# PROFILE OF ANTINUTRITIONAL FACTORS IN UMBRELLA THORN (*VACHELLIA TORTILIS* F.) PODS FROM NORTHERN YOBE STATE

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**ABSTRACT**
*Anti-nutritional factors in Umbrella thorn (Vachellia tortilis F.) pods harvested from northern of Yobe State, Nigeria were analysed. Samples of the pods were randomly collected from 18 locations within the study area, using multi-stage sampling procedure. Pods from each sample were processed and levels of saponins, tannins, oxalates and phytates concentration in Umbrella thorn pods were analysed. The results revealed significant (P<0.0001) differences across all the locations. Sample gathered from Afunori shown to have highest 0.93% content for saponins while 0.94% tannins level was found in pods sample from Dogon Jeji village. Oxalates and phytates have highest means values of 1.84% and 32.9% in pods samples from Garin Tsangai and Garanda villages accordingly. The lowest levels 0.54% saponnins, 0.30% tannins, 0.07% oxalates and 15.63% phytates were obtained in pods samples for Dumar, jajeri, kaciya and Goniri kukawa villages correspondingly. Conclusively, Umbrella thorn (Vachellia tortilis) pods are potentially nutritive as forage material for small ruminants' production and the levels of anti-nutritional factors has no negative effects when consume by small ruminant.*
**Keywords: Anti-nutritional Factors; Northern Yobe; Pods; Tannins and Umbrella Thorn.**

## INTRODUCTION
Anti-nutritional factors (ANFs) are plant metabolic substances associated with most animal feedstuff synthesized by plants from many naturally-occurring chemicals in the soil or artificially applied agro-chemicals (Kingsley, 2019); though ANFs however directly or indirectly decrease rate of one or more nutrients utilization by animal (Yacout, 2016). Nutritionally, pods of browse legumes constitute notable source of locally affordable nutrients supplement for ruminant sustainability amid feed shortage during dry season feeding. Plants naturally contains several types of anti-nutritional factors (ANFs) classified in different perspectives by many researchers, for instance, Kingsley (2019) classified ANFs based on their chemical structures, biosynthetic origins and on basis of their specific actions they elicit on nutrition, though these basis does not cover the entire groups of ANFs. Meanwhile, Huisman and Tolman (2016) classified ANFs based on their biological response to feeds; and based on their effect on nutritional value of feeds in the animal. Generally, feedstuffs contain one or more of the numerous substances proven to negatively affect bioavailability of nutrients in animal nutritional process despite their vital contribution to the animal health. This study aimed to evaluate the presence of anti-nutritional factors in Umbrella Thorn (*Vachellia tortilis* F.) pods harvested in selected location of northern Yobe State.

## MATERIALS AND METHODS
### Description of Experimental Site
The study was conducted at northern part of Yobe State. Yobe State is situated in the North-Eastern part of Nigeria, located between latitudes 12 ° 00' and 13 ° 28' N and longitude 9 ° 45' and 12 ° 30'E (Ambrose *et al*., 2017).
### Determination of Anti-nutritional Factors
Plants secondary metabolites or polyphenolic compounds (anti-nutritional factors) such as tannins and oxalates was determined according to AOAC (2005) procedures meanwhile phytates and saponins were as determined by (Domengza *et al*., 2009; Eneh *et al*., 2018) respectively.

**Statistical analysis**

Analysis of variance (ANOVA) was used to analyze all data gathered according to standard procedures of the General Linear Model (GLM); Using Statistical Analysis System (SAS, 2002). Turkey multiple comparison tests was used to separate means and significant differences was tested at 5% probability level. All data presented in the table are ($\overline{X}$ ± S.E)

**Results**

**Antinutritional Factors in *Vachellia tortilis* Pods.**

The levels of saponins, tannins, oxalates and phytates concentration in Umbrella thorn pods were presented in table 1. The results revealed significant (P<0.0001) differences across all the locations. Sample gathered from Afunori shown to have highest 0.93% content for saponins while 0.94% tannins level was found in pods sample from Dogon Jeji village. Oxalates and phytates had highest means values of 1.84% and 32.9% in pods samples from Garin Tsangai and Garanda villages accordingly. The lowest levels 0.54% saponnins, 0.30% tannins, 0.07% oxalates and 15.63% phytates were obtained in pods samples for Dumar, Jajeri, Kaciya and Goniri kukawa villages correspondingly.

**Table 1: Anti-Nutritional Factors of *V. tortilis* Pod from Different Geographical Locations in Northern Yobe State**

| | Parameters | | | |
|---|---|---|---|---|
| **Locations** | **Sapponins** | **Tannins** | **Oxalates** | **Phytates** |
| Goniri K. | 0.79 ± 0.09$^{cc}$ | 0.87 ± 0.13$^{aa}$ | 0.07 ± 0.00$^{g}$ | 27.79 ± 0.07$^{bc}$ |
| Kindilmari | 0.81 ± 0.12$^{cc}$ | 0.81 ± 0.33 $^{aa}$ | 0.10 ± 0.00$^{c}$ | 27.10 ± 0.09$^{bb}$ |
| Bature W. | 0.71 ± 0.17$^{dd}$ | 0.78 ± .04 $^{aa}$ | 0.80 ± 0.00$^{ee}$ | 24.50 ± 0.10$^{cde}$ |
| Kaciya | 0.78 ± 0.12$^{cc}$ | 0.83 ± 0.69 $^{aa}$ | 0.90 ± 0.00$^{dd}$ | 15.63 ± 0.07$^{i}$ |
| Dilala | 0.59 ± 0.20$^{hh}$ | 0.64 ± 0.59 $^{ab}$ | 1.03 ± 0.00$^{bcc}$ | 20.00 ± 0.11$^{gh}$ |
| Kalgi | 0.68 ± 0.08$^{ee}$ | 0.74 ± 0.12 $^{aa}$ | 0.80 ± 0.00$^{ee}$ | 24.10 ± 0.07$^{def}$ |
| Abatira | 0.63 ± 0. 03$^{gg}$ | 0.63 ± 0.76 $^{ab}$ | 0.90 ± 0.00$^{dd}$ | 21.40 ± 0.02$^{gh}$ |
| G/Tsangai | 0.74 ± 0.03$^{dd}$ | 0.72 ± 0,37 $^{aa}$ | 1.87 ± 0.00$^{a}$ | 25.60 ± 0.02$^{bcd}$ |
| Bilan G. | 0.63 ± 0.03$^{gg}$ | 0.58 ± 0.47 $^{ab}$ | 0.90 ± 0.00$^{dd}$ | 21.50 ± 0.02$^{fgh}$ |
| Afunori | 0.93 ± 0.08$^{a}$ | 0.65 ± 0.52$^{ab}$ | 0.73 ± 0.00$^{eff}$ | 18.98 ± 0.03$^{hh}$ |
| Dumar | 0.54 ± 0.23$^{i}$ | 0.56 ± 0.15 $^{ab}$ | 1.10 ± 0.00$^{bb}$ | 18.91 ± 0.13$^{h}$ |
| Malan B. | 0.59 ± 0.00$^{hh}$ | 0.54 ± 0.57$^{abb}$ | 0.90 ± 0.00$^{d}$ | 20.1 ± 0.00$^{gh}$ |
| Dogon jeji | 0.64 ± 0.00$^{fgg}$ | 0.94 ± 1.18$^{aa}$ | 0.80 ± 0.00$^{ee}$ | 21.7 ± 0.01$^{efgh}$ |
| Jajeri | 0.72 ± 0.00$^{dd}$ | 0.30 ± 2.50$^{b}$ | 0.57 ± 0.00$^{f}$ | 24.46 ± 0.00$^{cde}$ |
| Krs Galu | 0.57 ± 0.00$^{h}$ | 0.86 ± 0.77 $^{aa}$ | 0.90 ± 0.00$^{dd}$ | 19.7 ± 0.00$^{gh}$ |
| Machina | 0.67 ± 0.77$^{eff}$ | 0.75 ± 3.28 $^{aa}$ | 0.80 ± 0.00$^{ee}$ | 22.6 ± 0.04$^{efg}$ |
| Garanda | 0.90 ± 0.07$^{b}$ | 0.60 ± 2.25 $^{ab}$ | 0.70 ± 0.00$^{ff}$ | 32.9 ± 0.28$^{a}$ |
| Lamisu | 0.71 ± 0.02$^{d}$ | 0.81 ± 0.90 $^{aa}$ | 0.80 ± 0.00**ee** | 24.1 ± 0.01$^{def}$ |
| P-Value | P<0.0001 | P<0.0001 | P<0.0001 | P<0.0001 |
| Threshold | 0.20% | <50g/kg | 2-5mg/100g/BW | 30-40% |
| **REFERENCES** | Francis *et al*. (2002) | Pandey *et al*.(2022) | Oloyede *et al.* (2013) | Jasia *et al.* (2017) |

$^{abc}$: means on the same row having different superscripts are significantly different = significant at (P<0.0001); and not significant at (P>0.0001), ±SEM = standard error of mean, BW=body weight.

**DISCUSSION**

The saponin values (0.93 ± 0.08 to 0.54 ± 0.23 mg/g) obtained from pods in the present study were in-line with the values (0.67 to 0.53 mg/g) reported by Abdurrahaman *et al.* (2017), however they were within the tolerable amount 1.5 to 2% for ruminant animal as reported by Onwuka (1983). Nonetheless, Cheeke, (1996) findings shows that saponins concentration in tropical forage legumes reported to pose no harmful effect on animals unlike in most temperate forage legumes. The oxalates values 1.87 ± 0.00 mg/g **TO** 0.07 ± 0.00 mg/g were lower than 2.64 mg/g to 3.96 mg/g reported by Uguru (2014) and in-line with the findings (1.71 mg/g to 3.10 mg/g) of Abdurrahaman *et al.* (2017) in *Piliostigma reticulatum* pods. Similarly, the values were contrary to the findings of Njidda (2010)

reported 4.58 mg/g to 8.15 mg/g for browse forage of semi-arid zone. The difference could be perhaps, due to difference in soils of the location. Oxalate content in this present study was low. Oxalate has been shown to deplete the calcium reserve, but this browse species are found to contain reasonable amount of calcium, magnesium and phosphorus. Ca and carbon are also released from the hydrolysis of oxalates some of which will be either absorbed or excreted by the ruminant animals (Njidda, 2010). Moreover, seedpods has moderately containable oxalates compares to leaves which have higher percentage and much lower in stems (Osweiler *et al*., 1985)

The levels of tannins ranged of 0.94 mg/g to 0.30 ± 2.50 mg/g found in this study was in agreement with 1.30 mg/g to 0.80 mg/g reported by Uguru (2014) for pods *Acacia spp*. Similarly, the values conform to 0.99 mg/g to 1.21 mg/g reported by Abdurrahaman *et al.* (2017) in *Piliostigma reticulatum* pods. The level of tannin in the present study was within the normal range of (2-5%) for safe animal feeding (Oloyo, 2004). However, in ruminants, dietary tannins of 2 to 3% have been shown to have beneficial effects because they reduce the protein degradation in the rumen by the formation of a protein-tannin complex (Njidda, 2010). The level is lower than the range of 60 to100g Kg DM that is considered to depress feed intake and growth (Abdurrahaman *et al.,* 2017). A threshold concentration of tannin of 5% has been reported beyond which there may be rejection of browses by goats and wild browsers (Okoli, 2003a).

The phytate concentrations (32.9 ± 0.28 mg/g to 15.63 ± 0.07 mg/g) recorded in this research were higher than the range of values (13.80 mg/100g to 25.20 mg/100g) reported by (Okoli, 2003b) for browse plants. Similarly the values were in-line with (27.59 mg/100g) for *P. hirsute* reported by Bassey (2014). Higher concentration of phytic acid in forages may chelate several mineral elements especially calcium, magnesium and iron and also interferes with their absorption and utilization in ruminant animals (Ologhobo, 1980). Although, phytate concentration in some foodstuffs suggested not hazardous to health (Kingsley, 2019) however, concentration reduction strategies has been suggested. On this, Gupta *et al*., (2015) recommended use of lactic acid fermentation and soaking in acid medium to alleviate phytate menaces in animal nutrition. Variations in anti-nutritional levels of Umbrella thorn (*Vachellia tortilis* F.) pods samples across all the locations under this study might have occurred due to variable effect of climatic conditions, as well as edaphic factors on plant development (Nikolopoulou *et al.,* 2007).

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