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# Proximate, Elemental and Anti-nutrients Composition of Pumpkin Seed (*cucurbita maxima duch ex lam*) Obtained from Duvu Mubi South Adamawa State, Nigeria

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**Abstract:** In this study the proximate composition, elemental and anti-nutrients composition of pumpkin seed (cucurbita maxima duch ex lam) obtained from Duvu were determined using standard methods. The proximate composition of pumpkin seed showed protein (5.63 ± 0.01%), fats/lipids (2.65± 0.00%), fibre (49.83± 0.01%), ash (2.50± 0.00%), moisture (9.00 ± 0.00%) and carbohydrate (26.46±0.02%) for peels only while protein (35.46 ± 0.01%), fats/lipids (2.20 ± 0.00%), fibre (17.63± 0.01%) ash (4.49± 0.01%), moisture (10.5 ± 0.00%) and carbohydrate (6.08 ± 0.02%) for the unpeeled seeds flour, and protein (33.80 ± 0.01%), fats/lipds (43.15±0.00%), fibre (1.86±0.01%), ash (5.23±0.01%), moisture (10.30 ±0.00%) and carbohydrate (5.65 ±0.03%) for the peeled seed kernel flour. The elemental analysis carried out showed Ca (42.16± 0.01 mg/100 g), Fe (2.72±0.01 mg/100 g), P (124.14 ±0.02mg/100 g), K (177.34 ±0.02mg/100g), Na (41.35 ±0.01mg/100g), Mg (64.84 ±0.02mg/100 g) and Zn (8.42 ±0.01mg/100 g) for the peels only and that of unpeeled seed flour showed Ca (128.67 ±0.02mg/100 g), Fe (10.49 ±0.02mg/100 g), P (875.63 ±0.01mg/100 g), K (511.43 ±0.01mg/100 g), Na (68.26 ±0.02 mg/100 g), Mg (284.54 ±0.01mg/100 g) and Zn (6.44 ±0.02mg/10 g) while Ca (145.30±0.02 mg/100 g), Fe (13.59 ±0.01mg/100 g), P (124.35 ± 0.00 mg/100 g), K (752.64 ±0.02mg/100 g), Na (51.23 ± 0.01mg/100 g), Mg (351.63 ±0.01mg/100 g) and Zn (1.76 ± 0.01mg/100 g) for the peeled seed kernel. The anti-nutrient analysis showed tannin (2.15 ± 0.01%), cyanide (0.026 ± 0.00%), phytate (6.26 ± 0.01%) and oxalate (3.74 ± 0.02%) for the peels only while tannin (3.14 ±0.02%), cyanide (0.062±0.00%), phytate (4.54 ± 0.02%) and oxalate (2.92 ±0.01%) for the unpeeled seed and tannin (0.86 ± 0.01%), phytate (0.86±0.01%) and oxalate (1.96 ± 0.01%) for the peeled seed kernel while cyanide was not detected. The fats, protein and fibre were higher in the sample while moisture, ash and carbohydrate were low. Phosphorus, K and Ca showed higher concentration with Zn been the least in all the samples. Peeled seed kernel showed higher concentration of Ca, Fe, P, K and Mg in all the samples. Unpeeled seed showed higher concentration of phytate than in the peels and peeled seed kernel. The result of this research will be useful in nutritional, pharmaceutical and oil industry.

**Keywords:** Pumpkin, Determination, Proximate, Elemental, Anti-nutrient, Diet, Pharmaceutical

## 1. Introduction

Knowledge of the nutritive value of local dishes, soup ingredients and local foodstuffs is necessary in order to encourage the increased cultivation and consumption of those that are highly nutritive. Consumption of nutritive local foodstuffs will help to supplement the nutrients of the staple carbohydrate foods of the poor who cannot afford enough protein foods of animal origin [1, 2]. The ways of expanding the use of available local food source are increasingly pursued, some of these local food sources contained seed, many reports on some lesser known seed and fruit such as pumpkin indicated that they could be good source of nutrients for both man and livestock [3].

The seed can be a potential source of protein and lipid. One need to chew it either raw or baked as snack or ground

in to powder and made into tasty dish [4, 5]. Seed are good source of protein, carbohydrate and minerals [6]. Researches have shown that seed contain nutritionally important phytochemicals and other phytocompounds which at certain critical levels have significant anti-nutritional effects, these compounds include oxalate, phytate, nitrate, cyanide etc [7].

Pumpkin has received considerable attention in recent years because of the nutritional health protective value of the seed. Pumpkin seed are consumed directly as snacks food in some countries throughout the world [8]. Pumpkin is from the family cucurbitaceae, (*cucurbita maxima duch ex lam*) is commonly known as Wadla in Kilba.

The plant is an annual plant with leafy green vegetable; it has a climbing stem of up to 12m long and fruits with round fibrous flesh ([8]. Pumpkin fruits are variable in size, colour, shape and weight. They have moderately hard pericarp under which a thick edible flesh and a central cavity containing the seed are found. [9]. Pumpkin is a worm, long seasoned crop, which is widely consumed by human but its seeds are discarded in most place.

Pumpkin has long been used for traditional medicine in many countries such as China, Argentina, India, Mexico, Brazil, Korea and Nigeria. Since pumpkin flesh and seed are rich not only in proteins, antioxidant, vitamins such as carotenoids and tocopherols and minerals but low in fat and calories [10]. Beta carotene reduces skin damage from the sun and act as an anti-inflammatory agent. Alpha carotene is thought to slow the aging process, reduce the risk of developing cataracts and prevent tumor growth. Vitamin E (tocopherols) protects the cell from oxidative damage by preventing the oxidation of unsaturated fatty acid in cell membrane.

Pumpkin seeds often eaten as snack are a good source of Zn, polyunsaturated fatty acid and phytosterols which can prevent chronic diseases [9, 11, 12]. Recent studies have reported that pumpkin can benefit the treatment of benign prostate hyperplasia, because of its high beta phytosterol content [4, 13]). Beta phytosterol has been indicated to reduce blood cholesterol and to decrease risk of certain types of cancer [14]. In Nigeria it is a traditional vegetable mainly grown for its leaves, fruits and seeds. It is Consumed in variety of ways including boiling (the leaves and fruits), by roasting or baking the seeds [15].

Currently, there is limited research analyze the nutrients in *cucurbita maxima* grown in Nigeria and the nutrients in the different parts of each pumpkin species, because the nutrients composition of pumpkins will differ depending on their origins and cultivation environment [16, 17]. It is important to know the nutritional profiles of the various pumpkin species grown in Nigeria.

The pulp is used for human consumption raw, boiled or baked, while the seeds are discarded as solid waste [18]. This could be due to lack of information on the importance and uses of pumpkin seeds. However, the present study aims to evaluate the proximate, anti-nutritional and elemental analysis to find out if the seed can be a nutrient source in order to enhance the nutritional requirement of the rural populace.

# 2. Method and Materials

### *2.1. Sample Collection*

The sample was collected from Duvu Mubi South Adamawa State, Nigeria which was identified and authenticated by Dr J M. Akesa of the department of botany of Adamawa State University Mubi

### *2.2. Sample Preparation*

The pumpkin fruit sample was shelled by removing the husk seed and the unwanted particles, the seeds was dried and divided into two equal parts, one portion was peeled and the other portion was left unpeeled. The unpeeled seed sample, peeled seed kernel sample and the peels from the peeled seed kernel sample were grounded separately into fine powder each, using clean motors and pestle. Each of the three different powdered samples was used for the proximate, anti-nutritional and elemental analysis.

### *2.3. Chemicals and Reagents*

All Chemical and reagents used were of analytical grade

### *2.4. Proximate Analysis*

The proximate composition (moisture, crude fibre, crude fat, ash content, protein and carbohydrate) of powdery sample of cucurbita maxima was determined according to the method described by AOAC [19].

### *2.5. Determination of Mineral Composition*

The dried samples were weighed into crucible and placed in muffle furnace at room temperature and the temperature raise to 550°C for 3 hours to complete ash. The ash was then dissolved in hot 10% $HNO_3$, filtered and diluted to required volume in a standard flask with deionized water. This was used to determine the elemental composition by the use of atomic absorption spectrophotometer (AAS) following the standard method of AOAC [20].

### *2.6. Anti-nutritional Content Analysis*

The anti-nutrient contents (oxalates, phytates cyanide and tannins) were determined using high-performance liquid chromatography (HPLC) following the standard procedures described by AOAC [19]

### *2.7. Statistical Analysis*

All determinations were replicated three times and results were reported in mean (±) standard deviation.

# 3. Results and Discussion

The result of the proximate composition of peels flour, unpeeled seed flour and peeled seed kernel were presented in Table 1. The result revealed the presence of protein, fats, fibre, ash, moisture and carbohydrate.

***Table 1.*** *Proximate content in the peels flour, unpeeled seeds flour and peeled seeds kernel flour of the cucurbita maxima seed sample.*

| Proximate | peels flour (%) | unpeeled seed flour (%) | peeled seed kernel (%) |
|---|---|---|---|
| Protein | 5.63 ± 0.01 | 35.46 ± 0.01 | 33.80 ± 0.01 |
| Fats | 2.65 ± 0.00 | 2.20 ± 0.00 | 43.15 ± 0.00 |
| Fibre | 49.83 ± 0.01 | 17.63 ± 0.01 | 1.86 ± 0.01 |
| Ash | 2.50 ± 0.00 | 4.49 ± 0.01 | 5.25 ± 0.01 |
| Moisture | 9.00 ± 0.00 | 10.5 ± 0.00 | 10.30 ± 00 |
| Carbohydrate | 26.46 ± 0.02 | 6.08 ± 0.02 | 5.65 ± 0.03 |

***Table 2.*** *Elemental analysis of peels flour, unpeeled flour, and pleed seed kernel flour of the cucurbita maxima seed sample (mg/100 g).*

| Elements | peel flour | unpeeled seed flour | peeled kernel |
|---|---|---|---|
| Ca | 42.16 ± 0.01 | 128.67 ± 0.02 | 145.30 ± 0.002 |
| Fe | 2.72 ± 0.01 | 10.49 ± 0.02 | 13.59 ± 0.01 |
| P | 124.14 ± 0.02 | 875. 63 ± 0.01 | 124. 35 ± 0.00 |
| K | 177. 34 ± 0.02 | 511.43 ± 0.01 | 752. 64 ± 0.02 |
| Na | 41.35 ± 0.01 | 68.26 ± 0.02 | 51.23 ± 0.01 |
| Mg | 64.84 ± 0.02 | 284.54 ± 0.01 | 351.63 ± 0.01 |
| Zn | 8.42 ± 0.01 | 6.44 ± 0.02 | 1.76 ± 0.01 |

***Table 3.*** *Anti-nutrient composition of the peels flour, unpeeled seed flour and the peeled seeds kernel flour of the cucurbita maxima seeds (%).*

| Antinutrient | peels flour | unpeeled seed flour | peeled seed kernel |
|---|---|---|---|
| Tannin | 2.15 ± 0.01 | 3.14 ± 0.02 | 0.86 ± 0.01 |
| Phytate | 6.26 ± 0.01 | 4.54± 0.02 | 0.86 ± 0.01 |
| Oxalate | 3.74 ± 0.02 | 2.92 ± 0.01 | 1.96 ± 0.01 |
| Cyanide | 0.026 ± 0.00 | 0.062 ± 0.00 | ND |

ND = not detected

### *3.1. Proximate Composition*

The protein content of the seed was 5. 63 ± 0.01% for the powdered peels, 35.46 ± 0.01% for the unpeeled seed flour and 33.80± 0.01% for the peeled seed kernel. Proteins have unique functional property and are important for biological function and cell structure. The result obtained (35.46± 0.01%) can serve as a source of protein considering the demand for the protein food source in the society.

The crude fats content of the seed showed that, the peels flour contains 2.65 ± 0.00%, unpeeled seed flour 26.20 ± 0.00% and the peeled seed kernel contain 43.15 ± 0.00%. The lipids content of this seed are of great importance as lipids are fatty substance widely distributed in foods and play variety of metabolic roles in cells. Lipid is high in the unpeeled seed than that of peels and lower than that of peeled kernel. Lipids are essential because it provide the body with maximum energy [21].

Fibre content of seed was 49.83±0.01% for the peels flour, 17.63 ± 0.01% for the unpeeled seed flour and 1.86± 0.01% for the peeled seed kernel. Crude fibre value for the peeled seed kernel is lower than that of egusi melon whereas the peels and unpeeled seed flour were higher compared to that reported for eusi melon 12% by Ojieh *et al*., [22]. Based on the fibre content of this seed, the peels and the unpeeled seeds are recommended for adult human being while the peeled seed kernels are recommended for children. Fibre containing food are known to expand the inside walls of the colon, easing the passage of waste, thus making it an effective anti-constipation, it reduces the risk of various cancer by lowering the level of cholesterol in the blood. In the nutrition or diet of infant and weaning children, high level of fibre can lead to irritation of the gut mucosa [6].

The ash content of the peels flour was found to contain 2.50 ± 0.00%, unpeeled seed flour 4.46 ± 0.01% and peeled seed kernel 5.25 ± 0.01%. The ash content represents the total mineral content in foods. The ash content of peeled seed kernel flour is higher compare to that of peels flour. The ash content of peels flour, peeled seed flour and peeled seed kernels are close to that of cucurbita pepo L. seed 5.50% obtained in Kaduna State by Elinge *et al., [23]* but the ash content of the peels is lower compare to that of butter 2.9% and is higher than whole wheat flour 1.7% as reported by Suzanne [24]. The% ash of the sample gave an idea on the inorganic content of the samples from where the mineral content could be obtained. Samples with high ash content are expected to have high concentration of various mineral elements, which are expected to speed up metabolic process, improve growth and development. Considering the values obtained, pumpkin seed (*cucurbita maxima duch ex lam*) obtained from Duvu could be used for the formulation of animal feeds and also for human consumption.

The moisture content was found to contain 9.00± 0.00%, 10.15± 0.00% and 10.30 ± 0.00% for the peels flour, unpeeled seed flour and peeled seed kernel respectively. The result show that the seed has moisture content higher than that of *Cucurbita pepo L*. seed as reported by Elinge *et al.,* [23]. Moisture is an important factor that gives it storage advantage.

Carbohydrate contents of the seed was found to be 26.46 ± 0.02%, 6.08 ± 0.02% and 5.65 ± 0.03% for peels, unpeeled seed and peeled seed kernel respectively. Carbohydrate plays

an important role in human nutrition as energy reserves e.g. glucose can be converted into many natural substances [24]. The values obtains show that peels flour contains high carbohydrate value compared to the peeled seed kernel and unpeeled seed. Despite its high value it could not be considered as potential source of carbohydrate considering some conventional sources like cereals with 72 – 90 g/100g [25]. The carbohydrate content of the peels seed flour is lower compare to 28.03% of the cucurbitapepo L. reported by Elinge *et al.,* [23].

### *3.2. Mineral Composition*

The result of the elemental composition of peels flour, unpeeled seed flour and peeled seed kernel were presented in Table 2. The result revealed the presence of Ca, Fe, P, K, Mg and Zn.

Potassium (K) is one of the abundant elements found in the seed 177.34 ± 0.02 mg/100 g, 511.43± 0.01 mg/100 g and 752.64 ± 0.02 mg/100 g for the peels flour, unpeeled seed flour and peeled seed kernel respectively. High amount of K in the body was reported to increase Fe utilization [26] and beneficial to people taking diuretics to control hypertension and suffer from excess excretion of K through the body fluid [27].

The concentration of Na in the sample was 41.35± 0.01 mg/100 g, 68.26± 0.02 mg/100 g and 51.23± 0.01 mg/100 g for the peels flour, unpeeled seed flour and peeled seed kernel respectively. Na was also a significant element in the sample, which is required by the body to regulate the blood and blood volume. It helps regulate the fluid balance in the body and also helps in the proper functioning of the muscle and nerves [28].

The Ca content of the sample was found to be 42.16 ± 0.01 mg/100 g, 128.67± 0.02 mg/100 g and 145.3 ± 0.02 mg/100 g for peeled seed flour, unpeeled seed flour and peeled seed kernel respectively. Ca helps to ease in sonsomnia and helps regulate the passage of nutrients through cell walls, without Ca the muscle in the body cannot contract correctly the blood in the body will not clot and the nerves will not carry message. If the body doesn't get Ca enough from the food we eat they automatically takes the Ca needed from the bones and if the body continue to take more Ca than it replaces over a period of years the bones will become weak and break easily (Payne, 1990). Calcium ions are also necessary for the normal functioning of nerve and muscles [29, 30].

The concentration of Mg in the sample is 64.84 ±0.02 mg/100 g, 284.54 ±0.01 mg/100 g and 351.63± 0.01 mg/100 g for the peels flour, unpeeled seed flour and peeled seed kernel respectively. Mg is a constituent of bone and teeth and is closely associated with Ca and P. Magnesium is necessary for release of parathyroid hormone and for its action in the back bone, kidney and intestine and for the reactions involved in converting vitamin D to its active form. Magnesium is important in tissue respiration especially in oxidative phosphorylation lead to formation of Adenosine triphosphate (ATP). It is also involved in normal muscular contraction. Ca stimulates muscles while Mg relaxes the muscles [31]. Magnesium deficiency results in uncontrollable twisting of muscles leading to convulsion and tetanus which may both lead to death (Hegarity, 1988).

The concentration of P in the sample was estimated as 124.14± 0.02 mg/100 g, 875.63 ± 0.01 mg/100 g and 1024.35 ± 0.00 mg/100 g for the peels flour, unpeeled seed flour and peeled seed kernel respectively. This indicates its high nutritional value. Phosphorus is found bound in the blood and cells while most of the non-Skelton P is inorganic in the form of nucleic acid phosphor – lipids ATP and sugar phosphate [28]. Phosphate plays important role as buffer that prevent change in the acidity of body fluids because of their ability to combine with additional hydrogen ion. The combination with phosphorus makes it possible for nutrient to cross the cell membrane [31].

The concentration of Fe in the sample was found to be 2.72± 0.01 mg/100 g, 10.49 ± 0.02mg/100 g and 13.59 ± 0.01 mg/100 g for the peels flour, unpeeled seed flour and peeled seed kernel respectively. This is one of the least elements in the sample. Fe performs several works in the body; it helps in the formation of blood, it also helps in the transfer of oxygen and carbon dioxide from one tissue to another. Fe deficiency results in anemia which impairs muscle metabolism, Fe deficiency in children result in impaired learning ability and behavioral problems [32, 33]. Pumpkin seed presented fair concentration for Zn 8.42 ± 0.01 mg/100 g, ± 6.4 ± 0.02 mg/100 g and 1.76 ± 0.01 mg/100 g for peels flour, unpeeled seed flour and peeled seed kernel respectively. Zinc is known for boasting the health of the hair, it is believed to play a role in the proper function of some sense organs such as ability to taste, sense and smell [28]. Zinc plays a very important role in protein and carbohydrate metabolism and also help in mobilizing vitamin A from its storage site in the liver and facilitates the synthesis of DNA and RNA necessary for cell production [31].

### *3.3. Anti-nutritional Content*

Table 3: shows the result of the anti-nutrient (tannin, phytates, oxalate and cyanides) of the *cucurbita maxima* seed. The concentration of oxalate found in the seed was 3.740 ± 0.02%, 2.92 ± 0.01% and 1.96 ± 0.01% for peels flour, unpeeled seed flour and peeled seed kernel respectively, which was not high. High oxalate diet can increase the risk of renal calcium absorption and have been implicated as a source of kidney stones [34]. The level of oxalate in the sample was not high to cause any health treat.

The tannin content: 2.15 ± 0.01%, 3. 14± 0.02% and 0.89 ± 0.01% for the peels flour, unpeeled seed flour and peeled seed kernel respectively which was not high. High levels of tannins produced adverse effects such as decreased nutrients utilization and animal productivity and death in certain animals [23].

The phytate content: 6.26 ± 0.01%, 4.54± 0.02% and 2.16 ± 0.01% for the peels flour, unpeeled seed flour and peeled seed kernel respectively which was more significant than that of oxalate. The problem with phytates in food is that it can bind some essential mineral nutrients in digestive tract and

can result in mineral deficiencies [6]. The phytates composition of the sample might not pose any health hazard when compared to phytates diet of 10 – 60 mg/100 g which if consumed over a long period of time that has been reported to decrease bioavailability of minerals in mono gastric animals [35]

The concentration of cyanide in the seed was 0.026 ± 0.00% and 0.062 ± 0.00% for peels flour and unpeeled seed flour respectively while in peeled seed kernel cyanide was not detected. This shows that the level of the acid in the sample is within the acceptable range for human consumption. Only plants with more than 200 mg of hydrocyanic acid equivalent per 100 mg fresh weight are considered dangerous [36]. Consumption of high levels of cyanides is associated with a serious health problem, a neurological disease known as Tropicalataxis Neuropathy (TAN) was linked to consumption of high level of cyanide in cassava base diet [37]. It should be noteworthy that in addition to the importance of pumpkin (*Cucurbita maxima*) presented in this work, the seed has also received considerable attention in recent years as an excellent source of protein and also has pharmacological activities such as antidiabetic, antifungal, antibacterial and anti- inflammation activities and antioxidant effect [38].

# 4. Conclusion

The proximate analysis of the peels flour, unpeeled seed flour and peeled seed kernel showed considerable amount of carbohydrate and lipid for provision of energy to the body and protein which enhances enzymes activity in the body. The amount of lipids obtained from this seed had shown that the seed can be exploited for oil on a commercial bases and cake used in animal feeds and biscuits. The crude protein, fats/lipids showed higher concentration in unpeeled seed flour and peeled seed kernel samples than peels flour. While carbohydrate was higher in peels flour sample. The elemental analysis has further shown the great quality of minerals as deposited in the seed. This had shown that the seed can be used as a source of minerals in diet and also as part of drugs in pharmaceutical. Most of the investigated elements; Mg, K, P, Ca and Fe showed higher value in unpeeled seed flour and peeled seed kernel. It can be concluded that the seed is a good source of some protein and oil. From the highlight of the study, we can also deduce that this can be a constituent of minerals to animal and human through dieting. Generally, result and findings from this research agreed favorably with those of other wild plants recommended as supplement.

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