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Comparative studies of the level of toxicant in the seeds of *Terminalia catappa* (Indian Almond) and *Coula edulis* (African Walnut)

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ABSTRACT

The mean concentrations of tannin, oxalate, hydrogen cyanide and phytic acid in the seeds of Indian almond fruits were found to be 3820.00mg/100g, 140.80mg/100g, 8.64mg/100g and 2546.72mg/100g respectively. In the seed of the African walnut fruits, the corresponding mean concentrations were 2898.00mg/100g, 48.40mg/100g, 10.80mg/100g and 1932.00mg/100g respectively. The concentrations of these toxicants in the two seeds were significantly different from each other when subjected to t-test statistics. Their concentrations were also compared with the concentration of the respective toxicants in some edible fruits. The concentration of phytic acid in these fruits was relatively higher than the concentration of phytic acid reported for some common fruits.

Key Word: Toxicant, Indian almond & African walnut seeds, comparative studies.
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INTRODUCTION

The seeds of African walnut fruit and Indian almond fruits have been reported to be a good source of nutrients [1]. However most of the studies on edible plant seeds are concentrated on the proximate composition of the seeds for example, Indian almond seed have been reported by Ekop and Eddy [2] to contain 25% moisture, 4.50% ash, 9.20% lipid, 22.05% protein, 3.00% fibre, 61.25% carbohydrate and 416.00 kcal of calories while that of African walnut were also found to contain 59.12% moisture, 2.1% ash, 8.9% lipid, 4.38% protein, 1.4% fibre, 83.22% carbohydrate and 430.50 kcal of calories. The lipid content of these seeds has also been reported by Ekop and Eddy [2].

Studies on the level of toxicants in food materials is important because of the effect toxicant exert on the human body, for example, in Nigeria, four deaths were reported to have occurred due to the toxicant present in *amala* [3]. In eastern Kenya, at least 11 deaths cases were confirmed to have been due to aflatoxin after the consumption of mold-contaminated grain [4].

According to Munro and Bassir [5], toxicants occur in different parts of plants as natural toxins. The effect of toxicants in the body depends on the type of toxicant and the concentration in which this toxicant is present in the food materials [6, 7]. For example, when oxalate is eaten, it produces some irritation in the mouth [8], prevent the adsorption of calcium and iron in food and thus reduces their bioavailability [9, 10, 11].

Tannins are polyhydric phenols [12,13] and their role in the inhibition of trypsin, chymotrypsin, amylase and lipase activities have been confirmed [14,15,15]. Tannins form insoluble complexes with proteins, carbohydrates and lipids leading to a reduction in digestibility of these nutrients [16, 17]. Phytic acid lowers the utilisation of Ca^{2+} and Mg^{2+} due to its ability to form insoluble salts with these ions. The presence of phytic acid in some fruity have been reported [18]. Although cyanide is present in high concentrations in tuber crops, the presence of cyanide in some fruits have also been reported [19]. Cyanide can inhibit cellular oxidation by combining with catalytic ion of cytochrome oxidase leading to elimination of the active unit concerned with transfer of electrons to molecular oxygen [20]. Hydrocyanic acid have also been found to inhibit the activity of vitamin K dependent carboxylase of the liver [21].

Although the antinutritional roles of tannin, cyanide, phytic acid and oxalate have been confirmed, studies on the toxicant level of most fruits are scanty. The present study is aimed at analysing and comparing samples of Indian almond seeds and African walnut seeds for the concentration of these toxicants. The study is necessary because these seeds are normally consumed in their raw form without cooking or processing.

MATERIALS AND METHODS

In the determination of the concentration of hydrogen cyanide in the seed samples, 2.5g of each sample was soaked in distilled water for four hours in order to liberate cyanide. The liberated cyanide was steamed-distilled into a conical flask. 6M NH_4OH (2ml) and 5% w/v KI (0.5ml) were added to the distillate before it was titrated with 0.02M $AgNO_3$ to a faint permanent turbidity.

The oxalate content of the seed was determined by the method reported by Dye [22]. The sample (2.6g) was extracted with HCl, concentrated ammonia (5ml) and precipitated as calcium oxalate. The precipitate was washed with 2.5% H_2SO_4 (20ml) and dissolved in hot water before titrating with 0.05N $KmnO_4$. The concentration of tannin was determined by the method reported by Burn [23]. 1g of the dried sample was treated with 50ml methanol and kept for 24hours before filtration. Freshly prepared vanalin-hydrochloric acid (5ml) was added and the solution was left for 20minutes after which the absorbance was measured at 500nm wavelength using Spectronic 20.

The method reported by James [24] was adopted in the determination of the concentration of phytic acid in the sample. The sample (5g) was weighed into a conical flask. Trichloroacetic acid (TCA) (2ml) was added. The system was agitated for 30min and centrifuged. The supernatant was transferred into a conical flask and $FeCl_2$ (4ml) was added. This was followed by addition of 1.5M NaOH (3ml) and hot HNO_3 (3%). The concentration of phytic acid was calculated from the concentration of iron in the solution.

RESULT AND DISCUSSION

The mean concentration of hydrogen cyanide in the Indian almond seed was 8.64mg/100g. The value ranged from 8.62 to 8.66mg/100g. The mean concentration of hydrogen cyanide in African walnut seed was 10.8mg/100g. The values ranged from 10.59 to 11.01mg/100g. The concentration of hydrogen cyanide in Indian almond seed was significantly lower than the concentration in African walnut seed ($t = -7.9675$, $n = 5$, $\alpha = 0.05$). These values are higher than the value of 1.51mg/100g reported by Umoh [25] for *Carica papaya* but lower than the values of 6.8mg/100g, 355.0mg/100g and 34.20mg/100g reported for the fruits of *Chryspylum albidum, Dennettia tripetala* and L*agenaria sicerarin* reported by Kochhar [26], Umoh [25], Udoessien ansd Ifon [26] and Dunu *et al*,. [27] respectively. The lethal dose for the concentration of hydrogen cyanide in food materials is 50– 60mg [23]. The observed concentrations of HCN in Indian almond seed and African walnut seed are lower than this lethal dose.

The mean concentration of oxalate in Indian almond seed and African walnut seed were 140.80mg /100g and 48.40mg/100g respectively. The range for the concentration in the two seeds was 139.85 to 141.75mg/100g and 47.60 to 49.12mg/100g respectively. The concentration of oxalate in Indian almond seed was significantly higher than its concentration in African walnut seed ($t = 134.26$, $n = 5$, $\alpha = 0.05$). The concentration of oxalate in the Indian almond seed was higher than the concentration of 95.0mg/100g oxalate in C*arica papaya* [25]. The concentrations of oxalates in the two seeds were however lower than the concentration of oxalate in C*hryspylum albidum* (211.0mg/100g), *Dennettia tripetala*(404.00mg/100g) and L*agenaria sicerarin* [523.90mg/100g) reported by by Kochhar [26], Umoh [25], Udoessien ansd Ifon [26] and Dunu *et al*,. [27] respectively.

The significant difference between the concentrations of oxalate in the two seeds implies that the concentration of total oxalate in Indian almond seed (140.8mg/100g) is higher than the concentration of oxalate in African walnut (48.4mg/100g). This shows that Indian almond seed has a higher oxalate content compared to African walnut hence excessive consumption of African walnut seed should be avoided. However, processing generally lowers toxicants hence if these seeds are processed, it is expected that the oxalate intake of these seeds can be reduced if they are processed before consumption [28].

The mean concentration of phytic and in Indian almond seed and African walnut seeds were 2546.2mg /100g and 1932.0mg/100g respectively. Their concentra- tion ranged from 2543.47 to 2549.9mg/100g and from 1930.11 to 1934.89mg/100g for Indian almond seed and African walnut respectively. There was a significant difference between the concentration of phytic acid in seeds of Indian almond seed and African walnut ($t = 244.821$, $n = 5$, $\alpha = 0.05$). These values were higher than the value of 2.02 reported for *Carica papya* by Umoh [25], 0.8-1.6mg/100g reported for C*hrysophylum albidum* by Umoh [25] and 335.70mg/ 100g reported for L*agenaria siceraria* by Dunu *et al*., [27]. The con- centration of phytic acid in Indian almond seed was higher than its concentration in African walnut seed, which implies that Indian almond seed contained higher amount of phytic acid compared to African walnut seed. Excessive consumption of unprocessed African walnut seed could cause problems. The mean concentration of tannin in Indian almond seed was found to be significantly higher than its concentration in African walnut seed.

The mean concentration of tannin in Indian almond seed was 3420.00mg/100g and 2898.00mg/ 100g. These concentrations ranged from 3817.27 to 3822.73mg/100g and from 2894.46 to 2901.54mg/100g for Indian almond seed and African walnut respectively. The concentration of tannin in Indian almond seed was significantly higher than its concentration in African walnut seed (t = 357.22, n = 3, α = 0.05). These concentrations were higher than the concentration of 240-627mg/100g, 31-80mg/100g and 72.60mg/100g reported for *Chrysophyllum albidum, Dennettia tripe- tala* and L*agenaria sicerarin* by Umoh [25], Udoessien and Ifon [26] and Dunu *et al*. [27] respectively.

CONCLUSION

The concentrations of the toxicants in the two fruits were found to be significantly different from each other. The observed concentrations of tannin, oxalate and hydrogen cyanide are not alarming when compared with their respective concentration in some fruits that can be eaten raw. However, the concentrations of phytic acid in these fruits are relatively higher than values reported for other fruits.

In spite of the presence of some toxicants in the seeds of Indian almond fruit and African walnut fruit, the consumption of these fruits should not be discouraged due to their nutritional significant. However, it may be necessary to adopt processing techniques that can reliably reduce the level of toxicant in these fruits.

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