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PROXIMATE AND MINERAL COMPOSITION OF SOME FRUIT PEELS IN THE ENVIRONMENT

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Abstract

The production of fruit in the world has grown significantly. Large quantities of fruits are harvested worldwide. In some fruits, peels represent about 30% of the total weight and are the main by-product. This study aims to investigate the Proximate and mineral Composition of Some fruit peels in the environment. The peels of eight fruits (orange, watermelon, apple, pomegranate, pawpaw, banana, pineapple and mango) were removed and their nutritional and nutritional properties were analyzed. The results showed that lipid, protein, ash, crude fiber and carbohydrates contents in fruit peels were respectively from 3.36 ± 0.37 to 12.61 ± 0.63%, from 2.80 ± 0.17 to 18.96 ± 0.92%, from 1.39 ± 0.14 to 12.45 ± 0.38%, from 11.81 ± 0.06 to 26.31 ± 0.01% and from 32.16 ± 1.22 to 63.80 ± 0.16%. The minerals composition of fruit peels was respectively from 8.30 ± 0.54 to 162.03 ± 7.54 mg/100g for calcium, 0.66 ± 0.06 to 6.84 ± 0.55 mg/100g for zinc, 9.22 ± 0.63 to 45.58 ± 2.37 mg/100g for iron and 0.52 ± 0.10 to 9.05 ± 0.34 mg/100g for manganese. Peels of these fruits can be used as good ingredients in formulation of health benefits food products.

Keywords: fruit, fruit peel, mineral, proximate value, nutrition

Introduction

Fruit production in the world has seen an amazing increase. Results have been growing at about three percent over the past decade. Large tons of fruit are harvested worldwide. India is the second largest producer of the fruit after China, producing 81,285 million tonnes of the fruit from an area of 6,892 hectares. A large number of fruits are grown in India, among them, banana (32.6%), mango

(22.1%), citrus (12.4%) and pawpaw (6.6%) are the main crops (Indian Horticulture Database, 2021).

According to the recommendations of the WHO, it is necessary to see at least 400 grams of fruits and vegetables every day, considering that there are a number of protective measures against heart disease and some diseases. This decision led to the launch of the '5-a-day' fruit and vegetable campaign in many countries (Oyebode et al., 2014) which led to an increase in fruit consumption. On the other hand, because most of these fruits are early and do not last long, most of our fruits are grown as they are. Therefore, fruits are processed into bottled fruits, juices, jams, marmalades, jellies, wine, pickles, dried fruits or crystallized fruits, etc. (UNIDO, 2004). However, washing fruits produces a lot of waste, some of which are called peels.

The byproducts from the fruit processing industry are considered to be the main waste of fruit, seeds, pomace and peel, with a high water content and in the form of easily digestible water. If left untreated, these agricultural products produce odors, pollute the soil, harbor insects and can cause severe environmental pollution (Shalini and Gupta, 2010). Before that, attempts were made to use agricultural equipment mainly for animal feeding and feeding. Recently, scientists have been able to create high-quality products from products such as cosmetics, medicines and drugs that are good for the economy (Ashoush and Gadallah, 2011) . Fruit peel waste accumulates every day, both at home and at the industrial level. Most of the time, people peel off the skin of the fruit and throw it away as garbage. It is important, especially at the industrial level that needs to be managed properly (Jariwala and Syed, 2016) to protect the environment from pollution.

The idea of using products from fruits is mostly the peels of some fruits which represent about 30% of the total weight, became popular especially when researchers discovered that the peels have more educational activity than other parts of the fruit goes (Wata and Shibamoto, 2009). Recently, with the increasing interest in the source of bioactive compounds and the popularity of the functional food concept, food products containing fruit peel have been developed (Babiker et al., 2013; Altunkaya et al., 2013). However, the application of fruit peels and nutritional supplements depends on their ingredients. Hence in this study, the Proximate and mineral Composition of Some fruit peels in the environment is investigated.

Materials and Methods

Two kilos of pawpaw, pineapples, mangoes, apples, bananas, oranges, pomegranates, and watermelon were purchased a market in New Delhi. The fruits used were Carica pawpaw var. local (pawpaw local), Ananas cosmos var. Smooth Cayenne (Pineapple Smooth Cayenne), Mangifera indica var. Alphonso (mango Alphonso), Malus sylvestris var. Red Delicious (apple Red Delicious), Musa acuminata var. Cavendish (banana Cavendish), Citrus sinensis var. Navel (orange Navel), Punica granatum var. red cultivar (red cultivar of pomegranate) and Citrullus lanatus var. green cultivar (watermelon regular). Fresh fruits were washed and allowed to dry at room temperature. For mango, pawpaw, apple, banana and pineapple, all the skin is removed using a sharp or sharp knife. For watermelons, pomegranates and oranges, only the rind is washed to reduce the albedo, which is the white sponge inside. The harvest is recorded in fresh peels that are dried at 50 ° C and then ground into a fine powder. The water content was determined after heating the oven until it reached 105 ° C. Ash, proteins, lipids and crude fibers were evaluated according to the AOAC method (AOAC, 1990; AOAC, 2000) and the carbohydrate content was determined according to FAO (1982) by classification as follows: Carbohydrate % = 100 – (moisture % + protein % + ash % + lipid % + crude fiber %).

An amount of 2 g of fruit peels was dried in an air oven at 105 °C for 3 hours. The dried sample was next charred until it ceased to smoke. The charred sample was then ashed in a muffle furnace at 550°C until a whitish or greyish ash was obtained. The ash was treated with concentrated hydrochloric acid transferred to a volumetric flask and made up to 100 mL before submission to atomic absorption spectrophotometry (AAS). For AAS, a SHIMADZU atomic absorption flame emission spectrophotometer model AA-670 IF with an air-acetylene flame, and wavelength respectively set to 422.7 nm for calcium, 279.5 nm for manganese, 248.3 nm for iron and 213.9 nm for zinc determination was used. Stock solutions (1000 ppm) of calcium, manganese, iron and zinc were used to prepare working standard solutions with at least 4 concentrations within the analytical range. To eliminate phosphorus interference, lanthanum chloride was added to working standard solutions of calcium and to the test ash solution destined to calcium determination so that the final solutions contained 1% La. Concentration of each mineral contained in test solutions was calculated from the standard curve prepared.

RESULTS AND DISCUSSION

Table 1: Proximate composition of some fruit peels

Fruit	Yield (g/100 g of fresh weight of fruit)	Proximate composition (g/100g dry peel)				
		Crude proteins	Lipids	Ash	Crude fibers	Carbohydrates
Pawpaw	10.21 ± 0.04	18.06 ± 0.92	5.47 ± 0.67	10.22 ± 0.05	12.16 ± 0.06	37.49 ± 0.74
Pineapple	9.17 ± 0.67	5.11 ± 0.02	5.31 ± 0.74	4.39 ± 0.14	14.80 ± 0.01	55.52 ± 0.92
Mango	9.94 ± 0.03	5.00 ± 0.09	4.72 ± 0.55	3.24 ± 0.18	15.43 ± 0.13	63.80 ± 0.16
Apple	10.20 ± 0.03	2.80 ± 0.17	9.96 ± 1.52	1.39 ± 0.14	13.95 ± 0.10	59.96 ± 0.44
Banana	33.81 ± 0.56	10.44 ± 0.38	8.40 ± 1.15	12.45 ± 0.38	11.81 ± 0.06	43.40 ± 0.55
Orange	14.27 ± 0.05	9.73 ± 0.63	8.70 ± 0.65	5.17 ± 0.98	14.19 ± 0.01	53.27 ± 0.10
Pomegranate	11.69 ± 0.03	3.46 ± 0.02	3.36 ± 0.37	6.07 ± 0.07	17.63 ± 0.05	59.98 ± 1.52
Watermelon	6.44 ± 0.02	12.42 ± 0.08	12.61 ± 0.63	5.03 ± 0.80	26.31 ± 0.01	32.16 ± 1.22

The yield of some fruit peels and their nutritional composition are presented in table 1. The table reveals that the yield of the fruit peels ranged from 6.44 ± 0.02 to 33.81 ± 0.56%. The yield of banana peel obtained (33.81 ± 0.56%) was similar to the finding of Nagarajaiah and Prakash (2011) stating that banana peels form about 18-33% of the whole fruit. Similarly, the proportion of peels in pomegranate (11.69 ± 0.03%) was consistent with the finding of Eikani et al. (2012) who reported that pomegranate peel constitutes 5 to 15% of its total weight. In the eight analysed fruit peels, the protein content ranged from 2.80 ± 0.17 to 18.96 ± 0.92%; the minimum level was found in apple peel and the maximum in pawpaw peels. This protein content found in pawpaw peels (18.06 ± 0.92%) was comparable to 17.9% obtained by Munguti et al. (2006) but higher compared to the protein content (14.1%) found in Solo pawpaw peel by Okai et al. (2010). The protein content in mango peel (5.00 ± 0.09%) was comparable to the crude proteins levels (4.68% and 4.32%) found in mango peels respectively by Omutubga et al. (2012). The lipids content of fruit peels ranged from 3.36 ± 0.37 to 12.61 ± 0.63 % with pomegranate peels having the lowest content and watermelon peels the highest level. The lipids content in apple peels, pawpaw peels, orange peels and in mango peels was comparable to the content obtained respectively in apple star peel (8.94%) by Ukana et al. (2012), in pawpaw peel (5.78%) by Okai et al. (2010), in orange peel (9.52%) by Magda et al. (2008) and in mango peels (4.80%) by Omutubga et al. (2012). The lipids content found in banana peel (8.40 ± 1.15%) was comparable to 7.9% obtained by Munguti et al. (2006) but lower than 13.1± 0.2 %, value found in banana peel by Wachirasiri et al. (2009). This might be due either to the differences in varieties or to geographical factors. The ash content of fruit peels under study varied from 1.39 ± 0.14% in apple peels to 12.45 ± 0.38% in banana peels. Similar observations was made by Emaga et al. (2007) who reported that the ash content in different banana peels varied from 6.4 to 12.8%. The concentrations of ash found in pomegranate peels (6.07 ± 0.07%) and in mango peels (3.24 ± 0.18%) were comparable to the level found by Naseem et al. (2012) in pomegranate peels (5.01 ± 0.14%) and in mango peels (3.88%) by Omutubga et al. (2012). The crude fibers and carbohydrates content of fruit peels respectively ranged from 11.81 ± 0.06 to 26.31 ± 0.01% and from 32.16 ± 1.22 to 63.80 ± 0.16%. The crude fibres level observed in pomegranate peels (17.63 ± 0.05%) was comparable to the content obtained with peels of white cultivar of pomegranate (17.53 ± 0.74%) by Ismail et al. (2014). However, the carbohydrates level observed in pomegranate peels (59.98 ± 1.52%) was lower than 78.67% in pomegranate peel by the same author. This might be due either to the differences in varieties of cultivars.

Table 2: Mineral composition of fruit peels

Fruit	Elements (mg/100g dry peel)			
	Calcium	Zinc	Iron	Manganese
Pawpaw	11.44± 2.09	2.68± 0.47	27.61± 0.15	0.52 ± 0.10
Pineapple	8.30±0.54	6.46 ± 0.43	25.52± 3.38	5.32 ± 0.49
Mango	60.63± 4.58	0.66 ± 0.06	12.79±1.56	4.77 ± 0.22
Apple	14.89 ± 2.25	0.95 ± 0.09	25.63 ± 2.47	1.28 ± 0.10
Banana	19.86 ± 0.24	1.72 ± 0.17	15.15 ± 0.36	9.05 ± 0.34
Orange	162.03±7.54	6.84 ± 0.55	19.95 ± 0.50	1.34 ± 0.27
Pomegranate	52.92±1.34	0.98 ± 0.11	9.22 ± 0.63	0.58 ± 0.08
Watermelon	11.21±0.58	3.78 ± 0.27	45.58 ± 2.37	1.25 ± 0.34

The mineral composition of fruit peels is represented in table 2. Calcium is an important constituent of bones and teeth and it is actively involved in the regulation of nerve and muscle functions (Soetan et al., 2010). The calcium content of fruit peels ranged from 8.30 ± 0.54 to 162.03 ± 7.54 mg/ 100 g. The minimum content was found in pineapple peel and the maximum in orange peels. The calcium content in banana peel (19.86 ± 0.24 mg/ 100g) was comparable to 19.20 mg/g of peel observed by Anhwange et al. (2009). The calcium content in apple peels (14.89 ± 2.25 mg/ 100 g) was lower than 48.9 ± 0.99 mg/ 100 g obtained by Manzoor et al. (2012) in apple peels. According to Leterme et al. (2006), several factors like variety, state of ripeness, soil type, soil condition, and irrigation regime may cause variation in the mineral and trace elemental contents in different types of fruits as well as within different parts of the same fruit.

Zinc is particularly necessary in cellular replication and the development of the immune response. Zinc also plays an important role in growth; it has a recognized action on more than 300 enzymes by participating in their structure or in their catalytic and regulatory actions (Salgueiro et al., 2002). Zinc levels in the fruit peels ranged from 0.66 ± 0.06 to 6.84 ± 0.55 mg/100 g, with the minimum being in mango peels and the maximum in orange peels. Zinc contents observed in peels of apple (0.95 ± 0.09 mg/100 g) and of pawpaw (2.68 ± 0.47 mg/100 g) were comparable to values obtained respectively by Soetan et al. (2010) in apple peels (0.9 ± 0.06 mg/100 g) and by Santos et al. (2014) in pawpaw peels (3.28 ± 0.06 mg/100 g). Iron carries oxygen to the cells and is necessary for the production of energy, synthesis of collagen and the proper functioning of the immune system. Manganese is known to aid the formation of skeletal and cartilage. Iron and Manganese levels in analysed fruit peels ranged respectively from 9.22 ± 0.63 to 45.58 ± 2.37 mg/ 100g and from 0.52 ± 0.10 to 9.05 ± 0.34 mg/ 100g. The lowest level in both minerals was found to be in pomegranate peels while the highest levels are respectively found in watermelon for iron and in banana peels for manganese. However, the contents in both iron and manganese observed in banana peels are respectively lower than 0.61 and 76.20 mg/g obtained in banana peels by Anhwange et al. (2009).

Conclusion

Orange, pineapple, banana, apple, Watermelon, pawpaw, mango and pomegranate have important proportions of peels. Those peels are sources of nutrients (lipids, proteins, minerals, etc.). Therefore, peels of these fruits can be used as good ingredients in formulation of health benefits food products.

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