Proximate and Mineral Compositions of Seeds of Some Conventional and Non Conventional Fruits in Niger State, Nigeria

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ABSTRACT

The proximate and mineral composition of water melon, bitter melon, pawpaw, guava and cherry seeds were carried out; these sample seeds were obtained from discards of plants and prepared for use by decocting, sun drying and grinding into powder. Using petroleum ether; of boiling range 40-60°C, their fats were extracted, the protein content, ash content, crude fibre, moisture, carbohydrate as well as the mineral contents were determined using standard methods. The fats yield of 44.00±0.04, 34.00±0.00, 26.01±0.00, 19.01±0.02 and 13.00±0.01% were obtained for water melon, bitter melon, pawpaw, guava and cherry seeds samples respectively. From this result, water melon and bitter melon seeds can be regarded as oil seeds. The mineral compositions determination of the samples showed that water melon had the highest mineral compositions which were 14.46±0.00, 7.37±0.20, 28.87±0.10 and 12.25±0.01 mg/100g for potassium, calcium, iron and copper respectively while cherry seed had the least values.

Keywords: proximate, mineral composition, seeds, conventional and non-conventional fruits

INTRODUTION

Plant seeds are a good source of food for animals as well as humans, since they contain nutrients necessary for plant's growth, including many healthy fats, such as omega fats. In fact, the majority of foods consumed by human beings are seed-based foods. Some of the edible seeds are cereals, legumes and nuts. Oil seeds are often pressed to produce rich oils – sunflower, flaxseed, rapeseed, sesame. Seeds are typically high in unsaturated fats and, in moderation, are considered a healthy food, although not all seeds are edible (Wikipedia, 2011).

The description of the study plants: The bitter melon is a tropical plant which grows in most parts of East America, and the Caribbean. It belongs to the family of *Cucurbitaceae*, order: *Cucurbatales,* Genus: *Momordica,* species: *Charantia* and common name: bitter melon. This plant grows in almost all tropical and subtropical areas and is cultivated throughout South America as a food and medicine (Walters and Decker, 1988). Guava with the botanical name as *Psidium guajava linn,* belongs to family of *Myrtaceae,* genus: *Psidium,* species: *Guajava* and common name as guava. The plant has spread widely throughout the tropics because it thrives in a variety of soils, propagates easily and bears fruits relatively quickly. The fruits contain numerous seeds that can produce a mature fruit- bearing plant within four years. In the Amazon rainforest, its fruits are much enjoyed by birds and monkeys, which disperse its seeds in their droppings and cause spontaneous clumps of guava trees to grow throughout the rainforest (Lozoya, 1994). Pawpaw (*Carica papaya L.*) belongs to the family of *Caricaceae* with many species such as *Asimina reticulate, Asimina incarna, Asimina longifolia* and *Asimina parviflora* etc. It is a deciduous, often narrowly conical tree growing from 12 to

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around 20 feet. Its trees are prone to producing root suckers a few centimetres from the trunk and when these are permitted to grow, the single clone pawpaw patch comes into being (Peterson and Neal, 1991). Water melon belongs to the family of *Cubitaceae* with botanical name *Citrullus lanatus* and commonly known as water melon. It contains many obavate, smooth compressed seeds thickened at the margin and of a black or yellowish white colour (Sodeke, 2005). Water melon plays a very important role in Africa as it is used to quench thirst when there is shortage of water. Cherry is a shrub. It belongs to the family of *Myrtaceae* and the order *Myrtales.* It has a solitary auxiliary four –part flower with a dense ring of white stamen around the edge of the receptacle. The plants are usually shrubs that grow as small trees. They have localized distribution along the coast. They are cultivated by planting the seeds from a matured fruit (Emmanuel & Francis, 2010).

MATERIALS AND METHODS

Sample Collection

The seeds of five plants used in the course of this work; water melon, pawpaw, guava, bitter melon and cherry seed were obtained from Minna, Niger state of Nigeria. While the water melon, pawpaw and cherry seeds were obtained from Minna Cental Market, the bitter melon seeds were obtained from Government Day secondary School along Bosso road. The guava seeds were obtained from Hanya Gwari, Bosso in Minna, Niger state, Nigeria.

METHODS

Moisture Content

2g of the sample was put into the crucible, dried in an oven at 105^0C overnight. The dried samples were cooled in a dessicator for 30 minutes and weighed to a constant weight. The percentage loss in weight was expressed as percentage moisture content (AOAC, 1999).

This was repeated twice.

Ash Content

2.00g of the grounded sample was placed in a crucible and ashed in a muffle furnace at 600^0C for 3 hours. The hot crucibles was cooled in a dessicator and weighted. The percentage residual weighed was expressed as ash content (AOAC, 1999).

Crude Lipid Content

2.00g of the sample was used for determining crude lipid by extracting lipid from it for 5 hours with petroleum ether in a soxhlet extractor.

Protein Determination

Total protein was determined by the Kjeldahl method as modified by Williams (1964). 500mg of the sample was weighed into a filter paper and put into a Kjedahl flask, 8-10 cm^3 of concentrated H_2SO_4 were added and then digested in a fume cupboard until the solution becomes colourless. Distillation was carried out with about 10 cm^3 of 40% of NaOH. The condenser tip was dipped into a conical flash containing 5 cm^3 of 4% boric acid in a mixed indicator till the boric acid solution turned green. Titration was done in the receiver flask with 0.01 M HCl until the solution turned red.

Crude Fibre Content

2.00g of each sample were used for estimating crude fibre by acid and alkaline digestion methods with 20% H_2SO_4 and NaOH solution.

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Carbohydrate Determination

The carbohydrate content was calculated using following:

Available carbohydrate (%), = 100 – [protein (%) + Moisture (%) + Ash (%) + Fibre (%) + Fat (%)].

Mineral Analysis

Sodium and potassium were determined using Gallenkamp Flame analyzer, while calcium, magnesium, iron, zinc and copper were determined using Buch Model 205 Atomic Absorption Spectrophotometer. Phosphorus level was determined using the phosphovanado molybdate colorimetric techniques on JENWAY 6100 Spectrophotometer Pearson (1976).

RESULT AND DISCUSSION

Table 1. The proximate compositions (%) of the five seeds analyzed

Parameters	*Samples*				
	Cherry	*Water Melon*	*Pawpaw*	*Guava*	*Bitter Melon*
Moisture	5.70±0.00^{d}	9.00±0.00^{b}	11.00±0.01^{a}	4.00±0.00^{e}	7.00±0.00^{c}
Ash	2.00±0.00^{d}	6.00±0.10^{a}	4.00±0.00^{b}	3.00±0.10^{c}	4.00±0.00^{b}
Crude Protein	7.00±0.04^{c}	21.50±0.13^{a}	8.75±0.01^{d}	8.05±0.00^{c}	19.50±0.00^{b}
Crude Fat	13.00±0.01^{e}	44.00±0.04^{a}	26.01±0.00^{c}	19.01±0.02^{d}	34.00±0.00^{b}
Crude Fibre	10.00±0.20^{c}	14.02±0.20^{a}	14.01±0.20^{a}	12.00±0.00^{b}	12.00±0.00^{b}
Carbohydrate	62.30±0.00^{a}	5.50±0.11^{e}	36.25±0.01^{c}	53.95±0.00^{b}	23.50±0.00^{d}

Values are means ±SD of three determinations

Table 2. The mineral composition of the five selected seeds (mg/100g)

Parameters	*Samples*				
	Cherry	*Water Melon*	*Pawpaw*	*Guava*	*Bitter Melon*
Na	9.23±0.10^{b}	11.13±0.00^{a}	9.00±0.10^{b}	2.91±0.20^{c}	2.10±0.00^{c}
K	13.93±0.10^{a}	14.16±0.00^{a}	13.70±0.01^{a}	4.84±0.00^{b}	3.17±0.01^{c}
P	10.01±0.20^{b}	6.41±0.03^{d}	9.00±0.12^{c}	6.01±0.01^{d}	11.09±0.30^{a}
Ca	6.64±0.10^{b}	7.37±0.20^{a}	5.46±0.03^{c}	3.03±0.12^{d}	3.69±0.00^{d}
Fe	12.40±0.10^{e}	28.87±0.10^{a}	26.58±0.02^{b}	16.00±0.07^{d}	22.44±0.04^{c}
Mg	3.21±0.12^{a}	3.28±0.02^{a}	3.43±0.21^{a}	3.28±0.11^{a}	3.50±0.00^{a}
Cu	6.25±0.20^{c}	12.25±0.01^{a}	9.06±0.30^{b}	2.14±0.00^{d}	1.74±0.02^{d}
Zn	2.68±0.00^{e}	5.52±0.20^{b}	7.06±0.10^{a}	4.23±0.00^{c}	3.45±0.30^{d}

Values are means ±SD of three determinations

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Fats play a vital role in maintaining health skin and hair, insulating body organs against shock, maintaining body temperature and promoting health cell function. It is also essential in diets as they increase the pleasant to taste of food by absorbing and retaining their flavours (Omotoso, 2006). The crude fat of the studied seeds ranged from 13.00±0.01-44.00±0.04% where watermelon had the highest fat content, followed by bitter melon, pawpaw and guava while cherry seeds had the lowest. The values of the fat yield of watermelon and bitter melon makes the industrial practice of the fat recovery from these samples a profitable venture and will reduce the level of waste that is obtained from juice making industries especially those using watermelon. The value obtained in this work (44.00±0.04%) for watermelon was very close to that recorded by Anwar *et al.*, (2008) on grape seeds (46.2%). This high value indicated that the seeds are a good source of oil. In the case of bitter melon it can also be consider being a source of oil since its fat content is above 30% (Anthony, 1986). The pawpaw, guava and cherry seeds on the other hand, cannot be regarded as oil seeds as their crude fat contents were below 30%.

From table 1.0, it was observed that, the crude protein contents of the samples range from 7.00±0.04 – 21.50±0.13%. The watermelon seeds had the highest content of crude protein follow by bitter melon, while pawpaw and guava seeds tended to have almost the same content of protein. The cherry seeds had least crude protein content which was 7.00±0.04%. The protein content of watermelon seeds (21.50±0.13%) is higher than the reported protein content of orange, grape and white roselle seeds which were found to be 20.20, 21.40 and 22.70% respectively by Gerner and Poiters, (2008). The relatively higher protein contents in each sample showed that the samples can be regarded as good sources of protein hence the cake can be modified into protein concentrate feeds for livestock. The high levels of protein in the samples indicate that they contribute significantly to the daily protein requirement of 23-56g for humans as stipulated by the NRC, (1980).

The watermelon seeds (6.00±0.10%) showed the highest value of ash content followed by pawpaw and bitter melon (4.00±0.00%) which had the same ash contents followed by the guava seeds (3.00±010%) and cherry seeds (2.00±0.00%) had the least ash content. The sample with the highest ash content (water melon seeds) had the highest probability of being the one with the highest mineral contents, as the ash content of grape was taken as a rough measure of the mineral contents of the food material (Anwar *et al.*, 2008). The result of the ash content of water melon seeds (6.00±0.10%) which was higher than that of citrus seeds (4.60%) signified that water melon seeds will have higher mineral content than citrus seeds (Anwar *et al.*, 2008), while citrus seeds have higher ash content than pawpaw, bitter melon, guava and cherry seeds. Therefore, watermelon seeds are expected to be the ones with higher mineral contents.

The moisture contents of the 5.70±0.00, 9.00±0.00, 11.00±0.01, 4.00±0.00 and 7.00±0.00% were recorded for cherry, water melon pawpaw, guava bitter melon seeds respectively. The pawpaw seeds showed the highest value of moisture content followed by water melon, bitter melon and cherry seeds while guava seeds had the least moisture content. This indicates that they can all be preserved for a reasonable period of time without the risk of microbial deterioration and spoilage. The long shelf-life promised here is an added advantage over other sources of protein like beef, egg and fish which are easily prone to spoilage if proper care is not given to them.

The result shows that, pawpaw and water melon seeds had the same crude fiber contents (14.02±0.20%) which were the highest. Bitter melon and guava seeds also had the same crude fibre (12.00±00%) while cherry seeds had the least value of 10.00±0.00%. These values agreed with 5.0-58% reported by Anwar *et al.*, (2008). The fibre content of pawpaw

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and water melon seeds were higher than that of orange seeds (11.0%) and grape seeds (7.50%) but lower than that of red roselle (28.50%). Guava and bitter melon seeds (12.0%) also had higher fibre values than the grape seed (7.50%) and the orange seeds (11.0%) but lower than white and red roselle seeds (Chittendron, 1986). The physiological role of crude fibre in the body is to maintain an internal distension for proper peristaltic movement of the intestinal tract (Oduor *et al*., 2008).

From the results of proximate composition, it was observed that, the plant with the highest crude protein, crude fat and moisture contents had the lowest carbohydrate. This was observed in water melon seeds and also bitter melon seeds. Others with lower fat, moisture and protein contents tended to have higher carbohydrates as in the case of cherry, guava and pawpaw seeds.

From table 2.0, the metallic compositions of water melon, bitter melon, guava, cherry and pawpaw seeds were compared with one another. Calcium contents of the five seed samples were 6.64±0.10, 7.37±0.20, 5.46±0.03, 3.03±0.12 and 3.69±0.00 mg/100g for cherry, water melon, pawpaw, guava and bitter melon seed respectively. While water melon seeds had the highest calcium content, followed by pawpaw seeds, guava and bitter melon seeds tended to have almost the same calcium content. Cherry on the other hand, had the least calcium content were however, in agreement with what was obtained for the melon seeds reported by Anwar *et al.* (2008).

The zinc and magnesium contents from the table tended to have the least of metallic composition for both plant, but the values agreed with that of citrus seeds 1.00-9.00 mg/100g reported by Brown *et al.,* (1993).

From the table, the potassium level of cherry, water melon, and pawpaw seeds were about the same where guava and bitter melon seeds had the least potassium contents. These levels were lower than the reported for the melon seeds 25.0 mg/100g (Bird, 1990) but higher than that of the citrus seeds 1.0 mg/100g reported by Anwar *et al.*, (2008).

In the case of iron content in the plants, it was observed that pawpaw (0.06458%) had the highest, followed by bitter melon (22.44±0.04), water melon (28.87±0.10) and guava (16.00±0.07) while cherry seeds (12.40±0.10) mg/100g had the least value of iron contents. However, the iron content of melon seeds was lower than that of other seeds but higher than cherry seeds.

It was also observed that water melon had the highest copper content (12.25±0.01%) compared to others. However these values agreed with the 11.0-19.0 mg/100g reported by Anthony, (1986) for the melon seeds.

Generally, from table 2.0 above, it was observed that, the plant seeds were rich in calcium, potassium and iron contents while copper, zinc and magnesium were not as much as other three.

CONCLUSION

From the results of this work, it is strongly recommended that the industrial production and commercialization of the water melon and bitter melon seeds is given adequate attention in other to supplement the conventional seed fats/oils like cornflower, groundnut, linseed and citrus seeds to provide more sources of edible and industrial oils. This will also reduce waste hence a useful tool for economic development since wealth will actually be produced from waste. In addition, they can be used in feed formulations.

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