

PHYTOCHEMICAL AND PROXIMATE COMPOSITIONS OF YOHIMBE (*Pausinystalia yohimbe*) BARK

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ABSTRACT

The inclusion of botanical extracts in livestock diet was reported to have positive outcomes in animal productivity and health. Studies on *Pausinystalia yohimbe* suggest that it possesses medicinal properties which could be useful for animal productivity and welfare. This study assessed the phytochemical constituent and the proximate composition of *P. yohimbe*. Data were collected on oxalate, phytate, phenolic, saponin, flavonoid, tannin, and alkaloids, as well as the proximate constituents. Result shows that *P. yohimbe* contains oxalate, phytate, phenolic, saponins, flavonoids, tannins, and alkaloids in varying proportions, with phenolics being the highest. Also, carbohydrate fraction of the proximate carries the highest composition of the plant bark. It is therefore concluded that *P. yohimbe* bark has the potential of improving the health of livestock as well as supply nutrients for its maintenance.

Key words: *Pausinystalia yohimbe*, Proximate composition, Phytochemical analysis

INTRODUCTION

Naturally occurring compounds exerts significant influence on the health and welfare of livestock. Herbal supplements contain various bioactive compounds; examples of bioactive compounds found in herbal supplements include: phenolic, flavonoids, vitamins, carotenoids and alkylamids (Miranda et al., 2024). These compounds are found in various plant parts such as: roots, stems, flowers, leaves as well as bark, which could be added as nutrient source or as nutraceuticals (Milião et al., 2022).

Pausinystalia yohimbe is a tree plant from the family *Rubiaceae*. The common name is Yohimbe, and it originates from the Gulf of Guinea. It is distributed in the rainforest of Southern Nigeria, across Congo, Gabon, as well as Cameroon (Tchoundjeu et al., 2004). *P. yohimbe* is known for its medicinal and therapeutic use in ancient medicine as a blood tonic and aphrodisiac. Although the predominant chemical composition is Yohimbine, an indole alkaloid, there are other derivatives of Yohimbine which are reportedly present (Zanolari, 2003). Other chemical compound found aside from yohimbe and its derivatives include: stearic acid, linoleic acid, Palmitic acid, 2-Methylene- 11- hexadecynoic acid, 11- Phenylundeca noic acid, nHexadecanoic acid or Palmitic acid, 3,5-Dihydroxy-6- methyl-2,3- dihydro-4Hpyran-4-one, 2,4-Dimethyl- 1,3-dioxan (Igwe et al., 2016). However, aside from the mentioned compounds, there is a need to understand other chemical constituent of the Yohimbe, as this would inform of other uses it could be applied. Therefore, this study intended to investigate the phytochemical and proximate composition of *P. yohimbe* bark.

MATERIALS AND METHODS

Sourcing of test material

Fresh *Pausinystalia yohimbe* bark was purchased from an herb store at Abeokuta, Ogun State Nigeria, after which it was cleaned and air dried until there was no observable weight loss. The wet and dried bark were pulverized using wooden mortar and pestle until it was reduced into small particles. The particles were sieved using 0.3 cm metal sieve. The sifting was collected for laboratory analysis.

Phytochemical Analysis of Test Material

Test material was taken to the laboratory to determine the quantity of natural chemicals such as: oxalate, phytate, phenolic, saponin, flavonoid, tannin and alkaloid present in the wet and dry samples of Yohimbe.

Procedure for Phytate determination

The procedure for phytate determination was described by Lucas and Markakes (1975).

Alkaloid Determination

The alkaloid was determined using a method prescribed by Harborne (1973). Five grams (5g) of the finely ground sample was weighed into a 250ml beaker and 50ml of 10% acetic acid in ethanol (10ml of acetic acid into 90ml of ethanol) was added and covered and allowed to stand for 4 hours. This was filtered and the extract was concentrated on a water bath to one quarter of the original volume. 5ml of 1N ammonium hydroxide was added drop wise to the extract until the alkaloid was precipitated. The whole solution was allowed to settle and the precipitate collected was washed with dilute ammonium hydroxide and then filtered. The residue is the alkaloid, which was dried in oven at 30 °C and weighed. The alkaloid content (w) was calculated using the formula.

$$\text{Alkaloid content} = \frac{W3 - W2}{W1} \times 100$$

Where: W1 = weight of dried filter paper
W2 = weight of the preweigh filter paper
W3 = weight of the sample.

Flavonoid Determination

The Flavonoid was determined using a method prescribed by Harborne, (1973). Fifty milliliters (50ml) of 2M HCL was added to 2g (W1) of the sample and boiled for 30 minutes. The sample was allowed to cool and then filtered. 5ml of the filtrate was pipette into another flask and 5ml of ethyl acetate was added in drop to obtain a precipitate. The precipitate was then filtered through a pre weighed filter paper (W2), dried in an oven at 30°C. The dried filtered paper was weighed (W3) and flavonoid content was calculated using the formula:

$$\text{Flavonoid content} = \frac{W3 - W2}{W1} \times 100$$

Determination of total Phenolic

The protocol used followed the method described by Singleton and Rossi, (1995).

Tannin Determination

Tannin value was determined by weighing 0.2g of the finely grounded sample after which 20ml of 50% methanol was added. The samples were covered with paraffin and placed in water bath at 80°C for 1h. The samples were allowed to cool and the filtered into 100ml volumetric flask using watman filter paper and then marked off to the 100ml mark. 20ml of distilled water was added and the standard 2.5 ml of folin-Dennis reagent was added to the sample and the standard (blank) after which 10ml of 17% sodium carbonate solution was added to the sample and standard. The samples were allowed to stand for 20minutes for a bluish-green coloration to develop. The absorbance was read at 760nm using a photospherometer. Tannin was calculated using the formula:

$$\text{Tannin} = \frac{\text{absorbance} * \text{average gradient} * \text{dilution factor}}{\text{weight of sample}} \times 100$$

Proximate analysis of test ingredient, experimental diets and meat samples

A sample per replicate of *P. yohimbe* bark powder and experimental diets were collected for the determination of proximate composition (moisture, crude protein (CP), ether extract (EE), carbohydrate and ash content) using methods outlined by AOAC (2005). Values are expressed in percentage weights of wet samples.

RESULTS

Proximate analysis of *Pausinystalia yohimbe* bark powder

Table 1 shows the proximate composition *Pausinystalia yohimbe*. Proximate constituents vary from 2.67% (Ash) to 62.27% (Carbohydrate).

Phytochemical composition of wet and dry *Pausinystalia yohimbe* bark powder

Table 2 shows the phytochemical constituents of wet and dry *Pausinystalia yohimbe*. Concentration of most phytochemicals in the sample reduced after drying, aside from flavonoid. Tannin has the least composition (0.080 and 0.024%) before and after drying respectively, while phenolic (17.91%) was the highest in the wet sample, and flavonoid (15.40%) is the highest in the dry sample.

Table 1: Proximate analysis of *Pausinystalia yohimbe* bark powder

Ash (%)	Ether Extract (%)	Crude Fiber (%)	Crude Protein (%)	Carbohydrate (%)	Moisture Content (%)
2.67	3.22	3.96	12.38	62.27	15.50

Table 2: Phytochemical composition of wet and dry *Pausinystalia yohimbe* bark powder

Phytochemicals	Oxalate mg/g	Phytate (%)	Phenolic (%)	Saponin (%)	Flavonoid (%)	Tannin (%)	Alkaloid (%)
Wet	12.61	6.08	17.91	6.40	8.45	0.080	2.86
Dry	9.45	4.64	4.59	6.00	15.40	0.024	1.88

DISCUSSION

The proximate analysis of the *Pausinystalia yohimbe* bark sample demonstrate a relatively low moisture content, which can be attributed to the initial air-drying process (Stévant et al., 2018). This indicates that the sample had undergone sufficient drying to effectively reduce its moisture content, thereby minimizing the risk of microbial growth (Barbosa-Cánovas et al., 2020).

Carbohydrates were found to be the predominant fraction in the proximate composition, suggesting that the bark could serve as a potential source of energy for livestock (Knudsen et al., 2022). However, the analysis revealed a crude protein content of 12.38%, which provides a limited supply of essential amino acids necessary for optimal growth and development in animals (Lopez and Mohiuddin, 2024). Furthermore, the relatively low levels of crude fiber, ether extract, and ash indicate that the *Pausinystalia yohimbe* bark is not a significant source of dietary fiber, lipids, or minerals. This suggests that while it may provide energy, it lacks substantial nutritional value in other critical areas necessary for comprehensive animal nutrition (Ely and Fike, 2022).

The phytochemical screening of both wet and dried *Pausinystalia yohimbe* samples revealed the presence of oxalate, phytate, phenolic, saponins, flavonoids, tannins, and alkaloids. The presence of tannins and alkaloids has been previously reported in this plant species (Duke, 1992; Zanolari, 2003; Wink et al., 2008). The other identified phytochemicals align with the broader spectrum of phytochemicals commonly found in plants, as documented by Martins et al. (2000). Although literature reports that the active component of Yohimbe are alkaloids, it could have been assumed that alkaloids would be of higher concentration compared to other phytochemicals. However, the relative composition of phytochemicals in Yohimbe show phenolics are the highest present compound.

In addition, the drying process led to a reduction in the levels of these phytochemicals. This finding is consistent with the observations of Irondi et al. (2013) who reported a similar decrease in phytochemical content upon drying pawpaw seeds. Among the identified phytochemicals, flavonoids and polyphenols are known for their potent antioxidant properties (Tiwari and Rao, 2002). Additionally, phenolic compounds have been implicated in inhibiting key enzymes involved in carbohydrate digestion, such as α -amylase, sucrase, and SGLT-1 (sodium-glucose cotransporter-1) (Tiwari and Rao, 2002). This inhibitory effect on carbohydrate digestion could contribute to the anti-diabetic properties of *P. yohimbe*. Furthermore, phytate, tannins and flavonoids, have been reported to possess anti-diabetic activity by inhibiting glucose transport mediated by SGLT-1 (Tiwari and Rao, 2002).

CONCLUSION

The presence of other phytochemicals in Yohimbe bark could be an advantage, as this could improve the health of livestock when included in supplementary quantity. Proximate fractions of Yohimbe bark shows it contains more of carbohydrate, and this suggests that Yohimbe bark can supply energy in animal diets.

REFERENCES

- Barbosa-Cánovas, G. V., Fontana Jr, A. J., Schmidt, S. J., and Labuza, T. P. (Eds.). (2020). *Water activity in foods: fundamentals and applications*. John Wiley and Sons.
- Duke, J. A. 1992. Handbook of Phytochemical Constituents of GRAS Herbs and Other Economic Plants CRC press 1985, p351.
- Ely, K., and Fike, J. (2022). Industrial hemp and hemp byproducts as sustainable feedstuffs in livestock diets. *Cannabis/Hemp for Sustainable Agriculture and Materials*, 145-162.
- Harborne, J. B. 1973. Phytochemical methods, London. Chapman and Hall, Ltd. pp. 49-188.
- Ironi, A. E., Anokam, K. K. and Ndidi, U. S. 2013. Effect of drying methods on the phytochemicals composition and antioxidant activities of *Carica papaya* seed. *International Journal of Bioscience*, 3 (11) 1 – 7.
- Lopez, M. J., and Mohiuddin, S. S. (2024). Biochemistry, essential amino acids. In *StatPearls [Internet]*. StatPearls Publishing.
- Lucas, G.M and Markakes, P. 1975. Phytic acid and other phosphorous compounds of nevy beam. *Journal of Agricultural Food Chemistry*, 15: 15 - 23.
- Knudsen, K. E. B., Lærke, H. N., and Jørgensen, H. (2022). Carbohydrates and carbohydrate utilization in swine. *Sustainable swine nutrition*, 151-187
- Martins, E. R., Castro, D. M., Castellani, D. C. and Dias, J. E. 2000. *Editora UFV. Universidade de Viçosa, MG, Brasil*, 220.
- Milião, G.L.; de Oliveira, A.P.H.; Soares, L.D.S.; Arruda, T.R.; Vieira, É.N.R.; Leite Junior, B.R.d.C., 2022. Unconventional Food Plants: Nutritional Aspects and Perspectives for Industrial Applications. *Futur. Foods*, 5:100-124.
- Miranda C. T. C. S., Soares S.D., de Oliveira W. Q., Lima A. S., Neri Numa I. A., Pastore G. M., 2024 Unconventional Edible Plants of the Amazon: Bioactive Compounds, Health Benefits, Challenges, and Future Trends. *Foods*; 13(18):2925. <https://doi.org/10.3390/foods13182925>.
- Singleton, V.L. and Rossi, J.A. 1995. Colorimetry of total phenolics with phosphomolybdic phosphotungstic acid reagents. *American Journal of Enology and Viticulture*, 16(3), 144-158.
- Stévant, P., Indergård, E., Ólafsdóttir, A., Marfaing, H., Larssen, W. E., Fleurence, J., and Nordtvedt, T. S. (2018). Effects of drying on the nutrient content and physico-chemical and sensory characteristics of the edible kelp *Saccharina latissima*. *Journal of Applied Phycology*, 30, 2587-2599.
- Tchoundjeu, Z., Ngo Mpeck, M.L., Asaah, E. and Amougou, A. (2004) The role of vegetative propagation in the domestication of *Pausinystalia johimbe* (K. Schum), a highly threatened medicinal species of West and Central Africa. *Forest Ecology and Management*, 188(1-3): 175-183. doi:10.1016/j.foreco.2003.07.010
- Tiwari A. K., Rao J. M., (2002). Diabetic mellitus and multiple therapeutic approaches of phytochemicals: Present status and future prospects. *Current science*, 83(1): 30-37
- Wink, M., van Wyk, B. E., & Wink, C. (2009). Handbuch der giftigen und psychoaktiven Pflanzen. *Naturwissenschaftliche Rundschau*, 62(1): 45.
- Zanolari, B. 2003. Natural aphrodisiacs. Studies of commercially-available herbal recipes, and phytochemical investigation of *Erythroxylum Vacciniifolium* Mart. (Erythroxy- laceae) from Brazil. Ph.D. Thesis, University of Lau- sanne, Lausanne.