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# Effect of processing methods on the proximate composition, minerals, anti-nutrient, in-vitro protein digestibility and protein fractions of Melon seed (*Citrullus lanatus)*

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***Abstract***

*Processing treatments are considered an effective way of enhancing nutritional quality through mineral availability, protein digestion and anti-nutrient reduction. This study seeks to examine the effect of processing methods on the nutritional quality, protein fraction and digestibility as well as mineral content and anti-nutrient values. Matured, harvested and defatted melon seeds were subjected to varying processing treatments viz MD: Melon defatted (control); MDS: Melon defatted soaked; MDB: Melon defatted Boiled; MDSB: Melon defatted soaked boiled (boiled for 15mins); MDSBB: Melon defatted soaked boiled (boiled for 30mins). Results showed that processing methods (soaking and boiling) revealed a decreased effect on some minerals such as calcium, iron and sodium. The decreasing effect was noticed more when boiled for 15 and 30 minutes respectively. Protein fraction evaluation showed that glutenin, globulin and total extractable protein were significantly higher in MDS samples with values of 19.57, 22.06 and 48.31 respectively. The anti-nutrient results showed that the control sample MD had a higher significantly tannin content of1.31mg/g than other samples. Invitro protein digestibility values revealed that the processing methods had no effect on protein digestibility of defatted melon seed*

***Keywords: In-vitro protein digestibility, Melon seed, Processing methods***

## INTRODUCTION

Melon is a cucurbit crop that belongs to the cucurbitaceae family with fibrous and shallow root system. Melon seeds (*Citrullus lanatus*) is the biological ancestor of the water melon now found all over the world, but it originated from West Africa. Melons are major food crops with several varieties which serve as major food sources (Mabalaha *et al.,* 2007). Curcubit spp are among the economically most important vegetable crops worldwide and are grown in both temperate and tropical regions (Pitrat *et al.,* 1999).

Melon seed popularly called 'Egusi' in South Eastern part of Nigeria is presented primarily as the seed of *Citrullus lanatus* a type of watermelon. The specie is very popular, highly productive and has a good quality (Anons, 2006).Unlike the water melon, whose flesh is sweet and red, the (egusi)

melon's juice flesh are pale yellow or green and taste bitter, enough to be repulsive. This is one fruit that even the monkeys do not bother with. A creeping annual herb, the egusi (melon) has hairy stems, forked tendrils and three lobed hairy leaves (Ojieh *et al.,* 2008).

The melon seed is a tasty seed that is not only rich in oil but rich in protein and it could be of exceptional value in most parts of Africa, especially where chronic malnutrition strains health and drains initiative (Anons, 2006). Melon seeds are less expensive and widely distributed. They can contribute substantially towards obtaining a balanced diet (Fokou, *et al.,* 2004).

In West Africa where soups are integral of life, they are a major soup ingredient and a common component of daily meals. Coarsely ground up, they thicken stews and contribute to widely enjoy steamed dumpling, some are soaked, fermented, boiled and wrapped in leaves to form a favourite food seasoning (Oluba *et al.,* 2008).

Melon seeds comprise 50% oil and 35% protein sssss, vitamin C and B2, minerals, riboflavin, fat, carbohydrates and protein (Lazos, 1986). Despite the vast nutritional and medicinal significance of melon seeds, little detail on its amino acid and mineral composition is available. Nwokolo and Sim (2006) reported that defatted melon seed has protein content of 66.2% with an excellent profile of amino acids, containing higher levels of most essential amino acids (except lysine) than soybean meal.

The biological indices of its protein quality have been described as: “lower than soybean but comparable to or higher than most oilseeds”. The seed contain significant amount of Vitamins, Thiamin and Niacin. Egusi (melon) has some additional dietary bonuses which come from its minerals. It is a vital tool against marasmus, kwashiorkor and other debilitations. Flours produced from locally grown egusi seed could improve diets of many African countries whose population currently suffers inadequate diets. Soaking a cost effective method employed in the removal of anti-nutrients from grains have been shown to improve grain value and nutritional quality ( Singh et.al, 2017; Kajihausa et. al, 2014). According to Embaby 2010, the hydration of grains can be achieved through the process of soaking, a pretreatment that is time dependent. Investigations have further revealed that heat processing of grains and seeds inactivate heat labile anti-nutritional factors. Boiling, Cooking, Autoclave, Pressure cooking are some of the heat treatments applied during processing. Osungbade et. al, (2016) reported improved protein quality of Sandbox seeds after thermal application.

## MATERIALS AND METHODS:

### Source of Materials:

The melon seed were purchased from market, sorted to remove debris and extraneous materials. They were further dehusked and packaged in an air tight container for processing.

### Sample Preparation;

The samples were divided into five equal parts of 200g each. One part was used as control ( MD ) while the second part was soaked in de-ionized water (1: 3w/v) in an aluminum bowl for 12hrs at room temperature ( MDS ).Sample (MDB) was boiled for 30mins at 100$^{o}$C without soaking

(MDB ). Further samples MDSB and MDSBB were boiled for 15mins and 30mins at 100°C respectively.

The soaked and boiled samples of the seeds were oven dried (Model No. 320 Gallenkamp, England) at 60°C for 6hrs. The dry seeds were milled to fine flour in a manually driven attrition mill (Manesty machines Ltd, Liverpool) while the control was milled directly without any treatment. The flour was defatted in a soxhlet extractor (Barnstead) for 3h and dried in an air oven at 105°C for 30mins to remove residual solvent. The defatted flour was packaged in a polythene bag and stored in the refrigerator at 4°C until ready for analysis

The samples were analyzed for moisture, crude protein, ether extract, total ash and total carbohydrate.

**Moisture Content**

Five (5 g) grams of milled sample was weighed into a heated, cooled, and dried aluminium dish. Thereafter, the samples were heated in oven ( Gallenkamp Hot box) at 105°C for 3 hours. The dish and its content were removed after one hour in the oven, cooled in a dessicator and re-weighed. The percentage moisture content of the samples was calculated from the weight loss.

$$\text{Moisture (\%)} = \frac{Loss\ of\ wt}{Wt\ of\ sample} \times 100$$

**Total Carbohydrate**

The Clegg Anthrone method of Osborne and Voogt (1978) was used in the determination of total available carbohydrate of prepared flours and developed products. One gram (1 g) of sample was digested using 13 ml of 52% perchloric acid (diluted with water in the ratio of 270 ml : 100 ml). One (1 ml) of the digest was pipette into a test tube and 5 ml of freshly prepared Anthrone reagent was added, mixed and allowed to stand in a boiling water bath for exactly 12 minutes. The test tube and its content were then removed and cooled quickly to room temperature. The absorbance of the sample mixtures and standards were then read at 630 nm against the reagent blanks and the total available carbohydrate content of the biscuits and raw material was thus calculated:

$$\text{Total available carbohydrate (as \% Glucose)} = \frac{25 \times b}{a \times w}$$

Where:

w = weight (g) of sample

a = Absorbance of dilute standard

b = Absorbance of sample

**Crude Protein**

The micro-kjeldahl method was used for the determination of total nitrogen. Fifty milligram (50 mg) of the sample was weighed into a 100 ml Kjeldahl flask. Thereafter, one and half tablet of Kjeldahl catalyst was added and 10 ml of nitrogen free concentrated sulphuric acid added. The mixture was heated slowly for digestion in a fume cupboard with the flask placed an angle of 40º for 30 minutes. Heating was then increased and continued until frothing ceased. The sample was allowed and then transferred into 100ml volumetric flask and made to volume with distilled water. Ten millilitres (10 ml) of the digest was introduced into 100 ml Kjeldahl distillation flask and 10ml of 45% NaoH was added. The ammonia liberated was steam distilled into a 5 ml of boric acid indicator in a conical flask until 50 ml of distillate was obtained. This was titrated against 0.05N $H_2SO_4$ to give the nitrogen content of the sample. A blank determination was also carried out and subtracted from the sample reading and the %N was calculated thus:

$$N\,(\%) = \frac{(Titre - Blank) \times Normality\ of\ acid}{Wt\ of\ sample}$$

The percentage crude protein content of the sample and biscuits was calculated thus:

Crude protein (%) = % N × 6.25

(Where: 6.25=Conversion factor of protein)

**Ether extract**

Determination of crude Fat was carried using the soxhlet e x 1.4 ction unit). Fifty milligrams (50 mg) of dried sample was weighed, wrapped in a whatman number 1 filter paper and extracted in the extraction unit for 3 hours using petroleum ether as solvent. At the end of the extraction process, the ether was evaporated and the weight of the extraction flask taken. The difference in weight of the extraction flask before and after extraction was recorded as the amount of fat or ether extract.

$$\text{Crude Fat (\%)} = \frac{Wt\ of\ ether\ extract}{Wt\ of\ sample} \text{ x } \times 100$$

**Total Ash**

One gram (1gm) of sample was weighed into a previously ignited and cooled porcelain with lid. The crucible and sample were heated on a heating mantle in a fume cupboard until smoking ceased. The crucible and the content were then transferred to a pre-heated muffle furnace and allowed to ash for 3 hours at 500ºc. Upon completion of ashing the crucible along with its content were removed from the furnace and cooled in a dessicator, and then weighed again. The percentage ash content of the sample was then calculated as follows:

$$\text{Ash (\% )} = \frac{Wt\ of\ Ash}{Wt\ of\ sample} \times 100$$

**Anti-nutrients Analysis**

**Determination of Phytic Acid**

Phytic acid determination was carried out using the method of Lucas and Markaka (1975) as described by Essien and Akpan (2014).

Two grams of sample was weighed into a 250 ml conical flask, and 100 ml of 2% concentrated HCl added. This was allowed to soak for 3hr and then filtered. Thereafter, 50 ml of the filtrate was pipetted into a 250 ml beaker containing 107ml of distilled water to improve acidity and 10 ml of 0.3% ammonium thiocyanate solution was added as indicator and titrated with standard iron iii chloride ($FeCl_3$) solution which contained 0.00195g iron/ml until a brownish yellow colour appear and persist for 5 minutes. Phytic acid content was calculated as shown by Russel (1980) below.

$$\text{Phytic acid g/100g} = \frac{0.00195 \times Vol.\ of\ FeCl_3\ consumed \times DF}{Wt\ of\ sample}$$

**DF:** Total volume of extraction solvent added/volume of aliquot taken for the titration

**Determination of Tannin**

The determination of Tannins was carried out using the Folin Ceocalteu method described by Jaffe (2003). One gram (1g) of dried and well blended sample was weighed into a flask and 10 ml of distilled water added and agitated. This was allowed to stand for 30 min at room temperature and centrifuged (L 600) at 2500 rpm for 15 minutes. Then, 2 ml of supernatant was measured into a 10 ml volumetric flask and 1ml of folin-ceocalteu reagent added. Thereafter, 2 ml of saturated $Na_2CO_3$ solution was added and then diluted with 10 ml of distilled water. This was incubated for 30 minutes at room temperature.

Tannic acid standards of 20, 40, 60, 80, 100, 120 mg/l was prepared from a stock of 500 ppm (50 mg of Tannic acid standard dissolved in 100 ml of distilled water). A wavelength of 725 nm was used to read off the absorbance of tannic acid concentrations. A calibration curve for the tannic acid standards was drawn, that is, absorbance against concentration and extrapolated by tracing the absorbance of the sample down the concentration axis to obtain the tannic acid concentration of the sample

**Calculation:**

$$\text{Tannic Acid content (mg/100g)} = \frac{\text{Conc.obtained in mg per litre x Vol of sample x DF}}{Wt\ of\ sample}$$

**DF:** Dilution factor. If not diluted, then DF = 1

### Mineral Analysis of the Sample

Mineral analysis was done by incineration according to AOAC (2012). One gram of sample was weighed into a dry porcelain crucible of known weight and ignited at 550ºC for 3 hours in a muffle furnace and then allowed to cool. Five millilitres (5 ml) of concentrated Hydrochloric acid (HCL) was diluted with 20 ml of distilled water and 5 ml of the solution was added to the crucible. The content of the crucible was heated on a hot plate to half of its volume and allowed to cool, then filtered with Whatman filter paper no 4 into a 100 ml volumetric flask and made up to volume with distilled water. The filtrate was used in the determination of mineral elements. All the mineral elements were determined spectrophotometrically on the Buch Scientific Atomic Absorption Spectrophotometer. The light source used was the hollow cathode lamp of each element with wavelength as follows: Ca = 422.7 nm; Na = 330.3 nm; Fe = 248.3 nm; Cu = 327 nm; Mg = 202.6nm; and K 766.5 nm. De-ionized water was used to set the equipment at zero before running the mineral element standards.

$$\text{Metal (\%)} = \frac{\text{Concentration (ppm) X Solution Vol.}}{10^4 \text{ x weight of sample}} \text{ x } 100$$

### Analysis of In- vitro protein digestibility

In – vitro protein digestibility of the samples were determined by the method of Nawal *et al.* (2015) with slight modifications. Defatted flour samples (250 ± 0.01mg) were suspended in 15ml of 0.1 M hydrochloric acid in a glass tube. Pepsin enzyme (1 . 5 ± 0.0lmg) was introduced into the suspension and shaken at $37^0$C for 3hours . The solution was neutralized with 0.5N sodium hydroxide and treated with 4mg of pancreatic enzyme in 7.5ml of 0.2M phosphate buffer (pH 8.0) containing 0.005M sodium azide. The mixture was shaken gently at 37 $^0$C for 24 hours. The solids were separated by centrifugation at 4000rpm for 30 minutes and washed with water (5 x 30ml) and filtered with Whitman No. 1 filter paper. The residue was dried in the oven at $100^0$C and analyzed for nitrogen by the Kjeldahl method. The in-vitro protein digestibility was calculated in accordance with the formula:

$$\text{\% In- vitro protein digestibility} = \frac{N_2 \text{ of Sample} - N_2 \text{ of residue x } 100}{N_2 \text{ of sample}}$$

**RESULTS:** The result of the effect of processing methods on the proximate composition of melon seed are shown in Table 1. The results indicated that the processing methods had significant effects on the moisture, crude protein and total carbohydrate contents of the melon seeds while ash, fat and energy values, had no significant differences ($p>0.05$) resulting from the treatment methods. It showed that the processing methods significantly increased ($p<0.05$) the moisture contents of

the *Citrullus lanatus* samples when compared with the control. The result also showed that soaking (MDS) significantly lower ($p<0.05$) the carbohydrate content of melon seeds.

**Table 1: Effect of processing methods on the proximate composition of Melon seeds**

| Proximate (%) | Mean ± Std. | | | | |
|---|---|---|---|---|---|
| | **MD (control)** | **MDS** | **MDB** | **MDSB** | **MDSBB** |
| Moisture | $6.35 \pm 0.98^{b}$ | $8.90 \pm 1.00^{a}$ | $8.42 \pm 0.95^{ab}$ | $10.00 \pm 2.13^{a}$ | $8.98 \pm 1.01^{a}$ |
| Ash | $5.43 \pm 0.12^{a}$ | $4.80 \pm 1.99^{a}$ | $5.20 \pm 1.20^{a}$ | $4.38 \pm 0.69^{a}$ | $4.88 \pm 1.11^{a}$ |
| Fat | $9.18 \pm 1.02^{a}$ | $10.97 \pm 0.99^{a}$ | $9.41 \pm 2.99^{a}$ | $9.74 \pm 1.01^{a}$ | $9.72 \pm 1.34^{a}$ |
| Crude Protein | $65.8 \pm 3.95^{ab}$ | $67.13 \pm 1.94^{a}$ | $66.08 \pm 1.92^{ab}$ | $66.06 \pm 4.03^{ab}$ | $63.13 \pm 1.94^{b}$ |
| Total Carbohydrate | $13.24 \pm 0.88^{a}$ | $8.20 \pm 0.92^{c}$ | $10.89 \pm 1.10^{b}$ | $9.82 \pm 1.00^{b}$ | $13.29 \pm 4.80^{a}$ |
| Energy value (kcal) | $398.78 \pm 1.21^{a}$ | $400.05 \pm 29.95^{a}$ | $392.57 \pm 17.68^{a}$ | $391.18 \pm 8.09^{a}$ | $393.16 \pm 2.87^{a}$ |

Each data is mean of three replicates ± Standard Deviation (SD). Mean values with the same letters as superscripts along the row are considered non-significant ($p>0.05$) while mean values with different letters as superscripts are considered significant ($p<0.05$).

**Effect of processing methods on mineral constituents of Melon seeds**

Table 2 showed the effects of processing on mineral content such as calcium, iron, copper, sodium and potassium constituents of the melon samples. There was no significant differences ($p>0.05$) observed for zinc and magnesium contents of the sample. However, the sodium and potassium, showed decreasing values with the boiling method for the melon seed. The result also showed that MSDSBB had a significant higher ($p<0.05$) content of calcium with a value of 1.17mg/100g and MDSB; had a significantly higher ($p<0.05$) amount of iron (11.34mg/100g) when compared to other groups.

**Table 2: Effect of processing methods on mineral constituents of Melon seeds**

| Minerals (mg/100g) | Mean ± Std. | | | | |
|---|---|---|---|---|---|
| | **MD (control)** | **MDS** | **MDB** | **MDSB** | **MDSBB** |
| Calcium | 0.64 ± 0.00b | 0.70 ± 0.20b | 0.76 ± 0.18b | 0.28 ± 0.01c | 1.17 ± 0.08a |
| Iron | 5.77 ± 0.78b | 6.59 ± 1.01b | 6.07 ± 1.00b | 11.34 ± 0.98a | 5.87 ± 0.88b |
| Copper | 0.49 ± 0.10a | 0.14 ± 0.01bc | 0.45 ± 0.30a | 0.36 ± 0.01ab | 0.07 ± 0.00c |
| Zinc | 7.05 ± 1.01a | 7.38 ± 1.69a | 6.48 ± 2.10a | 6.81 ± 2.09a | 6.38 ± 1.69a |
| Sodium | 1.37 ± 0.08a | 1.25 ± 0.01ab | 1.10 ± 0.10c | 1.12 ± 0.11bc | 1.01 ± 0.01c |
| Magnesium | 3.31 ± 1.00a | 3.59 ± 0.69a | 3.16 ± 0.88a | 3.02 ± 1.01a | 2.85 ± 0.08a |
| Potassium | 23.20 ± 1.80a | 20.27 ± 3.11b | 24.80 ± 4.95a | 16.00 ± 2.00c | 16.53 ± 1.19c |

Each data is mean of three replicates ± Standard Deviation (SD). Mean values with the same letters as superscripts along the row are considered non-significant ($p>0.05$) while mean values with different letters as superscripts are considered significant ($p<0.05$).

**Effect of processing methods on protein fraction of Melon seed**

The methods of processing had varying effects on protein fraction of the melon samples as shown in Table 3. The result showed that soaking had a significant increase ($p>0.05$) on the protein fractions when compared with control (MD). except for albumin that soaking showed a significant decrease ($p>0.05$) with a value range of 1.81 – 4.24 as compared with the different boiling methods. In the case of globulin, the result revealed a significant increase ($p>0.05$) as affected by the processing methods when compared with that of the control (MD).

**Table 3: Effect of processing methods on protein fraction of Melon seed**

| Protein fractions | Mean ± Std. | | | | |
|---|---|---|---|---|---|
| | MD(control) | MDS | MDB | MDSB | MDSBB |
| Globulin | $12.24 \pm 1.98^{c}$ | $22.06 \pm 0.06^{a}$ | $20.62 \pm 3.02^{ab}$ | $20.36 \pm 1.01^{ab}$ | $18.96 \pm 1.81^{b}$ |
| Albumin | $9.42 \pm 1.02^{a}$ | $4.24 \pm 1.01^{b}$ | $3.20 \pm 1.01^{bc}$ | $1.81 \pm 0.01^{c}$ | $1.82 \pm 0.02^{c}$ |
| Glutelin | $10.24 \pm 1.61^{b}$ | $19.57 \pm 3.21^{a}$ | $9.66 \pm 1.98^{b}$ | $9.88 \pm 1.02^{b}$ | $9.74 \pm 2.54^{b}$ |
| Prolamine g/100g | $2.58 \pm 0.08^{ab}$ | $2.44 \pm 0.08^{b}$ | $1.62 \pm 0.01^{c}$ | $1.20 \pm 0.10^{d}$ | $2.48 \pm 0.02^{ab}$ |
| Total Extractable Protein | $34.48 \pm 3.01^{b}$ | $48.31 \pm 8.31^{a}$ | $35.10 \pm 4.01^{b}$ | $33.25 \pm 1.02^{b}$ | $33.00 \pm 1.95^{b}$ |
| Crude protein | $65.8 \pm 9.90^{ab}$ | $67.13 \pm 2.81^{a}$ | $66.06 \pm 5.01^{ab}$ | $66.06 \pm 2.03^{ab}$ | $63.13 \pm 11.02^{a}$ |

Each data is mean of three replicates ± Standard Deviation (SD). Mean values with the same letters as superscripts along the row are considered non-significant ($p>0.05$) while mean values with different letters as superscripts are considered significant ($p<0.05$). Key: MD....Melon defatted (control), MDS.... Melon Defatted Soaked, MDB.... Melon Defatted Boiled, MDSB.... Melon Defatted Soaked Boiled (boiling is for 15mins), MDSBB.... Melon Defatted Soaked Boiled (boiling for 30minns)

**Effect of processing methods on In vitro protein digestibility, anti-nutrients tannins and phytate on Melon seeds**

The result of the effect of processing methods revealed no significant differences when compared melon defatted (control), melon defatted soaked (MDS) and melon defatted boiled (MDB) for in-vitro protein digestibility (Table 4). There was an observed significant decrease in the tannin content of the melon samples resulting from the processing methods as seen in the table below. The result also showed that soaking decreased the phytate content of the melon samples when compared with the control and boiling.

**Table 4: Effect of processing methods on In vitro protein digestibility, anti-nutrients tannins and phytate on Melon seeds**

| Samples | In vitro protein digestibility (%) | Anti-nutritional factors (mg/g) | |
|---|---|---|---|
| | | Tannin | Phytate |
| MD**(control)** | 85.23 ± 1.78$^{a}$ | 1.13 ± 0.01$^{a}$ | 0.25 ± 0.08$^{ab}$ |
| MDS | 87.95 ± 1.02$^{a}$ | 0.94 ± 0.01$^{b}$ | 0.15 ± 0.02$^{b}$ |
| MDB | 85.29 ± 4.80$^{a}$ | 0.63 ± 0.08$^{c}$ | 0.23 ± 0.11$^{ab}$ |
| MDSB | 74.54 ± 1.43$^{b}$ | 0.83 ± 0.08$^{b}$ | 0.37 ± 0.10$^{a}$ |
| MDSBB | - | 0.83 ± 0.10$^{b}$ | 0.37 ± 0.01$^{a}$ |

Each data is mean of three replicates ± Standard Deviation (SD). Mean values with the same letters as superscripts along the column are considered non-significant ($p>0.05$) while mean values with different letters as superscripts are considered significant ($p<0.05$).

Key: MD....Melon defatted (control), MDS.... Melon Defatted Soaked, MDB.... Melon Defatted Boiled
MDSB.... Melon Defatted Soaked Boiled (boiling is for 15mins), MDSBB.... Melon Defatted Soaked Boiled (boiling for 30minns)

**Discussion**:

The findings indicate that soaking and boiling at various time intervals did not significantly ($p<0.05$) affect the ash, fat, or energy contents of the melon samples (MDS, MDB, MDSB, and MDSBB) when compared to the control sample (MD). The observed carbohydrate content of the defatted melon sample (8.20%) was lower than that of other samples, which ranged from 9.82% to 13.29%. Moisture content is a critical factor since it influences the yield of oil during extraction, with high moisture levels potentially reducing oil yield (Mansor et al., 2012). Soaking and boiling likely increased the moisture content of the melon seeds due to water absorption through simple diffusion during boiling.

The high crude protein content found in the samples suggests that melon seeds are nutritionally valuable and could serve as an excellent source of dietary protein. Obasi et al. (2012) reported oil yields ranging from 44.26% to 50.42% for melon seeds, which are fairly consistent with previous reports on the proximate composition of these seeds by Makinde and Akinoso (2013), and Okorie and Abiara (2012).

Table 2 revealed significant differences ($p<0.05$) in the calcium, iron, sodium, and potassium contents of melon seeds. Soaking and boiling reduced the levels of these minerals in the melon seeds. However, the magnesium content of *Colocynthis lanatus* remained unchanged ($p>0.05$) after processing.

The results in Table 4 highlight the impact of processing methods on in vitro protein digestibility and the levels of anti-nutrients such as tannins and phytates in melon seeds. Protein digestibility is a key indicator of amino acid availability and is crucial for assessing the nutritional quality of food

proteins. The in vitro protein digestibility (IVPD) of *Colocynthis lanatus* improved after processing, which can be attributed to the reduction or elimination of various anti-nutrients. Phytic acid, condensed tannins, and polyphenols are known to form complexes with proteins, leading to cross-linking that decreases protein solubility and impedes protease access to peptide bonds (Genovese and Lajolo, 1996). Thermal processing, on the other hand, may induce structural changes in proteins, such as in globulin, enhancing chain flexibility and protease accessibility.

The application of heat treatments in this study significantly ($p<0.05$) reduced the tannin content in *Colocynthis lanatus*. This reduction aligns with previous studies on various plant foods subjected to boiling, microwave cooking, autoclaving, and roasting ( Fagbemi et al., 2005; Nithya et al., 2007). The decrease in tannin levels during boiling may be attributed to the loss of these compounds at high temperatures (Nithya et al., 2007) or due to interactions with other seed components, such as proteins, forming insoluble complexes (Embaby, 2010).

The observed reduction in phytate content during thermal processing might be partly due to the formation of insoluble complexes, such as phytate-protein or phytate-protein-mineral complexes, or due to the hydrolysis of inositol hexaphosphate to lower phosphate forms like penta- and tetraphosphates (Siddhuraju and Becker, 2001).

**Conclusion:**

The samples were found to possess appreciable amount of fat, protein, carbohydrate and energy contents which suggests that the seeds are nutritionally potent. Further, there was a content of protein and protein fractions with soaking but this tends to decrease at boiling for 30mins which could suggest that decrease in protein content may occur as a result of leaching loss and solubility of nitrogen when boiling the melon seeds for a longer time and high temperature as observed in this study. This study further revealed that heat processing methods had a decreased effect on the anti-nutritional contents, and some mineral contents such as calcium, iron and sodium, including protein fractions such as albumin and glutelin. Finally, the processing methods increased the moisture contents of the seeds but did not have effect on other proximate constituents.

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