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Enhancement of Feeding Value of Tannineferous *Acacia* Leaves as Supplementary Feeds for Livestock

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Abstract:

The nutritional value (DM, Fat, CP, CF, Ash, NFE, ME, NDF, ADF, LDF and OM) of two Acacia species; A. nilotica subsp. tomentosa and A. mellifera was approximated. The nutritive value and the In vitro digestibility were improved using Polyethylene glycol (PEG) and animal feces ash. The main objective of this study is to increase the potentiality of using these non-conventional feed resources as supplementary feeds for livestock especially during the dry season when deficient feed supply prevails. This study revealed that A. mellifera leaves have the advantage over A. nilotica leaves in terms of nutritive value, that is, DM%, Fat%, CP%, CF%, Ash% and ME% for A. mellifera leaves were 99.06, 4.00, 7.36, 15.7, 8.36 and 4.61 respectively, while for A. nilotica leaves they were 99.06, 3.32, 5.5, 10.78, 8.31 and 4.24 respectively. A. nilotica leaves have the advantage over A. mellifera leaves in NDF and ADF content; that is 58% and 30.5% for A. nilotica while, 55.5 and 29.5 for A. mellifera . The study also confirmed that PEG is more effective in improving the In vitro digestibility than the animal feces ash; PEG increased the In vitro digestibility from 62.01% to 65.12% for A. nilotica leaves and from 63.22% to 66.14% for A. mellifera leaves , while the animal feces ash

increased the In vitro digestibility from 62.01% to 65.09% for A. nolitica leaves and from 63.22% to 66.14% for A. mellifera leaves.

Key words: nutritional value, Tannins, *Acacias*, digestibility, improvement, feces ash

Introduction:

Developing countries experience serious shortage in animal feeds of the conventional types. In Sudan, the total available dry matter to livestock is estimated to be 104.8 million tons. Total number of animal units in the country is 64.618 million; 213.2 million ton dry matter is required to support this number. Hence, the feed gab was estimated to be 108.4million tons (Abusuwar and Yahia, 2010).Leguminous trees and shrubs are widely used as fodder for livestock in the tropics and subtropics of the world. Tanniniferous trees and shrubs are of importance in animal production because they can provide sufficient protein supplements but unfortunately the amount of tannins that they contain vary widely and unpredictably. In fact, plants contain thousands of compounds which, depending upon the situation, can have beneficial or deleterious effects on organisms consuming them. These compounds, with the exception of nutrients, are referred to as "allelochemicals" (Rosenthal and Janzen, 1979). Anti-nutritional factors ANFs may be regarded as a class of these compounds, which are generally not lethal. They diminish animal productivity but may also cause toxicity during periods of scarcity or confinement when the feed rich in these substances is consumed by animals in large quantities. Their effects on animals range from beneficial to toxic, including death. The toxic or anti-nutritional effects may be exacerbated in times of stress when a very large proportion of the diet is tanniniferous. The anti-nutritional effects of tannins contained in tree leaves

may be understood by their ability to form complexes with dietary proteins and may bind and inhibit the indigenous protein such as digestive enzymes (Kumar and Singh, 1984). The consumption of plant secondary metabolite PSL-rich plants by herbivores can result in reduced intake,weight loss, toxicity and death (Milgate and Roberts, 1995; Waghorn and McNabb, 2003). Methods to alleviate the ant nutritional effects of tannins contained in tree leaves include dilution and lopping (Vaithiyanathan and Singh, 1989), supplementation e.g. Polyethylene glycol-5000 with tannin-rich leaves, simple heating or autoclaving and simple washing. In vitro evidence provide further support that condensed tannins in which Acacia leaves are rich, have the ability to exert ant parasitic properties mainly against nematodes and many other economically important parasites (Athanasiadou *et al*., 2004). The uncertainty of quantification and the imperfectly understood biological effect of ANFs impede the development of methods to alleviate their effects. The simplest approach of dilution, i.e., feeding allelochemical containing leaves in mixture with other feeds, may certainly reduce the risk of toxicity but simultaneous nutritional benefits may not accure. Several studies indicate that tannin-rich leaves, in combination with concentrate ratios, could be fed to animals without any adverse effect (Raghavan, 1990). Another approach of supplementation, e.g., polyethylene glycol-4000 with tannin rich-leaves , may be suitable during acute shortage to avoid livestock losses. These cannot be used routinely because of prohibitive costs. However, metal ions and urea supplementation to farmers after thoroughly assessing their alleviating effects against higher possible reported concentrations of allelochemicals. Many ANFs are heat labile. Hence simple heating or autoclaving has been found useful in removing the effect of allelochemicals. This practice can be used by the feed industry but not by farmers. Unfortunately, heating would substantially increase the cost due to the energy involved both in the treatment an transport.

Simple washing with water removes the soluble allelochemicals but nutrients also leach out (Kumar, *et al*., 1984).

Materials and Methods:

Sufficient quantities of *A. nilotica* subsp. *tomentosa and A. mellifera* leaves were collected during January 2011from different sites within Khartoum state (Al. Sunut '*Acacia nilotica'* forest and the National Botanical Garden). The samples were dried in shade and transferred to the Animal Nutrition Laboratory, Faculty of Animal Production, University of Khartoum-Shambat for proximate analysis and In vitro digestibility trials. Kjeldahl Method was used to determine the total nitrogen content and then the crude protein by multiplying with a factor (6.25). The total fibre in fibrous feed was determined using the nutral detergent procedure. The NDF includes cellulose, hemicellulose and lignin as major components. The acid detergent fibre is a rapid method for determmination of lignocellulose in feed stuffs. This method is also a preparatory step for lignin determination. Subsequently, hemicellulose and cellulose were determined by difference between NDF and ADF, ADF and ADL resprctively. ADL is a continuation of ADF analysis. Cellulose % was calculated as ADF-ADL.

The *In vitro* rumen fermentation is based on Hohenheim gas method. In brief, feed samples (500 mg) are incubated in the presence and absence of PEG (MW 6000) and animal feces ash in graduated glass syringes of 100 ml capacity. Incubation is started by injecting 40 ml medium containingrumen liquor and bicarbonate buffer and then transferring the syringes in a water bath adjusted at 39ºC. PEG and animal feces ash bind to tannins and make them inert. PEG also has the capability to release protein from the already formed tannin-protein complexes. The difference in the parameters observed in the presence and absence of PEG and animal feces ash can be

attributed to the biological effects of tannins on rumen fermentation.

Result and Discussion:

Parameter	*A. nilotica*	*A. mellifera*
DM%	99.06	99.06
Fat%	3.32	4.00
CP%	5.50	7.36
CF%	10.78	15.70
Ash%	8.31	8.36
NFE%	8.31	-
ME Kcal/Kg DM	4.24	4.61
NDF%	58	55.50
ADF%	30.50	29.50
LDF%	20.50	30.50
OM%	34.03	35.26

Table (1): The nutritional value of *A. nilotica* subsp. *tomentosa* and *A. mellifera*

Treatment	Digestibility%	
	A.nilotica	***A.mellifera***
Without treatment	62.01	63.22
With PEG	65.12	66.43
With animal feces ash	65.09	66.14

Table (2): Digestibility of A. nilotica and A. mellifera leaves before treatment, After treatment with PEG and after treatment with animal feces ash.

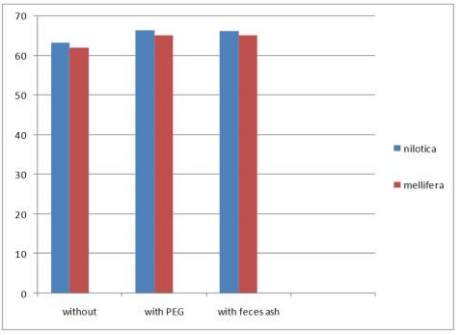

Figure 1: digestibility of A.nilotica and A.mellifera leaves with and without treatment

Table (1) above shows that *A. mellifera* leaves are more nutritious that that of *A. nilotica* in all of the studied

parameters with the exception of NDF and ADF. Table (2) shows the effectiveness of treatment with PEG and animal feces ash in increasing the digestibility of the two species' leaves, given that PEG is more effective in this respect than animal feces ash. It should be mentioned here that the animal feces ash is economically more efficient in that it is of low cost. The results obey what mentioned by von Maydell (1986) in his evaluation of the trees and shrubs of the sahel as fodder where he found that *A. mellifera* (leaves, twigs, pods or seeds) is a very important fodder (+) for all animal species except cattle when compared to *A. nilotica* whose flowers are considered less important (0) and its value to wild animals and bees is unknown. The results also coincide that of (Deaville *et.al*., Al 2010) who found that the addition of tannins decreased the metabolic rate of dry matter (DM), organic matter (OM) and the neutral detergent fibres (NDF) compared to the tannin free fodder. The point of agreement between the result of this study and that of (Deaville *et.al*., 2010) can be seen in the clear effect of PEG and the animal feces ash in increasing the digestibility of both of the studied species due to their ability to inhibit the tannins contained in the leaves and, hence preventing protein precipitation. The crude protein (CP) values revealed by this study (5.5%) for *A. anilotica* and (7.36%) for *A. mellifera*, approaches the value revealed by (AlSoqeer, 2008) whose CP values ranges from 8 – 18.7% when he studied 14 Acacia species in Saudi Arabia. The results of this research in terms of metabolisible energy (ME) (4.24 Kcal/Kg DM) is very close to that of (Al.Soqeer, 2008) (4.35 – 6.69 Kcal/Kg DM). The OM content of *A. nilotica* found by this study (34.03%) is very different compared to that of Al. Soqeer (88.00%), this may be a result of local, environmental, or soil variation

In between Sudan and Saudi Arabia or may be due to differences in sampling seasons or the stage of growth. This study confirms that the use of PEG is an attractive choice to improve the nutritive value of tannin rich feeds, this argument

was made by (Makkar *et.al*., 1994) who mentioned that the addition of PEG is effective when tannin level is high.

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