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(RESEARCH ARTICLE)

Evaluation of the proximate and anti-nutrient composition of methanol extract of *Mangifera indica* (mango) seed kernel and impact of its consumption on haematological parameters

Amah Akuma Kalu [1], Melford Uche Elendu [1,*], Chris Akunne Wariso [2] and Iheukwumere Chinedu Barry [2]

[1] *Department of Human Physiology, Imo State University, Owerri, Nigeria.*
[2] *Department of Human Physiology, College of Medicine and Health Science, Abia State University, Uturu Nigeria.*

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Abstract

The aim of this study was to evaluate the proximate and anti-nutrient composition of methanol extract of *Mangifera indica* (mango) seed kernel and impact of its consumption on haematological indices of treated rats. Mango seed kernels were processed into fine powder which was subsequently divided into two parts. While one half of the flour sample was used for proximate analysis, the remaining half was subjected to extraction. Twenty five adult male wistar rats were divided into five groups of five rats each. Group I was the normal control and was fed rat chow and water only, Groups II-V were administered with 200, 400, 600 and 800 mg/kg bw of Mango Seed Kernel Extract (MSKE) respectively. Administration of extract lasted for 21 days after which rats were sacrificed and blood sample collected for analysis of haematological indices which were determined by standard procedures. Proximate analysis revealed the presence of ash, crude fibre, crude protein, fat and total carbohydrate (70.12±1.34%) which was reportedly more abundant. The study also revealed the presence of anti-nutrients such as oxalate, tannins, phytate, alkaloid and saponins and phytate (1.49±0.01 mg/100g) which was most abundant, while alkaloid (0.03±0.02 mg/100 g) was the least abundant. Administration of 200, 400, 600 and 800 mg/kg body weight of MSKE significantly ($P<0.05$) reduced Haemoglobin concentration (Hb), Red Blood Cell (RBC), Packed Cell Volume (PCV). However, 400, 600 and 800 mg/kg MSKE reduced WBC compared to the control, there was a non-significant ($P>0.05$) difference between the WBC of the control group and that of the group II administered with 200 mg/kg bw MSKE. In conclusion, the fact that MSKE is an embodiment of nutrients and anti-nutrients has undoubtedly been consolidated further through this research and the alterations observed in the studied blood parameters are direct consequence of the anti-nutrient.

Keywords: Blood; Mango; Nutrient; Seed; Haemoglobin; Kernel

1. Introduction

An estimated 150,000-400,000 tons of mango seed is generated from mango processing in Nigeria [1]. Its inedible kernel accounts for 9-40% of the whole mango seed [2]. Owing to the potential of mango seed waste to build up within the environment and consequent pollution threat, it has become extremely imperative to devise a productive waste management approach for the said bye-product, a development which has birthed the ideas that have driven processes that culminate to the production of valuable products which has complemented raw materials used in the making of finished product such as biscuit and bread [3] known to contain appreciable amounts of minerals and vitamins [4] which cannot be considered a constant owing to a number of factors such as cultivar variation, harvesting time, climate changes, time and degree of maturity, harvesting time as well as extraction technique employed all of which are pivotal to ensuring efficient conversion and effective utilization of the said waste [5].

* Corresponding author: Melford Uche Elendu
Department
of Human Physiology, Imo State University Owerri, Imo State .

Anti-nutrients are poisonous compounds inherent in most food which can impede nutrient availability to the body and consequently undermines utilization. Although arrays of processing methods with potential to eliminate these deleterious compounds abound, the fact that their presence in different food materials vary and may determine the extent of submissiveness to the various processing methods makes it imperative to probe their presence in food products.

Blood parameters serve as a mirror that aid tangible assertions on the physiological as well as nutritional status of an individual and alterations in the haematological parameters wield the potential of being used to elucidate the impact of nutritional factors in diets [6].

2. Material and methods

2.1. Plant material

Mango fruits were harvested from a particular mango tree located within a residential area in June, 2020 in Amasiri, Afikpo North Local Government Area of Ebonyi State, Nigeria. The fruits were subsequently identified as *Mangifera indica* at the herbarium unit of the Department of Biological Science, Ahmadu Bello University, and Zaria. The seed stone obtained by getting rid of the flesh was sun dried for five days. The dried stone was cracked with a club to obtain the seed kernels which were subsequently chopped into bits and sun dried for 10 days after which they were ground and sieved to fine powder.

2.2. Extraction of seed kernel powder

Exactly 600 g of powdered mango seed kernel powder (MSKP) was steeped in 2.5 L of 70% methanol and stirred intermittently. The extract was filtered and the filtrate concentrated according to the method described by Egbuonu [7] and was subsequently preserved in the refrigerator at 4 ^{o}C until used.

2.3. Determination of proximate composition

Ash, crude fibre, fat, protein and moisture were determined in accordance with the methods described by AOAC [8]. Total carbohydrate was calculated by difference. Nitrogen content was determined with the aid of the micro-Kjeldahl method and the factor 6.25 was used to convert the nitrogen to protein [9].

2.4. Determination of Anti-Nutrient composition of Mango Seed Kernel Powder (MSKP)

Anti-nutrient composition of mango seed kernel powder (MSKP) was determined in accordance with the methods described by Odebiyi and Sofowora [10], Trease and Evans [11]. Phytate was quantitatively determined as was described by Wheeler and Ferrel [12]. Oxalate was by the method of Iwuoha and Kalu [13], while tannin was determined with the aid of cupper-acetate gravimetric method described by Joslyn [14].

2.5. Median Lethal Dose 50% (LD50)

The Median Lethal Dose 50% was established at two phases. At the first phase, 10, 100 and 1000 g/kg bw was separately administered on three groups of three adult male wistar rats by oral route. This was followed by the observation for signs of toxicity which lasted for 24 h in the absence of which the second phase involving three groups of one rat separately administered with 1600, 2900 and 5000 mg/kg of extract was initiated. Subsequently, animals were observed for 48 h for signs of toxicity [15].

2.6. Animal

Twenty five (25) adult male wistar rats weighing 150-200 g procured from the animal house of the Department of Science Laboratory Technology (SLT) Akanu Ibiam Federal Polytechnic Unwana Afikpo were housed in plastic cages where they acclimatized for 21 days.

2.7. Experimental design

The rats were divided into five groups of five rats per group thus:

- Group I: was fed with rat chow and water adlibitum.
- Group II: rat administered with 200 mg/kg of MSKE.
- Group III: rat administered with 400 mg/kg of MSKE.

- Group IV: rat administered with 600 mg/kg of MSKE.
- Group V: rat administered with 800 mg/kg of MSKE.

2.8. Sample collection and preparation

Animals were fasted and sacrificed after the 28th day of treatment through cardiac puncture and blood sample collected in clean tubes and were used to determine haematological parameters viz: Red Blood Cells (RBC), White Blood Cells (WBC) and Packed Cell Volume (PCV) and haemoglobin concentration (Hb).

2.9. Determination of haematological indices

White blood cells (WBC) count, haemoglobin concentration (Hb), Red Blood Cells (RBC) count was determined according to the method of Sood [16]. To determine Packed Cell Volume (PCV), blood sample was introduced into the capillary tube before being sealed with plasticine. The filled tubes were loaded onto a microhematocrit centrifuge and subsequently spun at 12,000 rpm for 6 min, before being read on a scale [17].

2.10. Statistical analysis

Results were expressed as mean ± standard deviation. The data were analysed using analysis of variance (ANOVA). The difference in mean was compared using Multiple Range Test. $P<0.05$ was considered significant.

3. Results and discussion

Evaluation of blood indices can be instrumental to the determination of the extent to which alien compounds can influence and impact blood components and consequently health (Ashafa et al. [18]).Table 1 shows the proximate composition of *Mangifera indica* (mango) seed kernel flour indicating that ash, crude fibre, crude protein, total carbohydrate and fat were reportedly present. The proportion of carbohydrate (70.12±1.34%) present in the said seed kernel was higher than other components found present. This was followed by the fat which was 14.80±0.13%, crude protein (10.06±0.12%), ash (2.62±0.03%) and lastly crude fibre (2.40±0.01%). This result is consistent with the finding of Kayode and Sani [19] who reported the proportions of crude fat, fibre, protein and total ash in mango seed kernel of a given mango variety which were at variance with the values reported on the aforementioned parameters in this study. Anti-nutrients are compounds inherent in most food crops which are deleterious to health or may impede nutrient availability to cellular metabolism which translates to diminished nutritive value of such food. Their amount in food may vary depending on the kind or variety of food crop.

Table 1 Proximate Composition of *Mangifera indica* (Mango) Seed Kernel

Composition	% (Dry weight)
Ash	2.62±0.03
Crude fibre	2.40±0.01
Crude protein	10.06±0.12
Total carbohydrate	70.12±1.34
Lipid	14.80±0.13

Results are expressed as mean ± standard deviation of three determinations

Table 2 shows the anti-nutrient composition *Mangifera indica* (mango) seed kernel flour indicating the presence of alkaloids, saponins, oxalate, tannins, phytate. Of the reported anti-nutrients, phytate (1.49±0.01 mg/100 g) was more abundant, while alkaloid (0.03±0.02 mg/100 g) was the least abundant. Cyanide was reportedly absent. This finding is in tandem with the finding of Kayode and Sani [19] which reported the presence of tannins, oxalate and phytate and absence of cyanogenic in a mango seed kernel but rather reported absence of alkaloids which is reportedly available in the variety studied. Blood parametres undoubtedly are dependable indicators of physiological and nutritional status of an individual. This is evident by the fact that changes in such indices can be relied upon to derive the impact of nutritional factors and additives present in a diet [6]. The hematological indices evaluated in this study can be critically employed in assessment of the toxicity of a phytochemical in the body [20].

Table 2 Anti-nutrient Composition of *Mangifera indica* (Mango) seed kernel

Anti-nutrients	Content (mg/100 g)
Alkaloids	0.03±0.02
Tannins	1.06±0.00
Phytate	1.49±0.01
Cyanide	0.00±0.00
Saponins	0.71±0.00
Oxalate	1.44±0.01

Results are expressed as mean ± standard deviation of three determinations

Table 3 Shows the haematological indices (Haemoglobin concentration (Hb), Red Blood cell (RBC), White Blood Cells (WBC) and Packed Cell Volume (PCV) of rats administered with methanol extract of *Mangifera indica* (mango) seed kernel showing that administration of 200, 400, 600 and 800 mg/kg body weight of MSKE significantly ($P<0.05$) reduced Hb, RBC, PCV. However, while 400, 600 and 800 mg/kg MSKE reduced WBC compared to the control. There was a non-significant ($P>0.05$) difference between the WBC of the control group and that of the group II administered with 200 mg/kg bw MSKE. The reduction in the red blood cell, haemoglobin concentration and packed cell volume of treated rats could be attributed to the presence of phytate which is known to reduce the bioavailability of iron, an essential component of the hemoglobin molecule [21].

Table 3 Haematological Indices of Rats administered with Methanol Extract of Mango Seed Kernel (MSK)

Groups	Treatments	Hb (g/dl)	RBC (1012/L)	WBC (1012/L)	PCV (%)
Group I	Normal control	18.23 ± 0.02^{d}	68.38 ± 0.20^{c}	8.31 ± 0.20^{a}	49.57 ± 0.06^{c}
Group II	200 mg/kg	17.98 ± 0.04^{c}	66.46 ± 0.94^{b}	8.38 ± 0.04^{a}	47.44 ± 0.04^{b}
Group II	400 mg/kg	14.57 ± 0.01^{b}	63.30 ± 0.72^{a}	11.31 ± 0.02^{b}	47.39 ± 0.03^{b}
Group IV	600 mg/kg	13.06 ± 0.02^{a}	63.29 ± 0.07^{a}	11.45 ± 0.02^{b}	46.84 ± 0.01^{a}
Group V	800 mg/kg	13.09 ± 0.02^{a}	63.42 ± 0.51^{a}	11.70 ± 0.06^{b}	46.96 ± 0.06^{a}

Results are expressed as mean ± standard deviation of three determinations. Values with same superscript column are not significantly different ($P>0.05$).

4. Conclusion

The fact that mango seed kernel is an embodiment of nutrients and anti-nutrients undoubtedly has been consolidated further through this research and have resulted in the alterations that characterized the studied blood indices of animals treated with the MSKE.

Compliance with ethical standards

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Disclosure of conflict of interest

Authors hereby declare that no conflict of interest statement must be inserted here.

Statement of ethical approval

Ethical approval was obtained from the Ethical committee on Care and Handling of Laboratory Animals of the university

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