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# Comparative Proximate Composition And Cyanogenic Glycoside Content Of Cucurbita Maxima And Citrullus Lanatus

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***Abstract:*** ***Investigations on the proximate composition and cyanogenic glycoside content of the pulp of C. lanatus dried at 45°C and C. maxima dried at 45°C and 100°C were carried out. The dried pulps were ground and stored at ambient room temperature and 30-55% relative humidity until used for analyses. Proximate composition and cyanogenic glycoside contents of the samples were measured using standard methods. The moisture content of Citrullus lanatus dried at 45°C was significantly ($p<0.05$) higher when compared with that of Cucurbita maxima dried at both 100°C and 45°C respectively which could be due to water retained as a result of hydrothermal application. The protein content of C. lanatus dried at 45°C was significantly ($p<0.05$) higher than that of its Cucurbitacean counterpart, dried at both 100°C and 45°C. The ash content of C. lanatus dried at 45°C was significantly ($p<0.05$) lower than that of C. maxima dried at both 100°C and 45°C respectively. This indicates that the pulp of C. maxima has good mineral content, hence, can serve as a viable tool for nutritional evaluation. The fibre content of C. maxima pulp dried at 100°C was significantly ($p<0.05$) lower than its 45°C dried sample but higher than C. lanatus dried at 100°C. More so, fat content of C. lanatus dried at 45°C was significantly lower at $p<0.05$ when compared with the dried pulp of its counterpart dried at 100°C and 45°C. The carbohydrate content of C. maxima dried at 45°C was significantly higher at ($p<0.05$) when compared with its 100°C dried pulp and C. lanatus sample dried at 45°C recording the lowest significant carbohydrate value. This trend may be attributed not only to heat treatment which may have hydrolyzed some organic bonds to release more free nutrients such as fats, ash and sugars but also to geographical location, varietal difference and growth conditions. In the present work, the cyanogenic content in C. lanatus dried at 45°C was significantly ($p<0.05$) lower than cyanogenic glycoside content observed in C. maxima dried at 100°C with C. maxima dried at 45°C recording the highest significant cyanogenic glycoside content; though all three values observed gave marginal low cyanogenic glycoside content. The established superior beneficial nutritional composition of C. maxima pulp over C. lanatus can contribute immensely to recommended daily allowance and maintenance of good nutritional status and good health for both man and animals and should therefore be promoted due to their high nutritional value.***

***Keywords:*** ***Citrullus lanatus, Cucurbita maxima, Cyanogenic glycoside, Phytochemicals, Toxicity.***

## I. INTRODUCTION

The importance of food in our life cannot be over emphasized. Indigenous food crops, edible seeds & plant products which are widely grown but neglected & rarely consumed by people in urban areas are much more highly nutritious than most exotic foods (Okafor and Okolo, 1974). *Cucurbits* are among the economically important vegetable crops worldwide & are grown in both temperate & tropical regions (Pitrat *et al*, 2000).

*Cucurbita maxima*, known as pumpkin in English and *aňu* by the Igbos, is an annual climbing shrub of 3–6 meters long.

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In Nigeria, it is found prevalently in Anambra, Enugu, Imo, Abia & Ebonyi State more than other States. There is a wide distribution of biologically-active constituents throughout the plant kingdom, particularly in plants used as animal feeding stuff & in human nutrition (Igile, 1996). The knowledge that these compounds elicit both toxic & advantageous biological responses has given rise to several investigations in recent times as to their possible physiological implications in various biological systems (Igile, 1996). *Citrullus lanatus* (watermelon) is the fruit of a plant from Southern Africa. It produces about 93% water; hence name "water" melon (Baker *et al*, 2012). *Citrullus lanatus* is a prostrate animal plant with several herbaceous, firm and stout stems. In Nigeria, though there are no official figures recorded for *Citrullus lanatus'* production, the crop has a wide distribution as a garden crop and as a commercial vegetable production; its cultivation is confined to the drier savanna regions of Nigeria (Anon, 2006) while *Cucurbita maxima* is cultivated as a vegetable crop for its leaves and fruits in the southern parts of Nigeria. Due to the environmental conditions in Nigeria, flexibility of both ecological management as well as individual and economic activity is a vital component of any strategy for agricultural and rural livelihood in the country (Adams *et al*, 1997). It is now a common thing to regularly see the influx of trailers fully loaded with *C. lanatus* coming fron the northern part of the country into the southern states. Recent reports indicate that an overwhelming cost of transportation is incurred during the course of this transportation. Also, the cost of storing and preserving them prior to when they are conveyed to the final consumer cannot be over emphasized. This should not be so when *C. maxima* can be cultivated on a wider scale as a vegetable crop for its leaves and fruits in the southern parts of Nigeria. It has also been recently noticed that younger generations have little or no idea of the existence of the *Cucurbitacean* specie, *C. maxima.* This could probably be as a result of the reduced availability of the fruit as families residing in the urban communities seldom incorporate them into their diet. Hence the following research questions were raised:

- ✓ Does *Citrullus lanatus* contain more nutrients than *Cucurbita maxima?*
- ✓ Can *Cucurbita maxima* be consumed without boiling (raw)?
- ✓ Why is *Cucurbita maxima* not grown in large quantities so as to be transported to the North just the way *Citrullus lanatus* is transported down to the South in massive trailer loads?
- ✓ Why do younger generations know little or nothing about *Cucurbita maxima* let alone consume it*?*

Accordingly, studies were carried out to ascertain the proximate composition and cyanide content of the pulp of *Citrullus lanatus* dried at 45°C and *Cucurbita maxima* dried at 45°C and 100°C (since sometimes up North in Nigeria temperatures can get as high as 45°C) as this will present an individual with the option of appreciating and consuming the fruit native to his or her homeland.

## II. MATERIALS AND METHODS

### FRUIT COLLECTION AND PREPARATION

*Citrullus lanatus* and *Cucurbita maxima* used for this study were obtained from a local market (Relief Market) in Owerri North LGA and taken to a taxonomist, Mr. Francis Iwueze in the Department of Forestry and Wildlife Technology, School of Agriculture and Agricultural Technology, FUTO for authentication. The samples for drying were washed and cut open with a knife into pieces. The seeds from both fruits were removed from the pulp before separating the pulp from the rind. The pulp was chopped into shreds, allowed to drain and placed in another tray lined with foil and transferred into the oven in three batches. First, the *Citrullus lanatus* dried at 45$^{o}$C, and then the *Cucurbita maxima* dried at 45$^{o}$C and 100$^{o}$C, respectively. The dried samples were removed and ground separately in a steel-blade blender mill to pass through a 30-mesh sieve (AOAC, 2006). These composite powders were packaged in air-tight containers, labeled accordingly and stored in desiccators for further usage.

### *PROXIMATE ANALYSES*

Proximate composition, namely, moisture, ash, crude protein, crude fibre, crude fat and carbohydrate contents, of 5.0g portions of the various samples were measured according to the standard methods previously described (AOAC, 2006).

### *CYANOGENIC GLYCOSIDE CONTENT*

Cyanogenic glycosides content of the samples was determined using the procedure described by Amadi, Agomuo and Ibegbulem (2004). Cyanogenic glycosides are anti-nutrients or glycosides that contain the cyanide (-CN) group. Some of each sample was weighed into a 250ml round bottomed flask. 200ml of distilled water was added and allowed to stand for 2 hours (for autolysis to occur). Full distillation was then carried out and 150-170ml of distillate was collected in a 250ml conical flask containing 20ml of 2.5% NaOH. An antifoaming agent (silicon oil or tannic acid) was added before distillation. 8ml of 6N $NH_4OH$ and 2ml of 5% KI was added to 100ml of the distillate containing cyanogenic glycoside, mixed and titrated with 0.02N silver nitrate ($AgNO_3$) using a micro-burette against a black background. Permanaent turbidity indicated end point.

Cyanogenic glycosides mg/100g =

$$\frac{\text{Titre value (ml) x 1.08g x extract vol. (ml) x 100}}{\text{Aliquot vol. (ml) x sample wt. (g)}}$$

### *STATISTICAL ANALYSES*

Data was analyzed using one-way analysis of variance (ANOVA). Values of $p < 0.05$ were considered statistically significant. All data were expressed as the mean ± SD of three observations.

## III. RESULTS

Result of the moisture content of *Citrullus lanatus* dried at 45°C, *Cucurbita maxima* dried at 45°C and *Cucurbita maxima* dried at 100°C is shown in Figure 1. The moisture content of *C. lanatus* dried at 45°C (91.67±0.17) was significantly ($p<0.05$) higher than *C. maxima* dried at 45°C (89.68±0.41). The moisture content of *C. maxima* dried at 45°C was significantly higher than *C. maxima* dried at 100°C (87.54±0.16).

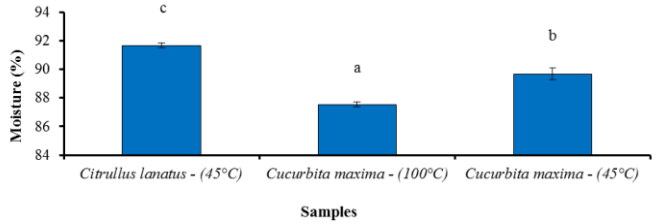


*Figure 1: Moisture contents of Citrullus lanatus dried at 45°C, Cucurbita maxima dried at 45°C and Cucurbita maxima dried at 100°C*

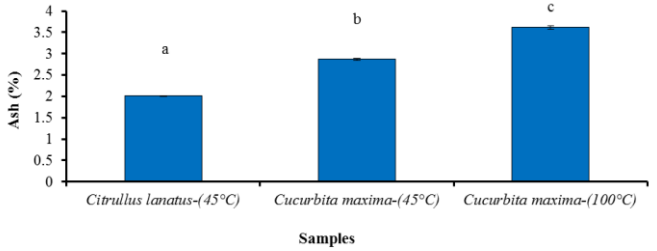


*Figure 2: Ash contents of Citrullus lanatus dried at 45°C, Cucurbita maxima dried at 45°C and Cucurbita maxima dried at 100°C*

Result of the ash content of *Citrullus lanatus* dried at 45°C, *Cucurbita maxima* dried at 45°C and *Cucurbita maxima* dried at 100°C is shown in Figure 2. The ash content of *C. lanatus* dried at 45°C (2.014±0.01) was significantly ($p<0.05$) lower than *C. maxima* dried at 45°C (2.87±0.02). The ash content of *C. lanatus* dried at 45°C was significantly lower than *C. maxima* dried at 100°C (3.62±0.04).

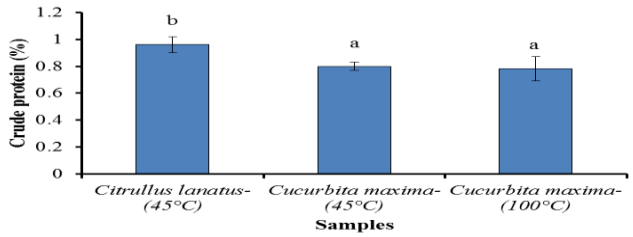


*Figure 3: Crude protein contents of Citrullus lanatus dried at 45°C, Cucurbita maxima dried at 45°C and Cucurbita maxima dried at 100°C*

Result of the crude protein content of *Citrullus lanatus* dried at 45°C, *Cucurbita maxima* dried at 45°C and *Cucurbita maxima* dried at 100°C is shown in Figure 3. The crude protein content of *C. lanatus* dried at 45°C (0.96±0.06) was significantly ($p<0.05$) higher than *C. maxima* dried at 45°C (0.80±0.03). There was no significant difference between *C. maxima* dried at 100°C (0.78±0.09) and *C. maxima* dried at 45°C

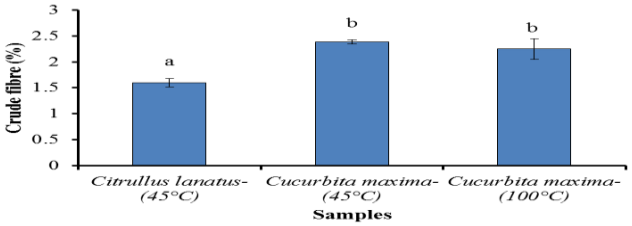


*Figure 4: Crude fibre contents of Citrullus lanatus dried at 45°C, Cucurbita maxima dried at 45°C and Cucurbita maxima dried at 100°C*

Result of the crude fibre content of *Citrullus lanatus* dried at 45°C, *Cucurbita maxima* dried at 45°C and *Cucurbita maxima* dried at 100°C is shown in Figure 4. The crude fibre content of *C. lanatus* dried at 45°C (1.60±0.08) was significantly ($p<0.05$) lower when compared to *C. maxima* dried at 45°C (2.38±0.04). There was no significant difference in the fibre content of *C. maxima* dried at 100°C (2.25±0.20) and *C. maxima* dried at 45°C (2.38±0.04).

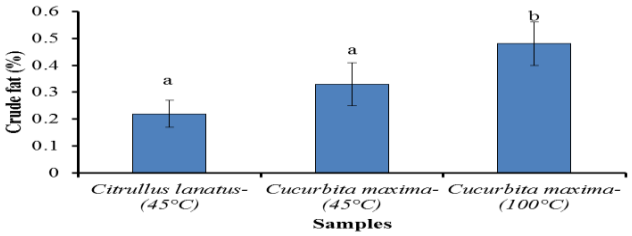


*Figure 5: Crude fat contents of Citrullus lanatus dried at 45°C, Cucurbita maxima dried at 45°C and Cucurbita maxima dried at 100°C*

Result of the crude fat content of *Citrullus lanatus* dried at 45°C, *Cucurbita maxima* dried at 45°C and *Cucurbita maxima* dried at 100°C is shown in Figure 5. The crude fat content of *C. lanatus* dried at 45°C (0.22±0.05) was significantly ($p<0.05$) lower when compared to *C. maxima* dried at 45°C (0.33±0.08). There was also a significant increase in the fat content of *C. maxima* dried at 100°C (0.48±0.08) when compared to *C. maxima* dried at 45°C.

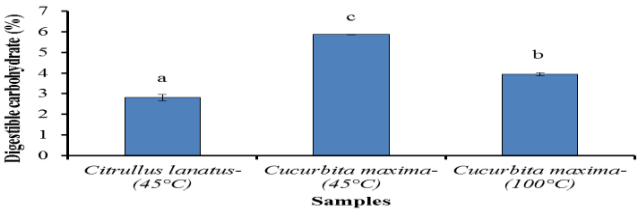


*Figure 6: Carbohydrate contents of Citrullus lanatus dried at 45°C, Cucurbita maxima dried at 45°C and Cucurbita maxima dried at 100°C*

Result of the digestible carbohydrate content of *Citrullus lanatus* dried at 45°C, *Cucurbita maxima* dried at 45°C and *Cucurbita maxima* dried at 100°C is shown in Figure 6. The digestible carbohydrate content of *C. lanatus* dried at 45°C (2.81±0.15) was significantly ($p<0.05$) lower than *C. maxima* dried at 45°C (5.87±0.01. There was a significant difference between *C. maxima* dried at 100°C (3.49±0.07) and *C. maxima* dried at 45°C.

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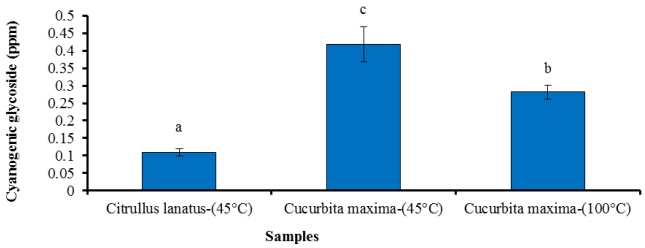


*Figure 7: Cyanogenic glycoside contents of Citrullus lanatus dried at 45°C, Cucurbita maxima dried at 45°C and Cucurbita maxima dried at 100°C*

Result of the Cyanogenic glycoside of *Citrullus lanatus* dried at 45°C, *Cucurbita maxima* dried at 45°C and *Cucurbita maxima* dried at 100°C is shown in Figure 7. The Cyanogenic glycoside content of *C. lanatus* dried at 45°C (0.109±0.01) was significantly ($p<0.05$) lower when compared to *C. maxima dried at 45°C* (0.418±0.05). The Cyanogenic glycoside content of *C. maxima* dried at 100°C (0.282±0.02) was significantly lower when compared with *C. maxima* dried at 45°C (0.418±0.0).

## IV. DISCUSSION

With modernized and increasing stressful life conditions, different types of diseases are having a field day and people are inclining towards the use of herbal products to keep various diseases at bay and boost the health (Dahiya, 2013). Regular consumption of plant foods is associated with numerous health benefits rooted in their various physiological effects as a result of their phytochemical and nutritional constituents (Hunter and Fletcher, 2002). Fruits and green leafy vegetables are particularly important in promoting health because of their nutritive contents (Gupta and Prakash, 2009). The percentage moisture content of *Citrullus lanatus* dried at 45°C was significantly higher (91.67±0.17) when compared with that of *Cucurbita maxima* dried at both 100°C and 45°C (87.54±0.16 and 89.68± 0.41) respectively which could be due to water retained as a result of hydrothermal application. These findings were consistent with the report of Albrecht *et al*, (2010) that this increase in the 45°C dried samples was due to the absorption of water by simple diffusion. The protein content of *C. lanatus* dried at 45°C was significantly higher (0.96%) than that of its *Cucurbitacean* counterpart, dried at both 100°C (0.78%) and 45°C (0.80%). The ash content of *C. lanatus* dried at 45°C (2.01%) was lower than that of *C. maxima* dried at both 100°C and 45°C (3.62% and 2.87%) respectively. Ash represents the mineral matter left after food material is burnt in oxygen (Enwereuzoh *et al*, 2015). It is used as a tool to measure the mineral content in any sample (Enwereuzoh *et al*, 2015). This indicates that the pulp of *C. maxima* has good mineral content, hence, can serve as a viable tool for nutritional evaluation (Lienel, 2002). Fibre has some physiological effect in the gastrointestinal track such as supporting the proper peristaltic movement of the colon and eliminating accumulated toxins from the intestines. (Effiong *et al*, 2009) and low fibre in diet is undesirable as it may cause constipation. *C. maxima* pulp dried at 100°C was significantly lower than its 45°C dried sample at $P < 0.05$ but higher than its *C. lanatus* counterpart. This agrees with the findings of Fila *et al*, 2013 were similar trends were observed and also this could be attributed to loss of solid particles during the individual drying process (Edijale, 1980). More so, fat content of *C. lanatus* dried at 45°C was significantly lower at $P < 0.05$ when compared with the dried pulp of its counterpart dried at 100°C and dried at 45°C. The digestible carbohydrate content of *C. maxima* dried at 45°C as seen in Figure 6 was significantly higher at ($P<0.05$) when compared with its 100°C dried pulp. *C. lanatus* sample dried at 45°C had the least value. This trend may be attributed not only to heat treatment which hydrolyses some organic bonds to release more free nutrients such as fats, ash and sugars but also to geographical location, varietal difference and growth conditions. (FAO, 1998; Raules and Nair, 1993). Also, the difference could be attributed to environmental factors prevalent during the growth of the plant or time of collection and processing (Amadi *et al*, 2006).

The level of cyanogenic glycoside was found to be in trace amount. The knowledge of the cyanogenic glycoside content of food is vital because cyanide being an effective cytochrome oxidase inhibitor interferes with aerobic respiratory system (Aina *et al*, 2012). Cyanogenic glycosides are compounds that yield glucose, hydrogen cyanide and aldehyde or ketone upon hydrolysis with an acid or enzyme. The lethal dose of hydrocyanate is believed to be about 60 mg per day in adult man (Oyenuga and Amazigo, 1957). Maduagwu, (1979), observed a concentration of 32.0 ± 0.8mg/kg of sample in Garri while Tichy (1977) observed, that a dose of 50mg/100g sample in foods. In the present work, the cyanogenic content in *C. lanatus* dried at 45°C, *C. maxima* dried at 100°C and *C. maxima* dried at 45°C was below the lethal dose (0.5 - 3.5mg/kg) for man. In 1991 however, FAO/ WHO recommended that HCN levels in mammals is 10mg/kg dry weight (10ppm) which is higher than what was obtained in this study.

## V. CONCLUSION

The results of the present study indicate that *Cucurbita maxima* have a higher nutritional value when compared with *Citrullus lanatus.* This study also indicated that the ash and fibre content of *Citrullus lanatus* and especially *Cucurbita maxima*, when properly processed could be helpful in reducing nutritional related problems (such as mineral deficiency) and improve digestive health, decrease cardiovascular risk factors and prevent colorectal cancer especially in Africa. *Cucurbita maxima* contain appreciable level of proximate compounds, vitamins and minerals that are readily available; they could be consumed to supplement the scarce or non-available sources of nutrients.

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