Journal of Herbal Drug
journal homepage: www.jhd.iaushk.ac.ir

Evaluation of *Cucurbita pepo* L. Fruit Shell by Proximate and Mineral Analyses

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ARTICLE INFO

Type: *Original Research*
Topic: *Medicinal Plants*
Received *June 14th 2019*
Accepted *August 26th 2019*

Key words:
- ✓ *Cucurbitaceae*
- ✓ *Cucurbita pepo*
- ✓ *fruit shell*
- ✓ *mineral composition*
- ✓ *proximate analysis*

ABSTRACT

Background & Aim: The leaves, fruit pulp and seeds of *Cucurbita pepo* are widely consumed as vegetables, and as food additives. They are used as condiments in some part of the country and also for their medicinal properties. This study, however investigated the fruit shell of *Cucurbita pepo* for its proximate and mineral composition using standard analytical methods.

Experimental: The fruit shell was separated from the pulp and seeds, washed, dried and homogenized. Proximate composition was determined using standard procedures; the sample was later digested with concentrated nitric acid and perchloric acid for mineral analysis.

Results: The proximate composition showed that the fruit shell is rich in carbohydrates (44.60±0.06%) and crude fiber (28.53±0.08%). Protein, ash, moisture and fat were also present in considerable amounts. Minerals such as Na, K, P, Cu, Mg, Fe, Ca and Mn were present at varying concentrations while Zn and Cr were not detected. Findings from this study which correlate with previous works show that *C. pepo* fruit shell is a natural repository of nutrients which play a range of important roles in different metabolisms of the body.

Recommended applications/industries: The results showed that *C. pepo* fruit shell is nutritious and can be used in formulating feed for livestocks, hence its disposal should be discouraged.

1. Introduction

The use of plants as food, flavorings/spices and medicine by man can be traced to pre-historic times. *Cucurbita pepo,* usually cultivated for its edible fruits has also gained popularity in traditional medicine as a mild diuretic and vermifuge. It is of the family Cucurbitaceae and commonly called squash (Kew science, 2017), flutted pumpkin (Obi *et al.*, 2009), marrow (Iheanacho and Udebuani, 2009) and elegede in Yoruba (Elinge *et al.*, 2012). The common names are used interchangeably for more than one species of the same family such as *C. maxima*, *C. argyrosperma* and *C. moschata* (Kew science, 2017). It grows in the tropics and temperate regions (Kwiri *et al.*, 2014) with fruits that are variable in shape, size and colour (Iheanacho and Udebuani, 2009). It is a natural laxative, also used in treating benign prostatic hyperplasia in men, skin problems, obesity and irritable bladder in children (Obi *et al.*, 2009). It is used traditionally as an anti-inflammatory, anti-ulcer, anti-diabetic and an antioxidant (Perez, 2016).

The seeds, seed kernels, seed oil and pulp of *C. pepo* have been extensively studied (Ouattara *et al.*, 2015; Kwiri *et al.*, 2014; Rabia *et al.*, 2014; Adebayo *et al.*, 2013; Ardabili *et al.*, 2011; Mohammed, 2004) for their nutritional and anti-nutritional status, physicochemical composition, anti-microbial properties to name a few. There is dearth of scientific information on the potentials of the fruit shell which is usually disposed as waste after the seeds and pulp have been used. Production of animal feed or food from waste products generated during food processing would reduce problems arising from waste disposal and also help in maximizing natural resources (Mohammed, 2004). This study therefore aimed to investigate the nutritional potentials of *Curcubita pepo* fruit shell. The use of the fruit shell or rind would help in generating wealth from waste and achieving a sustainable environment.

2. Materials and Methods

2.1. Sample Collection and Preparation

Dry, whole fruits of *C. pepo* were gathered from Aba Olu-Ode, in Oluyole local government, Oyo state, Nigeria. They were identified at the Taxonomy Section, Department of Forest Conservation and Protection, Forestry Research Institute of Nigeria (FRIN), Ibadan. The fruit shell or rind was separated from the pulp and seeds, and then washed with running water to remove extraneous materials after which it was dried to constant weight, homogenized and stored in air tight container prior to analyses.

2.2. *Determination of Proximate Composition*

This was carried out using the standard procedures of Association of Official Analytical Chemists (AOAC, 2000) as described by Adeniyi and Ariwoola (2019).

2.3. Mineral Analysis

Sample was digested with concentrated nitric acid and perchloric acid. Minerals (Fe, Ca, Mg, Mn, Cu, Cr, Zn) were determined using Bulk Atomic Absorption Spectrophotometer. Na and K were determined with the aid of Jenway flame photometer and P was estimated using the Vanodomolybdate method (AOAC, 1990; Adebayo et al., 2013).

3. Results and discussion

3.1. Proximate Composition

The proximate composition of dried *Cucurbita pepo* fruit shell is presented in Figure 1.

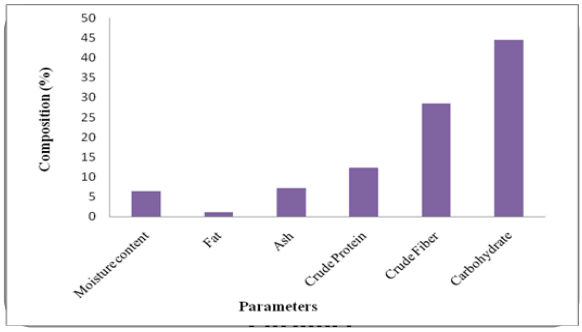

Figure 1. Proximate composition of *Cucurbita pepo* fruit shell

6.32±0.02% moisture content was detected, Fila *et al*, (2013) who analyzed the proximate composition of cooked and dried pumpkin rind obtained from Calabar, (Cross River state, Nigeira) discovered moisture content of 41.54±1.31 g/100g for the cooked sample, while the dried rind had 1.71±0.02 g/100g. Moisture content present in food is quite important to both the consumer and processor because it is inversely related to the amount of dry matter present in the food (Suleiman *et al.*, 2013; Adeniyi and Ariwoola, 2019). Crude fat content of 1.14±0.01% was detected in the sample studied; this value is a bit lower than 2.30±0.10% reported by Adebayo *et al*, (2013) for *C. pepo* pulp obtained from Osun state in Nigeria. Fats are important in the structural and biological functions of the cell; they help in transporting fat soluble vitamins, they also absorb and retain flavours in food (Mohaammed *et al.*, 2014). Ash content of food gives insight into the total amount of minerals present in the food (Adeniyi and Ariwoola, 2019). Pumpkin fruit shell analyzed in this study had ash content of 7.18±0.01%; this value is higher than 0.81±0.02 g/100g discovered for cooked pumpkin rind and 2.46±0.09 g/100g discovered for dried pumpkin rind both analyzed by Fila *et al*, (2013). A crude protein value of 12.24±0.01% was detected in the present study; this is lower than 25.40±0.61% discovered by Ardabili *et al*, (2011) who determined the chemical composition and physicochemical properties of Pumpkin seeds grown in Iran. Proteins are used to produce amino acids, enzymes and antibodies which are needed for normal body functions (Adeniyi and Ariwoola, 2019). Crude

fiber helps by increasing the water retention capacity as food moves along the gut; it also aids production of larger and softer faeces (Adeniyi and Ariwoola, 2019). The presence of appreciable amount of fiber in foods could reduce the risk of cardiovascular diseases such as artherosclerosis (Mensah *et al.*, 2008). *C. pepo* fruit shell analyzed in this study had a high crude fiber content of 28.53±0.08%; this is higher than 0.60±0.05 g/100g present in cooked pumpkin rind and 1.80±0.02 g/100g detected in dried pumpkin rind both analyzed by Fila *et al*, (2013). This had a positive correlation with the previous report on the potential of fiber to reduce cardiovascular related diseases. Carbohydrate content had the highest value of 44.60±0.06%; Adebayo *et al*, (2013) discovered carbohydrate content of 66.647±0.10% in the pulp while Ardabili *et al*, (2011) discovered 25.19±3.30% carbohydrate content in the whole pumpkin seed grown in Iran. Carbohydrates provide energy for cellular metabolism, aids the proper functioning of the intestinal tracts and help in the utilization of body fats (Adeniyi and Ariwoola, 2019).

3.2. Mineral Composition

The result of the mineral analysis presented in Table 1 shows that *C. pepo* fruit shell contains considerable amount of minerals. Sodium had the highest value of 11.30±0.53, Potassium, Phosphorus, Copper, Magnesium, Iron, Calcium and Manganese had values of 8.80±0.08, 6.23±0.21, 4.00±0.03, 3.00±0.02, 1.86±0.07, 1.10±0.01 and 0.03±0.01 mg/g respectively. Zinc and Chromium were not detected in the sample.

Table 1: Mineral composition of Cucurbita pepo fruit shell

Parameter	Concentration (mg/g)
Potassium	8.80±0.08
Sodium	11.30±0.53
Calcium	1.10±0.01
Magnesium	3.00±0.02
Iron	1.86±0.07
Zinc	ND
Copper	4.00±0.03
Manganese	0.03±0.01
Phosphorus	6.23±0.21
Chromium	ND

Data are presented as mean ± standard deviation of three replicates. ND – Not detected

Minerals are inorganic constituents found in fluids and tissues of the body; they play a range of vital metabolic roles in the body (Soetan *et al.*, 2010). The minerals detected are similar to those reported by Adebayo *et al*., (2013) for Pumpkin pulp. Kwiri *et al*, (2014) reported the presence of Zinc (1.244±0.010 mg/100g) in *C. pepo* seeds from Zimbabwe. Sodium which had the highest concentration is a principal cation in extracellular fluids that maintains membrane potentials, helps in transmission of nerve impulses and helps in the absorption of metabolites (Soetan *et al.*, 2010). Potassium, the main cation in intracellular fluid is needed for glycogenesis, involved in enzymatic reactions of the cell and helps to regulate osmotic pressure. Phosphorus is present in the teeth, bones and ATP (adenosine triphosphate) and also acts as a buffer (Casiday and Frey, 2012). It is also essential for proper functioning of the kidney in filtering waste as well as growth, maintenance and repair of worn-out tissues and cells of the body (Healthline, 2019). Copper is essential for haematologic and neurologic systems as it helps in the incorporation of iron in hemoglobin and formation of myelin sheaths in the nervous systems (Soetan *et al.*, 2010; Tan *et al.*, 2006). Magnesium plays important role in several body functions which include proper growth, formation, and function of muscles and bones. It also enhances oxidative phosphorylation and is a component of enzyme systems that have thymine pyrophosphate as a cofactor (Soetan *et al.*, 2010). Iron is an essential mineral for all plants. It is also is present in the blood mainly as a vital component of haemoglobin and aids oxygen transport (Gupta, 2014); it is also required for the synthesis, uptake and degradation of neurotransmitters (Soetan *et al*., 2010). Iron also plays important role in DNA synthesis and electron transport (Kaya and Incekara, 2000). Calcium is present in the bone and teeth; it plays a vital role in blood clotting and activates many enzymes (Soetan *et al.*, 2010). Manganese is is one of the trace elements essential for carbohydrate and fat metabolism. It is also needed for the activation of many important enzyme systems; and for the production of chondroitin sulphate which is used in forming bone matrix (Soetan *et al*., 2010). The result of this study corroborates with the findings on *Cucurbita pepo* shell in portugal which revealed a high percentage of beneficial health properties of the plant shell (Saavedra *et al*., 2013).

4. Conclusion

The findings of this study revealed that *Cucurbita pepo* fruit shell is naturally abundant in beneficial nutrients just as its seeds, seed kernel and pulp. Hence, its disposal as waste should be discouraged as it can be used as a valuable resource for the production of animal feed so as to exploit the full potentials of the plant. Further research should be carried out to ascertain the presence and mechanisms of action of other bioactive and anti-nutritional factors that might be inherent in it.

5. Acknowledgments

The authors remain grateful to Dr. Lawal of Biomedicinal research centre (FRIN), the staff of Soil Science laboratory (FRIN) and Mr. Adegboyega of Pharm/Chem Laboratory, University of Ibadan for the assistance rendered in the course of this study.

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