.*, (2012) who found that milk yield was significantly ($P < 0.01$) increased with the supplementation of goats with concentrate. Sánchez *et al.*, (2006) conducted an experiment on effects of feeding *Moringaolifeira* to dairy cows and found that it increased ($P < 0.05$) DM intake from 8.5 to 10.2 and 11.0 kg DM day⁻¹ and milk production from 3.1 to 4.9 and 5.1 kg.

Effects of goat with *Moringaolifeira* Meal on milk composition: Crude protein and total solids % was similar for all goat groups that were on different levels of *Moringa olifeira* meal but fat was higher in milk produced from goats on natural grazing and concentrate than those on MOM. Lactose was higher in milk produced from dose fed MOM at different levels. This is consistent with the fact that high milk yield is associated with lower fat %. The results reported here are similar to those reported by McDonald *et al.*, (2010) who demonstrated that low fat and total solids were obtained from goats that produced higher levels of milk. Contrary, Bhatta *et al.*, (2002) studied the effects of feeding tree foliage on milk yield and composition of natural grazing lactating goats and found that the milk composition (milk protein and solid-not fat) also significantly ($P<0.05$) improved in goats on tree biomass. The authors concluded that feeding of tree biomass in lactating goats maintained on range improved milk yield and composition.

Effects of feeding *Moringa olifeira* Meal on body weight of does and kids: Live body weight gain of lactating increased in goats supplemented with MOM compared with those fed the natural grazing alone. It was greater for the group of goats on NG supplemented with 400g MOM followed by those on NG and 300g MOM and NG supplemented with 250 g CS and finally those on the NG alone. Greater weight gain was reported for goats on NG supplemented with MOM and that might be attributed to increased feed intake, better nutrients digestibility and higher level of energy, protein, minerals and vitamins of *Moringaolifeira* leaves. Consuming *M olifeira* might have also increased microbial protein that contains all essential amino acids needed for optimal metabolism. The group that was fed NG with concentrate ration gained smaller weight less than that recorded for MOM fed groups. That difference could be explained on better utilization of nutrients when the supplement was tree forage rather than concentrate diet in ruminants. Similar results were reported by McDonald *et al.*, (2010) who concluded that feeding tree leaves have resulted in increased body weight gains of ruminants. Butterworth and Mosi (1985) also reported that feeding goats and sheep with legume hay resulted in increased intake, nutrients digestibility and eventually higher live body weight gains. However, Jadalla *et al.*, (2012a) reported small weights of sheep fed natural grazing supplemented with a limited amount of groundnut haulms because the study was intended to envisage sustaining lambs at maintenance level by such pattern of feeding since taking NG alone resulted in weight loss during the dry season. The differences in weight gain between the two groups that were supplemented with MOM were insignificant ($P>0.05$).

Kids that belonged to dams on natural grazing supplemented with MOM or concentrate gained greater daily weight than those on the natural grazing alone. The groups that were supplemented with MOM or natural grazing and concentrate showed significant differences ($P<0.01$) in weight gain. The improved weight gain might be attributed to increased milk production of the lactating goats on supplementation. Similar results were reported by Sitana (2010) who showed that feeding molasses blocks to Desert does on natural grazing improved their milk production and weight gain of their kids. Jadalla *et al.*, (2012b) studied supplementation of Desert does on sorghum straws supplemented with concentrates and observed increased milk production and greater body weight gains of the does and kids compared with those on the straws alone.

Conclusion

It was concluded that feeding goats with *Moringa olifeira* meal at 300 and 400 g / head per a day was capable for increasing feed intake, nutrients digestibility, milk production as well as improving milk quality. Consequently live body weight gain of the lactating Desert goats and their kids increased. *Moringa olifeira* meal can substitute concentrates for feed which is high in nutritive value and low in price to be planted in the area that suitable for its growing.

Recommendations

It is recommended that *Moringa oleifera* meal at different levels can be used as low cost feed source that reduce production cost and make production sustainable. It will also assist in better performance for both does and their kids. It is also recommended that North Kordofan community be encouraged to grow *Moringa olifeira* on rangelands of the state. More studies are recommended for using MOM in different purposes for feeding goats and other animal classes.

REFERENCES

- AOAC. (1997). Official methods of analysis of AOAC International 16th ed. 3rd Revision. *Association of Official Analytical Chemists, Washington, DC.*
- Baba, A.S., Noraida, H. I., and Sembiring, M. (2000). The effects of supplementation with selected browse plants on feed intake, production and composition of milk in lactating Katjang-cross goats. *Asian - Australasian Journal of Animal Sciences*, 13 (1), 369-372
- Bailly Street, R.B.,(1937). Some observations on methods of shing cereal products. *Cereal chemistry*, 14:120-128
- Bhatta, Raghavendran; Shinde, A. K.; Sankhyan, S. K.; Verma, D. and Vaithyanatha, S. (2002). Effects of feeding tree *foliage* on milk yield and composition of lactating goats on semi-arid rangeland Butterworth, M.H. and Mosi A.K. (1985). Voluntary intake and digestibility of combinations of cereal crop residues and legume hay. *ILCA bulletin* No.24 14-17
- El Hag , F.M.; Fadalla, B. and Mukhtar, H. K. (2001). Some Production Characteristics of Sudan Desert sheep under range condition in North Kordofan. *Sudan Tropical Anim Health and Production*, 33: 229-239.
- FAO, (1999). Food and Agriculture Organization of the United Nations. *Production year book, statistical series. Vol. 53, No. 156, Rome, Italy.*
- FAO, (2008). Food and Agriculture Organization of the United Nations. FAO database 2008 in www.fao.org/dad-is FAOSTAT (2008), <http://faostat.fao.org/default.aspx>.
- Fischer SD. 1990. Micro-computer Statistical Program (MSTATC-C) Statistical Package. *Michigan State University, USA*
- Harrison, M. N and Jackson, J. K. (1958). Ecological classification of vegetation of the Sudan. *Agricultural publications committee. Khartoum*
- Heuzé V., Tran G., Bastianelli D., Hassoun P., Lebas F., (2014). *Moringa (Moringa oleifera)*. Feedipedia.org. A programme by INRA, CIRAD, AFZ and FAO. <http://www.feedipedia.org/node/124> Last updated on December 22,2014, 10:49
- Jadalla J. B., Mekki D. M. and Mohamed T.A. (2012), Effects of Supplementation of the Dry Season Grazing with Groundnut Haulms on Nutrients Utilization and Sheep Performance in West Kordofan State, Sudan *J Anim Prod Adv* 2012, 2(10): 462-468
- Jadalla, J. B., Ismail, I. A and Mekki, D. M. (2012). Effects of Dietary Protein Level on Milk Yield, Composition and some Hematological Parameters in Desert Goats of North Kordofan, Sudan. *J. Anim. Prod.Adv.*, 2012, 2(9):379-388
- Kakengi, A. M.V.; Shem, M. N.; Sarwatt, S. V., Fujihara, T., 2005. Can *Moringa oleifera* be used as a protein supplement for ruminants. *Asian Aust. J.Anim. Sci.*, 18 (1): 42-47
- Khatir, A.A., and Jadalla, J. B. (2014) Assessment of rangelands biomass using Remote Sensing and Geographical Information System (GIS) in Kordofan, Sudan, *University of Kordofan Journal of Natural Resources and Environmental Studies, UKJNRES*, 1(1): 60-70, 2014

- Makkar, H. P. S.; Francis, G.; Becker, K. (2007). Bioactivity of phytochemicals in some lesser-known plants and their effects and potential applications in livestock and aquaculture production systems. *Animal, feedipedia 1 (9): 1371-1391*
- McDonald, P Edwards, R A Greenhalgh J F D, Morgan CA, Sinclair L A, and Wilkinson., R G (2010) Animal Nutrition seventh edition *Longman Scientific and Technical, Prentice Hall, New Jersey, USA*
- NRC (1991) National Research Council. Micro-livestock: little known small animals with a promising economic future. *National Research Council, Washington D.C., National Academy Press. pp.193-205 and pp. 263-269*
- Ragha Vendra Bhatta, Shinde, A. K. , Sankhyan, S. K. Verma D. L., and Vaithyanathan S. (2002) Effect of feeding tree foliage on milk yield and composition of lactating goats on Semi-arid rangeland. *Central Sheep and Wool Research Institute, Avikanagar, Rajasthan 304 501 India, Indian Journal of Animal Sciences, 72 (1) : 84-86*
- Sánchez , Nadir Reyes; Spörndly, Eva and Ledin, Inger (2006). Effect of feeding different levels of foliage of *Moringaoleifera* to creole dairy cow's on intake, digestibility, milk production and composition. *Livestock Science, 101,(1-3), 24-31.*
- Sitana Ibrahim Yousif (2010). Performance of Lactating Desert Goats Fed on Molasses and Crop Residues Blocks in North Kordofan, Sudan *M.SC thesis, Faculty of Natural Resources and Environmental Studies, University of Kordofan Sudan.*
- Steel R G, Torrie J H (1980). Principles and Procedures of Statistics. *McGraw Hill Book Company Inc. New York.*
- Tilley J M A and Terrie R A(1980). A two stage technique for the in vitro digestion of forage crops *Current Contents/Agricultural Biology and Environmental Sciences 15:16*
- Van Soest P J (1982) Nutritional Ecology of the Ruminant. *O & B Books, Inc. Corvallis, Oregon. USA. pp. 76-78*
- Wikipedia,(2015).wikipedia.org/wiki/North_Kurdufan/sudan/states//.
- Willit, C. O., (1951). Methods for determination of moisture through oven drying. *Analytical chemistry, 23:1058-1062*