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Determination of Tannins and Alkaloids Content of Some Rangeland Plants Commonly Consumed by Grazing Camels in Sudan

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Abstract

Rangeland plants are important for domestic and wild animals nutrition in the Sudan and animal production relied mainly on rangeland plants. They are mainly classified into herbs, shrubs and trees . Anti-nutritional factors especially Tannins and Alkaloids have adverse effects on plants nutritive value and informations of Tannins and Alkaloids content in rangeland plants are not available. Consequently, this study was conducted to furnish these informations. Anumber of five Rangeland plants were brought from Gedarif State (eastern Sudan) and sixteen Rangeland plants were brought from North Kordofan State (western Sudan) that are common feed for Camels in Sudan were investigated. The samples of the Rangeland plants were air dried and grinded for laboratory analysis to determine Tannins and Alkaloids contents. Tannins and Alkaloids percentages varied among plants. The highest percentage of Tannins was in *Boscia senegalensis* (Mukheit) *(*15.2%) and the least one was in *Cenchrus biflorus* (Huskanit) (0.11%) . Alkaloids percentage was highest in *Acacia senegal* (Hashab) (2.4%) and least in *Sida cardifolia* (Njata), *Cenchrus biflorus* (Huskanit) and *Sesamum alatum* (Semsemlgumal) (0.6%) . It was concluded that Rangeland plants varied in anti-nutritional factors and recommended that anti-nutritional factors should be considered due to adverse effects on plants nutritive value and limit many plants exploitation.

Keywords: Rangeland, Plants, Tannins, Alkaloids, Camels.

Introduction

Rangeland is very important in the world with about 50% of livestock population and it is also important for wildlife (Briske and Heitschmidt, 1991). It is important for domestic and wild animals nutrition in the Sudan (Mohamed, 2004). Animal production relied mainly on rangeland (AOAD, 1981). Anti-nutritional factors are also called plants secondary metabolites (Hassanpour *et al*., 2011). They are substances in plants formed by normal metabolisms and different mechanisms to store nutrients or defend structures and reproductive elements (Harborne, 1989). They affect humans and animals (Osagie, 1998) by inactivating some nutrients, diminishing digestive process or feeds metabolic utilization and hence affect optimum nutrition (FAO, 1991). They include non protein amino acids, glycosides, alkaloids, triterpenes and poly phenolics. They also include saponins, flavenoids , tannins , oxalate , phytates , trypsins (protease) inhibitors , phytohaem-agglutinins and lectin (Soetan, 2008) . Anti-nutritional factors limit many plants exploitation. Tannins They are complex phenolic compounds and include phenolic acids, flavonoids and condensed polymeric phenols known as tannins (Dreyer *et al*., 1981). The mechanism of tannins dietary effects is due to the ability

to form complexes with protein, carbohydrates, lipids, minerals and some vitamins and it is the main nutritonal and toxicological effect (Hagerman and Butler, 1981). Tannins protection is due to precipitating plant proteins, inhibition gastrointestinal enzymes and reduce protein digestibility (Zucker, 1983). They reduced protein rumen degradation (Mcleod, 1974). Tannins adverse effects in ruminants were > 5% (Mcleod, 1974). Higher levels (5-9%) were serious (Barry and Manley, 1984) due to reduced rumen fibre digestibility (Reed *et al.*, 1985) due to inhibited bacterial activity (Chesson *et al.*, 1982) and anaerobic fungi (Akin and Rigsby, 1985). In addition tannins high levels reduced feed intake (Metron and Ehle, 1984). Tannins > 9% may be lethal to animals with no access to other feeds (Kumar, 1983). Tannins stringent effects may protect leaves by rendering it unpalatable to animals (Zucker, 1983).

Alkaloids are cyclic organic compounds contaning nitrogen in a negative oxidation state (Plant Science 4u, 2016). They are natural chemical compounds with mostly basic nitrogen atoms (Manske, 1965). Alkaloids content in plants is low and in homogeneous in plant tissues depending on the type. Different tissues in plants may contain different alkaloids (Wikipedia, 2016). Alkaloids are produced by a large variety of organisms including bacteria, fungi and animals. Alkaloids had anti-nutritional properites and affected rumen microbes, feeds nutritive value and ruminants (VanSoest, 1982). Alkaloids have a wide range of pharmacological activities including antimalarial (e.g quinine), antiasthma (e.g ephedrine) and anticancer (e.g homoharringtonine). Alkaloids act on a diversity of metabolic systems in humans and animals, they almost uniformaly evoke a bitter taste (Wikipedia, 2016).

The aim of this study was to determine Tannins and Alkaloids contents of some Rangeland plants in Sudan.

Materials and Methods

Samples origin and collection

The rangeland plants were brought from North Kordofan State in November 2015 after the end of rainy season including Sixteen samples were *Grewia tenax, Acacia mellifera , Sesamum alatum, Leptadenia pyrotechnica, Balanites aegyptiaca, Sida cardifolia, Geigeria alata, Cenchrus biflorus, Chrozophora brocciana, Guiera senegalensis , Boscia senegalensis, Ocimum basilicum, Acacia seyal var seyal , Acacia Senegal , Ziziphus* spina – *Christi* and *Blepharis linarifolia.* and five samples from Gedarif State were *Cymbopogon nervatus, Sorghum arundinaceum, Sonchus cornutus, Corchorus trilocularis* and *Ipomea cordofana*. Those samples were hand collected and packed ready for the next step .

Identification of plants materials

The plants were identified and authenticated by a botanist at the Medicinal and Aromatic Plants Research Institute, Khartoum, Sudan.

The voucher specimen has been deposited in the herbarium museum of the Institute. The voucher includes the vernacular name, description and distribution of the plants. After that the plant samples air dried in the shade, grinded into fine powder and kept in plastic bags at room temperature ready for laboratory analysis to determine Tannins and Alkaloids contents.

Determination of Tannins content

The modified Vanillin - Hcl method was used to determine Tannins content as described by Price *et al* . (1978). 0.5 g of each powdered sample was dissolved separately in equal amount of acidified Methanol (5 ml Hcl in 5 ml Methanol) the mixure was shaken and allowed to stand for 30 min . The extract was centrifuged for 10 min . Vanillin reagent was freshly prepared by combining 1 g Vanillin in 100 ml Ethanol. 1 ml of each centrifuged extract was added in a tube of 2 ml Vanillin reagent. Absorbance was read on a spectrophotometer 600 nm .

Calculation of Tannins content
Tannins (%) = A × 2 × 10
A = Absorbance of the sample.

Determination of Alkaloids content

Alkaloids in plant samples were determined using the method described by Onwuka (2005). 5g of each powdered samples separately in 50 ml of 10% acetic acid in Ethanol in conical flasks. Each of the mixure was shaken and allowed to stand 4 hrs before filtering of each ¼ of the filtrate was evaporated on a hot plate. Then 1% concentrated NH_3 was dded to each drop wise to precipitate the Alkaloids. Each of the precipitate was filtered with a weighed Whatman filter paper (W_1) and each of the precipitate in the filter paper was dried in an electric oven at 60℃ for 30 min and was cooled in the desicator before each was weighed as (W_2) . By weight difference the weight of the Alkaloids was determined and expressed in % .

$$\text{Alkaloids (\%)} = \frac{W2 - W1 \times 100}{\text{Weight of sample}}$$

W_1 = Weight of empty filter paper
W_2 = Weight of filter paper + filter
W = Weight of sample .

Results and Discussion

The results of Tannins percentages for rangeland plants are presented in table 1 . Tannins percentages varied among plants. It was highest in Mukheit (15.2%) followed by Taleh (12.41%). However, Huskanit and Marakh had the least percentages (0.11%) and (0.27%), respectively. The variations in tannins percentages among plants were mainly genetic. Similar results were found by Ali (2015). Mohamed (2003) found that condensed tannins varied among plants. Mukheit highest tannins percentages followed by Taleh was because they were trees and shrubs. Huskanit least tannins percentages was because it is a grass. Marakh low tannins percentages was not expected as it is a shrub. The results showed variations in tannins among trees and shrubs and among grasses. Mukheit tannins percentage was higher (15.20%) than that found by Ali (2015) . Gubeish tannins percentage (4.68%) differed from the (14.69%) reported by Ali (2015). Seha tannins percentage (9.75%) was close to that recorded by Ali (2015) . Njata and Argassi tannins percentages differed from that found by Ali (2015). Huskanit tannins percentage was lower than that stated by Ali (2015). The discrepancy in plants tannins percentages among workers could be genetic and environmental.

As shown in table 2. Alkaloids percentages varied among range palnts. It was highest in Hashab (2.4%) followed by Taleh (2.2%) and least in Njata, Huskanit and Semsemelgumal (0.6%). Some plants had the same alkaloids percentage and it was (0.8%) in Marakh, Gudaim and Gubeish, (1.4%) in Mukheit , Sidir and (1.6%) in Seha and Hegleeg . The variations in alkaloids percentages among range palnts were mainly genetic. Mohamed (2003) found that alkaloids varied among plants. Hashab highest alkaloids followed by Taleh were mainly because they were trees. The least alkaloids in Njata is interesting as it is a shrub and showed variations among trees and shrubs in alkaloids. Huskanit low alkaloids was because it is a grass. Semsemelgumal low alkaloids as because it is a forb. Marakh, Gudaim and Gubeish similar alkaloids could be because they are shrubs. There is no available information on alkaloids percentages in rangeland plants. However, there were differences in alkaloids percentaes in different plants spieces in the literature (Luyang *et al*., 2015 ; Taiga, 2013 ; Nuhu and Ghani , 2002). Variations in alkaloids could be genetic and environmental.

Conclusions

This study concludes that range plants including grasses, forbs, trees and shrubs varied in Tannins and Alkaloids percentages. In addition anti-nutritional factors should be considered in animal feed evaluation due to adverse effects on

plants nutritive value and limit many plants exploitation.

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Table (1): Total tannins percentages in some rangeland plants from Gedarif and North Kordofan States, Sudan.

Botanical Name	Family	Vern Name	Plant Type	Tannins (%)
Cymbopogon nervatus	Poaceae	Nal	Grass	07.29
Sorghum arundinaceum	Poaceae	Adar	Grass	07.51
Cenchrus biflorus	Poaceae	Huskanit	Grass	00.11
Geigeria alata	Asteraceae	Gutgat	Forb	11.27
Sonchus cornutus	Asteraceae	Molaita	Forb	04.32
Ocimum basilicum	Lamiaceae	Rehan	Forb	07.03
Blepharis linarifolia	Acanthaceae	Seha	Forb	09.75
Ipomea cordofana	Convolvulaceae	Tabar	Forb	07.22
Sesamum alatum	Capparidaceae	Semsemelgumal	Forb	09.24
Boscia senegalensis	Capparidaceae	Mukheit	Shrub	15.20
Guiera senegalensis	Combretaceae	Gubeish	Shrub	04.68
Grewia tenax	Tiliaceae	Gudaim	Shrub	06.66
Corchorus trilocularis	Tiliaceae	Mulukhia	Shrub	00.87
Leptadenia pyrotechnica	Asclepiadaceae	Marakh	Shrub	00.27
Sida cardifolia	Malvaceae	Njata	Shrub	01.07
Chrozophora brocciana	Euphorbaiceae	Argassi	Shrub	00.41
Acacia mellifera	Mimosaceae	Kitir	Shrub	11.55
Acacia seyal var seyal	Mimosaceae	Taleh	Tree	12.41
Acacia Senegal	Mimosaceae	Hashab	Tree	07.35
Ziziphus spina – Christi	Rhamnaceae	Sidir	Tree	09.89
Balanites aegyptiaca	Balanitaceae	Hegleeg	Tree	12.39

Table (2): Alkaloids contents in rangeland plants from Gedarif and North Kordofan States, Sudan

Botanical Name	Family	Vern Name	Plant Type	Alkaloids (%)
Cymbopogon nervatus	Poaceae	Nal	Grass	1.884
Sorghum arundinaceum	Poaceae	Adar	Grass	1.530
Cenchrus biflorus	Poaceae	Huskanit	Grass	0.600
Geigeria alata	Asteraceae	Gutgat	Forb	1.000
Sonchus cornutus	Asteraceae	Molaita	Forb	1.626
Ocimum basilicum	Lamiaceae	Rehan	Forb	2.000
Blepharis linarifolia	Acanthaceae	Seha	Forb	1.600
Ipomea cordofana	Convolvulaceae	Tabar	Forb	1.564
Sesamum alatum	Capparidaceae	Semsemelgumal	Forb	0.600
Boscia senegalensis	Capparidaceae	Mukheit	Shrub	1.400
Guiera senegalensis	Combretaceae	Gubeish	Shrub	0.800
Grewia tenax	Tiliaceae	Gudaim	Shrub	0.800
Corchorus trilocularis	Tiliaceae	Mulukhia	Shrub	1.974
Leptadenia pyrotechnica	Asclepiadaceae	Marakh	Shrub	0.800
Sida cardifolia	Malvaceae	Njata	Shrub	0.600
Chrozophora brocciana	Euphorbaiceae	Argassi	Shrub	1.934
Acacia mellifera	Mimosaceae	Kitir	Shrub	1.200
Acacia seyal var seyal	Mimosaceae	Taleh	Tree	2.200
Acacia Senegal	Mimosaceae	Hashab	Tree	2.400
Ziziphus spina – Christi	Rhamnaceae	Sidir	Tree	1.400
Balanites aegyptiaca	Balanitaceae	Hegleeg	Tree	1.600

تحديد محتوي التانينات والقلويدات لبعض نباتات المرعي من ولايتي القضارف وشمال كردفان - السودان.

حسناء امين السيد و محمد الامين الامام و نهاء حامد طالب

مركز بحوث الانتاج الحيواني – حلة كوكو

المستخلص

تعتبر نباتات المرعي هامة لتغذية الحيوانات البرية والمحلية في السودان ويعتمد الانتاج الحيواني اساسا علي نباتات المرعي وتصنف الي اعشاب , شجيرات و اشجار . المضادات الغذائية خاصة التانينات والقلويدات لها اثار ضارة علي القيمة الغذائية للنباتات ولعدم توفر المعلومات المتاحة لمحتوي التانينات والقلويدات في نباتات المرعي اجريت هذه الدراسة لتوضيح هذه المعلومات . عدد خمسة نباتات مرعي تم الحصول عليها من ولاية القضارف (شرق السودان) وستة عشر نباتات مرعي من ولاية شمال كردفان (غرب السودان) وهي تعتبر غذاء شائع للابل في السودان تم اختبارها . تم تجفيف العينات النباتية هوائيا وطحنها للتحليل المعملي لتحديد محتوي التانينات والقلويدات . تباينت نسب التانينات والقلويدات بين نباتات المرعي . اعلي نسبة للتانينات كانت في نبات المخيط 15.2% والنسبة الاقل كانت في نبات الحسكنيت 0.11 % . النسبة الاعلي للقلويدات كانت في نبات الهشاب 2.4 % والاقل في النجاتا , الحسكنيت و سمسم الجمال 0.6 % . خلصت الدراسة لتباين نباتات المرعي في العناصر الغذائية المضادة كما اوصت بوضع المضادات الغذائية في الاعتبار وذلك لتاثيراتها الضارة علي القيمة الغذائية للنباتات وتحد من استغلال كثير من النباتات .