

Original Article

Proximate analysis of five plants species in Rangeland enclosures in Khartoum State, Sudan.

Reem Ahmed Hamid^{1*}

¹Wildlife Research Center, Animal Resource Research Corporation, Ministry of Animal Resources and Fisheries, Bahri, Sudan.

Correspondence author: Dr. Reem Ahmed Hamid, Wildlife Research Center, Animal Resource Research Corporation, Ministry of Animal Resources and Fisheries, Bahri, Prof. Karib Street Khartoum North/Sudan, P.O. Box 16 Elmawrada/ Omdurman 13311, Sudan.

E-mail: reemasah01@yahoo.com

Abstract:

The present study was designed to determine the nutritional values of five palatable and common species in 5 rangeland enclosures in Khartoum State during 2013-2015. Proximate analysis of three grasses belong to poaceae family (*Aristida adscensionis*, *Schoenefeldia gracilis*, *Panicum turgidum* and two were forbs belong to Zygophyllaceae family (*Fagonia indica* and *Corchorus depressus*) were determined by using standard methods that include (AOAC, 1990). The studied parameters were dry matter DM, CP, CF, ash content, EE, NFE, NDF, ADF and RFV.

Fagonia indica and *Panicum turgidum* were the highest value of CP 3.205 and 3.150 respectively.

Aristida adscensionis was the lowest CP value which was 2.400. *Fagonia indica* was the highest CF value which was 47.060, while *Corchorus depressus* was the lowest value which was 33.450. The highest EE 1.4 is recorded by *Panicum turgidum* while the lowest EE is recorded by *Fagonia indica* 1.26. *Corchorus depressus* reported the highest ash and NFE content 5.195 and 51.94 respectively.

Fagonia indica was the lowest ash content and NFE 4.33 and 39.28 respectively. The highest NDF recorded by *Fagonia indica* 86.2 the lowest NDF is recorded by *Corchorus depressus* 84.2. The highest ADF recorded by *Schoenefeldia gracilis* 18.09, while the lowest ADF recorded by *Fagonia indica* 14.235. The highest RFV value is recorded by *Corchorus depressus* 85.060 and the lowest RFV was *Schoenefeldia gracilis* and *Aristida adscensionis* 83.100 and 83.205 respectively.

Keywords: Nutritive value, Proximate analysis, Rangeland, Poaceae, Zygophyllaceae.

Introduction:

Range animal productivity is based on a common goal of optimum economic gains through proper utilization of range forages. Nutritive value describes the forage's capacity to meet the animal's nutritional needs. Nutritive value is a function of the feed intake (FI) and the efficiency of extraction of nutrients from the feed during digestion (digestibility). The nutritive value of range plants can be influenced directly or indirectly by various environmental factors such as weather, soil, plant competition and grazing [1]. Feeds of high nutritive value promote high levels of production (live weight gain) [2].

Feed composition is determination of the chemical constituents making up a feedstuff. It is basically profiling the nutrient composition and density of the feed material. It is normally measured through the proximate system. The important proximate analysis parameters are dry matter (DM), crude fat/ether extracts (EE), crude fiber (CF), crude protein (CP), and nitrogen free extracts (NFE). Feed evaluation determines the potential usefulness of the feed to livestock [3].

The potential of any feed to support animal production depends on the quality consumed by animal and the extent to which the feed meets energy, protein, minerals and vitamin requirement [4]. In many cases determination of acid detergent fiber (ADF) and crude protein is sufficient to give an adequate assessment of forage quality.

The objective of this study is to assess the nutritive value of five dominant and/or most palatable species in term of chemical composition and relative feed value (RFV).

Five species were selected according to their palatability and dominance. These species are forbs, grass and one was perennial, these species namely *Aristida adscensionis*, *Schoenfeldia gracilis* and *Panicum turgium* belong to Poaceae family, which is a large family of grasses with about 620 genera and 1,000 species dispersed in many parts of the world where plants can survive. Poaceae is economically the most important family of flowering plants; the grasses provide diet of most of the world population.

Fagonia indica which belong to the family Zygophyllaceae were extensively studied by many workers regarding their medicinal uses, it was an antitumor, antioxidant, analgesic, astringent, asthma, urinary discharges, tooth ache, stomach troubles and kidney diseases [5] and [6].

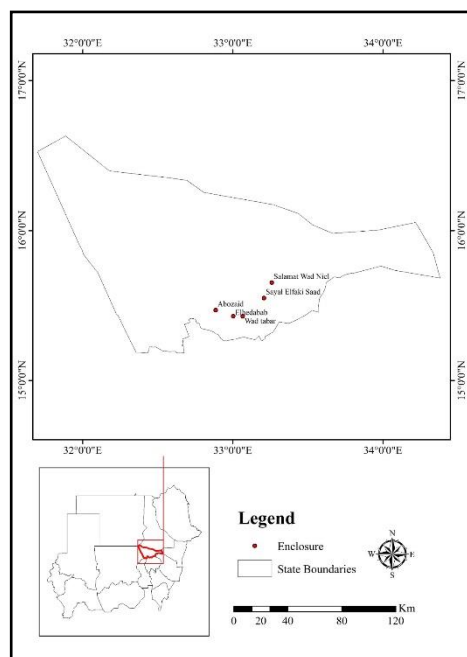
The genus *Corchorus depressus* belonging to the family Malvaceae is distributed throughout the tropical and subtropical regions of the world [7]; [8]; [9]. Leaves of *Corchorus* are consumed as leafy vegetables in various parts of the world especially in Asia, the Middle East, and part of Africa. African culinary traditions and Arabian countries where it is called “Molukhiya.” [10]; [11]. *C. depressus* widely use in ethno-medicine, Whole plant is used in urinary disorders, as an aphrodisiac, on swelling and in internal injury, urinary inflammation, fever and also for strengthening the body. The biological activities attributed to this particular species are, antifungal & antibacterial, anthelmintic, antimalarial,

angiotensin converting enzyme (ACE) inhibiting activity, analgesic and antipyretic activities [12].

Materials and Methods:

Study site:

The Eastern Nile Locality is in the Eastern part of Khartoum State, 45 Kilometers north eastern Khartoum. The studied area is located between 15°42' 846" - 15° 652' 680" N and 33° 25' 928" -32°88' 549" E. Five range enclosures has been established in this locality namely: Abozaid, Wadtabar, Elhedabab, Salmat Wad Niel and Seyal Elfaki Saad (Map 1).



Map 1: Study area

Methodology:

Five most palatable species in the area namely: *Aristida adscensionis*, *Schoenfeldia gracilis*, *Fagonia indica*, *Panicum turgidum* and *Corchorus depressus* were selected to test their proximate composition using [3].

The proximate composition tests were carried out following standard methods that include: dry matter, ash contents, crude protein, crude fiber [3], ether extract, nitrogen free extract [13], neutral detergent fiber [14]; [15], acid detergent fiber [16]; [17]. Also the nutritive value of the species was determined as Relative feed value (RFV).

Moisture:

Sample was dried in an oven to obtain a constant weight. The loss in weight is the moisture. Moisture content was determined in two stages: drying at 60 C° which yields air dry sample and drying at 105 C° overnight, which yields a total dry sample.

$$\text{Moisture \%} = \frac{(W_0 - W_1) * 100}{W_0}$$

Where:

W_0 = Weight of sample before drying

W_1 = Weight of sample after drying

Ash:

Sample was burned in a muffle furnace set at 550 C° to gives a total mineral content. As a result, the organic constituent such as protein carbohydrates and lipids disappear.

$$\text{Ash \%} = \frac{(W_2)}{(W_1)} * 100$$

Where:

W_1 = weight of original sample

W_2 = Weight of sample after ashing

Crude Fiber:

Two grams of each sample were put into 250 ml of conical flask and added 1.25% Sulfuric acid solution and then heated for about 30 min, filtered then washed until traces of acid could not be detected using pH paper. The acid extracted was transferred into 250 ml flask and added 1.25% NaOH subsequently. Heated the samples for 30 min and filtered and washed. The material was transferred into crucible and oven dried at 120° C for 12 h. After it, crucibles were placed in muffle oven for 12 h at 550° C and recorded the crucible weight.

$$\text{Crude fiber \%} = \frac{(W_1 - W_2)}{W_0} * 100$$

Where:

W_1 = dry weight of residue sample after drying.

W_2 = weight of residue sample after the separation of ash

W_0 = weight of fat-free sample.

Nitrogen (Crude protein):

Kjeldahl method is used to determine the total nitrogen content and then the crude protein by multiplying with a factor 6.25. The sample is digested in H_2SO_4 using $CuSO_4$ as a catalyst. Converting N to NH_3 which is distilled and titrated. The method described is mainly for analysis of feeds.

The, percentage crude protein was calculated from the % Nitrogen as:

$$\text{Crude protein\%} = N \times F \%$$

Where, F (conversion factor), is equivalent to 6.25

N = Nitrogen in sample

Neutral detergent fiber:

The total fiber in fibrous feed was determined using the neutral detergent procedure. The NDF includes cellulose, hemicelluloses and lignin as major component. A sample was boiled in NDS solution for 1 h and later ashing at 550 C.

$$\text{NDF (\%)} = \frac{\text{Wt. of crucible + residues - Wt. of crucible}}{\text{Wt. of sample}} * 100$$

Wt. of sample

Acid detergent fiber:

The acid detergent fiber ADF is a rapid method for determination of lingo-celluloses in feed stuffs. This method is also a preparatory step for lignin determination.

$$\text{ADF (\%)} = \frac{(\text{Wt. of crucible} + \text{ADF residues}) - \text{Wt. of the crucible}}{\text{Wt. of sample}} * 100$$

Nitrogen Free Extract (NFE):

NFE is determined by mathematical calculation. It is obtained by subtracting the sum of percentages of all the nutrients already determined from 100.

$$\% \text{NFE} = 100 - (\% \text{moisture} + \% \text{CF} + \% \text{CP} + \% \text{EE} + \% \text{Ash})$$

NFE represents soluble carbohydrates and other digestible and easily utilizable non-nitrogenous substances in feed.

Fat (Ether Extract):

Ether extract was determined using oven-dried samples from moisture content determination. This was extracted with petroleum ether (boiling point (BP) 40 to 60°C) for 6 h with soxhlet extractor. After evaporation of ether, drying to constant weight, and cooling, the result was expressed in percentage.

$$\text{EE\%} = \frac{(\text{Y}-\text{X})}{\text{Weight of sample}} * 100$$

Where:

Y= Weight of flask + extract

X= Weight of flask

Relative feed value (RFV)

Relative feed value (RFV), was calculated from the estimates of dry matter digestibility (DMD) and dry matter intake (DMI) [18].

$$\text{RFV} = \frac{(\text{DMD} * \text{DMI})}{1.29}$$

Where:

$$\text{DMD} = \text{dry matter digestibility} = 88.9 - (0.779 * \% \text{ADF})$$

$$\text{DMI} = \text{dry matter intake} = 120 / \% \text{NDF}$$

Results:

The result of proximate analysis of 5 most palatable and frequent species is shown in the table (1). The highest crude protein was recorded by *Fagonia indica* followed by *Panicum turgidum*, the lowest CP was recorded by *Aristida adscensionis* and *Schoenfeldia gracilis* and this result aligns with [19] in that the tall annual grasses show decline in their nutritive value when compare with perennial grass. The highest ADF recorded *Schoenfeldia gracilis* followed by *Aristida adscensionis*. The highest relative feed value is obtained by *Corchorus depressus* followed by *Panicum turgidum*.

Table (1): Nutritional analysis of the aerial parts of fodder species

Species	DM	CP	CF	EE	Ash	NFE	NDF	ADF	RFV
<i>Aristida adscensionis</i>	95.69 0	2.40 0	42.48 5	1.30 5	4.79 0	44.71 0	84.410	17.19 5	83.205
<i>Schoenfeldia gracilis</i>	94.40 0	2.62 0	34.68 5	1.38 5	4.71 5	50.99 5	84.270	18.09 0	83.100
<i>Panicum turgidum</i>	95.59 5	3.15 0	40.72 5	1.40 0	5.18 0	45.14 0	85.150	14.80 5	84.460
<i>Corchorus depressus</i>	94.83 5	2.88 5	33.45 0	1.36 5	5.19 5	51.94 0	84.200	15.29 0	85.060
<i>Fagonia indica</i>	95.13 5	3.20 5	47.06 0	1.26 0	4.33 0	39.28 0	86.200	14.23 5	83.970

DM: Dry matter **CP:** Crude protein **CF:** Crude fiber
NDF: Neutral detergent fiber **ADF:** Acid detergent fiber

EE: Ether extract **NFE:** Nitrogen Free Extract
RFV: Relative feed value

Results and discussion:

Fagonia indica and *Panicum turgidum* were the highest CP value while *Aristida adscensionis* and *Schoenfeldia gracilis* were lowest CP.

The highest CF is reported by *Fagonia indica* while *Schoenfeldia gracilis* and *Corchorus depressus* were the lowest CF. The highest EE 1.4 is recorded by *Panicum turgidum* while the lowest EE is recorded by *Fagonia indica* 1.26.

Corchorus depressus and *Panicum turgidum* were the highest ash content 5.195 and 5.18

respectively; *Fagonia indica* records the lowest ash content 4.33. The highest NFE was recorded by *Corchorus depressus* 51.94, the lowest NFE content is recorded by *Fagonia indica* which was 39.28.

Fagonia indica was the highest NDF 86.2, while the lowest NDF is recorded by *Corchorus depressus* 84.2. The highest ADF recorded by *Schoenfeldia gracilis* 18.09, the lowest ADF recorded by *Fagonia indica* 14.235. The highest RFV value is recorded by *Corchorus depressus* and the lowest RFV

was *Schoenefeldia gracilis* and *Aristida adscensionis*.

Discussion:

Aristida adscensionis had DM=95.69 this result aligns with to 94.25 and 92.46 which obtained by [20] and [21] respectively. The CP value of it was 2.400 which was higher than [20] 1.26 and lower than [21] and [22] 5.29 and 8.60 respectively. *A. adscensionis* had CF value= 42.485 was higher than [22] 28.01. NFE value of it =44.71 was lower than [22] 30.98. EE =1.305 lower than [20] and [21] 6.69 and 2.61 respectively. NDF = 84.410 this result aligns with to 81.16 obtained by [21] and higher than 73.75 obtained by [20]. ADF= 17.195 was lower than [20] and [22] 51.41 and 44.45 respectively. Ash= 4.8 was lower than 7.27 obtained by [21].

Schoenefeldia gracilis had CP= 2.620 was lower than 4.20 which obtained by [22]. CF value= 34.68 was nearly similar to [22] 30.51. NFE =50.99 was higher than [22] 43.33.

Panicum turgidum had 95.59 DM this result aligns with to 96.20 obtained by [23]. The CP was 3.15 this result aligns with to 3.20 by [23]. CF =40.72 lower than 45.47 by [23]. EE= 1.400 was lower than 2.49 by [23]. Ash= 5.180 lower than 9.15 by [23].

ADF=14.805 lower than 33 by [23]. NFE (45.140), NDF (85.150) was higher than [23] 39.69 and 65 respectively.

Corchorus depressus had CP= 2.88 lower than 10.19 by [22]. CF 33.45 and NFE 51.9 higher than 30.4 and 23.38 by [22] respectively.

Fagonia indica had DM= 95.135 lower than 8.07 by [24]. CP= 3.205 lower than 9.45 by [24]. EE= 1.269 lower than 5.9 by [24]. Ash= 4.330 lower than 11.45 by [24]. CF= 47.06 lower than 53.27 by [24]. All differences could be attributed to differences in growth stages.

Conclusions and Recommendations:

Proximate analysis of the five most frequent and palatable species was done to indicate the nutritive value. Three grasses and two forbs were selected. Poaceae family was the dominant species in the area. Some plants are used for medicinal purposes; others are edible as human food.

Recommendation:

1. Establish more range enclosures to protect and enhance the habitat.
2. Implement regular monitoring and fencing to improve the condition of the enclosures.

3. Establish fire lines to control the spread of wildfires.
4. Develop extension programs targeted at local herders to increase awareness and promote better land management practices.

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