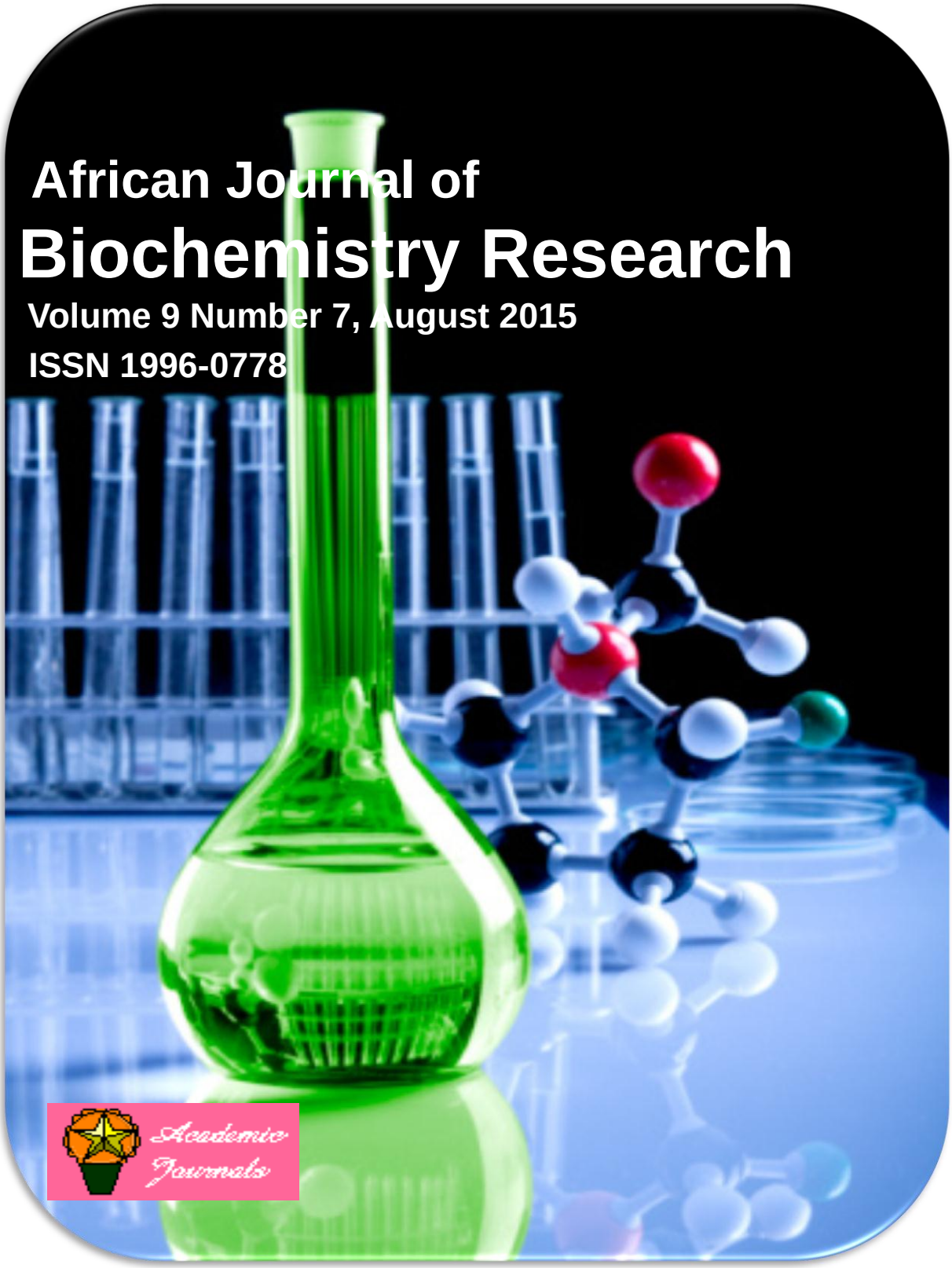


African Journal of Biochemistry Research

Volume 9 Number 7, August 2015
ISSN 1996-0778

Academic Journals

ABOUT AJBR

The **African Journal of Biochemistry Research (AJBR)** (ISSN 1996-0778) is published Monthly (one volume per year) by Academic Journals.

African Journal of Biochemistry Research (AJBR) provides rapid publication (monthly) of articles in all areas of Biochemistry such as Nutritional biochemistry, Analytical biochemistry, Clinical Biochemistry, Human and Plant Genetics, Molecular and Cell Biology, Enzymology, Toxicology, Plant Biochemistry, Biochemistry Education etc. The Journal welcomes the submission of manuscripts that meet the general criteria of significance and scientific excellence. Papers will be published shortly after acceptance. All articles are peer-reviewed.

Submission of Manuscript

Please read the **Instructions for Authors** before submitting your manuscript. The manuscript files should be given the last name of the first author

Click here to Submit manuscripts online

If you have any difficulty using the online submission system, kindly submit via this email ajbr@academicjournals.org.

With questions or concerns, please contact the Editorial Office at ajbr@academicjournals.org.

Editorial Board

Dr. Saad Tayyab
Institute of Biological Sciences,
University of Malaya,
50603 Kuala Lumpur,
Malaysia

Dr. Shijun Fu
Institute of Health Sciences,
Shanghai Institutes for Biological Sciences,
Chinese Academy of Sciences and Shanghai Jiao
Tong University School of Medicine, Shanghai,
P. R. China

Dr. Shiming Zhang
Weis Center for Research,
Geisinger Clinic,
Danville, Pennsylvania,
USA

Dr. Thomas Efferth
Department of Pharmaceutical Biology,
Institute of Pharmacy and Biochemistry,
University of Mainz, Heidelberg,
55128 Mainz,
Germany

Instructions for Author

Electronic submission of manuscripts is strongly encouraged, provided that the text, tables, and figures are included in a single Microsoft Word file (preferably in Arial font).

The **cover letter** should include the corresponding author's full address and telephone/fax numbers and should be in an e-mail message sent to the Editor, with the file, whose name should begin with the first author's surname, as an attachment.

Article Types
Three types of manuscripts may be submitted:

Regular articles: These should describe new and carefully confirmed findings, and experimental procedures should be given in sufficient detail for others to verify the work. The length of a full paper should be the minimum required to describe and interpret the work clearly.
Short Communications: A Short Communication is suitable for recording the results of complete small investigations or giving details of new models or hypotheses, innovative methods, techniques or apparatus. The style of main sections need not conform to that of full-length papers. Short communications are 2 to 4 printed pages (about 6 to 12 manuscript pages) in length.

Reviews: Submissions of reviews and perspectives covering topics of current interest are welcome and encouraged. Reviews should be concise and no longer than 4-6 printed pages (about 12 to 18 manuscript pages). Reviews are also peer-reviewed.

Review Process

All manuscripts are reviewed by an editor and members of the Editorial Board or qualified outside reviewers. Authors cannot nominate reviewers. Only reviewers randomly selected from our database with specialization in the subject area will be contacted to evaluate the manuscripts. The process will be blind review.
Decisions will be made as rapidly as possible, and the journal strives to return reviewers' comments to authors as fast as possible. The editorial board will re-review manuscripts that are accepted pending revision. It is the goal of the AJFS to publish manuscripts within weeks after submission.

Regular articles

All portions of the manuscript must be typed double-spaced and all pages numbered starting from the title page.

The Title should be a brief phrase describing the contents of the paper. The Title Page should include the authors' full names and affiliations, the name of the corresponding author along with phone, fax and E-mail information. Present addresses of authors should appear as a footnote.

The Abstract should be informative and completely self-explanatory, briefly present the topic, state the scope of the experiments, indicate significant data, and point out major findings and conclusions. The Abstract should be 100 to 200 words in length.. Complete sentences, active verbs, and the third person should be used, and the abstract should be written in the past tense. Standard nomenclature should be used and abbreviations should be avoided. No literature should be cited.
Following the abstract, about 3 to 10 key words that will provide indexing references should be listed.

A list of non-standard **Abbreviations** should be added. In general, non-standard abbreviations should be used only when the full term is very long and used often. Each abbreviation should be spelled out and introduced in parentheses the first time it is used in the text. Only recommended SI units should be used. Authors should use the solidus presentation (mg/ml). Standard abbreviations (such as ATP and DNA) need not be defined.

The Introduction should provide a clear statement of the problem, the relevant literature on the subject, and the proposed approach or solution. It should be understandable to colleagues from a broad range of scientific disciplines.

Materials and methods should be complete enough to allow experiments to be reproduced. However, only truly new procedures should be described in detail; previously published procedures should be cited, and important modifications of published procedures should be mentioned briefly. Capitalize trade names and include the manufacturer's name and address. Subheadings should be used. Methods in general use need not be described in detail.

Results should be presented with clarity and precision. The results should be written in the past tense when describing findings in the authors' experiments. Previously published findings should be written in the present tense. Results should be explained, but largely without referring to the literature. Discussion, speculation and detailed interpretation of data should not be included in the Results but should be put into the Discussion section.

The Discussion should interpret the findings in view of the results obtained in this and in past studies on this topic. State the conclusions in a few sentences at the end of the paper. The Results and Discussion sections can include subheadings, and when appropriate, both sections can be combined.

The Acknowledgments of people, grants, funds, etc should be brief.

Tables should be kept to a minimum and be designed to be as simple as possible. Tables are to be typed double-spaced throughout, including headings and footnotes. Each table should be on a separate page, numbered consecutively in Arabic numerals and supplied with a heading and a legend. Tables should be self-explanatory without reference to the text. The details of the methods used in the experiments should preferably be described in the legend instead of in the text. The same data should not be presented in both table and graph form or repeated in the text.

Figure legends should be typed in numerical order on a separate sheet. Graphics should be prepared using applications capable of generating high resolution GIF, TIFF, JPEG or Powerpoint before pasting in the Microsoft Word manuscript file. Tables should be prepared in Microsoft Word. Use Arabic numerals to designate figures and upper case letters for their parts (Figure 1). Begin each legend with a title and include sufficient description so that the figure is understandable without reading the text of the manuscript. Information given in legends should not be repeated in the text.

References: In the text, a reference identified by means of an author‘s name should be followed by the date of the reference in parentheses. When there are more than two authors, only the first author‘s name should be mentioned, followed by ’et al‘. In the event that an author cited has had two or more works published during the same year, the reference, both in the text and in the reference list, should be identified by a lower case letter like ’a‘ and ’b‘ after the date to distinguish the works.

Examples:

Abayomi (2000), Agindotan et al. (2003), (Kelebeni, 1983), (Usman and Smith, 1992), (Chege, 1998; 1987a,b; Tijani, 1993,1995), (Kumasi et al., 2001)
References should be listed at the end of the paper in alphabetical order. Articles in preparation or articles submitted for publication, unpublished observations, personal communications, etc. should not be included in the reference list but should only be mentioned in the article text (e.g., A. Kingori, University of Nairobi, Kenya, personal communication). Journal names are abbreviated according to Chemical Abstracts. Authors are fully responsible for the accuracy of the references.

Examples:

Chikere CB, Omoni VT and Chikere BO (2008). Distribution of potential nosocomial pathogens in a hospital environment. Afr. J. Biotechnol. 7: 3535-3539.

Moran GJ, Amii RN, Abrahamian FM, Talan DA (2005). Methicillinresistant Staphylococcus aureus in community-acquired skin infections. Emerg. Infect. Dis. 11: 928-930.

Pitout JDD, Church DL, Gregson DB, Chow BL, McCracken M, Mulvey M, Laupland KB (2007). Molecular epidemiology of CTXM-producing Escherichia coli in the Calgary Health Region: emergence of CTX-M-15-producing isolates. Antimicrob. Agents Chemother. 51: 1281-1286.

Pelczar JR, Harley JP, Klein DA (1993). Microbiology: Concepts and Applications. McGraw-Hill Inc., New York, pp. 591-603.

Short Communications

Short Communications are limited to a maximum of two figures and one table. They should present a complete study that is more limited in scope than is found in full-length papers. The items of manuscript preparation listed above apply to Short Communications with the following differences: (1) Abstracts are limited to 100 words; (2) instead of a separate Materials and Methods section, experimental procedures may be incorporated into Figure Legends and Table footnotes; (3) Results and Discussion should be combined into a single section.
Proofs and Reprints: Electronic proofs will be sent (e-mail attachment) to the corresponding author as a PDF file. Page proofs are considered to be the final version of the manuscript. With the exception of typographical or minor clerical errors, no changes will be made in the manuscript at the proof stage.

Fees and Charges: Authors are required to pay a $550 handling fee. Publication of an article in the African Journal of Biochemistry Research is not contingent upon the author's ability to pay the charges. Neither is acceptance to pay the handling fee a guarantee that the paper will be accepted for publication. Authors may still request (in advance) that the editorial office waive some of the handling fee under special circumstances

Submission of a manuscript implies: that the work described has not been published before (except in the form of an abstract or as part of a published lecture, or thesis) that it is not under consideration for publication elsewhere; that if and when the manuscript is accepted for publication, the authors agree to automatic transfer of the copyright to the publisher.

African Journal of Biochemistry Research

Table of Contents: Volume 9 Number 7, August 2015

ARTICLES

Research Articles:

academicJournals

Vol. 9(7), pp. 89-94, August, 2015
DOI: 10.5897/AJBR2015.0847
Article Number: 9B18A7654708
ISSN 1996-0778

http://www.academicjournals.org/AJBR

African Journal of Biochemistry Research

Full Length Research Paper

Effect of fermentation methods on the mineral, amino and fatty acids composition of *Cyperus esculentus*

Agbaje, R. B.[1]*, Oyetayo, V. O.[2] and Ojokoh, A. O.[2]

Department of Food Science and Technology Rufus Giwa Polytechnic, Owo, P. M. B 1019 Owo, Ondo State, Nigeria.
Department of Microbiology, Federal University of Technology, P. M. B 704, Akure, Ondo State, Nigeria.

Received 9 June, 2015; Accepted August 10, 2015

Tiger nut (*Cyperus esculentus*) was subjected to different fermentation methods such as traditional, back slope and control. The raw and fermented samples were analyzed for mineral, amino and fatty acids. The results of mineral analysis revealed potassium and sodium as the most abundant mineral element with their value ranging from 546 to 91.6 mg/100 g and 64.00 to 3383.33 mg/100 g, respectively while copper was found in trace amount with value ranging from 0.03 mg/100 g to 0.05 mg/100 g. All the fermented samples shows significant increase in calcium ranging from 8.50 to 9.83 mg/100 g compared to raw samples (7.66 mg/100 g). Amino acid result showed arginine (23.02 g/100 g) as the most abundant amino acid present in back slope fermented tiger nut while tyrosine was the least amino acid (0.05 g/100 g). The oil in tiger nut showed a greater percentage of oleic acid (73.08%) which was recorded in back slope fermented milled sample. The overall result of the investigation revealed that back slope fermentation was the best method that may enhance mineral, amino and fatty acids content of tiger nut.

Key words: Tiger nut, mineral, amino acid, fatty acid, fermentation.

INTRODUCTION

Tiger nut (*Cyperus esculentus* var. sativa) is an under-utilized crop which belongs to the division magnoliophyta and was found to be a cosmopolitan perennial crop of the same genus as the papyrus plant (Odoemelan, 2003; Belewu and Belewu, 2007). Despite its name, tiger nut is a tuber. However, its chemical composition shares characteristics with tubers and nuts (Umerie et al., 1997). The tubers are spherical in shape and edible.

There are varieties of tiger nuts readily available in the market, which are brown and yellow varieties. The yellow variety is preferred to all other variety because of its inherent properties such as larger size, attractive colour and fleshy body. The yellow variety is also reported to yield more soluble extracts, contains lower fat more protein and possesses less anti-nutritional factors (Okafor et al., 2003). Its tubers can be eaten raw, roasted with sugar, soaked in water or processed into starch and flour (Oladele and Aina, 2007; Cortes et al., 2005). It can be processed into a milky beverage called “Horchata de Chufa” in Spain or “Atadwe” milk in Ghana (Rita, 2009).

*Corresponding author. E-mail: bukola.agbaje@yahoo.com. Tel: +2348034956833.

In Nigeria, tiger nut is well grown and available in semi-dried form in Nigerian markets where it is sold locally and consumed uncooked (Omode et al., 1995).

Tiger nut have long been recognized to contain almost twice the quantity of starch as potato or sweet potato tubers. This tuber is a good source of energy (carbohydrate, fibre and protein), minerals (mainly phosphorus and potassium), and vitamins E and C (Arafat et al., 2009).

Processing techniques such as boiling, roasting, fermentation and germination are means of improving the nutritional value of foods (Nergiz and Gokgoz, 2007). Although little study have been carried out on the effect of fermentation on the nutritional composition of tiger nut. It is therefore important to investigate the effect of different fermentation methods on the mineral, amino and fatty acids content of tiger nut. Therefore, this research was conducted to determine the effect of fermentation methods on mineral, amino and fatty acid contents of *Cyperus esculentus*.

MATERIALS AND METHODS

Source of tiger nut

Raw tiger nut were purchased from Adedeji market in Akure, Ondo State, Nigeria. The nuts were stored in the laboratory till the second day when they were sorted, weighed and washed.

Processing of tiger nut

The sorted and washed nut were divided into six portions designated A to F. Each of the portion contained 500 g of cleaned tiger nut. Part A was analyzed raw and this serves as control. Part B was fermented whole that is, submerged in 1500 ml of portable water in a cleaned container that was covered for four days at 25°C and allowed to ferment with indigenous micro flora (spontaneous). C was milled and subjected to spontaneous fermentation. Part D and E were fermented by addition of the steep water from the previously fermented culture used as starter culture (back slope) but part E was milled before fermentation while F was allowed to undergo control fermentation, in which pure culture of *Lactobaccilus plantarum* isolated in part B was used to inoculate the sixth part F. The fermented nuts were dried in oven at 50°C for 24 h and dry milled to powder using attrition mill. The milled samples were packaged in polythene prior to analysis.

Chemical analysis

Mineral analysis

The mineral composition (potassium, sodium, calcium, magnesium, zinc, iron and copper) of each sample was determined by wet ashing method followed by reading of the level of mineral. Triplicate samples of 1 g each were weighed into porcelain crucibles and placed in a muffle furnace. The temperature was raised gradually to 450°C. The sample was ashed at 450°C for 5-6 h. After cooling to room temperature, the ash was dissolved in 1 ml of 0.5% HNO_3. The sample volume was brought to 100 ml, and the levels of mineral present were analyzed by Atomic absorption spectrophotometer Buck 201 VGP. The mineral content was calculated using the formula below.

$$\text{Mineral (mg/100 g)} = \frac{R \times V \times D}{Wt}$$

Where, R = Solution concentration obtained from graph, V = Volume of sample digest, D = Dilution factor and Wt = Weight of sample. Sodium (Na) and K were analyzed using flame photometer (Perkin-Elmer, 1982).

Amino acid determination

Amino acid composition was determined by the method of Spackman et al. (2006) 2.0 g of each sample was weighed into the extraction thimble and the fat extracted with chloroform methanol mixture using a Soxhlet extraction apparatus. The extraction lasted for 5-6 h. The defatted samples (30 to 35 mg) were weighed into glass ampoules. Seven milliliters of 6 MHCl were added and oxygen was expelled by passing nitrogen gas into the ampoule (to avoid possible oxidation of some amino acid during hydrolysis). Each glass ampoule was then sealed with a Bunsen flame and put into an oven at 105 ± 5°C for 22 h. The ampoule was allowed to cool before breaking open at the tip and the content was filtered to remove the humins. The filtrate was then evaporated to dryness at 40°C under vacuum in a rotary evaporator. Each residue was dissolved with 5 ml of acetate buffer and stored in a plastic specimen bottle and kept in the deep freezer. The amount loaded was between 5 to 10 µl. This was dispensed into the cartridge of the analyzer. The TSM (technicon sequential multisample amino acid analyzer) analyze free acidic, neutral and basic amino acids of the hydrolysate. The period of an analysis lasted for 76 min. The net height of each peak produced by the chart recorder of TSM (each representing an amino acid) was measured. The half-height of the peak on the chart was found and width of the peak on the half-height was accurately measured and recorded. Approximate area of each peak was then obtained by multiplying the height with the width at half-height. The norcleucine equivalent (NE) for each amino acid in the standard mixture was calculated using the formula:

$$\text{NE} = \frac{\text{Area of norcleucine peak}}{\text{Area of each amino acid}}$$

Fatty acid determination

Fifty milligram (50 mg) of fat extracted from raw and fermented tiger nut was esterified for 5 min at 95°C with 3.4 ml of the 0.5 M KOH in dry methanol. The mixture was neutralized using 0.7 M HCL. About 3 ml of boron triflouride (14%) in methanol was added. The mixture was heated for 5 min at the temperature of 90°C to achieve complete methylation process. The Fatty Acid Methyl Esters were thrice extracted from the mixture with redistilled n-hexane. The content was concentrated to 1 ml for gas chromatography analysis and 1 µL was injected into injection port of gas chromatography (Alejandro, 2013).

Statistical analysis

The experiment was carried out in triplicates. Data obtained were analyzed by one-way analysis of variance and mean were compared by Duncan's multiple range tests (SPSS 17.0 version). Differences were considered significant at $p<0.05$.

RESULTS AND DISCUSSION

Mineral composition (mg/100 g) of raw and fermented

Table 1. Mineral composition of raw and fermented Tiger nut (mg/100 g).

Mineral	Raw	TFM	TFW	BFM	BFW	CF
Ca	7.66^{c}±0.28	9.33^{ab}±0.28	9.50^{ab}±0.50	8.50^{bc}±1.00	9.00^{ab}±0.50	9.83^{a}±0.28
Cu	0.04^{a}±0.00	0.00^{b}±0.00	0.00^{b}±0.00	0.05^{a}±0.06	0.03^{a}±0.00	0.04^{a}±0.00
Fe	0.09^{b}±0.00	0.23^{ab}±0.30	0.14^{b}±0.00	0.13^{b}±0.00	0.14^{b}±0.00	0.41^{a}±0.00
K	606.33^{b}±0.57	533.66^{f}±1.15	562.00^{d}±1.00	577.00^{c}±1.00	546.00^{e}±1.00	91.6^{a}±1.00
Na	3383.33^{a}±28.8	3250.00^{b}±0.00	3366.67^{a}±76.37	3166.66^{b}±76.37	2950.00^{b}±50.00	64.00^{c}±1.00
Pb	0.00^{a}±0.00	0.00^{a}±0.00	0.00^{a}±0.00	0.00^{a}±0.00	0.00^{a}±0.00	0.00^{a}±0.00
Zn	0.07^{c}±0.00	0.64^{a}±0.10	0.00^{e}±0.00	0.51^{b}±0.00	0.02^{d}±0.00	0.51^{b}±0.38

Values are (mean±SD) of replicates. Values with the same alphabet are not significantly different at (p =0.05). RAW: Raw, TFM: traditional fermented milled, TFW: traditional fermented whole, BFM: back slope fermented milled, BFW: back slope fermented whole, CF: controlled fermented sample.

tiger nut is shown in Table 1. Sodium was the most abundant mineral with value 3383.3 mg/100 g which was recorded in raw sample while copper (0.03 mg/100 g) is the least mineral obtained which was found in back slope fermented whole sample. Micronutrients such as potassium, sodium and calcium were found to be appreciable in tiger nut samples analysed earlier reported by Bosch et al. (2005) and, Oladele and Aina (2007). Potassium and sodium are important in maintaining the normal water balance, conservation of osmosis and acid balance in the body. Potassium is necessary for the metabolism of carbohydrates and proteins. It also protects the internal arterial walls against any damages, prevents haemorrhages and brain/heart attack (Oladele et al., 2009). Hence, tiger nut is a good source of these elements.

The result of amino acid composition revealed that tiger nut is rich in essential amino acid such as lysine, threonine, leucine, phenylalanine and cystine. The most concentrated essential amino acid lysine (5.14 g/100 g) was recorded in back slope fermented whole sample. Tyrosine (0.50 g/100 g) was the least amino acid which was recorded in raw sample (Table 2). Some essential amino acid (threonine, leucine, phenylalanine and cystine) present in back slope fermented whole tiger nut were found to compare favourably with food and Agriculture Organization Standard (FAO, 1998). Back slope fermented whole sample showed significant increase ($p \leq 0.05$) in lysine (5.14 g/100 g), Threonine (3.15 g/100 g), leucine (4.39 g/100 g), phenylalanine (3.25 g/100 g) and cystine (2.56 g/100 g) content when compared to FAO standard (Table 3).

Oyetayo and Agbaje (2012) has earlier reported that amino acids of fermented Acha was higher than the raw sample. Also Oyetayo et al. (2007) reported that food rich in total essential amino acid will contribute to the supply of essential amino acid in diet. Amino acids distribution in controlled fermented sample is smaller to what was obtained in traditional and backslope fermented samples, this may be due to the effect of sterilization on the control sample, high temperature denature protein.

LAB fermentation has been shown to improve the nutritional value and digestibility of foods (Nout, 2009). The acidic nature of the fermentation products enhances the activity of microbial enzymes at a temperature range of 22-25°C (Mokoena et al., 2005). The enzymes, which include amylases, proteases, phytases and lipases, modify the primary food products through hydrolysis of polysaccharides, proteins, phytates and lipids respectively. This is in line with this paper finding.

Results shown in Tables 2 and 3 show an increment in some nonessential and essential amino acid of fermented samples when compared with unfermented (raw) sample, these was in agreement with Steinkraus report (1997) that bacterial enzymatic hydrolysis may enhance the bioavailability of protein and fat and increase the production of free amino acids, short chain fatty acids and also reported that fermentation increase biological environment of food substrates with protein essential amino acids and vitamins.

The result of the fatty acid composition of oil extracted from raw and fermented tiger nut are as shown in Table 4. This study shows that all the sample contain appreciable amount of oleic acid with value recorded ranging from 64.91 to 73.08%, but low in erucic acid with values ranging from 0.02±0.00 to 0.05±0.01%. Key et al. (1986) reported that epidemiological studies also suggested that the presence of a high proportion of monounsaturated acid especially oleic acid in the diet is linked with a high reduction in the risk of coronary heart diseases. Oleic acid is also reported to be useful for building cellular membranes, attracting oxygen to tissues, to transform energy into nerve impulses, and as precursors to molecules of cellular communication such as prostaglandins (Odutuga et al., 1992).

Result also reveals that traditional fermentation had reduces the value of linolenic acid from 0.65 to 0.57%. High percentage of linolenic acid is not desirable in edible oils because of the off-flavours and potentially harmful oxidation products formed. As reported by Warner and Gupta (2003), a decrease from 2 to 0.8% linolenic acid content in oils improved flavor quality and oxidative

Table 2. Amino acids composition of raw and fermented tiger nut (g/100 g).

Amino acid	Raw	TFW	TFM	BFW	BFM	CF
Alanine	2.77^{e}±0.12	3.42^{bc}±0.02	3.27^{cd}±0.00	3.56^{ab}±0.04	3.10^{d}±0.08	3.76^{a}±0.24
Arginine	17.78^{c}±0.51	21.53^{b}±0.51	20.93^{b}±0.00	23.02^{a}±0.13	19.91^{c}±0.25	21.27^{b}±0.34
Aspartic	5.01^{d}±0.09	5.95^{b}±0.05	5.43^{c}±0.06	7.07^{a}±0.19	5.11^{d}±0.09	6.08^{b}±0.11
Cystine	1.97^{e}±0.10	2.38^{b}±0.03	2.28^{c}±0.00	2.56^{a}±0.00	2.14^{d}±0.00	2.42^{b}±0.07
Glutamic	5.79^{e}±0.18	7.64^{b}±0.04	6.39^{c}±0.07	8.63^{a}±0.15	6.11^{d}±0.07	7.64^{b}±0.11
Glycine	2.40^{e}±0.10	3.03^{c}±0.03	2.89^{c}±0.02	3.80^{a}±0.19	2.70^{d}±0.04	3.31^{b}±0.03
Histidine	2.02^{c}±0.11	2.41^{a}±0.02	2.23^{b}±0.01	2.50^{a}±0.03	2.08^{c}±0.02	2.42^{a}±0.01
Isoleucine	0.78^{d}±0.03	1.71^{c}±0.01	1.24^{d}±0.03	2.80^{a}±0.35	0.89^{d}±0.01	1.81^{b}±0.05
Leucine	2.74^{d}±0.07	3.91^{b}±0.10	3.36^{c}±0.10	4.39^{a}±0.13	2.51^{e}±0.04	4.12^{b}±0.19
Lysine	3.31^{e}±0.09	4.89^{b}±0.08	4.06^{c}±0.05	5.14^{a}±0.11	3.87^{d}±0.05	4.91^{b}±0.10
Methione	0.57^{d}±0.01	0.91^{b}±0.02	0.76^{c}±0.04	1.11^{a}±0.15	0.71^{c}±0.01	1.11^{a}±0.06
Phenylalanine	1.80^{cd}±0.04	2.42^{bc}±0.04	2.24^{bc}±0.04	3.25^{a}±0.85	1.38^{d}±0.80	2.59^{b}±0.04
Proline	1.50^{d}±0.00	2.03^{b}±0.06	1.80^{c}±0.06	2.44^{a}±0.00	1.68^{c}±0.06	2.14^{b}±0.17
Serine	2.14^{e}±0.08	2.62^{b}±0.01	2.48^{c}±0.01	2.91^{a}±0.09	2.32^{d}±0.03	2.57b^{c}±0.01
Threonine	2.24^{f}±0.02	2.78^{c}±0.03	2.55^{d}±0.02	3.15^{a}±0.05	2.42^{e}±0.02	2.89^{b}±0.05
Tyrosine	0.50^{d}±0.00	0.83^{b}±0.00	0.66^{c}±0.00	1.15^{a}±0.16	0.58c^{d}±0.08	1.07^{a}±0.08
Valine	1.65^{d}±0.07	2.31^{b}±0.06	2.10^{c}±0.03	3.21^{a}±0.11	1.71^{d}±0.07	2.41^{b}±0.04

Values are (mean±SD) of replicates. Values with the same alphabet are not significantly different at (p =0.05). RAW: Raw, TFM: traditional fermented milled, TFW: traditional fermented whole, BFM: back slope fermented milled, BFW: back slope fermented whole, CF: controlled fermented sample.

Table 3. Essential amino acid of raw and fermented tiger nut (g/100 g of protein) compared with FAO std`

Amino acid	Raw	BFW	FAO value
Lysine	3.31±0.09	5.14±0.11	4.20
Threonine	2.24±0.02	3.15± 0.05	2.80
Valine	1.65±0.07	3.21± 0.11	4.20
Methionine	0.57±0.01	1.11± 0.15	2.20
Isoleucine	0.78±0.03	2.07± 0.35	4.20
Leucine	2.74±0.07	4.39 ± 0.13	4.20
Tyrosine	0.05±0.00	1.15± 0.16	2.80
Phenylalanine	1.80 ±0.04	3.25± 0.85	2.80
Tryptophan	-	-	1.40
Cystine	1.97± 0.10	2.56 0.00	2.20

Values are (mean±SD) of replicates. RAW: raw, BFW: backslope fermented whole.

Table 4. Fatty acids composition of raw and fermented tiger nut (%).

Fatty acid	Raw	TFM	TFW	BFM	BFW	CF
Arachidic	4.93^{a}±0.02	4.23^{c}±0.15	4.71^{b}±0.01	2.77^{d}±0.02	4.32^{c}±0.02	5.40^{a}±0.40
Arachidonic	0.06^{a}±0.00	0.13^{c}±0.01	0.10^{d}±0.00	0.04^{b}±0.00	0.05^{ab}±0.01	0.00^{a}±0.00
Behenic	0.05^{b}±0.01	0.09^{a}±0.01	0.08^{a}±0.01	0.03^{e}±0.0	0.04^{c}±0,00	0.00^{a}±0.00
Capric	0.00^{a}±0.00	0.00^{a}±0.00	0.00^{a}±0.00	0.00^{a}±0.00	0.00^{a}±0.00	0.00^{a}±0.00
Caprylic	0.00^{a}±0.00	0.00^{a}±0.00	0.00^{a}±0.00	0.00^{a}±0.00	0.00±^{a}0.00	0.00^{a}±0.00
Erucic	0.03^{bc}±0.00	0.05^{a}±0.01	0.04^{a}±0.00	0.02^{c}±0.00	0.02^{c}±0.00	0.00^{a}±0.00
Lauric	0.00^{a}±0.00	0.00^{a}±0.00	0.00^{a}±0.00	0.00^{a}±0.00	0.00^{a}±0.00	0.00^{a}±0.00

Table 4. Contd.

Fatty acid	Raw	TFM	TFW	BFM	BFW	CF
Lignoceri	0.11^{b}±0.01	0.23^{a}±0.05	0.22^{a}±0.01	0.07±0.00	0.06^{c}±0.02	0.00^{a}±0.00
Linoleic	9.00^{b}±0.01	10.12^{a}±0.01	7.74^{c}±0.00	10.17^{a}±0.01	10.45^{a}±0.01	8.86^{c}±0.01
Linolenic	0.65^{c}±0.01	0.71^{c}±0.01	0.57^{d}±0.00	3.50^{a}±4.61	0.90^{b}±0.00	0.66^{c}±0.01
Margaric	0.00^{a}±0.00	0.00^{a}±0.00	0.00^{a}±0.00	0.00^{a}±0.00	0.00^{a}±0.00	0.00^{a}±0.00
Myristic	1.73^{a}±0.02	1.13^{c}±0.01	1.15^{c}±0.04	0.73^{e}±0.02	1.02^{d}±0.02	1.28^{b}±0.01
Oleic	69.77^{b}±0.02	70.61^{b}±0.01	69.33^{b}±0.03	73.08^{a}±0.01	69.10^{b}±0.01	64.91^{c}±0.01
Palmitolic	0.04^{d}±0.00	0.08^{c}±0.00	0.28^{b}±0.01	0.03^{d}±0.00	0.03^{d}±0.01	0.32^{a}±0.01
Plamitic	10.23^{b}±0.01	9.51^{c}±0.01	10.75^{b}±0.18	9.16^{c}±0.01	10.55^{b}±0.02	12.43^{a}±0.03
Stearic	3.38^{c}±0.02	3.16^{d}±0.01	5.34^{b}±0.02	3.01^{d}±0.01	3.40^{c}±0.11	6.10^{a}±0.00

Values are (mean±SD) of replicates. Values with the same alphabet are not significantly different at (p =0.05). Raw: Raw, TFM: traditional fermented milled, TFW: traditional fermented whole, BFM: back slope fermented milled, BFW: back slope fermented whole, CF: controlled fermented sample.

stability of fried foods. This therefore shows that the lower the linolenic acid content in oil, the more suitable is the oil for frying. This indicates that tiger nut oil is a good source of edible oil for cooking and frying that may be useful for the fight against cardiovascular diseases (Muhammad et al., 2011).

Conclusion

This study established the effect of different fermentation methods on the mineral, amino and fatty acids content of tiger nut (*Cyperus esculentus)*. The result of mineral composition revealed that tiger nut was rich in potassium, sodium and calcium. Also tiger nut is a poor source of copper and zinc. Back slope fermented sample was found to be high in the following amino acid: Arginine, glutamic, lysine and aspartic acid. Oleic is the most abundant fatty acid present in tiger nut. In conclusion, back slope fermentation is the best processing method that enhances the mineral, amino and fatty acids content of tiger nut. This method is the best because there is an increase in essential amino acid such as lysine, threonine, valine, methionine, isoleucine, leucine, tyrosine, phenylalanine and cystine recorded in back slope fermentation method

Conflict of interests

The authors did not declare any conflict of interest.

REFERENCES

Alejandro C (2013). Microbial metabolites in the human gut. Foodomics: Advanced Mass Spectrometry in Modern Food Science and Nutrition. John Wiley & Sons.

Arafat S, Gaafar A, Basuny A, Nassef L (2009). Chufa tubers (Cyperus esculentus L.): As a new source of food. World Appl. J. Sci. 7:151-156.

Belewu MA, Belewu KY (2007). Comparative evaluation of tiger nut, soybean and coconut milk sources. Int. J. Agric. Biol. 9(5):785-787.

Bosch L, Alegria A, Farre R (2005). RP-HPLC determination of tiger nut and orgeat amino acid contents. Food Sci. Technol. Int. 11:33-40. http://dx.doi.org/10.1177/1082013205051266

Cortes C, Esteve MJ, Frigola A, Torregrosa F (2005). Quality characteristics of horchata (a Spanish vegetable beverage) treated with pulsed electric fields during shelf-life. Food Chem. 91:319-325. http://dx.doi.org/10.1016/j.foodchem.2004.06.014

Food and Agriculture Organisation (1998). Carbohydrates in human Nutrition. FAO, Food and Nutrition Papers No. 66, Rome, Italy.

Key A, Menotti A, Karvonen MJ (1986). The diet and 15 year death rate in seven countries. Am. J. Epidemiol. 124:903-915.

Mokoena MP, Chelule PK, Gqaleni N (2005). Reduction of Fumonisin BI and zearalenone by lactic acid bacteria in fermented maize meal. J. Food Prot. 68:2095-2099.

Muhammad NO, Bamishaye EI, Bamishaye OM, Usman LA, Salawu, MO, Nafiu MO, Oloyede OB (2011). Physicochrmical properties and Fatty Acid Composition of Cyperus esculentus (tiger nut) tuber oil. Biores. Bull. 5: 51-54.

Nergiz C, Gokgoz E (2007). Effects of traditional cooking methods on some antinutrients and in vitro protein digestibility of vean varieties (Phaseolus vulgaricus L.) grown in Turkey. Int. J. Food Sci. Technol. 42(7):868-873. http://dx.doi.org/10.1111/j.1365-2621.2006.01297.x

Nout MJR (2009). Rich nutrition from the poorest – Cereal fermentations in Africa and Asia. Food Microbiol. 26(7): 685-692. http://dx.doi.org/10.1016/j.fm.2009.07.002

Odoemelan SA (2003). Chemical composition and functional properties of conophornut flour (Tetracarpidium conophorum). Int. Journal Food Sci. Technol. 38:729-734. http://dx.doi.org/10.1046/j.1365-2621.2003.00725.x

Odutuga AA, Asemota HN, Musac I, Golden KD, Kean EA (1992). Fatty acid composition of arili from ackee fruit (Blighia sapida). Jam. J. Sci. Technol. 3:30-32.

Okafor JN, Mondi JI, Ozumba AU, Solomon HM, Olatunji O (2003).Preliminary studies on the characterization of contaminants in tiger nut (yellow variety) in NIFST proceedings of 27th annual conference/AGM Kano. pp. 210-211.

Oladele AK, Aina JO (2007) Chemical Composition and Functional Properties of Flour produced from two varieties of Tiger nut (Cyperusesculentus). Afr. J. Biotechnol. 6(21):2473-2476.

Oladele KA, Osundahunsi FO, Adebowale AY (2009). Influence of processing techniques on the Nutrients and anti-nutrients of Tiger nut (Cyperusesculentus L.). World J. Dairy Food Sci. 2: 88-93.

Omode AA, Fatoki OS, Olaogun KA (1995), physicochemical properties of some underexploited and non-conventional oil seeds. J. Agric. Food Chem. 43:2850-2853. http://dx.doi.org/10.1021/jf00059a015

Oyetayo FL, Akindahunsi AA, Oyetayo VO (2007). Chemical profile and amino acids composition of Pleurotus sajor-caju. Nutr. Health 18: 383-389. http://dx.doi.org/10.1177/026010600701800407

Oyetayo VO, Agbaje RB (2012). Effect of different processing methods

on the micronutrient and amino acid composition of Digitaria exilis (Kippist) Stapf. J. Life Sci. 6: 365-369.
Perkin-Elmer (1982). Analytical Methods for Atomic Absorption Spectrophotometry, USA, Perkin-Elmer Corporation.
Rita ES (2009). The use of tiger nut (Cyperus esculentus), cow milk and their composite as substrates for yoghurt production. Pak J. Nutr. 6:755-758.
Spackman DH, Stein WH, Moore S (2006). Automatic recording apparatus for use in chromatography of amino acids. Anal. Chem. 30:1190-1206. http://dx.doi.org/10.1021/ac60139a006
Steinkraus KH (1997). Classification of fermented foods: Worldwide review of household fermentation techniques. Food Control 8(5/6):311-317. http://dx.doi.org/10.1016/S0956-7135(97)00050-9
Umerie SC, Okafor EO, Uka SA (1997). Evaluation of the tubers and oil of Cyperus esculentus. Bioresour. Technol. 61:171-173. http://dx.doi.org/10.1016/S0960-8524(97)00045-X
Warner K, Gupta M (2003). Frying quality and stability of low- and ultra-low-linolenic acid soybean oils. J. Am. Oil Chem. Soc. 80:275-280. http://dx.doi.org/10.1007/s11746-003-0689-x

academicJournals

Vol. 9(7), pp. 95-98, August, 2015
DOI: 10.5897/AJBR2014.0771
Article Number: 4BF2BC154710
ISSN 1996-0778

http://www.academicjournals.org/AJBR

African Journal of Biochemistry Research

Short Communication

The effect of aqueous leaf extract of fluted pumpkin on some hematological parameters and liver enzymes in 2,4-dinitrophenylhydrazine- induced anemic rats

Toma, I.[1]*, Victory, N. C.[1] and Kabir, Y.[2]

[1]Department of Chemistry, Adamawa State University, P. M. B. 25, Mubi, Nigeria.
[2]National Biotechnology Development Agency, P. M. B. 5118, Wuse, Abuja, Nigeria.

Received 14 April, 2014; Accepted 20 January, 2015

Anemia constitutes a serious health problem in many tropical countries including Nigeria because of the prevalence of malaria and other parasitic infections which possibly leads to decrease of hemoglobin. Fluted pumpkin has been reported to be very good in building the constituents of the blood and also replacing them. This study was designed to investigate the effects of the aqueous leaf extract of fluted pumpkin on some hematological parameters and liver enzymes; alanine aminotransferase (ALT) and aspartate aminotransferase (AST) in 2, 4-dinitrophenylhydrazine-induced anemia in experimental rat. Twelve Wister albino male rats were obtained from a nearby farm and separated into four groups of three rats each for the study. Rats in Groups 1 and 2 were injected 40 mg/kg 2, 4-dinitrophenylhydrazine for eight days to induce anemia, while rats in Groups 3 and 4 were fed with grower's mash and water *ad libitum*. All analysis was done using the standard methods. The result of this study shows that, oral administration of 50 mg/kg of aqueous leaf extract of fluted pumpkin to the rats in induced treated and normal treated groups (Groups 1 and 3), increased the hematological parameters under investigation while the rest remained significantly unchanged. Low level of ALT and AST was observed in rats in group 1 (induced treated group) suggesting a hepatoprotective property of the leaf extract which also indicate that the extract had no effect on the liver of the rats at the concentration used. The result of this research indicate that 50 mg/kg aqueous leaf extract of fluted pumpkin could elevate the packed cell volume, red blood cells and hemoglobin concentration in the rats induced with 2, 4-dinitrophenylhydrazine. Hence, oral administration of the extract could cure hemolytic anemia. The leaf extract also regulated the liver enzymes (ALT and AST) of the rats induced with 2, 4-dinitrophenylhydrazine. It can be concluded that aqueous leaf extract of fluted pumpkin is a potential blood booster and has hepatoprotective property.

Key words: Fluted pumpkin, hematological parameters, liver enzymes, 2, dinitrophenylhydrazine, anemia.

INTRODUCTION

Pumpkin as defined by the English dictionary is a large orange fruit or a round large fruit with a thick orange skinned rind, dry flesh and many seeds, cooked and eaten as a vegetable or in sweet dishes. It is known in many different countries because of its value as most of the parts can be eaten and are rich in nutrients. It is easily grown and one plant in the garden can supply pumpkins and green leaves throughout the year. It grows

best in loose, rich soil, mainly in any old rubbish heap. There are many different varieties of pumpkin whose botanical name is '*Telfairia'* which belong to the tribe, Joliffieae (Akoroda, 1990).

Fluted pumpkin is a dicotyledonous vegetable that develops long vine-like stems with trifoliate leaves and edible large fleshy fruits which can be 5 cm high. The leaves are simple dark green if properly grown on a suitable soil. It thrives in well-drained soils and is usually cultivated in garden and family farms around homes. The dark green leaves can be 18 cm wide and 35 cm long (Iweala and Onyechi, 2009), some of its native names include 'Ugu' as known by Ibos, 'Umee' in Efik and "Umeke" in Edo (Akoroda, 1990).

It is a common tropical green leafy vegetable native to many African countries especially Eastern Nigeria (Burkett, 1968). In ethno medicine, the fresh leaves are used in treatment of malaria and convulsion (Alada, 2000; Gbile, 1986). There are various methods by which fluted pumpkin leaves can be prepared as meal and drinks. It has been observed by the users to be a vegetable that is outstanding in health nourishing. It is used in cooking different variety of food, preparing salad, stew and soup. Some local users reported that it can be used as local or native blood tonic while some suggested that it can be used as a cure for anemia precisely anemia due to blood loss (personal communication).

Anemia constitutes a serious health problem in many tropical countries including Nigeria because of the prevalence of malaria and other parasitic infections which possibly leads to decrease of hemoglobin. Over millions of people have anemia in the sense that any disease that can lead to blood shortage or loss is mostly coupled with anemia. The aim of this study, therefore, is to evaluate the effect of aqueous leaf extract of fluted pumpkin on some hematological parameters and liver enzymes in 2, 4-dinitrophenylhydrazine induced anemic rats and the effect of aqueous at unveiling the possibility of curing anemia through the use of vegetable, hence the choice of fluted pumpkin.

MATERIALS AND METHODS

Sample collection and preparation

Fresh leaves of fluted pumpkin was obtained from a nearby farm in Mubi, Adamawa State, washed and weighed on daily basis for each of the experiment.

Extraction technique

About 50 g of fluted pumpkin leaves was chopped into smaller bits and ground with mortar and pestle. 100 ml of distilled water was poured into the ground leaves to obtain the extract which is 50 mg/ml. The aqueous extract was obtained raw using a sieve to avoid the entrance of particles. 50 mg/kg of the extract was administered to the rats according to the weight through oral gavage.

Experimental design

Twelve albino male rats weighing between 150 to 220 g were obtained from local breeders within Adamawa State University, Mubi. The rats were kept in the laboratory for one week for acclimatization before the on-set of the experiment. The rats were distributed into four groups of three rats each and were treated as follows:

Group 1 (Induced treated)

The rats in this group were labeled R_1, R_2 and R_3 and were also made anemic by daily oral administration of 40 mg/kg of 2,4-dinitro phenyl hydrazine for eight days. The rats were also fed with grower's mash and water *ad libitum*. They were treated with 50 mg/kg of the freshly prepared leaf extract for five days after being confirmed anemic.

Group 2 (Induced control)

The rats in this group; R_4,R_5 and R_6, were made anemic by daily oral administration of 2,4-dinitro phenyl hydrazine(PHZ) at 40 mg/kg for eight days during which they were fed with grower's mash and water *ad libitum* with no other treatment.

Group 3 (Control treated)

The rats in this group; R_7,R_8 and R_9 were fed normally with grower's mash and water and were given 50 mg/kg of the freshly prepared leaf extract each day for complete five days.

Group 4 (Normal control)

The rats in this group; R_{10}, R_{11} and R_{12} were fed with growers mash and water *ad libitum* throughout the period of experiment, with no other treatment.

Analysis of hematological parameters

Packed cell volume (PCV), white blood cell (WBC) and red blood cell (RBC) count

The packed cell volume, white blood cell count and red blood cell count were obtained by the method described by Hoffbrand and Moss (2011).

Hemoglobin concentration determination

The hemoglobin concentration was determined using acid haematin method also known as Sahli's method (Hoffbrand and Moses, 2011).

*Corresponding author. E-mail: dalitoma2006@yahoo.co.uk. Tel: +2348087383089, +2348058573668, +2347039622698.

Table 1. Effect of the aqueous leaf extract on some hematological parameters

Parameter	Group 1 (induced treated)	Group 2 (induced control)	Group3 (normal treated)	Group 4 (normal control)
PCV_1 (%)	45.33±1.77	48.00±0.58	46.33±0.88	44.00±0.06
PCV_2 (%)	38.00±0.18	39.00±0.58	49.00±1.55	48.67±3.72
PCV_3 (%)	41.67+±.88	39.67±0.88	51.67±0.88	49.33±3.39
$WBC_1(10^3/mm^3)$	1.92±0.05	2.08±0.05	2.00±0.03	1.90±0.06
$WBC_2(10^3/mm^3)$	2.72±0.05	2.48±0.12	2.12±0.02	2.02±0.08
$WBC_3(10^3/mm^3)$	2.27±0.12	2.35±0.03	1.62±0.05	1.88±0.05
$RBC_1(10^7/mm^3)$	2.31±0.02	2.47±0.13	2.37±0.02	2.36±0.06
$RBC_2(10^7/mm^3)$	2.18±0.02	2.27±0.06	2.72±0.02	2.69±0.09
$RBC_3(10^7/mm^3)$	3.31±0.03	3.00±0.08	3.79±0.02	3.01±0.19
Hb_1(g/dl)	9.67±0.18	10.00±0.12	10.10±0.16	9.87±0.37
Hb_2(g/dl)	8.20±0.12	8.50±0.12	10.47±0.18	10.40±0.35
Hb_3(g/dl)	12.37±0.13	10.07±0.07	12.97±0.04	11.47±0.37

All values are in Mean ± SEM for n=3. PCV_1, PCV_2 and PCV_3 are the packed cell volume of the rats before inducing anemia, after inducing anemia and after treatment, respectively; WBC_1, WBC_2 and WBC_3 are white blood cell count of the rats before inducing anemia, after inducing anemia and after treatment, respectively; RBC_1, RBC_2 and RBC_3 are red blood cell count of the rats before inducing anemia, after inducing anemia and after treatment, respectively; Hb_1, Hb_2 and Hb_3 are hemoglobin concentration of the rats before inducing anemia, after inducing anemia and after treatment, respectively.

Table 2. Effect of aqueous leaf extract of fluted pumpkin on the liver enzymes

Parameter	Group 1 (induced+extract)	Group 2 (induced control)	Group 3 (control treated)	Group 4 (normal control)
ALT(iu/l)	7.00±0.29	11.17±0.73	8.50±0.29	9.00±1.00
AST(iu/l)	22.17±0.44	28.33±0.88	47.33±0.34	30.00±1.48

All values are in Mean ± SEM for n=3; ALT stands for Alanine transaminase; AST stands for Aspartate transaminase.

Enzyme assays

The enzymes that were tested are Alanine aminotransferase (ALT) and Aspartate aminotransferase (AST). The test was done by the method described by Reitman and Frankel (1957) using Randox test kits.

Statistical analysis

Results were expressed as mean ± standard error of mean (SEM) for triplicate determination.

RESULTS

The results of the hematological parameters are presented in Table 1. The result shows that there was an increase in the hematological parameters of the rats as shown in Table 1. Daily intra peritoneal injection of 40 mg/kg 2, 4-dinitrophenyl hydrazine for eight days caused a decrease in the hematological parameters of the rats in group 1 and 2, while the packed cell volume dropped from 45.33 ± 1.77 and 48.00±0.58 to 38.00±0.18 and 39.00±0.58, respectively. There was also a drop in the red blood cell count and hemoglobin concentration, whereas the white blood cell count increased.

The hematological parameters were raised after the oral administration of the aqueous leaf extract. The packed cell volume, red blood cell count and hemoglobin concentration was 38.00±0.18, 2.18±0.02 and 8.20±0.12 respectively, with those of the induced and treated rats raised to 41.67±0.88, 3.31±0.03 and 12.37±0.13 respectively, while that of the induced control group remained low.

Table 2 shows the result of the effect of the extract on the liver enzymes; ALT and AST. In the groups treated with the extract, low level of ALT was observed. The average result was 7.00±0.29 iu/l and 8.50±0.29 iu/l for groups 1 and 3, respectively. Low level of AST was observed in the rats in group 1(22.17±0.44) and high level in the rats in group 3 (47.33± 0.34).

DISCUSSION

As shown in Table 1, the decrease in the hematological

parameters in Groups 1 and 2 could be as a result of break-down of the red blood cells caused by the 2,4-dinitro-phenylhydrazine. The increase in white blood cells could be due the defense mechanism against the entrance of a foreign material in the body system of the rats (2, 4-dinitrophenylhydrazine).

This study has shown that the aqueous leaf extract of fluted pumpkin caused an increase in packed cell volume, white blood cell count, red blood cell count and hemoglobin concentration in rats. The increase in hematological parameters investigated could be as a result of some constituents such as iron and some B complex vitamins which it possess as these serves as hematopoietic factors that influence directly on blood production in the bone marrow (Ganong, 2005). This study also agreed with the work of Salman et al. (2008), who reported that there was a significant increase in the hematological parameters of rats that were treated for two weeks with the aqueous leaf extract of fluted pumpkin. Some scientists have proposed the use of fluted pumpkin in treatment of anemia, following studies which reported that extracts of fluted pumpkin helps to maintain blood level in subjects given its extracts (Fiona and Latunde - Dada, 2011).

This research also shows that the leaf extract can serve as a cure for anemia as reported by some researchers. The increase in weight of the rats could be as a result of rich nutrients such as amino acids, fatty acids, mineral and vitamins (Fagbemi, 2007). Specified and suitable concentration of the aqueous extract leads to positive effects on the hematological parameters investigated.

As shown in Table 2, the lower level of ALT and AST in the rats induced with 2, 4-dinitrophenylhydrazine could be as a result of the hepatoprotective property of the plant on rats as reported (Oboh, 2005). AST of the normal rats was elevated than normal after treatment which showed that the concentration was high as regards to the health status of the rats, therefore, to some extent could be toxic to the rats. This effect attests to the observation of irregularity in the liver after a long term consumption of *Telfairia occidentalis* supplemented diet in rats (Iweala and Obidoa, 2009).

Conclusion

The result of this research indicated that 50 mg/kg aqueous leaf extract of fluted pumpkin could elevate the packed cell volume, red blood cells and hemoglobin concentration in the rats induced with 2, 4-dinitrophenyl-hydrazine. Hence, oral administration of the extract could cure hemolytic anemia. The leaf extract also regulated the liver enzymes (ALT and AST) of the rats induced with 2, 4-dinitrophenylhydrazine.

Conflict of interests

The authors did not declare any conflict of interest.

REFERENCES

Akoroda MO(1990). Ethnobotany of Telfairia occidentalis (Cucurbitaceae) among Igbos of Nigeria. Econ. Bot. 44:29-39. http://dx.doi.org/10.1007/BF02861064

Alada ARA (2000). The hematological effect of Telfairia occidentalis diet preparation. Afr. J. Biomed. Res.3:185-186.

Burkett HM (1968). The results of plants of West Africa.1:603-604.

Fagbemi TN (2007). Effects of processing on the nutritional composition of fluted pumpkin. Niger. Food J. 25(1):1-22.

Fiona HI, Latunde-Dada GO(2011). Iron Bioavailability from a Tropical leafy vegetable in anemic mice. Nutr. Metab. 8:9. http://dx.doi.org/10.1186/1743-7075-8-9

Gbile ZO (1986). Ethnobotany, Taxonomy and Conservation of Medicinal plant in the state of medicinal plant research in Nigeria. p. 19.

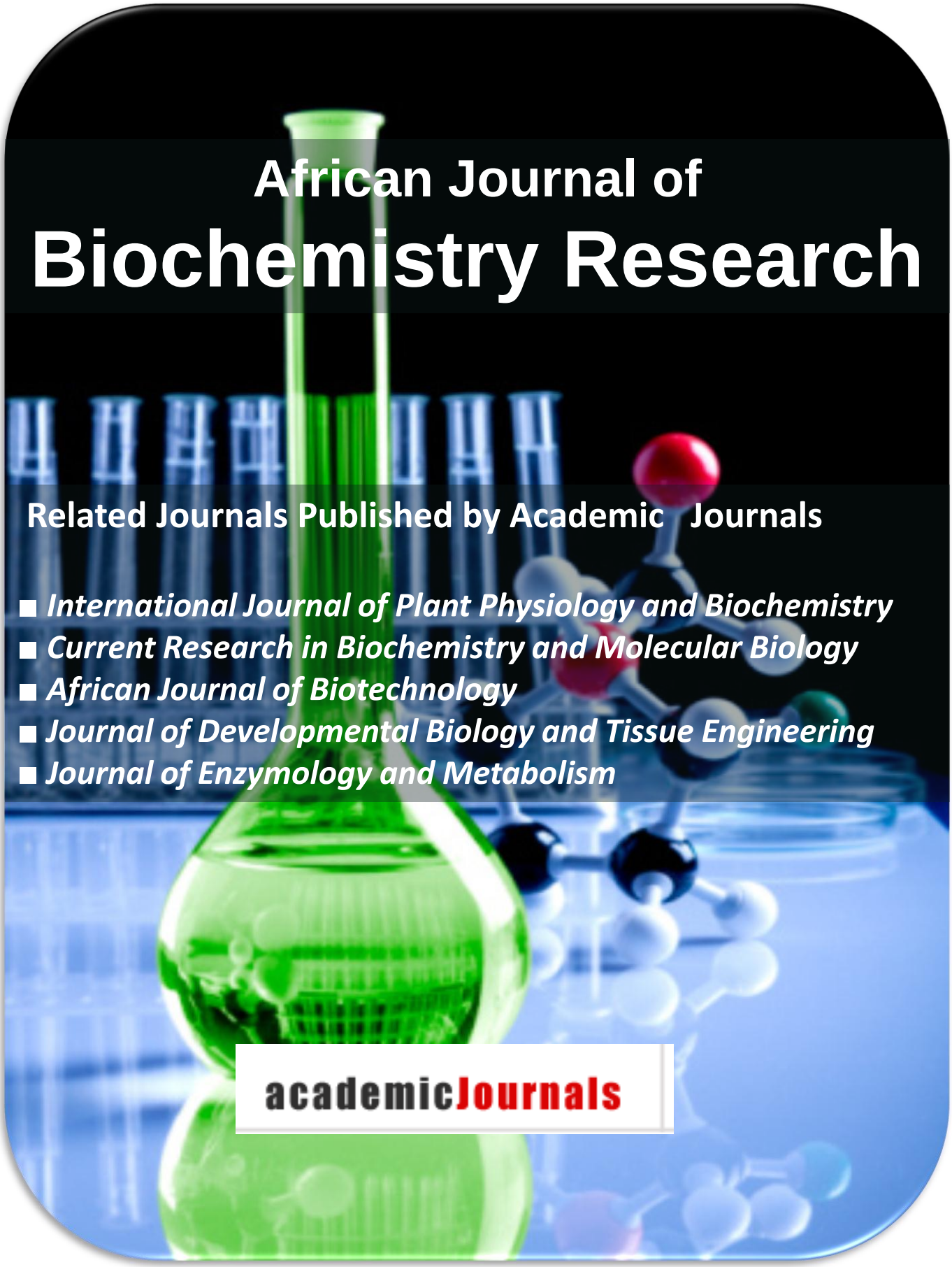
Hoffbrand V, Moses P(2011). Introduction to Hematology. In: Essential hematology. 5th Edition. Wiley-Blackwell Paperback.

Iweala EEJ, Onyechi O (2009). Some Biochemical, Hematological and Histological Responses to a long term Consumption of Telfairia occidentalis Supplemented Diet in Rats. Pak. J. Nutr. 8:1999-1203. http://dx.doi.org/10.3923/pjn.2009.1199.1203

Oboh G (2005). Hepatoprotective property of ethanolic and aqueous extracts of fluted pumpkin (Telfairia occidentalis) leaves against garlic induced stress. J. Med. Food 8(4):560-563. http://dx.doi.org/10.1089/jmf.2005.8.560

Reitman S, Frankel S (1957). Colourimetric method for the determination of serum transaminases. Am. J. Clin. Pathol. 28:56-61.

Salman TM, Olayaki LA, Oyeyemi WA (2008). Aqueous Extract of Telfairia occidentalis leaves reduces blood sugar and increases hematological and reproductive indices in male rats. Afr. J. Biotechnol. 7:2299-2303.


African Journal of
Biochemistry Research
Related Journals Published by Academic Journals
■ International Journal of Plant Physiology and Biochemistry
■ Current Research in Biochemistry and Molecular Biology
■ African Journal of Biotechnology
■ Journal of Developmental Biology and Tissue Engineering
■ Journal of Enzymology and Metabolism
academicJournals