PHYTOCHEMICAL INDICES OF SHIVAN (*GMELINA ARBOREA*) AND SANDPAPER (*FICUS EXASPERATA*) LEAVES AS FORAGES FOR RUMINANTS

***Okewoye, Abiola Temitope and Asaolu, Vincent Olajide**
Department of Animal Nutrition and Biotechnology, LAUTECH, Ogbomoso, Oyo State Nigeria
**corresponding author-okewoyeabiolat@gmail.com 07031530945*

ABSTRACT
Browses and shrubs can contribute to reduce feeding cost for ruminants. They are known to contain phytochemicals, some of which have great potentials as substitutes for classic antibiotics and can enter the structure of feed additives with a promising effect on animal production. There is however, paucity of information on the phytochemical contents of Gmelina arborea and Ficus exasperate leaves. Thus study qualitatively and quantitatively assess the levels of phenols, tannin, saponin, steroids, flavonoid, terpenoid, reducing sugar, phytates, anthraquinones, cardiac glycoside, alkaloids and volatile oils in the leaves. The qualitative screening revealed the presence of all the investigated phytochemicals in the two fodders. Quantitatively, Gmelina arborea had significantly (P< 0.05) higher contents of phenols (624.36 vs. 99.22 mg/100g), flavonoid (126.49 mg/100g), tannins (153.79 vs. 103.36 mg/100g) and phytate (152.99 vs. 105.81 mg/100g) compared to Ficus exasperata. No significant (P>0.05) differences were observed in the contents of the other investigated phytochemicals. It can be concluded that the two fodders show promise as ruminant feedstuffs, with Gmelina having an edge, from the standpoint of their phytochemical compositions.
Keywords: Nutrition, ruminant, phytochemicals, *Gmelina arborea*, *Ficus exasperata*

INTRODUCTION

Browse species can be used as an alternate feed in ruminant production to decrease feeding cost and feed shortages (Mnisi and Mlambo, 2017) as most of them are semi-deciduous during drought seasons (Gebru *et al.,* 2018). They have bioactive compounds such as tannins, phenols, flavonoids, and other phytochemicals as demonstrated by Hassan *et al.* (2020). These phytochemicals have great potentials as substitutes for classic antibiotics and can enter the structure of feed additives with a promising effect on animal production. They could however reduce nutrient intake, digestion, absorption and utilization (Sango *et al*. 2016) subject to ingestion levels. Hence, the qualitative and quantitative analyses of the phytochemicals of *Gmelina arborea* and *Ficus exasperata* were carried out to determine the possible presence and levels of selected phytochemicals in order to broaden the existing knowledge on their suitability as ruminant feedstuffs.

MATERIALS AND METHODS

Experimental Site: The study was carried out at the Small Ruminant Unit of Ladoke Akintola University of Technology, Ogbomoso and Rumen Ecology Laboratory University of Ibadan, Ibadan, both situated in Oyo State.

Procurement and Processing of Shivan and Sandpaper leaves: Fresh fodders of shivan and sandpaper were sourced from the wild within LAUTECH and its environs. These fodders were air-dried on nylon sheets spread on a clean concrete floor to constant weight, and this lasted for about two weeks. The dried leaves were then milled to pass through about 2mm mesh size using a laboratory hammer mill.

Qualitative and quantitative phytochemicals screening of the two leaves: The qualitative and quantitative phytochemical screening of the two fodder samples were done by adopting the methods of Harbone (1973), and enunciated by Sofowora (1993) and Trease and Evans (2002).

Statistical analysis: The qualitative presence of the phytochemicals was described using descriptive statistics while the quantitative parameters were separated using the students'-test at 5% level of probability (SAS, 2000).

Results

Qualitative screening of the two fodders: Table 1 indicates the presence of all the test phytochemicals in the two fodders. Phenolic compounds were observed to be present in abundant amount in *Gmelina arborea*, but only moderately present in *Ficus exasperata*. Appreciable amounts of flavonoids were also detected in *Gmelina arborea* relative to their moderate presence in *Ficus exasperata*. Tanin and phytate were present in appreciable amounts in the two fodders while they contained alkaloids, steroids, reducing sugars, anthraquinones, volatile oils and saponins in traceable amounts. Cardiac glycoside and terpenoids were observed to be present in moderate amounts in the two fodders.

Table 1. Qualitative phytochemical screening for the two fodders

Phytochemical Constituents	*Gmelina arborea*	*Ficus exasperate*
Phenols	++++	++
Flavonoid	+++	++
Tannin	+++	+++
Phytate	+++	+++
Cardiac Glycoside	++	++
Steroid	+	+
Terpenoid	++	++
Alkaloid	+	+
Saponin	+	+
Anthraquinones	+	+
Volatile oils	+	+
Reducing sugars	+	+

++++ = Present in abundant amount +++ = Present in appreciable amount AA, ++= Present in moderate amount MA, + = Present in traceable amount, CA = Completely absent

Quantitative screening of the two fodders: Table 2 shows that phenolic compounds, flavonoids, tannins and phytate were present in significantly ($P<0.05$) higher levels in *Gmelina arborea* leaves (624.36 vs. 99.22 mg/100g, 126.49 vs 75.39mg/100g, 153.79 vs. 103.36 mg/100g and 152.99 vs 105.81mg/100g respectively). On the other hand, no significant ($P<0.05$) differences were observed in the levels of saponins, alkaloids, cardial glycoside, steroids, reducing sugars, terpenoids, anthraquinones and volatile oils in the two fodders. Marginally however, Gmelina was observed to be higher in all the other phytochemicals other than saponins and terpenoids.

Table 2. Quantitative phytochemical screening of the two fodders

Phytochemical Constituents	Levels of presence in fodders (mg/100g)	
	Gmelina arborea	*Ficus exasperata*
Phenol	624.36[a]	99.22[b]
Flavonoid	126.49[a]	75.39[b]
Tannin	153.79[a]	103.36[b]
Saponins	24.89	28.21
Alkaloid	21.16	15.16
Phytate	152.99[a]	105.81[b]
Cardiac Glycoside	82.25	75.48
Steroid	34.83	27.43
Reducing sugar	24.74	18.55
Terpenoid	57.15	67.43
Anthraquinone	45.15	32.73
Volatile oils	8.54	6.08

[a,b,] Means with different superscripts are significant different at $p<0.05$

DISCUSSION

The actual values of phytochemicals that were obtained in the quantitative analysis confirmed the observations of the qualitative analysis. The higher levels of phenols, flavonoids, tannins and phytates in *Gmelina arborea* suggest their possible significance in the nutritional value of this fodder in ruminant nutrition. Papanikou (2016) stated that phenolics are an immense group of over 8,000 diverse compounds that are products of plant secondary metabolism; listing commonly known phenolics to include favanoids, tannins, oligomeric proanthocyanidins and lignans. The researcher identified the basic feature of phenolics as their significant antioxidant activity, with some phenolics having additional beneficial properties applicable to animal gut health, such as anti-inflammatory and anti-microbial activities. Flavonoid has been known for decades to promote anti-inflammatory activity in animals as reported by Ayoola *et al*. (2016). The higher flavonoid content in Gmelina could be an indication of higher nutritional potential in diet of ruminants as it is widely acknowledged to help fight off free radicals. Since the tolerable amount of tannin in the diet of sheep and goats is 5% (Cooper *et al*,. 1985; Asaolu, 2008), it can then be inferred that the tannin contents in both fodders can be tolerated by small ruminants. Plant extracts rich in flavonoid and phytate have been observed to increase rumen microbes, decrease the incidence of acidosis and promote growth in cattle receiving high concentrate diets (Breves and Schroder 1991; Balcella *et al*., 2012). The flavonoid contents of the two fodders were observed to be higher than values from some other natural browses (Diagayate and Huss, 1981; Akinola *et al.,* 2016). Akinola *et al*. (2016) reported that there are considerable species differences in susceptibility to alkaloids among livestock, with cattle and horses being highly susceptible while sheep and goats are resistant to alkaloid toxicoses, especially the pyro-lizidine alkaloids. The results obtained in this study suggest that the two fodders can be included in ruminants' diets with their tolerability and utilization being subject to specie variations (Ologhobo, 1980; Akinola *et al.*, 2016). Essential oils and their terpenoids have been shown by Inouye *et al*. (2001) to effectively control gastrointestinal nematodes. All cardiac glycosides may be regarded as highly toxic (Joubert, 1989; Majak and Benn, 2000). Sub-acute to acute signs of cardiac glycoside poisoning in cattle and sheep were reported by the researchers to include restlessness, dyspnea, ruminal atony, frequent urination and defaecation, tachycardia, arrhythma and ventricular fibrillation. Saponins are widely distributed in the plant kingdom, to the point that they appear ubiquitous (Majak, 2001). In spite of their wide distribution, only a small number of species contain saponins that are toxic to mammals (Cheeke 1996). This has been attributed to their negligible degree of absorption from the gastrointestinal tract (Majak, 2001). Kung Jr. *et al*. (2003) showed that anthraquinone can partially inhibit *in vivo* rumen methanogenesis, supporting previous *in vitro* findings. The presence of reducing sugars in the two fodders, even though at low levels, could act as a catalyst for a mild Browning reaction that could make more protein available for animal use (Leng, 1997).

CONCLUSION

It can be concluded that the two fodders show promise as ruminant feedstuffs, with Gmelina having an edge, from the standpoint of their phytochemical compositions.

REFERENCES

Asaolu, V. O. (2008). Evaluation of *Moringa oleifera* (Lam.) and *Oxytenanthera abyssinica* as protein supplements and natural dewormers for West African Dwarf goats. *PhD (Ruminant Animal Nutrition) Thesis.* Department of Animal Sciences, Obafemi Awolowo University, Ile- Ife, Nigeria.

Ayoola, A. A., Yussuf, A. O. and Oki, D. G. (2016). Phytochemical Screening and Proximate Analysis of *Newbouldia laevis* and *Allium sativum*. *Nigerian J. Anim. Sci.* 2016 (1):242 – 256.

Balcella, J., Aris, A., Serrano, A., Seradj A. R., Crespo, J. and Devant, M. (2012). Effect of an extract of plants flavonoid (Bioflarex) on rumen fermentation and performance in heifer fed high concentrates diet. *Journal of Animal Science,* 90 (13): 4975-4984

Breves, G. and Schroder, B. (1991). Comparatives aspect of gastrointestinal phosphorus metabolism. *Nutri.Res. Rev*.4: 125-140.

Cheeke, P. R. (1998). Natural toxicants in feeds, forages, and poisonous plants. Second Edition. Interstate Publishers Inc., Danville, Ill

Cooper, S. M and Owen-Smith, N. (1985). Condensed tannins deter feeding by browsing ruminant in a South Africa savannah, *Oecologia* (Berlin), 46:142-146.

Diagayate, M and Huss,W. (1981). Tannin contents of African pasture Plants, Effects of analytical data and *in vitro* digestibility, *Animal Research and Development*, 15: 79-90

Gebru G W; Ichoku H.E; Phil-Eze P.O. (2018). Determinants of livelihood diversification strategies in Eastern Tigray Region of Ethiopia. *Agric Food Secur*, 7, 62

Harborne, I. B. (1973). Phytochemical methods: A guide to modern techniques of plant analysis 2nd edn, Chapman and Hall, NewYork, pp. 88-185.

Hassan, F.U; Arshad, M.A;Li, M :Rehman, M.S.U; Loor J.J; Huang, J. (2020). Potential of Mulberry Leaf Biomass and its Flavonoids to improve Production and Health in Ruminants: Mechanistic Insights and Prospects. *Animals* 10, 2076.

Inouye S.S, Takizama T., Yamaguchi H (2001). Antibacteria activity of essential oils and their major constituents agaist respiratory tract pathogens by gaseous count. *Journal of Antimicrobial chemotherapy 47:565-573.*

Joubert, J. P. J. (1989). Cardiac glycosides, p. 61–69. In: P.R. Cheeke (ed.), Toxicants of plant origin, Vol. II, Glycosides. CRC Press Inc., Boca Raton, Fla.

Kung Jr. L., Smith, K. A., Smagala, A. M., Endres, K. M., Besset, C. A., Ranjit, N. K. and Yaisle, J. (2003). Effects of 9, 10 anthraquinone on ruminal fermentation, total tract digestion, and blood metabolite concentrations in sheep. *J. Anim. Sci*. 81(1): 323 - 328

Majak, W. and Benn, M. H. (2000). Glycosides, p. 299–349. In: Y.H. Hui, R.A. Smith, D.G. Spoerke (eds.), Foodborne disease handbook, Vol. 3, Plant Toxicants. Marcel Dekker Inc., New York, N.Y

Leng, R. A. (1997). Tree Foliage in Ruminant Nutrition. *FAO Animal Production and Health Paper*; Food and Agriculture Organization of the United Nations: Rome, Italy,

Mnisi C.M; Mlambo, V. (2017). Application of near infrared reflectance spectroscopy to the nutritional assessment of tree leaves as potential protein supplements for ruminants.Trop. Agric, 94, 9-19.

Ologhobo, A. D. (1980). Biochemical and nutritional studies of cowpea and limabean with particular reference to some inherent antinutritional components, *Ph.D,Thesis*, University of Ibadan, Nigeria.

Papanikou, E. (2016). Phenolic compounds in animal feeds. Pig International, May/June Edition. Retrieved from https://www.feedstrategy.com/animal-nutrition/poultry/article/15438549/phenolic-compounds-in-animal-feeds

Sango, C., Marafu, L., and Zimudzi, C. (2016). Phytochemical, anti-nutrients and toxicity evaluation of *Cleome gynandra* and *Solanum nigrum*: common indigenous vegetables in Zimbabwe. *British Biotechnology Journal, 13(3), 1-11*

SAS (2006). SAS User's Guide Statistics. SAS Institute Inc. Cary, N.C

Sofowora, E. A. (1993). Integration of traditional and orthodox medicine. Medicinal plants and traditional medicine in Africa. Spectrum books, Ibadan, Nigeria pp. 111-117.

Trease, G. E. and Evans, W. C. (2002). Pharmacognosy.15th Edition. Saunders, pp.214-393