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Nutrient Composition and Effect of Seed Extracts of African Black Pear (*Darcryodes edulis*) on Rats

[1]H.O.T. Iyawe, [1]V.E. Osagie, [1]A. Esekheigbe and [2]M.C. Azih
[1]Department of Biochemistry, [2]Department of Chemistry, Ambrose Alli University,
P.M.B. 14, Ekpoma, Edo State, Nigeria

Abstract: This research was designed to determine some of the nutrient composition (%w/w) of the African black pear using standard procedures and the effect the seed extracts may have on some blood constituents of rats. The seeds of three types of African black pear categorized as Small (S), Medium (M) and Large (L) on the basis of their body weights were investigated. The seeds were found to vary significantly ($p<0.05$) in moisture, dry matter and in lipid contents among the three types. Total carbohydrates in the samples were high [(50.74±1.29) for S; (50.97±0.54) for M and (49.21±0.23) for L], but did not differ ($p>0.05$) from each type examined. Protein contents of the seeds were low [Small (3.80±0.11); Medium (3.67±0.06) and Large (3.64±0.08)], while starch contents in the three types of seeds under study were high [40.96±0.09; 40.88±0.05; 40.92±0.07 for Small, Medium and Large, respectively]. Aqueous extract of the seeds administered to rats reduced ($p<0.05$) white blood cells count to $(1.14\pm0.01)\times10^{3}$ mm^{-1} from $(4.65\pm0.43)\times10^{3}$ mm^{-1} (control). Ethanolic extract reduced ($p<0.05$) serum cholesterol level (50.10±4.50) mg L^{-1} as against control (70.60±0.30) mg L^{-1} and the group that received water extract (68.85±1.25) mg L^{-1}. These novel findings suggest that the seeds of African black pear could be harnessed for their high starch content and cholesterol lowering potentials.

Key words: Nutrient composition (*D. edulis*), extracts of *D. edulis*, cholesterol, white blood cells.

INTRODUCTION

The African black pear (*Darcryodes edulis*) also called African plum or bush butter is an indigenous fruit tree of tropical Africa. When in season, the fruit pulp constitutes an important and much cherished local delicacy. It is consumed after tenderizing the fresh fruit by either dipping it in hot water or in hot ash and consumed with or without corn in Nigeria. There are several studies on African pear that focus mainly on the composition of the edible fruit pulp that constitutes the mainstay of the economic value of the fruit (Eka, 1979; Omoti and Okiy, 1987).

The seeds of African pear are usually discarded after consuming the edible fruit pulp. The seeds of African pear have been reported to be of considerable nutritional value, lacking toxins and have been suggested to be useful as supplement in animal feed (Obasi and Okolie, 1993).

There is a growing research interest in tapping valuable potentials that may be inherent in plants and plant seeds and as such, many plant materials have become more useful to man as a result. However, there are many plant materials that have not been adequately exploited and the seeds of African black pear (*D. edulis*) represent a common example. It is against this background that this study was designed, with the aim of determining the effect of African pear seed extracts on the blood chemistry of rats, as there are no such data in literature, in addition to enrich existing information on the nutrient composition of the pear seeds.

MATERIALS AND METHODS

Nutrient composition: Total carbohydrate was determined by the method of Dubois *et al.* (1956). Protein (Micro-Kjeldahl x 6.25), fat (Solvent extraction), ash, crude fibre and moisture were determined by the AOAC methods (1990). Starch was determined by the method of Ramnik-Sood (1990) and modified for this study as follows: The plant sample (0.5 g) was solubilized by grinding with mortar and pestle. The resulting mixture was made up to 50 mL and heated in a boiling water bath for 10 min, after which 0.5 mL of the extract was developed with 1 mL of 0.01 N iodine solution and absorbance taken at 660 nm. The actual starch contents in the seeds were extrapolated from a calibration curve prepared from serial dilutions of standard starch solution. Total soluble sugars were

Corresponding Author: H.O.T. Iyawe, Department of Biochemistry, Ambrose Alli University, P.M.B. 14, Ekpoma, Edo State, Nigeria

extracted with 80% warm ethanol (Southgate, 1969) and quantified by phenolsulphuric acid procedure of Dubois *et al.* (1956).

Experimental animals: Twenty-seven male Wistar strain albino rats weighing 50-75 g were used in this experiment. The animals were bred and obtained from the animal house unit of Ambrose Alli University College of Medicine with permission to employ the subjects in the study. The animals were observed for seven days for any sign of ill health. The rats were divided into three groups of nine rats. Group A served as control; Group B received cold water extract of African pear seed and Group C was administered ethanolic extract of the seed. Subjects were allowed free accesses to standard feed (Grower's mash from Bendel Feeds and Flour Mills Ltd.) and water *ad libitum*. At the end of the experiment, blood was collected from the tail vein into heparinized sample tubes and used as required.

Preparations and administration of extracts: Matured and ripe fruits of *D. edulis* were collected from three different trees and the specimen identified and authenticated in Botany Department of the University. The seeds were removed and oven dried at 60°C for 48 h to obtain constant weight. The samples were pulverized and filtered to pass through a 0.5 mm sieve. Twenty grammes of the sample were soaked overnight with equal volumes of cold water and 80% ethanol, respectively. The resulting solutions were filtered and refrigerated. One milliliter of each extract was administered intraperitoneally to rats in the respective group on a daily basis for twenty-eight days.

Biochemical and Haematological assays: Haemoglobin (Hb) was estimated by the standard cyanomethaemoglobin method. Packed Cell Volume (PCV) was determined by transferring fresh blood into a plain capillary tube to about two third of its volume. The tube is then sealed by gas flame and centrifuged for 5 min at 4,800 rpm after which the percentage of blood PCV is obtained using a haematocrit reader. The activities of plasma alanine aminotransferase (ALT), aspartate aminotransferase (AST), gamma glutamyltransferase (GGT) and glucose, total protein albumin, cholesterol and triglycerides were estimated using Randox analytical kits (Randox, UK).

Statistical analysis: Data collected from this experiment were subjected to analysis of variance (ANOVA) using computer software (InStat Graphpad software, SanDiego, CA). $p<0.05$ was considered significant and differences between means were separated by Tukey-Kramer multiple comparison test.

RESULTS AND DISCUSSION

The three types of *D. edulis* studied showed small but significant difference ($p<0.05$) in moisture, dry matter, lipids, total soluble sugar and crude fibre (Table 1). The seed extracts did not show any significant difference ($p>0.05$) on some haematological and lipid profile of rats, with White Blood Counts (WBC) and cholesterol levels being exceptions (Tables 2 and 3).

Results of the proximate composition of the three types of *D. edulis* seeds are presented (Table 1). Small but significant differences were found in moisture, dry matter, lipids and crude fibre contents. The values reported in this work are lower than that previously reported (Obasi and Okolie, 1993) with the exception of total carbohydrates. The high total carbohydrate content of the seeds is mostly due to starch which constitutes 62.12-65.38% of the seed dry matter. The high starch content is comparable to those reported for African yam beans (Azeke, 2003). Crude protein in the samples studied were low, ranging from 3.64-3.80 g/100 g sample. This result did not agree with an earlier reported value (338±4.38 g kg^{-1}) for the seed of *D. edulis* (Obasi and

Table 1: Percentage composition (%w/w) of African black pear seeds nutrients

Parameters	Small	Medium	Large
Moisture	34.07±0.04^a	37.47±0.48^b	39.95±0.02^c
Dry matter	65.94±0.06	62.53±0.54	60.05±0.02^c
Total carbohydrate	50.74±1.29	50.97±0.83	49.21±0.23
Crude protein	3.80±0.11	3.67±0.06	3.64±0.08
Lipids	7.91±0.18^a	4.78±0.20^b	6.01±0.04^c
Ash	1.22±00	1.30±00	1.37±00
Crude fibre	4.49±0.10^a	4.38±0.20^a	2.17±0.05^b
Starch	40.96±0.09	40.88±0.05	40.92±0.07
Total soluble sugar	5.29±0.23^a	5.74±0.14^b	6.12±0.44^c

Results presented are Mean±SEM of triplicate determinations; Values on same row with different superscripts are significantly different

Table 2: Effect of *D. edulis* extracts on some haematological properties of rat blood

Parameters	Control	Water extract	Ethanolic extract
Glucose (mmol L^{-1})	5.70±0.10	5.55±0.35	5.70±0.30
Haemoglobin (g dL^{-1})	11.00±1.00	11.50±0.17	11.84±0.23
Packed cell volume (%)	33.00±3.00	34.50±0.50	35.50±0.50
Total protein (g L^{-1})	67.50±0.50	67.60±0.40	68.55±0.45
Albumin (g L^{-1})	41.00±1.00	42.05±0.05	43.55±1.55
WBC (10^3 mm^{-1})	4.65±0.43**	1.14±0.01*	3.42±0.43**
Total bilirubin (mg L^{-1})	1.85±0.15	2.55±0.25	2.25±0.25
Direct bilirubin (mg L^{-1})	0.70±0.20	0.85±0.05	0.70±0.20
Indirect bilirubin (mg L^{-1})	1.15±0.35	1.70±0.20	1.55±0.05
Globulin (g L^{-1})	26.50±1.50	25.55±0.45	25.00±2.00

Results presented are Mean±SEM of triplicate determinations; Values on same row with different superscripts are significantly different ($p<0.05$); n = 27

Table 3: Effect of *D. edulis* extracts on some enzyme activities and lipid status of rat blood

Parameters	Control	Water extract	Ethanolic extract
Aspartate aminotransferase (U L^{-1})	23.66±0.16	23.18±0.18	23.06±0.39
Alanine aminotransferase (U L^{-1})	25.33±0.03	26.63±0.50	25.29±0.07
High density lipoprotein (mmol L^{-1})	6.61±0.47	6.20±0.43	5.14±0.58
Cholesterol (mg L^{-1})	70.60±0.30*	68.85±1.25*	50.10±4.50**
Triacylglycerides (mg L^{-1})	42.20±3.11	56.50±4.10	50.60±5.80

Results presented are Mean±SEM of triplicate determinations; Values on same row with different superscripts are significantly different ($p<0.05$); n = 27

Okolie, 1993). Several assays were conducted to authenticate the protein estimate in samples under investigation that appear to suggest a different trend. Our results were confirmed by the reproducibility test with coefficient of variation (2.43%; n = 9). The low protein contents in the seeds appear to follow the trend reported for other plum-type fruits (Mbofung *et al*., 2002).

Food materials are evaluated mainly on their energy, protein and vitamin contents. In developing countries food are mostly not limiting in carbohydrates but in protein content. It is the latter that determines the viability of such material as a possible ingredient in the formulation of rations and this factor is limiting in the seeds of *D. edulis*. The samples may not be referred to as oil seeds as the lipid contents found in this study are low, in contrast with the high lipid values reported for the pulp of the fruit (Omoti and Okiy, 1987). This observed discrepancy may be related to the status of the seed as the site of lipid synthesis while the pulp is mainly repository. The low ash and fibre contents may respectively suggest poor mineral and high digestibility potentials for the seeds.

The reduction ($p<0.05$) of White Blood Cell (WBC) counts (Table 2) and cholesterol (Table 3) in rats administered water and ethanolic extracts respectively are indications that the water-soluble components of the seeds may negatively affect the lymphoid tissue responsible for the formation of antibodies in the rats, thereby predisposing the organism to feasible serious health problem resulting from the inability to fight infection. It is known that resistance to microbial infection is reduced by any factor that interferes with the formation, maturation and release into circulation of white blood cells (Neil and Keele, 1979). Ethanol appears not to have effectively extracted the active agent responsible for reduction in WBC count as evidenced by the insignificant reduction ($p>0.05$) observed with the ethanolic extract. The reduction ($p<0.05$) of cholesterol level in rats administered the ethanolic extract suggests the presence of an agent that is antagonistic to either cholesterol synthesis or cholesterol, or both in the rats. This observation is worthwhile as cholesterol overload is undesirable in animals owing to the lack of a storage site for it. Conclusively, these findings showing the seeds of *D. edulis* as a repository for starch and containing aqueous and ethanol-soluble agents that affect WBC and cholesterol level in rats blood are novel.

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