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MINERAL AND PROXIMATE COMPOSITION OF OYSTERNUT, THE COMMON NUTS CONSUMED BY LACTATING MOTHER IN KILIMANJARO REGION.

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ABSTRACT

Background

The oysternut, or *kweme* is the seed of the liana *Telfairia pedata*. Oysternuts are often consumed by pregnant women and they are said to have a high protein content (about 25%) and high oil content (55 – 60%). The oil has beneficial minerals and delicious, sweet flavor. The seeds are said to have valuable galactagogue property and are in great demand amongst native mothers who consume them shortly after the birth of a child as a tonic in order to regain their strength and also to improve the flow of milk. The source of galactagogue property of oysternuts is may be due to the presence of caloric value and mineral contents although no scientific data documented on the mineral profile and proximate composition of oysternuts. Therefore the study aimed to determine proximate composition and mineral content in the oyster nuts which may be contributing to the milk production of lactating mothers.

Methods

The method used in mineral analysis was the atomic absorption spectroscopy (AAS) per AOAC (2010 and oven drying and Kjeldahl method AOAC (2005/6) for proximate composition.

Results

The results were as follows; mineral contents of the oysternuts were; Mg contains 43.2Mg/100g, Ca 20.97Mg/100g, Zn 0.4Mg/100g, and Fe 0.18Mg/100g. Proximate composition of the oysternuts gave

the results as the moisture of 4.22%, ash of 3.32%, crude protein of 3831%, carbohydrate of 7.84% fatty and oils of 49.2%and the gross calorific value of 6.11Kcal/g.

Conclusion

The findings concluded that the property of promoting milk production may be due to the very calorific value, a large amount of protein and fatty and oil although no enough scientific studies in this area were done against this product. It is recommended for further study to find the antibacterial activity of the outer part of oysternut seeds.

Key words: oyster nuts; mineral composition; proximate composition

INTRODUCTION

The oysternut, or *kweme* is the seed of the liana *Telfairia pedata*. This species is native to Tanzania (where it is known as kweme) and northern Mozambique (G Pearman 2005). The trees are also common in Kenya and some parts of Uganda. They can grow to the height of 20 – 30 meters and produce 3 – 4 centimeters in diameter round and oval for male and female seeds respectively (see in fig 1), which are then harvested when the fruits fall from the tree and break open at the end of the rainy season (Slow food foundation). The seeds are then consumed fresh or dried for later consumption. It is a valuable source of nutrition in East Africa where the nut is used as source of protein and oil about 25% and 55 – 60% respectively (Juliet et al 2019). The oil has a delicious, sweet flavor (Juliet et al 2019). The seeds are said to have valuable galactagogic properties (Sunmonu *et. al.*, 2017) and are in great demand amongst native mothers who consume them shortly after the birth of a child as a tonic to regain their strength and also to improve the flow of milk (Redhered et al). The oil obtained from the seed is used as medicine for stomach troubles and rheumatism. The fatty acids in the seeds (ex: Oleic, Linoleic, and Linolenic acids) give the oil moisturizing and anti-aging effects, making oysternut oil a prized possession in the cosmetic industry (Victor Kinyaiya). After extracting the oil, the remains of the nut can be nutritious feed for cattle. The grains outer part is said to have an antibacterial effect in which research is very important to prove the content.

Oily seeds have a very high content of macromolecules which are very important in human growth and development (Jumbe et al 2016), Magnesium is very important in the nervous system, Calcium for skeletal development, iron, and zinc for development and cognitive health and Potassium keep the cells alive through Sodium Potassium pump (World Health Organization, 2005, Vitamin and mineral requirements in human nutrition.) Despite the described benefits of the oysternut seeds, there is no enough published proof on the mineral and proximate composition of the oysternuts. They are still collected for personal consumption but are no longer found on the local market, though local farmers have expressed interest in cultivating the trees if there were demand among

consumers. They are on the list of most expensive nuts across the world due to their rarity. Therefore the study aimed to analyse the proximate and mineral composition so as to be used as the evidence on the nutritional status of the oysternuts to provide the confidence of the farmers and consumers.

Figure 1: Picture shows male and female oysternut grain

MATERIAL AND METHODS

Sample collection

Health fifty oysternuts seeds were collected from the Kilimanjaro region and transported to TIRDO Chemistry Laboratory. In the lab, the outer part of the seeds was removed and the inside nuts were crushed to make the paste sample for analysis. Half of the prepared paste from the samples were used to do proximate analysis with the parameters including moisture content, calorific value ash, carbohydrate, dry matter, crude fiber, crude protein and fatty and oil and another half was used for the analysis of mineral contents such as iron, magnesium, calcium, potassium, and zinc.

Laboratory procedure

Preparation of equipment and materials.

The preparation and handling of Pans (Petri dishes and Crucibles) before use requires consideration. All pans were oven treated to prepare them for use. Disposable aluminum pans were vacuum oven-dried for 3 h before use. At 3 and 15 hours in either a vacuum or forced draft oven at 100◦C, pans varied in their weight within the error of the balance or 0.0001 g (10). The dried moisture pans were stored in a functioning desiccator. The glass fiber covers were dried for 1 h before use. The small sample used for ash or other determinations was very carefully chosen so that represents the original materials. A 2–10-g sample generally is used for ash determination Distilled-deionized water was being used to avoid contamination.

Energy Determination

Energy Determination was done according to the method using a bomb calorimeter. Briefly, one gram of oyster nut paste was weighed into a crucible, followed by the attachment of ignition thread

and the filling of oxygen into the Oxygen Combustion Vessel for 1 min. The vessel was then kept into the calorimeter and the setting was done to operate the calorimeter for 15 mins and the readings of general calorific value were taken.

Moisture Content Determination

Moisture Content Determination was done per the oven drying method. In oven drying methods (Hart F.L., Fisher H.J. 1971), the sample is heated under specified conditions, and the loss of weight is used to calculate the moisture content of the sample. Briefly, 5 grams of oyster nut paste were weighed into Petri dishes in triplets followed by oven drying of the paste at 105^0C for 5hrs. The sample was then transferred into a desiccator to cool for about 30min before being weighed and the moisture content was determined using the formula below:

$$\text{M.C \%} = \frac{Weight\ of\ wet\ sample - the\ weight\ of\ dry\ sample}{Weight\ of\ wet\ \ sample} \text{ X 100\%}$$

Crude fat

Crude fat was analyzed by 5 g of the paste sample weighed in the porous extraction thimble by using petroleum ether in a soxhlet apparatus for 16 h. The soxhlet apparatus was equipped with a water-cooled condenser fitted on to the weighed 250 ml flat bottomed quick fit flask containing petroleum ether as a fat solvent. The solvent was boiled at 40°C continuously to extract the fat from the sample. The mixture of fat and solvent was collected in the flask and the solvent was evaporated at 40°C in a vacuum rotary evaporator. Thereafter, the flask was dried and re-weighed, and crude fat content was calculated as a percentage of the dry weight of the sample as shown below p

% Crude fat = [(A-B) / C] x 100 (AOAC, 1996)

Where A = weight of flask + oil, B = weight of flask only, C = weight of the dry sample.

Ash determination

Ash content was determined as described: 5 grams of oyster nut paste was weighed into a tared crucible, Then the crucibles were placed in a cool muffle furnace to incinerate the paste at 525^0C for 2 hrs. The sample was then transferred into a desiccator with a porcelain plate and desiccant to allow crucibles to cool for about 20min before weighing. The ash content is calculated as follows:

$$\text{\% ash (dry basis)} = \frac{Weight\ after\ ashing - tare\ Weight\ of\ crucible}{Weight\ of\ sample} \text{ X 100\%}$$

(AOAC, (2010)

Crude fiber

The crude fiber was determined by boiling 1.5 g of the samples in 200 ml of weak Sulphuric acid (1.25%) and Sodium Hydroxide (1.25%), with few drops of anti-foaming agents being added, for 30 min respectively. The residues were filtered and washed three times with hot water and then washed with 95% ethanol and dried at 105°C for 5 h to constant weight. The dried residues were ignited in a muffle furnace at 550°C for 2 h. The crude fiber, in grams, was calculated as the difference between the weight of the residues and ash and converted as a fraction of the sample weight in percentages as shown in the equation below:

% Crude fiber = [(Loss of weight on ignition / sample weight)] x 100 (AOAC, 1990).

The dry matter using the oven method

The dry matter using oven method Dry matter (DM) was determined by drying the samples in a laboratory drying oven at 105°C for 5 h. The crucibles were thoroughly washed, dried in the oven, cooled in a desiccator, and weighed. 2.5 g of the sample was weighed into the crucible and dried to constant weight. The sample dry matter in percentage was calculated as the fraction of the dried weight to that of the original one multiplied by 100 (Lesten C et al 2018)

Crude protein using the Kjeldahl method

Crude protein (CP) content of the samples was analyzed by using the micro- Kjeldahl method, and the N content was converted to CP by multiplying by 6.25. The method involves digestion of the samples in concentrated (98 %) sulphuric acid with selenium tablet as a catalyst, distillation of the digests into weak acids (4 % boric acid), and titration of the distillates with 0.1 M Hydrochloric (HCl) acid (AOAC, 1990).

Carbohydrates

Carbohydrates content was calculated by difference using the following formula; 100 % - (CP % + CF % + crude fat % + Ash %) as described in AOAC (2005).

Minerals determination

The concentration of minerals such as (Ca), magnesium (Mg), iron (Fe), and zinc (Zn) were determined by atomic absorption spectrophotometry, (AAS) according to AOAC method number 927.02 (AOAC, (2010). Ten (10) grams of each oyster nut oil were separately weighed into a crucible and placed into a muffle furnace. Heating of samples was done to char any organic matter present. Produced ash was digested in 5 ml of 20% hydrochloric acid (India), and filtered using filter paper, 125 mm. Procedure blank was also prepared and standard solutions of Ca, Mg, Fe, and Zn were prepared by measuring 10 µl of the stock solutions (1000 mg/l); (calcium nitrate

in nitric acid 0.5 mol/l, magnesium nitrate in nitric acid 0.5 mol/l, iron (III) nitrate in nitric acid 0.5 mol/l and zinc nitrate in nitric acid 0.5 mol/l) in diluted hydrochloric acid (HCl) using a micropipette to 100 ml volumetric flask and top up to the mark with distilled water. Standard solutions prepared in the concentrations of 0.1, 0.2 0.3, 0.4, 0.5 ppm were used in calibration. To prepare the calibration standard solutions, 1 ml of the standard was pipetted into a volumetric flask of 100 ml and diluted to the mark with 1% nitric acid (VWR, USA). The standards for each of Ca, Mg, Fe, and Zn were aspirated into the AAS and the absorbance was recorded. Calcium, magnesium, iron, and zinc were analyzed using by aspirating the liquid sample containing the metals into an air acetylene oxide lean, blue flame to allow atomization of metal atoms. These were then excited by multi-element lamps corresponding to Ca, Mg, Fe, or Zn. The absorbance was measured with a conventional UV-visible dispersive spectrometer with a photomultiplier detector. The respective wavelengths for detection of Ca, Mg, Fe, and Zn were 442.7, 285.2, 248.3, and 213.9 nm. Based on the absorbance of the sample, the mineral content was extrapolated from the standard curve.

RESULTS

The gross calorific value of the oysternut was observed to be 6.11 Kcal/g.

The proximate composition was observed as presented in table 2

Mineral contents of the oysternuts were also determined and given the results as summarized in table 3

Table 1 Proximate composition and mineral contents of oysternuts

	PROXIMATE COMPOSITION		MINERAL CONTENTS	
S/N	PARAMETER	CONTENT in %	PARAMETER	Mg/100g
1	Moisture content	4.22	Mg	43.21
2	Ash	3.32	Zn	0.42
3	Crude protein	38.31	Ca	20.97
4	Carbohydrates	7.84	Fe	0.18
5	Fatty and oils	49.2		

DISCUSSION

From the results, oysternuts indeed have a high and acceptable amount of protein (Lukmanji Z et al 2008) and calorific value. In the case of minerals from oysternuts, findings in this study indicated low content of Iron and Zinc with a large amount of Magnesium and Calcium. The presence of a large amount of Magnesium and Calcium defines the importance of oysternut in skeletal muscles and nervous development. Magnesium and calcium are valued as macronutrients while iron and zinc are micronutrients in plant nutrition. In the human body, minerals are required as enzyme cofactors in many biochemical reactions. The requirement of Mg, Ca, Fe, and Zinc to enable the body to perform important functions are minimal levels of these minerals. Exceeding the recommended daily intake (RDI) may result in toxicity. The concentrations of minerals in edible oil must be regularly monitored to ensure that they do not reach levels that might cause a reduction in the shelf life of oil and pathological conditions in the human body (Juliete Hatoho et al). For the oysternut to have the property of enhancing milk production was thought to be due to the high amount of zinc. Since findings show that oysternuts have a low amount of zinc, the property of promoting milk production may be due to a large amount of protein and fatty and oil. It is recommended for further study to find the real factor for the oysternut to have galactagogic property

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