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Variation in the Anti-Nutritional factors among Cultivars of Potato (*Ipomea Batata*)

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ABSTRACT

The variations of the anti-nutritional compositions (oxalate, tannin, phytate, saponin, alkaloid and hydrogen cyanide) among eight varieties of sweet potatoes (Ipeomea batata) grown in Abakaliki in Ebonyi state of Nigeria were determined. The results showed that the sweet potato varieties were highly significantly different (P>0.01) in all the anti-nutritional factors. cyanogenic glycoside was highest in CV-TIS-253 (17.88+0.02mg/g) with least value observed in EX-Igbariam (6.82+0.024mg/g). Highly significant variations also occurred in the levels of alkaloids, oxalate, phytate, saponin, and tannin in the various varieties.

Keywords: Sweet potato, alkaloids, oxalate, phytate, saponin, cyanogenic glycoside and tannin

INTRODUCTION

Many food crops used for food contain natural chemical substances known to have effects on the nutritional status of the food. Some of these naturally occurring toxicants are anti nutrients such as Cyanogenic glycoside, tannin, saponins, phytate, alkaloids and oxalate etc. [1]. This natural toxicant can be harmful to animals if taken for long period of time. The crop plants such as sweet potato are toxic if not adequately processed because of its high cyanogenic content (hydrogen cyanide - HCN). Hydrogen cyanide is readily absorbed by the gastrointestinal and respiratory tracts; the liquid and possible the concentrated vapours are absorbed directly through the intact skin [2]. Following absorption, cyanide is rapidly distributed throughout the body by the blood. Short term exposure to high concentrations produces almost immediate collapse, respiratory arrest and death [3]; [4]. Thyroid toxicity has been reported in humans and animals following oral and inhalation exposure to cyanide [5]. The thyroid toxicity is associated with cyanide metabolism via conversion to thiocyanate which inhibits the intra-thyroidal uptake of iodine, causing an increase in secretion of thyroid stimulating hormone (TSH) and reduction of thyroxin levels, thus it is a goitrogenic agent [6]. Also, some free HCN is excreted unchanged in breath, saliva, sweat and urine [7]. Sweet potato rich in phytate have adverse effect if not well processed. This naturally occurring toxicant has the potential of influencing the functional and nutritional properties of the food crop in which it is contained. Phytate forms insoluble salts with essential mineral like calcium, iron, magnesium and zinc in food, rendering them unavailable for absorption into the blood stream [8].

Foods rich in oxalate have adverse effect when eaten because oxalate binds calcium and other minerals causing calcium deficiency and the formation of kidney stone [9]. Evaluating the levels of these anti-nutrients in sweat potatoes is an important aspect of integrated and multi-sectional approaches required to achieve the goals set under the National Nutrition Policy (NNP). Hence this research work was therefore to determine and compare the anti-nutritional factors among eight cultivars of sweat potato grown in Abakaliki.

MATERIALS AND METHODS

Plant Materials: The materials used for this research project were eight varieties of sweet potatoes (*Ipomoea batata*). They includes: TIS-86/0356, TIS -8164, EX-Igbariam, TIS-253, TIS-8441, TIS-87/0087, CPI-Tazanian, Wagabalise.

Processing of plant materials: Before analysis, preprocessing of the samples was done as follows: The samples were peeled, washed and 50.0g of each sample were weighed with weighing balance. Then these were crushed into slurry form prior to the analysis

Method of Analysis: Method of AOAC (1984) were used to determine saponin, alkaloid and oxalate while tannin and phytate were determined using FAO, (1986) and cyanogenic glycoside was determined by [10]

Statistical Analysis: The data obtained were subjected to inferential studies using Statistical Analysis for Sciences, SAS.

RESULTS AND DISCUSSION

The results of anti-nutrient factors in the sweet potato varieties were presented in figure 1 to 6. From the figures it reveals that the values of hydrogen cyanide obtained in TIS-253 and TIS- 8441 were the same and the value is 17.88± 0.019 mg/g, while CPI-Tanzanian had the third greatest value of 13.96±0.019mg/g. The values are far below the lethal dose for HCN in man (50-60 mg/kg body) weight as reported by [11]. This implies that these varieties of sweet potato cultivars studied are within the acceptable limit for human consumption.

The phytate and oxalate levels were 0.53±0.022 and 0.26± 0.013 mg/g for TIS-8441 and Wagabalise respectively. From the result obtained, the phytate content in this studied is low when compared to the value 1.44±0.01mg/100g obtained by [12] using sweet potato. However, [13] reported that phytate is absent in root tubers (cassava and yam) but in this study phytate was detected although the content is low. The moderate level of phytate in sweet potato cultivars suggest that it will not render several mineral especially iron and zinc biologically unavailable to animals and human that feed on the potato in the study areas [14]. Also, the moderate levels of phytate are beneficial in human diets as it reduces the incidence of heart diseases and act as anti carcinogen [1]; [2]. TIS-8441 had the highest saponin concentration with a value of 0.54± 0.019mg/g and is low when compared with the value 17.80 mg/g obtained by [5], which were considered to be safe for human consumption.

TIS-253 had the highest concentration of tannin with a value of 0.30± 0.013 mg/g and this value is the same when compared to values (0.30 mg/100g) obtained by [7] and moderate when compared to the value 0.21±0.02mg/100g obtained by [9] using sweet potato.

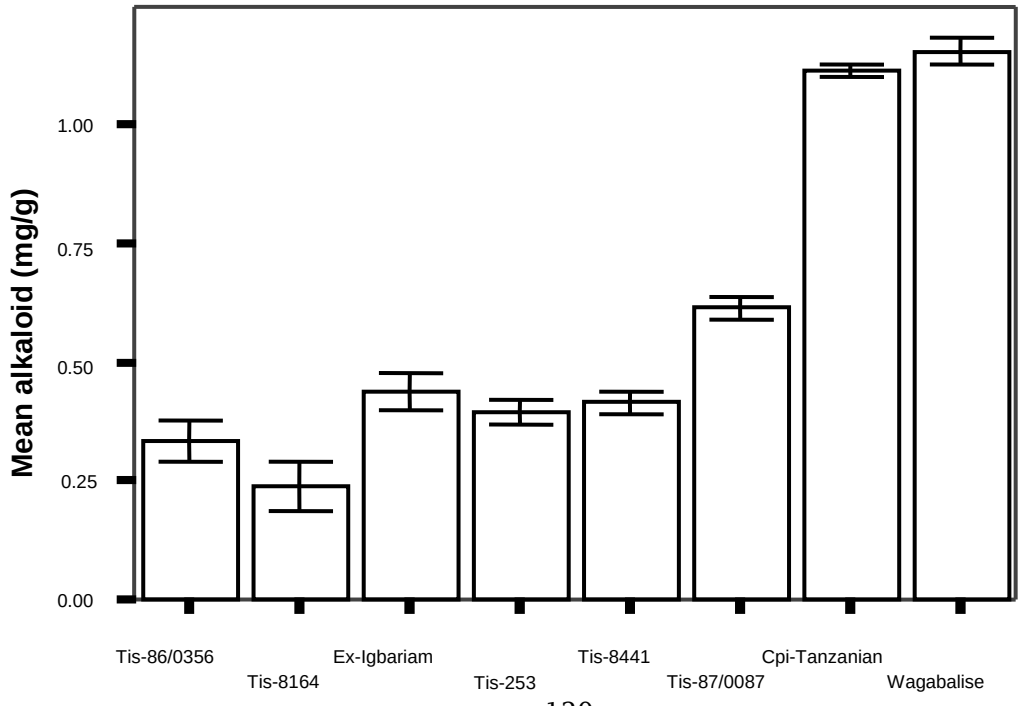

Fig. 1: Concentration of alkaloid (mg/g) in the various sweet potato varieties
From the figure 1, alkaloid content in Wagabalise had the highest concentration and least in TIS-8164

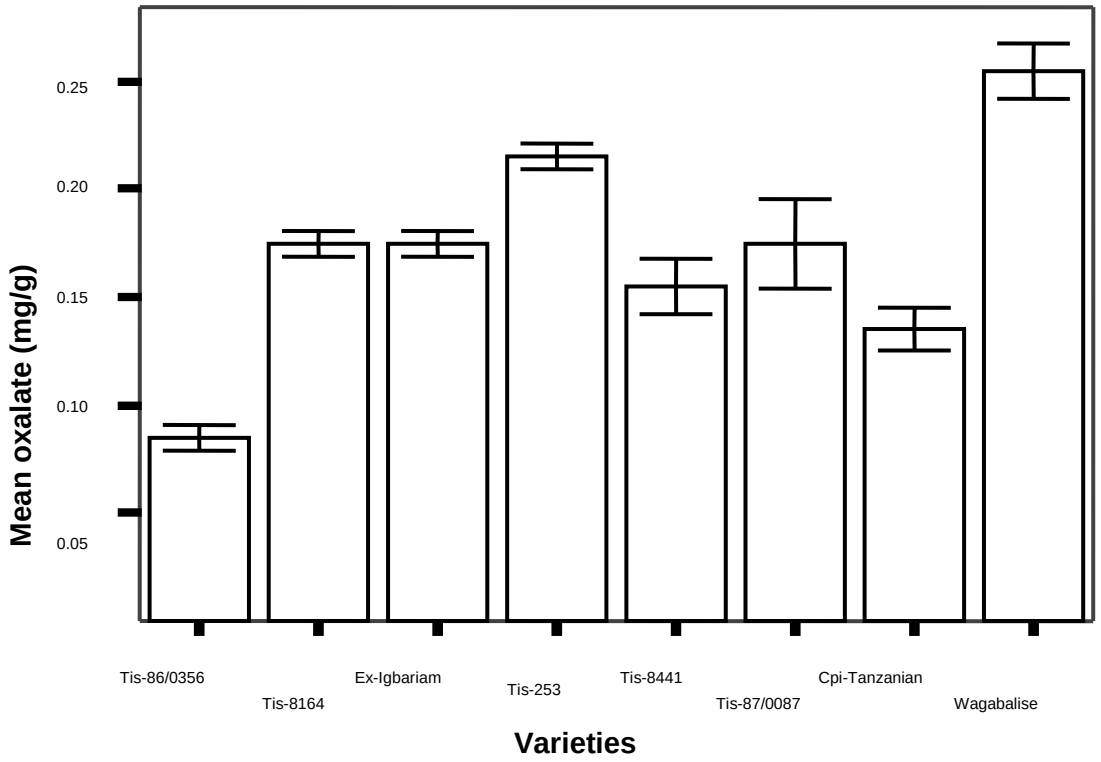

Fig. 2: Concentration of oxalate (mg/g) in the various sweet potato varieties
Figure 2 shows that the concentration of oxalate in Wagabalise was highest but had the least value in TIS-86/0356.

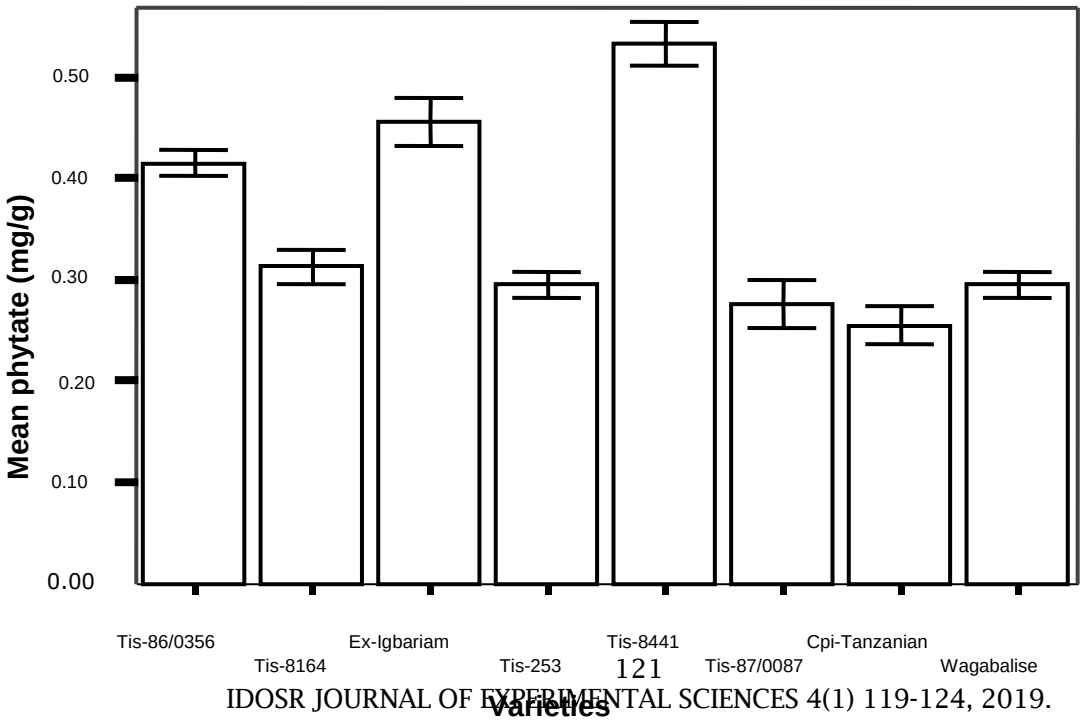

Fig. 3: Concentration of phytate (mg/g) in the various sweet potato varieties
Figure 3 indicates that the concentration of phytate in TIS-8441 had the highest value but CPI-Tanzanian recorded the least value.

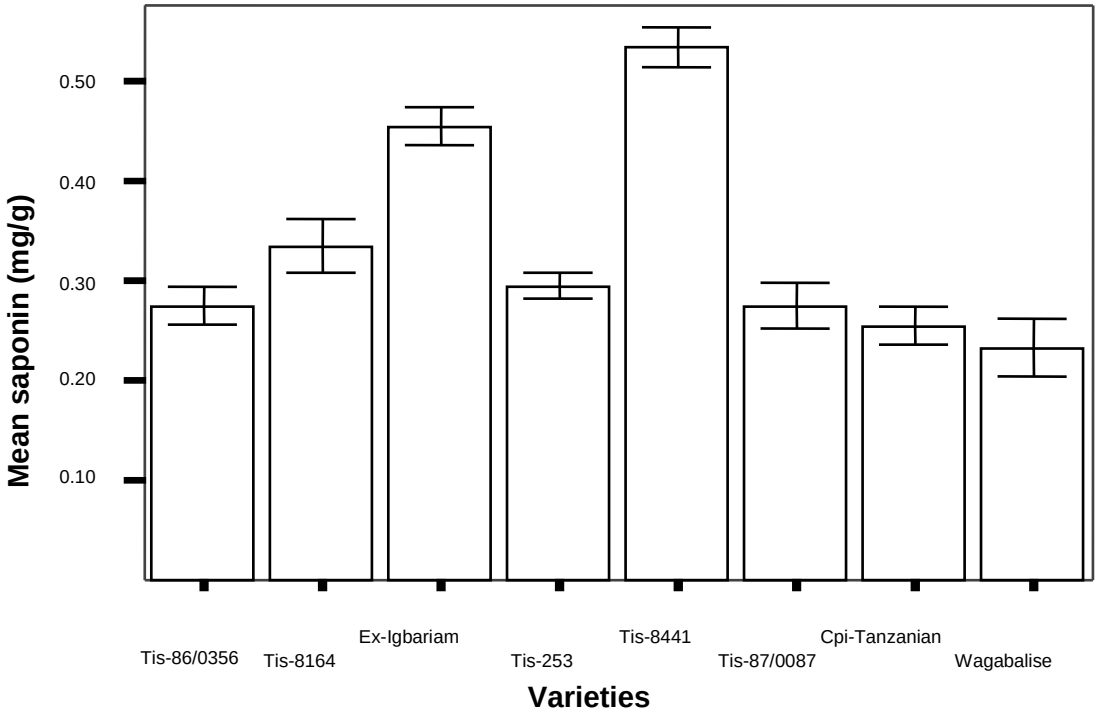

Fig. 4: Concentration of saponin (mg/g) in the various sweet potato varieties
Figure 4 indicates that the concentration of saponin was highest in TIS-8441 while the least value was in Wagabalise.

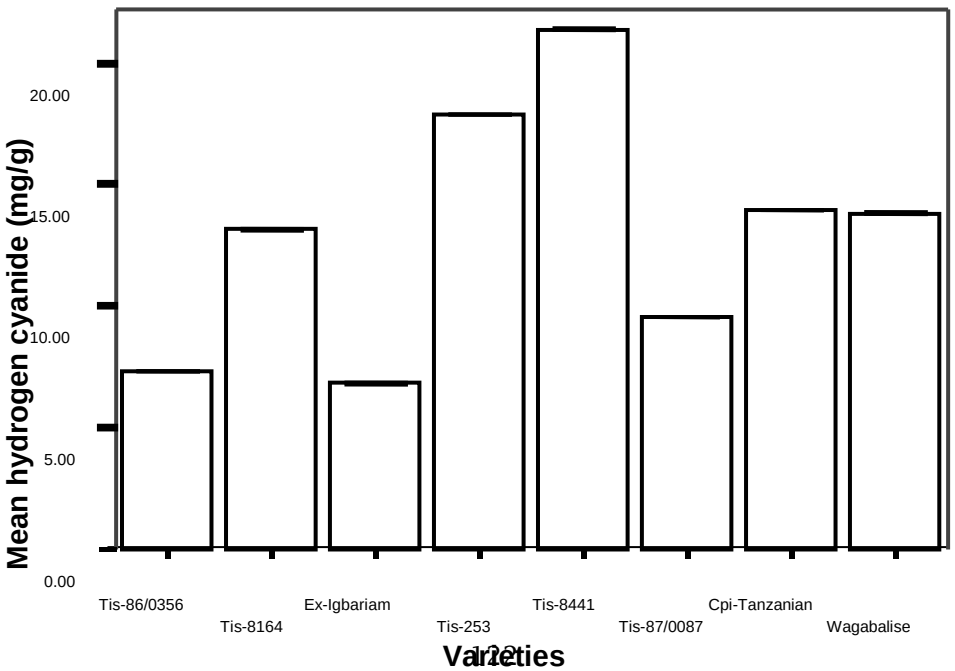

Fig. 5: Concentration of hydrogen cyanide (mg/g) in the various sweet potato varieties

Figure 5 indicates that the concentration of hydrogen cyanide was high in all the varieties but highest in TIS-8441and least in Ex-Igbariam.

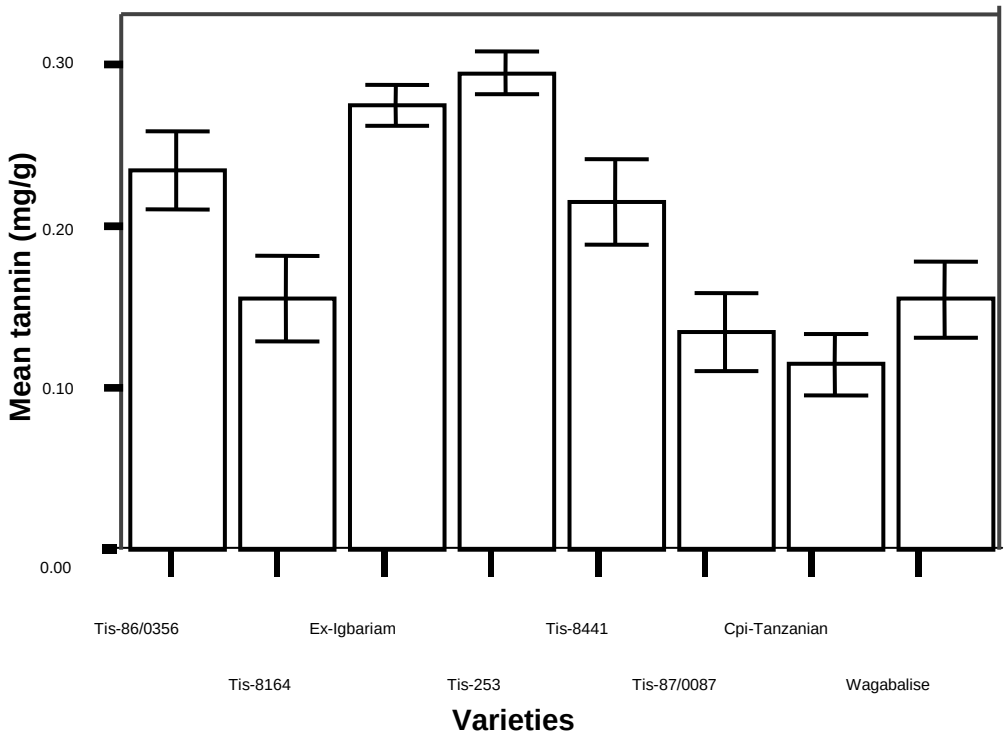

Fig. 6: Concentration of tannin (mg/g) in the various sweet potato varieties

From the figure 6, the concentration of tannin content was highest in variety TIS-253 and least in CPI-Tanzanian.

CONCLUSION

From the foregoing discussions, it can be concluded that anti-nutritional factors (oxalate, tannin, phytate, saponin, alkaloid, hydrogen cyanide), were present in all the varieties of sweet potatoes. These constituent were high in all the varieties, this obviously cause for concern as they may make them unsafe for human consumption since their concentration exceed the maximum recommended daily allowance. Hence this high concentration can be reduced by cooking the varieties very well to ensure safe level of consumption and high bioavailability of nutrients [5]

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