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Effect of Processing Techniques on Nutrient and Anti-Nutrient Contents of Mango Seed Kernel

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ABSTRACT

Background and Objective: Mango seed kernel is a waste from mango fruit, which has limited economic value. The knowledge of its nutrient and anti-nutrient composition could promote the value-addition. This study evaluated the effect of different processing methods on the nutritive and anti-nutritive contents of mango seed kernel. **Materials and Methods:** Mango seed kernels were subjected to four processing methods: Treatment A (ROMK) was roasted for about 10 min on low heat, Treatment B (SOMK) was soaked in water for 24 hrs drained and sundried, Treatment C (BOMK), boiled in water for 30 min drained and sundried, Treatment D (RAMK)-raw mango kernel was sundried. The samples were evaluated for nutritional and antinutritional contents. Statistical analysis was carried out using a one-way Analysis of Variance procedure of statistical analysis software (SAS) and means were compared using the Duncan Multiple Range Test at a 5% significant level **Results:** The study observed significant differences ($p<0.05$) in nutrient composition across treatments. Dry matter, protein, fiber and ether extract showed varying ranges, while calcium, potassium, phosphorus and sodium content were within acceptable limits. Anti-nutritional factors like oxalate, saponin and phytate were present in moderate concentrations. **Conclusion:** The study showed that the choice of processing technique has a significant effect on the nutritional and antinutritional contents of mango seed kernel. Mango seed kernel could find application as a feed supplement for livestock without posing any deleterious effect on the animals.

KEYWORDS

Mango seed kernel, roasting, soaking, solar-drying, nutritional contents, anti-nutritional contents

INTRODUCTION

Mango (*Mangifera indica* L.) is a tree crop well adapted to all ecological zones in Africa and widely cultivated. The seed content of different varieties of mangoes ranged from 9-23% of the fruit weight and the kernel content of the seed ranged from 45.7-72.8%[1]. Mango seeds constitute about 20-60% of the total fruit weight while the kernel is about 45-75% of the seed[2]. In general, Over 30% of mango fruit is inedible and this constitutes a huge amount of waste for the industry. Therefore, there is a need for value-addition for waste generated from mango fruit[3]. Although mango seed kernel is low in protein, however, it is rich in essential amino acids such as leucine, valine and lysine. Mango seed kernels were shown to be a good source of polyphenols and phytosterols such as campesterol, sitosterol and tocopherols[4]. In addition, mango seed kernel could be used as a potential source for functional food ingredients, antimicrobial compounds and cosmetics due to its high quality of fat and protein as well as high levels of natural antioxidants. Therefore, exploring the potential of mango seed kernel as a functional ingredient

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for animal feed could help reduce the current competition between human food and animal feed ingrdients[5]. This study aimd to evaluate the effect of processing on the nutritional and anti-nutritional contents of mango seed kernel using different processing methods. In order to determine its potential as feed for livestock.

MATERIALS AND METHODS

Study area: The study was conducted between February and August 2019 at the Federal College of Animal Health and Production Technology, Ibadan, Oyo State, Nigeria.

Collection and processing of experiment material: Ripe mango fruits (waste) were obtained from Oje Market in Ibadan. The kernel was manually removed from the seed and was divided into four treatments as follows:

- **Treatment A:** 500 g of mango kernel was roasted for 10 min on low heat (ROMK)
- **Treatment B:** 500 g of mango kernel was soaked for 24 hrs, drained and sundried (SOMK)
- **Treatment C:** 500 g of mango kernel was boiled in water for 30 min, drained and sundried (BOMK)
- **Treatment D:** 500 g of raw mango kernel was sundried (RAMK)

All four treatments were ground in a hammer mill into a powdery form and kept for laboratory analysis.

Chemical analysis: Dried samples were analyzed for crude protein, crude fiber, ether extract and ash according to AOAC[6]. After ashing of samples in a muffle furnace at 550°C, mineral analyses of calcium and potassium were determined using an Atomic Absorption Spectrophotometer while sodium was read in a flame photometer and phosphorus was read in the flame spectrophotometer. Saponin, Phytate, Tannin and oxalate were analysed using standard laboratory methods[6].

Statistical analysis: Data obtained were subjected to a one-way Analysis of Variance using the procedure of SAS (1987). Treatment means were compared using the Duncan's Multiple Range Test (Duncan, 1955) at 5% significant level.

RESULTS AND DISCUSSION

Proximate composition of processed mango seed kernel: The proximate composition of the processed mango seed kernel is presented in Table 1. The crude protein ranged from 5.60-6.30%. Soaking and roasting methods retained more protein than boiling. It was observed that processing reduced the protein content of the mango seed kernel. The reduction in protein content could be due to denaturation of protein by heat and leaching of soluble-proteins[7]. Diarra and Usman[8] also reported a reduction in the crude protein of boiled kernel. The highest value observed in raw (6.30%) is within the range (4.69-8.60%) reported by Das *et al*.[9]. The fiber content ranged between 9.50 and 10.10%. There was no significant difference ($p<0.05$) among the fiber contents of the processed mango kernel which were significantly lower than the unprocessed mango kernel (10.10%). The values of crude fiber obtained in this study were higher than the range of 1.61-3.66% reported by Das *et al*.[9]. Similar trends were observed for ash and ether extract contents, which was in agreement with the report of Diarra and Usman[8] who reported lower ash content in boiled mango kernel than raw.

Mineral contents of processed mango seed kernel: The results of mineral determination of raw and processed mango kernel are presented in Table 2. Processing had a significant ($p<0.05$) effect on the mineral contents of mango kernel; the raw recorded higher values among the treatments. Calcium ranged from 0.02% in treatments A and B and 0.04% in C while 0.12% was observed in D, potassium ranged between 0.37 and 1.06%, phosphorus ranged from 0.09-0.19%, sodium ranged between 0.96 and 1.24%. The values obtained for mineral contents of both raw and processed mango seed kernel were within the range recommended for ruminant[10].

Table 1: Proximate composition (g/100 g) of differently processed mango seed

Parameter	A (ROMK)	B (SOMK)	C (BOMK)	D (RAMK)	SEM
DM	86.71	86.54	85.23	86.50	0.03
CP	5.60^{d}	5.90^{b}	5.60^{b}	6.30^{a}	0.05
CF	9.55	9.55	9.50	10.10^{a}	0.80
EE	10.80^{b}	10.80^{b}	11.40^{b}	11.21^{a}	0.30
Ash	2.97^{a}	2.80^{a}	2.69^{b}	3.10^{a}	0.31
NFE	70.95	71.25	70.11	69.76	0.44

SEM: Standard error of mean, ^{abc}Superscript on the same column are not significantly different at ($p<0.05$), NFE: Nitrogen-free extract; DM: Dry matter, CP: Crude protein, CF: Crude fiber, EE: Ether extract, A (ROMK): Roasted mango kernel, B (SOMK): Soaked mango kernel and sundried, C (BOMK): Boiled mango kernel and sundried and D (RAMK): Raw mango kernel sundried

Table 2: Mineral contents (mg/100 g) of differently processed mango kernel

Parameters	A (ROMK)	B (SOMK)	C (BOMK)	D (RAMK)	SEM
Calcium	0.02^{c}	0.02^{c}	0.04^{b}	0.12^{a}	0.08
Potassium	0.93^{b}	0.37^{d}	0.46^{b}	1.06^{a}	0.69
Phosphorus	0.19^{a}	0.09^{b}	0.10^{b}	0.19^{a}	0.10
Sodium	1.21^{a}	0.96	0.85^{c}	1.24^{a}	1.20

SEM: Standard error of the mean, ^{abc}Superscript on the same column are not significantly different at ($p<0.05$), A (ROMK): Roasted mango kernel, B (SOMK): Soaked mango kernel and sundried, C (BOMK): Boiled mango kernel and sundried and D (RAMK): Raw mango kernel sundried

Table 3: Anti-nutritional factor (mg/100 g) of differently processed mango kernel

Parameters	A (ROMK)	B (SOMK)	C (BOMK)	D (RAMK)	SEM
Oxalate	34.78^{b}	24.39^{d}	30.65^{c}	42.99^{a}	0.62
Tannin	23.85^{b}	21.97^{c}	24.24^{b}	26.51^{a}	0.54
Saponin	19.04^{b}	10.17^{d}	13.28^{c}	22.95^{a}	0.78
Phytate	10.08^{d}	10.81^{b}	10.21^{c}	12.88^{a}	0.80

SEM: Sstandard error of the mean, ^{abc}Superscript on the same column are not significantly different at ($p<0.05$), A (ROMK): Roasted mango kernel, B (SOMK): Soaked mango kernel and sundried, C (BOMK): Boiled mango kernel and sundried and D (RAMK): Raw mango kernel sundried

Antinutritional contents of processed mango seed kernel: Table 3 shows the anti-nutritional factors of raw and processed mango seed kernel. The oxalate ranged between 24.39 and 42.99 mg/100 g. The results in this study were below the maximum limit for toxicity (2-5 g)[11] and consequently safe. Oxalate retards calcium and magnesium metabolism. Meanwhile, high oxalate food could be fed to ruminants without adverse effects as a result of microbial decomposition in their rumen[11]. Tannin ranged from 21.97 to 26.51mg/100 g, The lower trend in tannin content in this study was slightly higher than a range of 16.54-21.75 mg/g reported by Das *et al.*[9]. Tannins have been reported to bind proteins and reduce their availability[12]. Saponin ranged from (10.17-22.95 mg/g), Saponnins reduce intake of feed and uptake of certain nutrients including glucose and cholesterol. From the level obtained in this study, it is not likely that the saponnin content of mango seed kernel would affect its nutritional potential to any significant extent. Phytate ranged from 10.08 to 12.88 mg/100 g. The knowledge of the phytate level in feeds is necessary because high concentration can cause adverse effects on the digestibility[13]. Phytate forms stable complexes with Cu^{2+}, Zn^{2+}, Co^{2+}, Mn^{2+}, Fe^{2+} and Ca^{2+}.

CONCLUSION

The study investigated the nutritional potentials of processed mango kernel and the corresponding antinutritional contents. Processing of mango kernel via soaking retained higher protein while roasting conserved more ash contents than counter-part processing techniques. Specifically, roasting preserved potassium, phosphorus and sodium contents rather than soaking and boiling. Soaking caused a reduction in antinutrients such as oxalate, tannin, saponin and phytate that boiling and roasting. Mango kernel could be processed via soaking, roasting and boiling for potential application in animal feed formulation. Antinutritional information obtained in this study indicated that mango kernel could pose no toxicity problems if added as a supplement to livestock feeds.

SIGNIFICANCE STATEMENT

The study highlights the nutritional potential of processed mango kernel and its suitability for animal feed formulation. Processing methods such as soaking, roasting and boiling were found to influence the retention of nutrients and reduction of antinutrients. Soaking effectively reduced antinutritional factors, while roasting preserved essential minerals like potassium, phosphorus and sodium. The findings suggest that mango kernel, when appropriately processed, poses no toxicity risks and can serve as a valuable supplement in livestock feeds.

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