AFRICAN BLACK PEPPER LEAF POWDER AND ITS IMPACT ON SENSORY CHARACTERISTICS OF GRILLED CHICKEN

***Akpan, I.P., Ben, V.N. and Udombon, E.J.**
Animal Products Unit, Department of Animal Science, University of Uyo
*Corresponding author: idongesitpakpan@uniuyo.edu.ng

ABSTRACT
The study was carried out to assess the impact of African Black Pepper leaf powder (ABPLP) on the quality characteristics of grilled chicken. The fresh African black pepper leaves were harvested, washed, sliced, sun-dried and ground to powder. Fifteen chunks of chicken breast weighing about 100g each were prepared for grilling by marinating with ABPLP according to the following five treatments: T1- 0g APBLP which served as the control, T2- 5g APBLP, T3- 10g APBLP, T4- 15g APBLP and Treatment 5- 20g APBLP. Each treatment was replicated thrice in a completely randomized design. The African black pepper leaves both fresh and dried were screened phytochemically to identify its constituents using standard procedures and sensory properties of the grilled chicken were evaluated. Flavonoids, Saponins, Tannins, Terpenoids, Coumarins, Phenols, Diterpenes, Steroids were highly present while Alkaloids, phytosterols, Triterpenes, Glycosides, Anthraquinones were moderately present in both fresh and dried leaves. Quinones were higher in fresh leaves but less prominent in the dried leaves. Anthocyanins and Phytosteroids were absent in both fresh and dried leaves. Sensorially, ABPLP did not influence Juiciness, Ease of fragmentation and colour of grilled chicken breast rather flavour and overall acceptability were slightly disliked at higher concentrations. ABPLP at lower concentrations could be used in meat spicing in order to harness its rich bioactive compounds.
Keywords: *Piper guineense*, Uziza, Grilled chicken, Phytochemical, Sensory properties

INTRODUCTION

Meat spicing dates back to thousands of years with evidence that hunter/gatherers used spices to enhance the flavour of their food (Tapsell *et al.,* 2006). Spices were a valuable trade commodity in ancient and medieval times. In the middle ages, spices were as valuable as gold and gems. One of its many functions were for masking the flavour of spoilt food because of lack of refrigeration. Spices generally are parts of various plants cultivated for their aromatic pungent or otherwise desirable substances. They consist of rhizomes, bulbs, flower bud, fruit, seed, and leaves. They usually are categorized into tiny wild fruits, nuts, herbs, and leafy vegetables. Various spices have been used in meat processing which include basil, cilantro, curry, garlic, rosemary, onions, thyme, ginger, turmeric, cinnamon, paprika, piper species. Piper species encompasses plant from the piperaceae family of which black and white peppers belong. There are over seven hundred species of this plant (Anyanwu, and Nwosu, 2014) that are used for different purposes but majority are used as spices. *Piper nigrum* and *P. guineense* are popular species of this genera used as spice.

Piper guineense commonly known as African black pepper, Ashanti pepper in Ghana, Uziza in Igbo and Iyere in Yoruba, Benin pepper, Guinea pepper and false cubeb (Katzer and Gernot, 2015), is indigenous to tropical regions of Central and Western Africa and it predominates southern Nigeria where it is either cultivated in the homestead or found in the wild in rainforest, forest edges and usually in damp places. It is a climbling perennial plant with adventitious roots, bears a cone shaped cluster of drupe seeds which are red or reddish brown when ripe and black when dry. The leaves are heart-shaped, arranged in alternate petioles on the vines, green in colour with an acuminate apex and pinnate venation. It is pungent, aromatic and peppery in taste. The seeds mainly produce white, black or pepper depending on the method of processing (Milenkovic and Stanojevic, 2021). It adds a peppery, citrusy flavour to soups, stews and marinades. This plant has so many uses including medicinal, cosmetic, insecticidal and culinary uses (Martins, 2013). It is a staple in Nigerian dishes like egusi and pepper soups priced for its taste and health benefits. Several studies on the medicinal applications including anticonvulsant effect (Abila *et al.,* 1993), non-sedating anti-convulsant activity (Ashorobi and Akintoye, 1999) and the antimicrobial activity (Oyedeji *et al.,* 2005) of African black pepper have been investigated. The seeds have been used externally as counterirritant or as a stimulating ointment, internally as stomachic (reduce flatulence). The leaves are widely used for the same purpose during the rainy season when it is abundant and are often scare during the dry season. As a spice leaf with its characteristic taste and aroma, very minute quantities are used while the rest overgrow and dry out. In order to curtail the scarcity of this spice leaves during the dry season, it could be dried into powder as used when the need arises. In the powdery form, the African black pepper can be put to diverse uses easily.

However, there is paucity of information on the application of African black pepper leaf as a spice in meat and meat product processing hence the need for this research. This study was designed to assess the phytochemical constituents in fresh and dried leaves of African black pepper and also to evaluate the sensory properties of grilled chicken marinated with African black pepper leaf powder.

MATERIALS AND METHODS

Experimental site

This research was carried out at the biochemistry laboratory in University of Uyo annex campus, University of Uyo.

Experimental materials, design and Layout

Chicken breast meat, black pepper leaves, electric grill, basins, skewers, seviette paper etc were used in the experiment. The chicken meat samples were subjected to 5 treatments where T1 0g (Control), T2 (5g of ABLP), T3 (10g of ABLP), T4 (15g of ABLP), T5 (20g of ABPLP). The experiment was replicated thrice in a completely randomized design (CRD).

Sample and treatment preparation

The chicken meat samples were removed from the wraps which were properly sealed and sample were weighed 100g each using a sensitive scale. Each 100g of chicken meat samples were cut into small slices and skewed before setting on the grill. The leaves were picked from the stem, washed and sun- dried before slicing. It was then ground to powder to obtain African black pepper leaf powder (ABPLP). The chicken samples were marinated into the treatments accordingly for one hour before setting on the grill.

Parameters measured

Phytochemical screening of African black pepper leaves

The phytochemical screening was carried on both fresh and dried leaves of African black pepper leaves. The leaves were qualitatively screened for phytochemical constituents. The phytochemical constituents screened were alkaloids, terpenoids, saponins, tanins, cardiac, glycosides and phenols using the procedure of Harborne (1993), Sofowra, (1993) and Trease and Evans, (2002).

Sensory evaluation of the grilled chicken breast

The grilled chicken breast samples of about 1g each were served to a 10-member panel of undergraduate students of the Department of Animal science, University of Uyo, for the evaluation of the palatability attributes. The panelists were pre-trained on the general procedure for evaluating the samples. Each served sample was about 1g. A 9-point hedonic scale (1= extremely poor, undesirable extremely dry extremely difficult, extremely tight, extremely present, extremely dislike, dark respectively and 9 = extremely desirable extremely juicy extremely easy extremely loose, extremely absent, extremely like, extremely light, respectively) was used to evaluate flavour, juiciness, tenderness and overall acceptability of the meat and Colour. Panelists were required to cleanse their palate between samples with water and cracker biscuit (Naveena *et al.,* 2004).

Statistical analysis

All the data were subjected to Analysis of Variance (ANOVA) procedure of SPSS ver. 20. The means were separated using Duncan's Multiple Range Test of the same procedure (IBM, 2011)

RESULTS AND DISCUSSION

Phytochemical screening of African black pepper leaves

The Phytochemical screening of fresh and dried African black pepper leaves are presented in table 1. Flavonoids, Saponins, Tannins, Terpenoids, Coumarins, Phenols, Steroids were highly present, Alkaloid, Phytosterols, Triterpenes, Glycosides, Anthraquinones were moderately present while Anthocyanins and Phytosteroids were absent. Diterpenes, seemed to be affected by drying as it was seen to become moderately present in the dried sample while it was highly present when the leaves were fresh. Quinones appeared in trace quantity in fresh samples but became concentrated on the dried sample. Phytochemicals are biologically active compounds that play different roles in plants. Some defend the plants against diseases while others contribute to colour and flavour (Yang and Ling, 2025). They are also referred to as secondary metabolites. The presence of this phytochemical constituents portrays the African black pepper leaves' anti- inflammatory and antioxidant potentials (Abasiekong *et al.,* 2020). Various authors also reported the occurrence of alkaloids, steroids, glycosides, saponins, flavonoids, tannins, and terpenoids in African black pepper (Tavs *et al.,* 2020, Ohiagu *et al.*, 2021, Besong, 2006, Mgbeahuruike, *et al.,* 2018, Iwu, 2014).

Table 1: Phytochemical constituents of Fresh and dried African black pepper leaves (Piper guineense)

S/No	Phytochemicals	Fresh	Dried
1	Alkaloid	++	++
2	Flavonoids	+++	+++
3	Saponins	+++	+++
4	Tannins	+++	+++
5	Terpenoids	+++	+++
6	Anthocyanins	-	-
7	Coumarins	+++	+++
8	Phenols	+++	+++
9	Phytosterols	++	++
10	Diterpenes	+++	++
11	Triterpenes	++	++
12	Glycosides	++	++
13	Quinones	+	+++
14	Anthraquinones	++	++
15	Steroids	+++	+++

+++: Highly present; ++: Moderately present; +: Trace (Not Prominent); -: Not detected

Sensory Evaluation of grilled chicken breast marinated in African black pepper leaf powder

The sensory evaluation of the grilled chicken breast treated with ABPLP are presented on Table 3. The flavour ratings of the chicken breast treated with ABPLP showed significant (P>0.05) differences among the treatments. Treatments 4 and 5 were significantly (P> 0.05) different from T1 while T2 and T3 were similar to T1, T4 and T5. The flavour of the ABPLP treated samples were intermediate compared to the control which was slightly desirable. The flavour rating of ABPLP gradually tending to slightly disliked on the hedonic scale as the concentration increased. The highest concentration of 20g of ABPLP had the least flavour rating. ABPLP has a characteristic hot and pungent aroma that may tend to be choky when in excess. Inclusion with 20g seemed to be over spicy which lead to the slight dislike. The high presence of Terpenoids as seen in table 1 may be responsible for the in-between appreciation of the grilled meat as the terpenoids and phenyl propanoids are the compounds responsible for the aroma in black pepper leaves (Martins *et al.,* 2021). It may also be attributed to the unfamiliar flavour of ABPLP in grilled chicken as other spices such as ginger, garlic, curry and thyme are familiar and common. Juiciness, Ease of Fragmentation and Colour were not influenced by the application of ABPLP as there were no significant (P > 0.05) difference among treatments. The Apparent Adhesion which is an indicator of tenderness showed significant (P<0.05) differences among treatment. Grilled chicken in T5 with the highest amount of ABPLP had slightly loose muscle fibre compared to the control which had no ABPLP but were slightly tight. Other samples in T2, T3, T4 were similar to both T5 and T1. Addition of higher levels of ABPLP may be the cause of the muscle disintegration thereby making the meat tender. There were significant (P < 0.05) differences across the treatments in the overall acceptability of grilled chicken. The samples in T1 which had no ABPLP were rated higher (6.27±0.14) than those with ABPLP. The treatments with ABPLP T2 (4.57±0.08), T3 (5.87±0.58) T4 (4.30±0.70) and T5 (4.83±0.41) respectively, were similar in rating with T4 (4.30±0.70) having the least rating. The panelist slightly liked T1 which had no ABPLP treatment and slightly disliked T4 which had 15g of the ABPLP. Other samples treated with ABPLP were judged as intermediate. This may be attributed to African black pepper not being a usual spice in grilled chicken. Moreover, African black pepper is reported to be spicy due to the presence of piperine (Zachariah and Parthasarathy, 2008) and consumers detest overly spicy foods (Muhammad *et al.,* 2020). Ekpo *et al.* (2018) also reported that *Piper guineense* was least accepted when compared with *Monodora myristica* (African Nutmeg) and *Zingiber officinale* (Ginger) on quality of rabbit meat. There was no effect of ABPLP on the colour of the grilled chicken. Despite it's green colour, it was not able to fix the green pigment in the meat. This may be attributed to the absence of Anthocyanide in ABPLP as evident in Table 1. This result also colloborates the work of Teye *et al.,* (2014) who found no significant difference in colour of hamburger treated with Basil leaf paste.

Table 3: Sensory evaluation of grilled chicken treated with ABPLP

Parameters	T1 (0g ABPLP)	T2 (5g ABPLP)	T3 (10g ABPLP)	T4 (15g ABPLP)	T5 (20g ABPLP)	Sem
Flavour	6.73 ±0.42 [a]	5.60±0.55[ab]	5.40±0.87[ab]	5.26±0.61[b]	4.27±0.45[b]	0.26
Juiciness	5.83±0.86 [a]	5.67±0.38 [a]	6.87±0.27 [a]	6.80±0.28 [a]	5.83±0.42 [a]	0.23
Ease of fragmentation	6.40±0.80 [a]	5.90±0.49 [a]	6.57±0.26 [a]	7.2±0.08 [a]	6.7±0.62 [a]	0.26
Apparent adhesion	4.76±0.28[b]	5.6±1.55[ab]	6.23±0.37[ab]	6.40±0.69[ab]	6.59±0.76[a]	0.25
Residue after chewing	5.57±0.64[a]	4.93±0.44 [a]	5.57±0.37 [a]	5.26±0.06 [a]	4.67±0.32 [a]	0.18
Acceptability	6.27±0.14 [a]	4.57±0.08[bc]	5.87±0.58[ab]	4.30±0.70[c]	4.83±0.41[abc]	0.26
Colour	4.57±0.75 [a]	4.47±1.5 [a]	4.07±0.15 [a]	3.63±0.05 [a]	3.53±1.23 [a]	0.23

[abc] means in the same row with different superscripts are significantly different (P<0.05). ABPLP-African black pepper powder

CONCLUSION

The African black pepper leaf powder (ABPLP) contains a range of bioactive compounds that can be beneficial to human health. The phytochemical constituents were comparably the same in both fresh and dried forms. From the sensory standpoint, flavour, ease of fragmentation, apparent adhesion were influenced by ABPLP. The colour and acceptability of the ABPLP grilled chicken breast were not improved. Its application as an ingredient in grilled chicken was not well received at higher concentrations. Its application in meat spicing could be carried out at lower concentrations.

REFERENCES

Abasiekong, K. S., Okwunodulu, I. N. and Okorie, B. U. (2020). Optimization of mixed spices from scent leaf, curry and African Black Pepper. *Journal of Sustainable Agriculture and Environment*. 18(1), 22-35.

Abila, B., Richens A., Davies J. A. (1993) Anticonvulsant effects of extracts of the West African black pepper, Piper guineense. J.Ethnopharmacol. 39(2): 113–117

Anyanwu, C. U. and Nwosu, G. C. (2014). Assessment of the antimicrobial activity of aqueous and ethanolic extracts of Piper guineense leaves. *Journal of Medicinal Plants*. volume8, pages 436-440

Ashorobi, R. B. and Akintoye, O. S. (1999). Non-sedating anti-convulsant activity of Piper guineense in mice. *Nigerian Quarterly Journal of Hospital Medicine*, 9(3): 231 – 233.

Besong, E. E, Balogun, M. E., Djobissie, S. F. A., Mbamalu, O. S, Obinna, J. N. (2016). A Review of Piper guineense (African Black Pepper). Int. J. Pharm Pharm Res. 2016;6:368–384.

Ekpo, J. S., Sampson, S. O., Eyoh, G. D. and Sam, I. M. (2018). Comparative evaluation of the effects of three local spices on nutrient and organoleptic qualities of rabbit meat. Nig. J. Anim. Prod., 45(5):107 - 111. Available from: https://www.researchgate.net/publication/349655161 (accessed Feb 17, 2025).

Harborne, J. B. (1998). Phytochemical Methods - A Guide to Modern Techniques of plant analysis Chapman and Hall: London, 1998.

IBM SPSS. 2011. Statistical package for Social Sciences. Version 20. Cary, NC.

Iwu, M.M.(2014) Pharmacognostical Profile of Selected Medicinal Plants from: Handbook of African Medicinal Plants (2nd ed.). CRC Press.2014 https://doi.org/10.1201/b16292.2014

Katzer and Gernot (2015), Gernot Katzer Spice pages.

Martins, M. L., Jerônimo, G. T., A. B. Figueredo, K. R. Tancredo, E. A. Bertaglia, W. E. Furtado, N. B. Lehmann, P. F.O. Azevedo, J. L.P. Mouriño (2021). Chapter 4 - Antiparasitic agents. Aquaculture Pharmacology 2021, Pages 169-217

Martins (2013). http://www.Martinslibrary.com.

Milenkovic, A and Stanojevic L. (2021). Black Pepper: Chemical composition and biological activities. Advanced Technologies10(2): 40-50.

Mgbeahuruike, E. E., Fyhrquist,P., Vuorela, H., Julkunen-Tiitto, R., Holm, Y. (2018). Alkaloid- Rich Crude Extracts, Fractions and Piperamide Alkaloids of Piper guineense Possess Promising Antibacterial Effects. Antibiotics.2018;7(4):98. https://doi.org/10.3390/antibiotics7040098

Muhammad, M. B., Jibir, M., Hamza, K.Y., Garba, S., 2020. Consumer awareness and preference to spices used in meat products. *Scientific Journal of Animal Science*, 9(3): 565-570. Available from: https://www.researchgate.net/publication/351879825 (accessed Feb 17 2025).

Naveena, B. M. and Mendiratta, S. K. (2004). The tenderization of buffalo meat using ginger extract. *Journal of Muscle Foods* 15(4):235 - 244

Ohiagu, F.O., Chikezie,P.C, Maduka,T, Enyoh, C. E., Chikezie, C. M. (2021). Bioactive compounds and medicinal usefulness of edible leaves of Vernonia amygdalina, Ocimum gratissimum, Piper guineense and Gongronema latifolium. SAJ Pharma Pharmacology. 2021;7:101

Oyedeji1,O. A., Adeniyi,B. A., Ajayi, O. and König, W. A.(2005)Essential Oil Composition of Piper guineense and its Antimicrobial Activity. Another Chemotype from Nigeria .Phytother. Res. 19, 362–364

Tavs, A. A., Mumuni,S., Obi, I. S. (2020). Pharmacognostic and toxicological evaluation of the leaves of Piper guineense Schum. and Thonn (Piperaceae). *African Journal of Pharmacy and Pharmacology*. 2020; 14(7): 229-239.

Tapsell, L. C. , Hemphil, I, Cobrac, I. (2006). Health benefits of herbs and spices" the past, the present and the future. Medical Journal of Australia 185: S4-S24.

Teye, G. A., Bawah,J., Adzitey,F.,and Nathaniel,L. N. (2014). Effect of Sweet Basil (*Ocimum Basilicum*) Leaf Extract as a Spice in Hamburger. Global Journal of Animal Scientific Research. 2(2):92-96.

Trease, G. E., Evans, W.C.(1989).. Textbook of Pharmacognosy12th edition. Balliere Tindall: London, 1989.

Sofowara, E. A. (2008). Medicinal Plant and Traditional Medicine in Africa, 3rd Edition Spectrum Books, Ibadan, Nigeria, 2008.

Yan Yang and Wenhua Ling (2025). Health Health Benefits and Future Research of Phytochemicals: A Literature Review. *The Journal of Nutrition* 155 (1): 87-101. https://doi.org/10.1016/j.tjnut.2024.11.007

Zachariah, T. J., and Parthasarathy, B., (2008). Chemistry of spices. Calicut, Kerala: Typeset by Pondicherry, India. Printedand bound in the UK by Biddles Ltd, King's Lynn.