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The Effect of Processing Time on the Proximate and Phytochemical Composition of *Detarium microcarpum* (OFOR) Seeds

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Abstract:
Detarium microcarpum (ofor) seeds were analyzed to ascertain the effect of soaking and boiling time on its proximate and phytochemical compositions, using standard methods of AOAC (2005) and methods described by Okwu (2005) for its phytochemical determination. Results indicated remarkable influence of the two treatments on the proximate and phytochemical compositions of the seeds. The moisture content of the seeds showed significant difference (P<0.05) between the soaking and boiling time intervals, it increases as the treatment time increases, with values ranging from 9.10±0.05 – 10.75±0.20%. The ash, fibre, fat and protein content decreases as treatment time increases at 0.05 level of significance with the control. The phytochemical analysis showed presence of alkaloid, tannin and flavonoid, with saponin and cardiac glycoside absent. There are significant differences (P<0.05) between the phytochemical compositions at difference time interval of the treatment methods. From the result, boiling and soaking at short time frame will help conserve the nutrients and bioactive compounds and thus be recommended.

Keyword: *Proximate, Phytochemical, effect, processing time, Detarium microcarpum*

1. Introduction

In West Africa, a dietary pattern varies and is influence by the vegetation belt. For example, in Northern part of Nigeria, cereals dominate while in the Southern part, legumes, nuts, seeds and starchy roots and tubers are the main food components (Ezueh, 1997). However, processing of the cereals and the starch foods into a form of paste and eaten with soups is the general practice. Among the legumes used in soups mainly for emulsification and stabilization or thickening of soups are *Brachystegia eurycoma* (achi), *Detarium microcarpum* (ofor), *Mucuna sloanei* (ukpo) and *Irvingia gabonensis* (ogbono) each of the soup thickeners differ in species from the others and so have their individual characteristic flavours which they impart to the soups. Foods of plant origin constitute the major source of food for man due to mainly their availability and low cost. The bark of *Detarium microcarpum* tree had diuretic and anti-inflammatory effects and reduces blood glucose levels in diabetic patients (Uhegbu et al, 2009). The seed flour has gelation properties and imparts a gummy texture when used in soups (Uhegbu et al., 2009). Hence, it is equally classified as a food gum. Medicine properties are found in the roots, stems, barks, leaves, and fruits to treat ailments including tuberculosis, meningitis and diarrhea (Uhegbu et al, 2009). Roasting or soaking the seed has nutritional benefits as it increases the content and properties of certain nutrients (Uhegbu et al, 2009). Since majority of West African populace consumes *Detarium microcarpum* using different processing methods, without adequate information on the effect of the processing methods on the proximate and phytochemical composition of the seed. Therefore, this work is designed to ascertain the effect of soaking and boiling time on the proximate and phytochemical compositions of the seed *Detarium microcarpum.*

2. Materials and Methods

2.1. Sample Collection and Preparation

The mature dry seeds of *Detarium microcarpum* seeds (ofor) were purchased from Ekeukwu, Owerri market, Imo State. The seeds were sorted to remove debris and unviable ones. Thereafter, the seeds were divided into three parts; the first part was divided into five sub-portions and soaked at 6, 12, 18, 24 and 30 hours respectively. The second part was also sub-divided into five sub-portions and was boiled at interval of 20, 30, 40, 50 and 60mins. The third part was not treated, it serves as the control. All the samples were sun-dried for 4 days, ground into powder and was stored in a clean air-tight container and labeled separately.

2.2. Proximate Analysis

Standard conventional methods were employed in all the analysis. Crude fat was extracted by soxhlet extraction method with petroleum ether as described by Onwuka (2005). Crude protein was determined by the micro kjeldahl method. Available carbohydrate, crude fibre, ash and moisture contents were determined as described by the Association of Official Analytical chemist (A.O.A.C., 2005).

2.3. Phytochemical Compositions

Alkaloid contents of seeds was determined by quantitative and qualitative methods described by Harbone (1973), tannins were variously determined by the method of Van-Burden and Robinson (1981). Flavonoid value was determined using methods described by Boham and kopai (1994). While saponin was determined using the method of Obadoni and Ochuko (2001)

2.4. Statistical Analysis

All measurements were replicated three times, the means and standard deviation was determined. Analysis of variance (ANOVA) statistical tool was used to determine the differences between the means from the results at $p<0.05$ level of significance.

3. Result and Discussion

Samples	Sample size	% moisture mean ± S. D	% ash mean ± S. D	% fibre mean ± S. D	% fat mean ± S. D	% protein mean ± S. D	% carbohydrate mean ± S. D
A	3	9.10 ± 0.05^{ef}	1.55±0.26bcd	3.20 ± 0.26^{ab}	14.50 ± 0.26^{d}	8.16 ± 0.26^{b}	63.49 ± 0.48^{e}
B	3	9.70 ± 0.10^{d}	1.50±0.25bcd	3.10 ± 0.20^{ab}	13.06 ± 0.26^{e}	7.65 ± 0.26^{c}	64.99 ± 0.05^{d}
C	3	10.05 ± 0.10^{c}	1.30±0.18cde	2.70 ± 0.20^{b}	12.64 ± 0.20^{e}	7.41 ± 0.26^{c}	65.99 ± 0.13^{c}
D	3	10.20 ± 0.05^{bc}	1.25±0.20de	2.50 ± 0.26^{b}	12.20 ± 0.26^{f}	6.75 ± 0.26^{d}	67.10 ± 0.21^{b}
E	3	10.45 ± 0.13^{ab}	1.10±0.20e	2.23 ± 0.26^{b}	11.80 ± 0.26^{f}	6.34 ± 0.20^{d}	68.06 ± 0.45^{a}
F	3	9.30 ± 0.20^{e}	1.80±0.26ab	3.30 ± 0.26^{ab}	15.30 ± 0.26^{ab}	8.89 ± 0.26^{a}	61.41 ± 0.26^{f}
G	3	9.70 ± 0.20^{d}	1.75±0.26ab	3.25 ± 0.26^{ab}	15.06 ± 0.26^{bc}	8.86 ± 0.26^{a}	61.12 ± 0.81^{f}
H	3	10.15 ± 0.20^{bc}	1.70±0.20abc	3.15 ± 0.26^{ab}	14.88 ± 0.26^{bcd}	8.79 ± 0.20^{a}	61.33 ± 0.46^{f}
I	3	10.50 ± 0.36^{ab}	1.60±0.26abcd	3.10 ± 0.26^{ab}	14.60 ± 0.26^{cd}	8.73 ± 0.26^{a}	61.47 ± 0.55^{f}
J	3	10.75 ± 0.20^{a}	1.55±0.20bcd	3.00 ± 0.26^{ab}	14.44 ± 0.26^{d}	8.54 ± 0.26^{a}	61.72 ± 0.10^{f}
K	3	8.90 ± 0.26^{g}	2.00±0.26a	3.42 ± 0.29^{ab}	15.53 ± 0.26^{a}	8.92 ± 0.26^{a}	61.20 ± 0.63^{f}

Table 1: The result for the proximate analysis of pretreated seeds of Detarium microcarpum
Values are mean ± SD

Mean on the same column with different superscripts differ significantly at $p<0.05$ level of significance.

Samples	Tannin	Alkaloid	Flavonoid	Saponin	Cardiac glycoside
A	+	+	+	-	-
B	+	+	+	-	-
C	+	+	+	-	-
D	+	+	+	-	-
E	+	+	+	-	-
F	+	+	+	-	-
G	+	+	+	-	-
H	+	+	+	-	-
I	+	+	+	-	-
J	+	+	+	-	-
K	+	+	+	-	-

Table 2: Result of qualitative phytochemical screening

Sample	Sample size	Alkaloid (%)mean ± S. D	Flavonoid (%)mean ± S. D	Tannin (mg/kg) mean ± S. D
A	3	15.08 ± 0.26^{c}	1.70 ± 0.23^{ab}	116.00 ± 2.65^{b}
B	3	12.06 ± 0.26^{e}	1.47 ± 0.20^{abc}	113.00 ± 2.65^{bc}
C	3	9.04 ± 0.20^{f}	1.05 ± 0.20^{cd}	110.00 ± 2.65^{c}
D	3	7.60 ± 0.26^{g}	0.84 ± 0.26^{d}	87.00 ± 2.65^{d}
E	3	6.02 ± 0.26^{h}	0.66 ± 0.26^{d}	76.00 ± 2.65^{f}
F	3	16.10 ± 0.26^{ab}	1.73 ± 0.26^{ab}	112.00 ± 2.65^{bc}
G	3	15.98 ± 0.26^{ab}	1.64 ± 0.26^{ab}	91.00 ± 2.65^{d}
H	3	15.72 ± 0.26^{b}	1.45 ± 0.26^{abc}	90.00 ± 2.65^{d}
I	3	14.70 ± 0.26^{cd}	1.39 ± 0.26^{abc}	88.00 ± 2.00^{d}
J	3	14.50 ± 0.26^{d}	1.35 ± 0.26^{bc}	79.00 ± 2.65^{f}
K	3	16.26 ± 0.26^{a}	1.85 ± 0.26^{a}	133.00 ± 2.65^{a}

Table 3: Result of Quantitative Phytochemical determination
Values are mean ± SD
Mean on the same column with different superscripts differ significantly at p<0.05 level of significance

4. Discussion

The proximate result shows there is significant differences between the moisture content of the control (8.90%) and the other values of the other samples at different time interval at $p< 0.05$ level of significance. The soaked for 30hrs has the high moisture content than those treated at other different time interval. The moisture content of the seeds increases for the treatment time increases. The high rate of moisture in food substances increases its susceptibility to microorganism spoilage. There is significant difference ($P>0.05$) between the Ash, fibre, fat and protein of the seeds of *Detarium microcarpum*, with the control having the highest value in the four classes of food. The ash content of the treatment seeds is lower to the values reported on *Detarium microcarpum* and other related seeds. *Detarium microcarpum* (3.09%), *Muluna sloanei* (3.46%), *Brachysteria nigerica* (4.07) and *Afeeli africana* (13.51%) as reported by Igwenyi and Azoro (2014). The fibre content at different treatment is significant different ($P>0.05$) from one another, with the sample heated from a longer time having the lowest fibre content. The fibre value is lower to the value reported by Igwenyi and Azoro, (2014) for *Afzelia africana* (3.25%), and similar to the values of *Brachystegia nigerica* (2.63%), *Mucana shoanei* (2.99%) and *Detarium microcarpum* (2.63%), ash content measurement could be a measure of the food quality. The level of ash is an indication of adulteration. Adulteration is the contamination of food product due to inorganic substances present in the food being analyzed (Pearson, 1976; Schrozeler, 1986). While the crude fibre is an inorganic residue left after the defatted food materials have been treated with boiling dilute hydrochloric acid, diluted sulphuric acid, boiling dilute sodium hydroxide, alcohol and ether. Fibre shortens the transit time of food through the gastrointestinal tracts, reduces low density lipoprotein and hence, keeps the gut healthy. Fibre supplements or fibre-rich foods may function as normal dietary agents by modulating the digestive absorptive process (Ejiofor, 1994). They are very important in promoting a range of physiological effects, including increased fetal bulk, water holding capacity, absorption of organic molecules such as bile acids, cholesterol and toxic components (reduced bile acid and plasma-cholesterol levels) reduction of minerals and electrolytes (Igwenyi, 2008).

Crude fat result shows slight increase in the value of *Detarium microcarpum* to the value reported for *Detarium microcarpum* by Igwenyi and Azoro, (2012) which is (12.52%) and other related seeds like *B. nigerica* (7.91%), and *M. sloanei* (6.25%) and is in range with 14.0 – 18.5% reported by Uhegbu et al., (2009). However, lipids are the principal form of stored energy (fat and oils) in most organisms, and major constituents of cellular membranes specialized lipids serves as pigments iretinal, (arotene), cofactors (vitamin K), detergents (bile salts) transporters (dolicholis in bacteria cell wall synthesis), anchosis for membrane proteins (covalently attached fatty acids, phosphatidyl inositol etc.). (Voet and Voet, 2004; Nelson and Cox, 2005). The crude protein value is lower in all the samples at different treatment time than that reported by Igwenyi and Azoro (2014) for *Detarium microcarpum* which is (12.49%) and other related soup thickeners like *Afzelia african* (13.29%, *Brachystegia nigerica* (14.45%) and *Mucana sloanei* (12.52%). The carbohydrate content is in line with the work of Ejiofor who explained that defatted flour of some of these seeds like *Irvigina gabonesis* are still acceptable in terms of its colour, taste, texture, and availability after a period of time in ambient conditions, and is more viscous with greater emulsifying properties than undefatted flour (Ejiofor, 1994) and also in line with the values reported by Igwenyi and Azoro, (2014). Phytochemical screening carried out show the presence of tannin, alkaloid and flavonoid and absence of saponin and glycoside. There is significant different between the control and the treated samples at 0.05 level of significance. The alkaloid value was highest at the sample boiled at 20mins as well as the control. The sample boiled for 30mins appeared to be the lowest, which is lower than the value (61.78mg/100g) reported for *Detarium microcarpum* (Igwenyi and Azoro, 2014). *Afzelia africana* (59.63mg/100g), *B. nigerica* (73.58mg/100g) and *M. Sloanei* (165.85mg/100g). The flavonoid result shows significant different at 0.05 level of significant between the control and the treated samples, with the control having the highest value of (1.85±0.35%) which is lower than the value reported by (Iqwenyi and Azoro, 2014) for *Detarium microcarpum* which is (41.89mg/100g) and also lower compared to the value reported for *B. nigerica* (6.17mg/100g), *M. sloanei* (163.93mg/100g) and *A. africana* (9.75mg/100g). Flavonoids are most known for their antioxidant properties. However, it is now known that the health benefits they provide against cancer and heart disease are the result of other mechanism (Veridis et al., 2007). The tannin value is highest in the control and also at the sample boiled for 20mins. The samples treated by boiling tend to contain higher tannin content than that soaked. Tannins are known to possess health benefits wherein they are 15-30 times more efficient in free radical quenching activity than trilox and other simple phenolics (Hurrel et al., 1999).

5. Conclusion

The different processing methods affected *Detarium microcarpum* in different ways. The processing methods affected the concentrations of the proximate compositions and also the phytochemical. These reduce the anti-nutritive factors, making the nutrients more readily to be absorbed. From the result, the cooking tends to have less adverse effect on the compositions than soaking, so it is advised to process through cooking than soaking.

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