NUTRIENTS AND PHYTOCHEMICAL COMPOSITION OF SOME NON-CONVENTIONAL FEED SUPPLEMENTS

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Abstract

Phytochemicals are organic substances in plants that play various roles in maintaining healthy living of an organism; they achieve that in conjunction with the roles played by other nutrients such as vitamins and minerals. Fresh fluted pumpkin leaf, Moringa leaf, tomato, and garlic bulb were obtained, dried and milled. They were later analysed to quantify phytochemicals such as phenolics using the folinciocalteu's as oxidizing reagent, alkaloids, flavonoids and β-carotene using emulsion preparation method. Minerals such as calcium, magnesium, sodium, iron, phosphorous, copper and zinc were determined. The result showed significantly (P<0.05) higher flavonoid and alkaloid in fluted pumpkin, phenol and β-carotene were significantly (P<0.05) higher in moringa. Calcium, phosphorus and iron were significantly (P<0.05) higher in moringa, fluted pumpkin had significantly (P<0.05) higher magnesium and iron. The test supplements contain appreciable crude protein to be used in dietary formulation. It is concluded that leaf meals contain more phytochemicals and mineral than tomato and garlic.

Key words: fluted pumpkin, moringa, tomato, garlic, phytochemical

Introduction

Phytochemicals such as alkaloids, carotenoids, phenolics, and flavonoids reduce the deposition of fat in the arteries (Anderson, 2004). Sulphur compounds such as allixin and S-allyl-cysteine, as examples of phytochemicals, are known to decrease the cholesterol synthesis in the body and consequently keep the blood pressure low (Anderson, 2004).

Telfairia occidentalis has antioxidant, antidiabetic, haematological, anticancer, anti-Inflamatory, male fertility, hepatoprotective, antimicrobial, antimalaria, toxicity and biochemical activities. These activities may be due to the phytochemicals, vitamins and minerals present in the plant (Imosemi 2018). Umaya (2014) reported the health benefits of *Moringa Oleifera* include regulation of hyperthyroidism, radio-protective effect, vitamin A supplement, antihypertensive effect, hypoglycemic effect, antioxidant and enhanced milk yield. Garlic contains a compound, allicin (organosuphur compound), which is an oily liquid that contain more than 60% thiosulfinates, (Harunobu *et al.*, 2001). Allicin has odour and it is highly unstable compound that decomposes to sulfides, including ajoene and dithiins, (Freeman and Kodera, 1995). It has been tested to have antimicrobial effect, (Harunobu *et al.*, 2001). Tomato is a good source of vitamin, mineral, flavonoid and carotenoid (Campbell, *et al*., 2004). Because of their nutrients composition, they can serve the poultry sector as non-conventional feeding materials.

This study intends to screen four selected non-conventional feed supplements; fluted pumpkin leaf meal (*Telfairia occidentalis*), moringa leaf meal (*Moringa oleifera*) tomato powder (*Lycopersicom esculentus*), and garlic bulb powder (*Allium sativum*) for their chemical constituents

Materials and Methods

Fresh fluted pumpkin leaf (*Telfeiria occidentalis*), Moringa leaf (*Moringa oleifera*), tomato (*Lycopersicom esculentus*), and garlic bulb (*Allium sativum*) were obtained from local market in Ile-Ife and were dried, milled and stored in freezer for subsequent chemical analyses. They were later analysed to quantify phytochemicals such as phenolics as described by Othman *et al* (2007) using the folinciocalteu's as oxidizing reagent, alkaloids, flavonoids as described by Zhilen *et al.* (1999) and β-carotene using emulsion preparation method of Sarker *et al*. (1993). Minerals such as calcium, magnesium, sodium, iron, phosphorous, copper and zinc were determined using the method described by Sharma and Sangha (2009). Data collected were subjected to Analysis of Variance (ANOVA) of SAS (2002) and means were separated using Duncan's Multiple Range Test.

Results and Discussion

The result of phytochemicals analysed (Table 1) showed the flavonoid composition of the test supplements was higher significantly (P≤0.05) in fluted pumpkin leaves meal followed by moringa leaf meal. Flavonoids (myrecytin, quercetin and kaempferol) have high antioxidant ability as cited in the report Vergara-Jimenez *et al*. (2017). The alkaloid composition of fluted pumpkin (226.67 mgAAE/g) and moringa (215.88 mgAAE/g) were higher than those found in dried tomato fruit (199.61 mgAAE/g) and dried garlic bulb (94.44 mgAAE/g). This may be responsible for their medicinal properties. Vergara-Jimenez *et al*. (2017) reported that alkaloid contain several nitrogen compounds which include N,α-L-rhamnopyranosyl vincosamide, phenylacetonitrile pyrrolemarumine which have an anti-inflamatory effect on patients with ailments such as hypertension and heart related diseases. The result of phenol in moringa and fluted pumpkin were higher significantly (P≤0.05) than that of tomato and garlic. Phenolic acids such as gallic acid and chlorogenicacid have free radical scarvenging activities which have health promoting effects (Nour *et al*., 2018). The β-carotene was however, significantly (P≤0.05) higher in dried tomato powder than other test supplements. Tomato contained high lycopene (a form of carotenoid) which was reportedly essential for the alleviation of oxidative stress in chicken (Sahin *et al.* 2016), meaning that tomato could be used to address challenges of oxidative stress.

Table 1: The phytochemical composition of test supplements

Parameters	**Fluted pumpkin leaf meal**	**Dried tomato fruit meal**	**Moringa leaf meal**	**Dried garlic bulb meal**	**SEM**
Phenol (mg GAE/g)	57.48^{b}	43.28^{c}	60.21^{a}	11.20^{d}	0.55
Flavonoid (mgQUE/g)	29.81^{a}	23.44^{c}	26.34^{b}	24.24^{c}	2.14
Alkaloid (mgAAE/g)	226.67^{a}	199.61^{c}	215.88^{b}	94.44^{d}	6.23
β-Carotene (mg/kg)	138.48^{b}	174.81^{a}	179.64^{a}	66.50^{c}	6.50

^{abcd}Means in the same row having different superscripts differ significantly at P≤0.05

The result of mineral content of the test supplements (Table 2) showed that calcium was higher significantly (P≤0.05) in moringa leaf meal compared to other test supplements. Sebola *et al.* (2017) reported significantly higher calcium content (19.15g/kg) in moringa. The magnesium content was significantly (P≤0.05) higher in fluted pumpkin leaf meal compared to other test supplement followed by moringa leaf meal. This was in line with the result reported by Nworgu *et al. (*2007). The phosphorus content of the test supplements was significantly (P≤0.05) higher in moringa leaf meal followed by dried garlic bulbs. This shows the potentiality of moringa in improving egg shell thickness. The iron in fluted pumpkin and moringa were higher significantly (P≤0.05) than the content of other test supplements. This may be responsible for their effectiveness in the treatment of anaemia. Ustundag and Ozdogan (2016) reported significantly (P≤0.05) higher iron in fluted pumpkin and moringa, respectively. The zinc content of the test supplement was however significantly (P≤0.05) higher in dried garlic bulb than other test supplement. Ustundag and Ozdogan (2016) reported higher content of zinc in moringa than copper. Revell *et al*. (2009) reported an increased in the total iron content by over 15% compared to the control when an iron rich diet was fed to laying hens.

Table 2: The mineral composition of test supplements

Parameters	FPLM	DTFM	MOLM	DGBM	SEM
alcium (g/kg)	10.10^{b}	1.5^{d}	13.13^{a}	1.76^{c}	0.004
Magnesium (g/kg)	4.32^{a}	2.00^{c}	2.58^{b}	1.06^{d}	0.003
Sodium (g/kg)	1.80^{d}	3.02^{a}	2.92^{b}	2.01^{c}	0.009
Phosphorus(g/kg)	0.27^{d}	0.28^{c}	0.66^{a}	0.46^{b}	0.004
Iron (mg/kg)	155.00^{a}	76.00^{c}	154.00^{a}	94.00^{b}	0.763
Copper (mg/kg)	8.00^{c}	12.33^{a}	4.00^{d}	11.00^{b}	0.004
Zinc (mg/kg)	49.00^{d}	62.33^{c}	73.00^{b}	76.00^{a}	0.287

^{abcd}Means in the same row having different superscripts differ significantly at $P \leq 0.05$

Table 3 shows the results of the proximate composition of test supplements. The crude proteins (18.07-27.96%) in the test supplements were moderately higher to furnish requirement for farm animals except in garlic which had 8.93%. This tallied with result sited by Karangiya *et al.* (2016) who cited low crude protein in garlic when fed to broiler chicken. The fibre content of the test supplements were significantly low in dried tomato fruit and dried garlic bulb, this showed their potentiality for inclusion into the poultry diet as they cannot withstand high fibre diet. Ether extract was higher in fluted pumpkin (9.06%) than dried garlic (1.13%). The nitrogen free extract was significantly high in dried garlic than other test supplements. This was the same with 85.83% nitrogen free extract reported by Karangiya *et al.* (2016).

Table 3: The proximate composition of test supplements and experimental diets

	Supplements			
Parameters (%)	**FPLM**	**DTFM**	**MOLM**	**DGBM**
Dry matter	90.81	92.79	90.13	87.39
Crude protein	25.27	27.96	18.07	8.93
Crude fibre	10.91	3.37	10.63	3.5
Ether Extract	9.06	3.97	5.10	1.13
Ash	5.15	4.29	4.59	2.44
Nitrogen Free Extract	49.61	60.41	61.60	84.00

FPLM=fluted pumpkinleaf meal, DTFM=dried tomato fruit meal, MOLM=moringa leaf meal, DGBM=dried garlic bulb meal, Mix=mixture of FPLM and MOLM in a ratio of 1:1.

Conclusion

It is concluded that fluted pumpkin and moringa leaf meals contain more phytochemical and mineral than tomato and garlic. The crude protein in tomato is higher than other test supplements

References

Anderson, G.D. (2004). Phytochemicals 2004. Dynamic Chiropractic *Trends Food Science Technology*, 2(1):168-175.

Campbell, J. K., Canene-Adams, K., Lindshield, B. L., Boileau, T. W. M., Clinton, S. K., and Erdman, J. W., Jr. (2004). Tomato phytochemicals and prostate cancer risk. *The Journal of Nutrition*, 134 (12): 3486S-3492S, http://doi.org/10.1093/jn/134.12.3486S. Retrieved on 30th September, 2018.

Harunobu A., Brenda L. P., Hiromichi M., Shigeo K. and Yoichi I. (2001). Intake of Garlic and Its Bioactive Components. *American Society for Nutritional Sciences*, 995S-1002S. Downloaded from https://academic.oup.com/jn/article-abstract/131/3/955S/4687054 by guest on 20 October 2018.

Imosemi, I.O. (2018). Review of the Toxicity, Medicinal Benefits, Pharmacological Actions and Morphological Effects of *Fluted pumpkin* Hook. F. *European Journal of Phamaceutical and Medical Research*, 5(7): 22-32.

Nour, V., Panaite, T. D., Ropota, M., Turcu, R., Trandafir, I. and Curbu, A. R. (2018). Nutritional and bioactive compounds in dried tomato processing waste, CyTA - *Journal of Food*, 16:1, 222-229: https://doi.org/10.1080/19476337.2017.1383514

Nworgu, F.C., Ogungbenro S.A. and Solesi, K.S. (2007). Performance and Some Blood Chemistry Indices of Broiler Chicken Served Fluted pumpkin (*Telfairia occidentalis*) Leaves Extract Supplement. *American-Eurasian Journal of Agric and Environmental Science*, 2(1): 90-98.

Othman, A., Ismail, A., Abdul Ghani, N. and Adenan, I. (2007). Antioxidant capacity and phenolic content of cocoa beans. *Food chemistry*, 100(4): 1523-1530. Retrieved 18/10/2018 from https://doi.org/10.1016/j.foodchem.2005.12.021

Revell, D.K., Zarrinkalam, M.R. and Hughes, R.J. (2009). Iron content of eggs from hens given diets containing organic forms of iron, serine and methyl group donors, or phytoestogens. *Poultry sciences*, 30(4): 536-46.

Sahin, K., Orhan, C., Tuzcu, M., Sahin, N., Hayirli, A., Bilgili, S., and Kucuk, O. (2016). Lycopene activates antioxidant enzymes and nuclear transcription factor systems in heat-stressed broilers. *Poultry Science*, 95:1088–1095 http://dx.doi.org/10.3382/ps/pew012

Sarker, H., Mahtab, R. and Ahmed, M. (1993). Investigation on the chemical components of jute (*Corchorus capsularis* L.) leaf. Dhaka University Studies, Part-B Science 41, 13-18.

SAS (2002). Statistical Analysis System Institute. Users Guide Version 9 for Windows. Cary North Carolina USA.

Sebola, N.A., Mlambo, V., and Mokoboki, H.K. (2017) Chemical characterisation of *Moringa oleifera* Leaves and the apparent digestibility of *Moringa oleifera* leaf meal-based diets offered to three chicken strains. *Agroforestry Systems,* 93(1): 149-160. DOI: 10.1007/s10457-017-0074-9.

Umaya, S.R. (2014). Application of Moringa Oleifera in Poultry: A review. *World Journal of Pharmaceutical Research*, 3(2): 1955-1960.

Ustundag, A.O. and Ozdogan, M. (2016). Using *Moringa oleifera* in poultry Nutrition. *Journal of Agricultural Faculty of Uludag University*; 30: 195-201.

Vergara-Jimenez, M. Almatrafi, M. M. and Fernandez, M. L. (2017). Review: Bioactive Components in Moringa Oleifera Leaves Protect against Chronic Disease. *Antioxidants 6, 91: 1-12; doi:10.3390/antiox6040091*

Zhilen J, Mengeheng T, Jianming W. (1999). The determination of flavonoid contents in mulberry and their scavenging effects on superoxide radicals. *Food Chemistry*, 64:555-559.

Karangiya, V. K., Savsani, H. H., Patil, S. S., Garg, D. D., Murthy, K. S., Ribadiya, N. K., Vekariya, S. J. (2016) Effect of dietary supplementation of garlic, ginger and their combination on feed intake, growth performance and economics in commercial broilers, *Veterinary World*, 9(3): 245-250.

Sharma, R.K. and Sangha, S.P.S. (2009). Basic in Biochemistry and Molecular Biology. I.K. International publishing house, New Delhi

Freeman, F. and Kodera, Y. (1995). Garlic chemistry: stability of S-(2-propenyl)2-propene-1-sulfinothioate (allicin) in blood, solvents, and simulated physiological fluids. *Journal of Agriculture and Food Chemistry*, 43: 2332–2338.