Proximate, Minerals and Fatty Acids Composition of African Star Apple Seed (*Chrysophyllum albidum*)

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Introduction

Fruits are parts of the seed bearing structure of a flowering plant and they are usually from matured ovary (Ihenkoronye and Ngoddy, 1985). Fruits play an important role in the diet as they contain virtually all the classes of nutrients and their appealing taste and aroma have increased their acceptability in the diet. African star apple (*Chrysophyllum albidum* Linn) belongs to the family *Sapotaceae*. It is primarily a forest tree species and its natural occurrence has been reported in diverse economics in Nigeria, Uganda, Niger Republic and Cameroon (Bada, 1997). This study therefore aims at investigating the proximate, minerals and fatty acids composition of African star apple seeds. It is expected to provide additional information to the composition of food ingredients.

Materials and Methods

African star apple fruits were plucked from trees at Igbo-Aso farm in Ado-Ekiti, Ekiti State, Nigeria. The fruits were cut open longitudinally to remove the seeds. The seeds were screened to remove the defective ones. The viable seeds were deshelled, dried, ground and stored in a dry, cool place prior to analysis.The proximate analysis of the samples for moisture, crude fibre and total ash were carried out following the methods described by AOAC (2005). The crude fat was extracted with a chloroform / methanol (2:1) mixture using Soxhlet extraction apparatus as described by the AOAC methods. The micro-Kjeldahl method as described by Pearson (1976) was followed to determine the crude protein while carbohydrate was determined by difference. The calorific values in kilojoules (kJ) were calculated by multiplying the crude fat, protein and carbohydrate by Atwater factor of 37, 17 and 17, respectively. Proportions of total energy due to fat (PEF), protein (PEP), carbohydrate (PEC) and the utilizable energy due to protein (UEDP) were also calculated. Determinations were in duplicate.

Results and Discussion

Table 2 depicts the mineral safety index (MSI) of *Chrysophyllum albidum*. The standard MSI for the elements are; Na (4.8), Mg (15), P (10), Ca (10), Fe, (6.7), Cu (33) and Zn (33). For example, the recommended adult intake (RAI) of Na is 500 mg and the minimum toxic dose (MTD) is 2400 mg or 4.8 times the recommended daily average (RDA) (Hathcock, 1985). This is equivalent to the standard (or table) MSI of Na. This applies to other minerals whose MSI are determined. The difference between the standard and calculated MSI values (TV – CV) was positive for all the minerals except Zn which was negative. The positive (TV – CV) value reported for Na (4.58) implies that the body might not be overloaded with Na, therefore, the risk of secondary hypertension would be avoided. Also the TV – CV value for Ca (9.87) fell within the USRDA (Hathcock, 1985). The calculated MSI for Zn was higher than the table MSI. High doses of zinc can decrease the amount of high density lipoprotein (HDL) circulating in the blood, hence, increasing the risk of heart disease and excess Zn interacts with other minerals such as Cu and Fe, decreasing their absorption (Adeyeye, 2014).

The percent levels of various fatty acids in *Chrysophyllum albidum* are revealed in Table 3. Also, summary of the acids into saturated fatty acid (SFA), monounsaturated fatty acid (MUFA) and polyunsaturated fatty acid (PUFA) is presented in Table 4. In this report, the saturated fatty acids (SFA) were lauric acid (12:0), Myristic acid (14:0), palmitic acid (16:0), stearic acid (18:0), arachidic acid (20:0), behenic acid (22:0) and lignoceric acid (24:0). The most concentrated SFA was myristic acid (12:5%) whereas lignoceric acid had the lowest among the SFA with the value of 2.60%. The value of SFA (41.9%) in this report was far above 19.0 – 23.4% reported raw groundnut seeds (Adeyeye and Agesin, 2012) and 18.7 – 19.3% reported for various anatomical parts of bambara groundnut (Adeyeye *et al*., 2015). It is note worthy that SFA constitute at least 50% of the membranes giving our cells necessary stiffness and integrity; for calcium to be incorporated into the skeletal structure, at least 50% of the dietary fats should be saturated (Watkins *et al*., 1996). Among the monounsaturated fatty acids (MUFA) determined, palmitoleic acid had the highest concentration (9.35%) while oleic acid (1.09%) recorded the lowest concentration.

The total MUFA (14.9%) in this sample was much higher than the average value (2.83%) reported for six varieties of delulled African yam been flour (Adeyeye *et al*., 1999) but comparatively lower than 34.5 – 50.4% reported for bambara groundnut seed parts (Adeyeye *et al*., 2015). The MUFA /SFA in this study was 0.356. The relative proportion of SFA to MUFA is an important aspect of phospholipid compositions and changes to this ratio have been claimed to have effects on cardio vascular disease, obesity, diabetes, neuropathological condition and cancer (Christie, 2011). The polyunsaturated fatty acids (PUFA) of concern in this study were linoleic and α – linolenic acid with total value of 9.93%. Linoleic (n-6) and α – linolenic (n-3) fatty acids are the most important essential fatty acids required for growth, physiological functions and body maintenance (Salunkhe *et al*., 1985).

Table 1: Proximate composition (g/100g) of African star apple seed

Parameter	Composition (g/100g)
Moisture content	12.0 ± 0.38
Total ash	14 .3 ± 0.11

Crude fat	19.7 ± 0.13
Crude protein	13.1 ± 0.06
Crude fibre	3.0 ± 0.09
Carbohydrate	38.9 ± 0.12

Table 2: Mineral safety index (MSI) of African star apple seed

Minerals	TV	CV	D	%D
Sodium	4.80	0.223	4.58	95.4
Calcium	10.0	0.128	9.87	98.7
Magnesium	15.0	1.32	13.7	91.2
Zinc	33.0	42.7	-9.7	-29.4
Iron	6.70	4.33	2.37	35.4
Copper	33.0	5.83	27.2	82.3
Phosphorus	10.0	0.273	9.73	97.3

Table 3: Fatty acid composition of African star apple seed (% total fatty acid)

Fatty acid	%
Lauric acid	7.64 ± 0.31
Myristic acid	12.5 ± 0.18
Palmitic acid	6.13 ± 0.25
Stearic acid	4.10 ± 0.16
Arachidic acid	3.40 ± 0.18
Behenic acid	5.55 ± 0.53
Lignoceric acid	2.60 ± 0.08
Palmitoleic acid	9.35 ± 0.38
Oleic acid	1.09 ± 0.19
Erucic acid	4.42 ± 0.66
Linoleic acid	3.20 ± 0.23
α-linolenic acid	6.73 ± 0.76

Table 4: Summary of Table 5 into saturated, monounsaturated and polyunsaturated fatty acids

Fatty acid	Composition
SFA	41.9
MUFA	14.9
PUFA	9.93
MUFA/SFA	0.356
PUFA/SFA	0.237
2n-6/3n-3	0.475

SFA = saturated fatty acid, MUFA = monounsaturated fatty acid, PUFA = polyunsaturated fatty acid

Conclusion

This study has presented the proximate, minerals and fatty acids compositions of *Chrysophyllum albidum*. The results of proximate composition showed high level of fat and carbohydrate. The study showed that the sample is low in minerals especially the essential minerals and the results of fatty acid revealed that *Chrysophyllum albidum* is composed mainly of saturated fatty acid and the concentration of omega-3fatty acid was higher than omega-6 fatty acid. This work therefore will serve as baseline information for further work.

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