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Research Article

Effects of feeding *Ailanthus excelsa* (Roxb.) leaves on desert lamb's feed intake, nutrients digestibility and growth performance

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Abstract

This trial was designed to study the effect of intake of ailanto (*Ailanthus excelsa)* fodder on dry matter intake, nutrients digestibility and performance of Sudanese Desert lambs. Twelve heads of lambs, six months old and weighing (17+ 0.37) kg were divided into three groups with four heads each. They were vaccinated and dosed with broad-spectrum antihelmentics (ivermectin) for treatment against internal and external parasites and ear- tagged to facilitate identification during treatments. The *Ailanthus excelsa*, fodder, groundnut haulms and the natural grazing was fed to group I, II and III, respectively. Water was provided continuously and feed intake was monitored daily. The feed samples were analyzed and apparent nutrients digestibility was determined by total feces collection method. This complete randomized design data was analyzed via analysis of variance and differences among means were detected using Least Significant Difference test (LSD). Feed intake was significantly ($P<0.05$) higher for group 1 followed by the group on groundnut haulms and finally the group on the natural grazing where the amounts consumed was 865.90, 850 and 800 grams per day. Dry matter digestibility was the highest in the group on *Ailanthus excelsa* fodder, followed by groundnut haulms and the lowest for those on natural grazing where DMD was 75.67, 67.45, and 56.45%, organic matter digestibility 78.61, 69.65 and 57.55%. Body weight changes indicated that they were higher in the *Ailanthus excelsa* fodder group and then in the groundnut haulms group and lower in the natural grazing group. The highest daily weight gain (60 grams) was obtained when animals fed on *Ailanthus excelsa* fodder compared to 45 grams and 40 grams a day for the group fed groundnut haulms and natural grazing, respectively.

Introduction

Livestock plays an important role in providing food to the Sudanese, which is a source of livelihood for significant sector of the population of Sudan. It also meets the needs of human beings. It represents a burden of production, especially among nomadic tribes, which contribute to raising the standard of living of individuals and ensuring their food security [1].

Livestock is a major and advanced contribution to enriching the national income in Sudan. Livestock is the second largest contributor to the private economy in Sudan. Livestock in

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Sudan contributes to the coverage of local consumption of red meat Sudan also plays an important role in securing local consumption of milk and providing raw materials for leather industries. The herds of Sudan depend on the natural pasture in their food, which makes their meat of high quality. It is a source of income for rural families and herding families, providing them with all their meat needs dairy, eggs and fishing. It provides all the population of Sudan with their needs of the meat commodity and thus achieves self-sufficiency of meat commodity. Contribute significantly to meeting the country's dairy needs, thereby reducing the cost of milk recovery dried. A source of employment where livestock an absorb large numbers of manual and technical labor veterinarians, animal production specialists and pastoralists .An important source for bringing the country's hard currency by exporting live animals leather and meat. Is an important element for the conversion of agricultural wastes such as wheat stalks, corn stalks and residues such as fertilizers, pulses and molasses, to animal products of very high nutritional value Source of compost where manure, poultry and fish residues are used as fertilizer. The relationship between livestock production and agricultural production makes an integral relationship where supply is provided the animal needs food feed, crop and crop residues while the animal supplies the plant organic fertilizers. The animal is also used for "agricultural operations" as the heirs, and the Sudan the richest Arab and African countries in terms of livestock, which helps to increase growth rates in this area [2].

Sudan is characterized by multiple climates that impact on the diversity of livestock where camels are concentrated in the belt and cows in the southern and western belts while small ruminants (sheep and goats) spreading in all parts of Sudan ,Sudan has water resources with a variety of sources including the possibility of water harvesting , Sudan food supplier animals (cattle ,sheep, goats and camels) are estimated at 105 million heads [2,3].

Ailanthus is a deciduous tree belonging to the family Simaroubaceae and is widely distributed in tropical areas. Its native origin is China and it is known as 'tree of heaven', 'tree of sun' or 'Persian sumach'. *Ailanthus excelsa* (Roxb.) tree leaves which are used for feeding sheep are grown in areas where desert sheep are found abundantly and these trees grow on a large range of soils, climate and reproduce either through seeds/coppice or suckers. Information on the nutritive value of *Ailanthus excelsa* tree leaves particularly for sheep is limited as tree leaves are not largely available for many reasons. From the limited available literature some information about trees along with chemical compositions and nutritive values of their leaves for sheep have been reviewed which showed that most of these are rich in crude protein and TDN contents which can meet the requirements of sheep. *Ailanthus excelsa* (Roxb.) can even fully satisfy the maintenance requirement of sheep. The leaves of *Ailanthus excelsa* (Roxb.) are consumed in greater quantities by sheep as compared to bullocks. Most tree leaves contain tannins, an anti-nutritional factor for which proper precautions need to be taken in selecting the species of tree leaves and their maximum levels of feeding to sheep. *Ailanthus excelsa* (Roxb.) tree leaves are available at practically no cost so much attention should be given to their utilization for rearing sheep economically. So the general objective of the study is assist in development of sustainable production systems based on natural grazing from rangelands to fatten them development of national export and production.

Materials and methods

The study area

This study is conducted in the city of Elobeid, Sheikan locality in North Kordofan state Sudan. El-Obeid town is the capital of North Kordofan State. North Kordofan lies between latitudes 11°:15/ and 16°:30/ N and longitudes 27° and 32° E at an altitude of 560 meters above sea level. Maximum temperatures range between 30 and 35°C, with peaks of above 40°C during the months of April, May and June prior to the rainy season. The minimum temperatures could reach to 18-22° C during the winter season, which extend from November of February [4]. The temperatures are modified by precipitation. The rainy season is extends from July to October with the greatest monthly rainfall in August. The long term average annual rainfall is about 280 mm. The study area can be categorized into two major soil groups, sandy and sandy loamy soils (locally called *Gardud* soil), while the latter is found along depressions and valleys, the example of which is Khour Taggat.

Vegetation cover

The dominant tree species in the study area are composed of *Acacia senegal, Acacia mellifera, Adansonia digitata, Leptadenia pyrotechnica, Maerua crassifolia, Boscia senegalensis and Grewia tenax.* The vegetation grasses and herbs are dominated by *Sesamum alatum, Cenchrus biflorus, Zornia glochidiata, Aristida mutablis,Cassia obusiflora, C. occidentals. Ipomoea kotschyana and Farsetia longisiliqua* [5].

North Kordofan 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 [5,6].

Most crops are grown on Gardud while sands are used as rangeland with some cropping. 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 [7].

More than 80% of North Kordofan people depend on animal husbandry keeping cattle, sheep, desert goats and camels. Rain fed agriculture is practiced on Goz slopes and depressions. Main crops grown are millet, sorghum, watermelon and groundnut. *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 [8].

The experimental animals

Twelve Desert sheep lambs at age 6 month are used in this study. The animals are divided into three similar groups (A, B, C) each with 4 animals. Prior to commencement of treatments

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they are ear tagged and vaccinated against diseases endemic to the study area drenched with Ivormekteen (Ivomic)10cc/head by oral and repeat the dose after 15 days

One week is considered a preliminary adaptation period where the animals are to be adapted for feed and treatments, the adaptation period is also necessary for removal of the effects of the feed previously taken.

The animals are weighted at the beginning of trial, and once every week until end the trial 60 days to monitor their weight change as effected by type of rations.

Sampling of *Ailanthus excelsa*

For determination of biomass production was done by method as follows. The technique is amount of biomass per tree multiplied and forage from number of unit area can be estimated.

The experimental feed

The study is proposed to using type of rations, these are:-

Natural grazing with different grasses and herbs is harvested from the range land as control and two groups are supplemented with *Ailanthus excelsa*. The third group is supplemented with 500g of groundnut haulms. The experimental animals are supplemented with 500g *Ailanthus excelsa* leaves per head per a day. The basal feed is offered a dlibitum and water is provided continuously.

Data collection

The data are collected includes:

- Feed intake
- Collected
- Weight animals and feed

Chemical analysis

The plant biomass is analyzed using proximate analysis, and forage fiber analysis and minerals, *in vitro* digestibility TDN DE ME are calculated.

Statistical analysis

The experimental design is a complete randomized design (CRD) that has three treatments and four replicates.

The data is analyzed using analysis of variance, the difference among treatment means are detected using least significance difference (LSD).

Results

Chemical composition of *Ailanthus excelsa* biomass, groundnut haulms and natural grazing

Chemical composition of *Ailanthus excelsa* leaves, natural grazing and groundnut haulms is presented in the Table 1. Dry matter was highest in the *Ailanthus excelsa* (99.9 %) and followed by natural grazing 95.51 and 94.88 % for groundnut haulms. While organic matter reached 88.23 %for the natural grazing and 87.93, 87.23 for the *Ailanthus excelsa* and groundnut haulms respectively. Hence ash was 7.28 %for the natural grazing, 7.65% for groundnut haulms and 11.97% for *Ailanthus excelsa*

Feed intake of experimental animals

The dry matter intake of lamb groups on rations containing deferent levels of *Ailanthus excelsa* in presented in Table 2. The sheep lambs consumed 865.90, 850,800g dry matter per day when they were *Ailanthus excelsa* groundnut haulms and natural grazing I, II, III for groups of lambs respectively. The groups consumed throughout the experimental period amounted to 49, 47 and 44 kg per group I, II, and III respectively.

Vitro digestibility of *Ailanthus excelsa* biomass

The in vitro dry matter digestibility (IVDMD) and organic matter digestibility (IVOMD) as affected by the level of *Ailanthus excelsa* is presented in Table 3. The coefficient of dry matter digestibility was higher for the group *Ailanthus excelsa* 75.67% followed by that of the groundnut haulms 67.45% and last biomass of the natural grazing 56.45. The in vitro organic matter digestibility was 78.61, 69.65and 57.55% when the *Ailanthus excelsa*, groundnut haulms and natural grazing offered respectively.

Table 1: Chemical composition of the experimental feed ingredients.

Ingredients	DM	OM	CP	CF	EE	NFE	Ash
Ailanthus excelsa	99.9	87.93	19.87	12.72	3.53	51.81	11.97
Natural grazing	95.51	88.23	4.11	37.25	3.53	30.06	7.28
Groundnut haulms	94.88	87.23	19.56	31.7	7.1	65.05	7.65

DM= Dry Matter OM= Organic Matter CP= Crud Protein CF= Crud Fibre EE= Ether Extraction NFE= Nitrogen Free Extraction Ash= in organic Mater

Table 2: *In vitro* dry matter and organic matter digestibility of *Ailanthus excelsa*.

Feed type	Dry matter	Organic matter	SE+
Ailanthus excelsa	75.67	78.61	2.96
Groundnut haulms	67.45	69.65	2.2
Natural grazing	56.45	57.55	3.46

Table 3: Lambs performance as affected by the level of *Ailanthus excelsa*.

Parameters	I	II	III
No of animal	4	4	4
Days of trial	55	55	55
Initial body weight	17.75	17	16.75
Final body weight	21	19.5	19
Body weight change (kg/55days)	3.25	2.5	2.25
Total feed intake (kg)	49	47	44
Daily feed intake (g)	865.9	850	800
Daily weight gain (g)	60	45	40
LSD of BWT	A	B	B
LSD of feed intake	A	A	B

I=*Ailanthus Excelsa*, II= Groundnut Haulms, III=natural grazing

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General performance of the experimental animals

Performance of sheep lambs as affected by ingestion of different levels of *Ailanthus excelsa* biomass is presented in Table 4. From the initial weight of 17+ 340g the lamb groups increased to 21, 19.5 and 19(kg) for the group on *Ailanthus excelsa*, groundnut haulms and natural grazing respectively within the experimental period of 55 days. Body weight change (kg/55days) was highest (3.25 kg) in group (I) that was offered *Ailanthus excelsa* followed by the group on groundnut haulms 2.5kg in group (II) and finally those fed on natural grazing (2.25kg) in group (III). Weight change g/d was highest reaching to 60g/d in group I, 45g in group II and 40g in group III.

Digestibility coefficients of the experimental rations

The digestibility of nutrients as affected by the level of intake of *Ailanthus excelsa*, groundnut haulms and natural grazing is presented in Table 4. Dry matter digestibility found being 65, 45 and 41% it was highest when the *Ailanthus excelsa* was ingested followed by that of groundnut haulms and last biomass of natural grazing. So those lambs which consumed the *Ailanthus excelsa* had higher total intake and digestibility. The Organic matter digestibility similarly varied according to the level of the studied plant biomass ingested. At *Ailanthus excelsa* intake OMD % was 67 and decreased to 49 and 46 when the lambs fed on groundnut haulms and natural grazing respectively. The crude protein digestibility reached to 70 % in lambs consumed *Ailanthus excelsa* and decreased to 59 and when they were fed on groundnut haulms followed by those fed natural grazing biomass 50%. The differences were significant (P<0.05). Crude fiber digestibility has also shown similar trend. It was 45% when the lambs were offered *Ailanthus excelsa* biomass and then decreased to 34 % for groundnut haulms and 30% for the group on the natural grazing. Upon feeding lambs with the *Ailanthus excelsa* biomass EED was 77% then decreased to 60% on groundnut haulms and 54 % upon ingestion of the natural grazing. The Digestibility of Nitrogen free extract NFE was 68, 66 and 45% when the lambs were fed *Ailanthus excelsa* biomass, groundnut haulms and natural grazing respectively.

Feed intake

The dry matter intake of sheep lamb groups on *Ailanthus excelsa*, groundnut haulms and natural grazing was found being different in their intake. The sheep lambs consumed 865.90, 850,800g dry matter per day when they were *Ailanthus excelsa* groundnut haulms and natural grazing respectively

Table 4: Nutrients digestibility of the *Ailanthus excelsa*, groundnut haulms and NG.

Nutrients	I	II	III	SE
Dry matter	65	45	41	3.4
Organic matter	67	49	46	1.5
Crude protein	70	59	50	2.5
Crude fiber	45	34	30	4.5
Ether extract	77	60	54	3.7
Nitrogen Free extract	68	66	45	5.4

I= *Ailanthus excelsa*, II= Groundnut haulms, III=Natural grazing

There were significant (p<0.05) differences among the dietary treatment groups of animals. The groups consumed throughout the experimental period feed amounted to 49, 47 and 44 kg per group (I, II, III) respectively. It was observed one lambs of *Ailanthus excelsa* group suffered from diarrhea in week one but it was adapted after that. Greater amount of feed consumed by *Ailanthus excelsa* might be attributed to its better digestibility and higher % of soluble carbohydrates (NFE) and high palatability. The diarrhea might have been caused due to sudden change of rumen micro flora. The results reported in this study are similar to those found by Osman [9] who observed that this plant biomass could improve feed intake. Jadalla, et al. [8] and Thanh Van, et al. [10] also reported that sheep on good quality roughage consumed natural grazing in greater amounts that those consuming low quality roughage alone

Nutrients digestibility

The digestibility of nutrients of *Ailanthus excelsa* , groundnut haulms and natural grazing found being better for the tree browse. Dry matter digestibility found being 65, 45 and 41% in favor of *Ailanthus excelsa* followed by that of the groundnut haulms and lastly that of natural grazing. The higher nutrients content improved the rumen ecosystem for better digestion when *Ailanthus excelsa* was offered. It seems tannin content was low in *Ailanthus excelsa than* in groundnut haulms. The Organic matter digestibility similarly varied according to the level of the studied plant biomass ingested. 67, 49 and 46% for the *Ailanthus excelsa* , groundnut haulms and natural grazing. The crude protein digestibility reached to 70 % in lambs consumed *Ailanthus excelsa* biomass followed by those fed groundnut haulms59% and natural grazing 50%. The differences were significant (P<0.05). Crude fiber digestibility has also shown similar trend. It was 45% when the feeding lambs *Ailanthus excelsa* biomass, 34%groundnut haulms and 30% natural grazing. The Digestibility of ether extract, EED was 77,60 and 54% when the lambs were fed *Ailanthus excelsa* biomass, groundnut haulms and natural grazing respectively. Similarly Theng Kouch, *et al.* [11] and Shashank, et al. [12] found that DM digestibility and OM digestibility were 48.5 and 49.0 %, respectively. DM digestibility of the hanging jackfruit foliage (63.3%) was 14.8 units higher than for the separated leaves, an increase of some 30%, Rai, et al. [13] reported that the digestibility of jackfruit foliage was 52.6%, which is in agreement with the values for foliage fed in the trough in our experiment.

Effects of Ailanthus excelsa biomass on in vitro dry matter and organic digestibility

The in vitro dry matter digestibility (IVDMD) and organic matter digestibility (IVOMD) was found more efficient for *Ailanthus excelsa* than the other two feed. The coefficient of dry matter digestibility was higher for the group *Ailanthus excelsa* 75.67 followed by that of the groundnut haulms 67.45% and last biomass of the natural grazing 56.45. Similarly in vitro organic matter digestibility was highest when the *Ailanthus excelsa* and then the values obtained for groundnut haulms and lastly the values of IVOMD of the natural grazing 57.55%.

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The in vitro organic matter digestibility was 78.61,69.67 and 57.55% when the *Ailanthus excelsa* ,groundnut haulms and natural grazing offered respectively. The better dry matter and organic matter digestibility in vitro for *Ailanthus excelsa* can be explained on its balanced nutrients contents.

General performance of lambs as affected by the level of the ration

Performance of Desert sheep lambs as affected by the consumption of *Ailanthus excelsa* biomass was found to be far better than that of groundnut haulms and the natural grazing. Such results were expected since the plant biomass was found higher in protein, NFE and lower in fiber. Final body weight lambs highest 21kg in group I, 19.5 kg in group II and 19 kg in group III (*Ailanthus excelsa*, groundnut haulms and natural grazing) respectively it was significantly different between groups within the experimental period of 55 days. Body weight change (kg/55days) was highest 3.25 kg in group (I) *Ailanthus excelsa*, *2.5kgin* group (II) groundnut haulms and 2.25kg in group (III) natural grazing. Live weight gain was significantly ($P<0.05$) higher in *Ailanthus excelsa* 60g compared to 45g in group II and 40g in group III.

The results obtained in this study on live weight gain that was significantly ($P<0.05$) higher are similar to those found by feeding lambs with *L .leucocephala* diet when compared to poor roughage diet alone. The animals of diet poor roughage and good quality roughage led to weight gain of 44.6 g/d and (46.58 g/d, respectively. These were significantly ($P<0.05$) lower live weight gain than other diet for better feed (60.79 g/d) and D (50.7g/d). This decrease of intake is similar to that reported by Khalid, *et al.* [14], that bulkiness of neem leaf results in animals not being able to satisfy their energy and protein requirements.

Conclusions

The fodder from *Ailanthus excelsa* has shown to contain a higher percentage of protein than of the natural grazing and groundnut haulms, as well as low crude fiber while nitrogen-free extract high lower than that found in groundnut haulms as well as a high percentage of minerals (total ash) was more than that of the natural grazing and groundnut haulms. In vitro digestibility for fodder taken from *Ailanthus excelsa* was higher than natural grazing and groundnut haulms. Feeding Desert lambs on *Ailanthus excelsa* fodder found that feed intake was significantly higher than the amount consumed of natural grazing and groundnut haulms. *Ailanthus excelsa* fodder can be considered as good quality roughage for feeding sheep during the dry season.

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