Melon pod fermentation and its effects on physio-chemical characteristics of melon seeds

B. A. Jackson*, C. A. Adamade, I. I. Azogu and K. C. Oni

National Centre for Agricultural Mechanization, P. M. B. 1525, Ilorin, Kwara State, Nigeria.

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Studies were carried out to determine the effects of melon pod fermentation on the proximate and mineral composition of the melon seeds. Two varieties of melon commonly found in Nigeria were analyzed for similarities in this study. Proximate and mineral compositions of the seeds (Citrullus vulgaris, Egusi melon) were determined using standard analytical procedures. Comparative analysis of the seeds from the fermented pod and those from the unfermented pods showed that there were negligible differences in the seeds composition reported to dry weight. Results shows that the moisture content for the fermented samples was between 5.3±0.1% and 5.8±0.3%, while in the unfermented seeds it was 5.3±0.1% and 5.6±0.3% for the Bara and Sewere respectively. Ash content was 3.3±0.1% and 3.8±0.1% in the fermented while it was 3.5±0.1% and 3.6±0.1% in the unfermented Bara and Sewere respectively. Ether extract was between 31±0.1% and 33±0.1%, crude protein (18.25±0.1% and 19.30±0.2%), crude fiber (14.92±0.1% and 15.8±0.1%) and total carbohydrate (22±0.2% and 23±0.2%). The acid value for the unfermented melon seeds of all the varieties used was in the range of 1.65±0.1% and 1.68±0.1% while the iodine values obtained was in the range of 21.4±0.1% and 21.6±0.1%. The results showed that fermentation does not affect the mineral compositions of the melon seed and had no significant effect on the quality of the seed at the 5% significant level using the Duncan Multiple Range Test.

Key words: Fermentation, melon pod, seed.

INTRODUCTION

Melon most popularly called “Egusi” in Nigeria goes by various botanical names according to its variety; these include “Citrulus edulis, Citrus vulgaris, Citrus lanatus, as reported by Odigboh (1979) and Okoko (1997). C. lanatus (Egusi) is indigenous to the West African region; although, it is the progenitor of the water-melon it was domesticated only for its seeds in West Africa (Blench, 1997).

Melon (Egusi) is an important component in the traditional cropping system; it is usually inter-planted with stable crops such as cassava, maize, sorghum etc. (Omidiji et al., 1985).

Two varieties are commonly grown in Nigeria; these are the Bara and Sewere. Survey and evaluation trials conducted by Lanre and Adeniran (1998) showed definite geographical distribution and difference in the performance of the two types; with the Bara having the widest distribution.

Statistics have it that 100,000 and 488,000 metric tons of Melon were produced in Nigeria in 1992 and 1997 respectively (Federal Office of Statistics, 1998). Processing of melon involves depodding, fermentation, washing drying, cleaning and shelling (Kushwaha et al., 2006). Depodding and fermentation are carried out simultaneously as the pods are left on the field to rot for three to four days; after the pods are rotten and soft, the washing stage is then initiated. Fermentation is usually carried out to make the removal of the seeds from the
Left on the field to rot for 3 to 6 days

Figure 1. Flow chart for processing melon pod.

However, the process of fermentation and washing are very unpleasant, stressful and dangerous which sometimes lead to stings from scorpions and bites from snakes that hide within the rotten pods. Fermentation is usually carried out in a moist solid state involving contact with appropriate inocula of assorted microorganism. The desired state of fermentation is indicated by the formation of mucilage and over tones of ammonia produced as a result of the breakdown of amino acids during fermentation (Omofuvbe, 1998).

Researches have been conducted into the production of fermented "Iru from African locust bean by renowned researchers. (Eka, 1980; Odunfa, 1981, 1986) and also into fermented melon seeds “Ogiri” but so far there has been no work on the production of unfermented melon seeds and the associated changes that occur as a result of the non fermentation of the melon pod. Below is the processing flow chart for melon seed production.

In view of the immense importance of the shelled melon seed for domestic and industrial purposes, it becomes imperative to investigate means of increasing its production.

This study is intended to look into the effects of not fermenting the melon pod on the quality of melon seeds in terms of its proximate and mineral composition, and look into the possibility of eliminating the fermentation stage in the egusi melon processing as a means of increasing its production.

MATERIALS AND METHODS

Materials used in this study are mainly melon seeds, fresh melon pods and a melon shelling machine.

The melon seeds and pods used were purchased at the Idofian market in Ilorin, Kwara State. The extraction of seeds from the fresh melon pods to remove the seeds was carried out at the National Centre for Agricultural Mechanization, Ilorin, Kwara state, Nigeria. Stages in the processing of egusi melon pods to the seed are as shown in Figure 1.

Sample preparation

Two varieties of melon seeds were used for the experiment to determine the effects of non fermentation of melon pod on the quality of the melon seed. These are the Bara and the Sewere variety of melon pods. The samples were labeled sample A_B, A_S and B_B, B_S.

Where the subscripts denote the variety of melon pod. B - Bara and S – Sewere.

Sample identification

The samples used were identified as C. lanatus by a taxonomist in the Farm Management Unit of the National Centre for Agricultural Mechanization (NCAM) Idofian, Ilorin, Nigeria.

Sample A - These are seeds prepared from unfermented melon pods.

Sample B - These are seeds prepared from fermented melon pods.

Sample A

Seeds from unfermented melon pods were extracted by shearing, fresh from the farm pods using a knife, after which the seeds were carefully removed and washed. The washed and dried seeds are
Figure 2. a) Unshelled melon seeds, b) unfermented melon pod and c) Shelled melon seeds.

displayed in Figure 2a. This was followed by the drying of the seeds using the open air drying system. The ambient temperature at the period of drying ranged from 30 - 32°C (mean 31°C), while the relative humidity fluctuated between 65 - 68% (mean 66%). The dried seeds were then collected and sorted to remove bad and damaged seeds after which it was shelled. The shelled seeds are displayed in Figure 2c.

Sample B
Seeds from fermented melon pods were collected fresh from the farm after the pod had completely undergone fermentation (Figure 1). The seeds were then carefully collected and washed. The washed and dried seeds are displayed in Figure 2a. This is followed by drying of the seeds using the open air drying system. The ambient temperature at the period of drying ranged from 30 - 32°C (mean 31°C), while the relative humidity fluctuated between 65 - 68% (mean 66%). The dried seeds were then collected and sorted to remove bad and damaged seeds after which it was shelled. The shelled seeds are displayed in Figure 2c.

Determination of moisture content
The moisture content was determined by oven drying 10 g of ground seeds in the oven at 105°C to constant weight.

Determination of proximate composition
Proximate compositions analyses of the samples were carried out in triplicate using methods described by the Association of Official Analytical Chemist (AOAC) 2008.

Determination of Iodine value
The Iodine value was determined by shaking 25 cm of Dam’s Bromine solution with 0.5 g of sample dissolved in 10 cm of chloroform using a conical flask. The mixture is then placed in the dark for 30 min. 10 cm$^3$ of 10% potassium solution is then added to the mixture and shaken thoroughly. 75 cm$^3$ of distilled water was used to wash the sides of the conical flask free of any iodine while starch solution was used as indicator. The mixture is then titrated against 0.1 ml Na$_2$S$_2$O$_3$ until a colorless solution was obtained, signifying the end point.

Determination of acid value
This was determined using the Association of Official Analytical Chemist (AOAC) method (2001). 50 ml of mixture of diethyl ether
Table 1. Proximate composition of fermented and unfermented Citrulus Lanatus (Egusi melon) value.

<table>
<thead>
<tr>
<th>Composition</th>
<th>% by weight of fermented seeds</th>
<th>% by weight of unfermented seeds</th>
<th>% by weight of fermented seeds</th>
<th>% by weight of unfermented seeds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B_a(Bara)</td>
<td>B_s(Sewere)</td>
<td>A_b(Bara)</td>
<td>A_s(Sewere)</td>
</tr>
<tr>
<td>Moisture</td>
<td>5.64±0.3</td>
<td>5.74±0.1</td>
<td>5.8±0.3</td>
<td>5.30±0.1</td>
</tr>
<tr>
<td>Ash</td>
<td>3.76±0.1</td>
<td>3.46±0.1</td>
<td>3.88±0.1</td>
<td>3.35±0.1</td>
</tr>
<tr>
<td>Ether extract</td>
<td>31.50±0.1</td>
<td>31.01±0.1</td>
<td>33.92±0.1</td>
<td>32.02±0.1</td>
</tr>
<tr>
<td>Crude protein</td>
<td>19.25±0.1</td>
<td>18.75±0.1</td>
<td>18.79±0.1</td>
<td>19.31±0.1</td>
</tr>
<tr>
<td>Crude fibre</td>
<td>15.77±0.1</td>
<td>15.74±0.1</td>
<td>14.92±0.1</td>
<td>15.81±0.1</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>24.08±0.2</td>
<td>24.78±0.2</td>
<td>22.69±0.2</td>
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Means of three determinations ±standard deviations. Figures along horizontal lines followed by the same letter are not significantly different according to Duncan’s’ Multiple Range Test at the 95% confidence level.

and 95% ethanol was put into a conical flask and 1 ml of phenolphthalein indicator added. This was neutralized with 0.1 M NaOH.

2 g of sample was weighed using a sensitive balance and dissolved in the neutralized mixture. Titrations were done with 0.1 M NaOH until a persistent pink color was obtained. The acid value was then calculated using the equation below.

\[
\text{Acid value (A.V) = } \frac{\text{Average titre value (ml) } \times 5.61}{\text{Weight of sample used}}
\]

Where 5.61 is a constant.

**pH value**

The pH value of the samples was determined using a pH meter. (Jenway pH meter p165 model 3510).

**Determination of mineral composition**

The minerals were analyzed from solutions obtained by first drying the sample at 525°C and dissolving the ash in volumetric flasks using distilled, de-ionized water with a few drops of concentrated hydrochloric acid. Sodium and potassium were then determined using a flame photometer (Model 405, Corning, UK). Sodium Chloride (NaCl) and Potassium Chloride (KCl) were used for preparation of standards. The other metals in this report were determined by means of an atomic absorption spectrophotometer (PYE Unicon, UK, Model SP9), using the following salts: FeSO_4, (NH_4)_2SO_4, H_2O, CaCO_3, MgSO_4, CuSO_4, MnO_2 and Zn(NO_3)_2 for preparation of standards.

**Determination of peroxide value**

The peroxide values of the extracted oil were determined according to the thiocyanate method (Pearson, 1970).

**RESULTS AND DISCUSSION**

From the investigation carried out, there is a clear indication that the effects of fermentation on the proximate composition, the iodine, acid values and in the mineral composition of the melon seeds processed from the unfermented pods.

Results obtained as displayed in the various tables show the significances of fermentation on the proximate composition, the iodine value, acid values, the mineral composition, pH and the peroxide value of the melon seed.

Represented in Table 1, the results of proximate analysis shows that there were no significant differences in the proximate composition of the melon seeds, similar result was obtained by Sanni et al. (1988) and Bankole et al. (2005).

The moisture content values obtained for the two samples are similar to those earlier reported for some other edible oil seeds such as Groundnut (4.58%), Sesame seed (7 to 8%), Pumpkin seed (7.7%) (Karshaw and Hackett, 1987; USAID, 2002; Ige et al., 1984). It is noteworthy that the low moisture content of these seeds enables them to be preserved for long periods of time as reported by Oladimeji and Kolapo (2007).

The ash content of the seeds ranged from 3.76 to 3.88. These values are a little bit higher than that reported for almond (Prunus amygdalus) (3.34%) (Akpambang, 2008).

The oil content (ether extract) obtained ranged from 31 to 33.92; these are higher than that which was reported for soybean 19.1% (Oyenuga, 1968) but closer to that reported for almond (Prunus amygdalus) (33.4%) (Akpambang, 2008).

The peroxide values obtained for the two samples are similar to those earlier reported for some other edible oil seeds such as Groundnut (4.58%), Sesame seed (7 to 8%), Pumpkin seed (7.7%) (Karshaw and Hackett, 1987; USAID, 2002; Ige et al., 1984). These values are a little bit higher than that reported for almond (Prunus amygdalus) (3.34%) (Akpambang, 2008).

The high levels of oils in the seed qualify them as good sources of oils for both industrial and culinary applications.

The protein contents of the melon seeds range from 18.75 to 19.25. These results compare favorably with those obtained in previous studies. Vodouhe and Capo-Chichi (1998) reported melon seeds have between 20 and 30% protein and groundnut with protein content of 23 to 30%. FAO (1982) reported the value of 22.8% for cashew nut.

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The crude fiber and carbohydrate values are similar to those reported for oil seeds (Oladimeji and Kolapo, 2008), while the acid value, the iodine value and the pH value compares favorably with those reported by Omafuvbe (2000).
In Table 2 it is seen that the peroxide values are low and are pointers to the fact that the oils may not be easily susceptible to deterioration. The peroxide values of the melon seed fall in the range of values (1.59 to 2.50 mEq/kg) reported for peanut oils by Amoo and Asore in 2006.

The mineral composition of the seed considered in this report is presented in Table 3, and it reveals that the levels of the elements are low in both seed variety. However, there are no significant differences at 5% level in the mineral contents.

Statistically the treatments considered had no significant effects on the proximate composition, the mineral composition and the peroxide value of the melon seeds according to the Duncan Multiple Range Test at the 95% confidence level.

**Conclusion**

The proximate composition of the melon seed is not affected by the fermentation of the melon pod, in addition to this it has no effect on the acid, pH, iodine and peroxide values of the seed.

The mineral composition of the of the melon seed from both processing methods (fermented and unfermented) were similar, this means that the fermentation of the pod does not affect the mineral composition of the seed. The difference in the proximate composition of the seeds from the unfermented melon pods is negligible. It can be concluded that fermentation of the pod only eases the removal of the seeds from the pod and can be safely carried out if a mechanical means can be developed, as it does not have any effect on the proximate composition, the pH, acid, iodine and peroxide values of the unfermented seeds.

The mineral composition had no significant effect on the quality of the melon seeds. A maximum of unproductive seven days can be converted to productive days following the elimination of the fermentation stage in melon seed processing.

**REFERENCES**


