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Comparative Investigation of the Proximate and Functional Properties of Watermelon (Citrullus lanatus) Rind and Custard Apple (Annona squamosa) Peel

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Abstract
Fruit peels are a low-cost lignocellulose matter that is created as an organic waste by various food processing enterprises and households. They have some recycling potential. In the present study, two fruit peels, custard apple (*Annona squamosa*) and watermelon (*Citrullus lanatus*), which are easily available in large quantities, were analyzed for the proximate and functional properties by using standard procedures. The proximate compositions (gm/100gm) of the watermelon rind and custard apple peel were moisture (10.778 ±0.46 , 5.796±0.33), dry matter (89.222 ±0.46, 94.204 ±0.33), fat (2.492±0.37 , 1.549±0.50), crude protein (8.986±1.28 , 6.778±0.66), carbohydrate (70.45±0.25 , 80.192±0.26), crude ash (2.793±0.48 , 1.759±0.21), and crude fibre (4.501±0.76 , 3.926±0.31) respectively. The functional qualities of the watermelon rind were 0.925±0.013 gm/cm3 (Bulk density), 7.131±0.21% (Water absorption capacity), 1.65±00 % (Oil absorption capacity) and 8.43±0.07% (Swelling capacity). The functional qualities of the custard apple peel were bulk density, 0.902±0.013 gm/cm3; Water absorption capacity, 4.366±0.24%; Oil absorption capacity, 1.27±01%; Swelling capacity, 5.0 ± 0.04%. The results of functional properties revealed that both the rind & peel can be used in the development of food products. When compared to other dried and raw peel samples, the oven-dried peel sample has lower moisture content and may be preserved for a longer period of time. Other significant proximate values indicate that both watermelon and custard apple peel had higher ash content, which indicates that both are a rich source of mineral content and the higher value of crude fibre indicates the ability to lower the risk of chronic disease such as obesity, hypercholesterolemia etc.

Keywords: Custard apple peel, Functional properties, Proximate analysis, Watermelon rind.

Introduction

Plants are essential to all life forms' survival and well-being, whether directly or indirectly. This is due to the fact that plants and it's products fulfil essential human needs such as clothes, shelter, and food (Alaekwe and Mojekwu, 2013). The importance of fresh fruits and vegetables in our daily lives cannot be overstated (Pamplona-Roger, 2008). Ngoddy and Ihekoronye (1985) discovered that fruits and vegetables provided the quickest sources of vitamins, minerals, and fibre to people. They are also low-energy-density food items that can help in weight loss (Rolls et al., 2004). Fruits include a lot of water, carbohydrates, vitamins A, B1, B2, C, D, E, and minerals - calcium, magnesium, zinc, iron, potassium, and organic compounds that the body needs in modest amounts (Okwu and Emelike, 2006; Onibon et al., 2007; Dosumu et al., 2009; Dimari and Hati, 2010).Consumption of at least 400 g of fruits and vegetables per day, as well as whole grains, cereals, and legumes at least 30 g per day, is suggested by the World Health Organization and the Food and Agriculture Organization as the ideal diet for everyone (WHO/FAO, 2003).

Watermelon (*Citrullus lanatus*) is a tasty fruit and one of the most economically important Curcurbitaceae family members. The fruit contains both nutritional and therapeutic properties (Gwana et al., 2014). The pulp's juice can be converted into wine, while the seeds are eaten as treats in China and Israel. The pulp is boiled and the seeds are consumed in Nigeria, Sudan, and Egypt (Goda, 2007). The plant includes a high concentration of citrulline, which can help with erectile dysfunction. It has a high quantity of antioxidants, which reduces the incidence of kidney stones and bone loss caused by ageing. It constitutes a potent diuretic diet that contains enough amino acids and beta-carotene to avoid ailments such as heart disease. The lycopene concentration of the fruit, which gives it its colour, helps to prevent against prostate and oral cancer (Gwana et al., 2014).

Watermelon rind :-The skin of a watermelon is smooth, with a dark green rind or pale green stripes that turn yellowish green when ripe. It is a good source of phytochemicals as well as of vitamins (Perkins-Veazie and Collin, 2004). Watermelon peel is edible and contains a variety of nutrients, however most people avoid eating it due to its unpleasant flavour. They are occasionally used as a vegetable (Houqe, 2015). Watermelon rind keeps the sweeter flesh from rotting and offers extra vitamin C, fibre, potassium, and a trace of vitamin B-6. Watermelon peel is low in calories. Watermelon rind contains citrulline, according to Agricultural Research Service research Citrulline is converted into arginine, an amino acid that our bodies use to generate proteins and plays a role in blood vessel relaxation. Watermelon rind extract has a potential treatment for angina and other heart and blood disorders (Pradhananga, 2017).

Custard apples are typically served as a dessert fruit. When the fruit is solid, it contains a lot of starch, but when it softens, it contains a lot more sugar. Glucose and fructose are the two most important sugars (80-90 percent). Custard apple fruits have high levels of vitamin C, thiamine, potassium, magnesium, and dietary fibre as compared to other fruits. The calorific value is considerable (200-450 kJ per 100 g), nearly double of peach, orange, and apple (George, 2010).

Custard apple peel :- When fully ripe, custard apples have a golden green or brownish, thin but tough knobby skin with a yellow colour between the nodules. It contains a significant amount of carbohydrates and a little amount of protein. It is low in sodium and high in potassium, which helps to keep blood pressure normal, lowers the risk of hypertension, transmits nerve impulses to muscles, and promotes muscle contraction. It contains a modest amount of minerals such as calcium, iron, potassium, phosphorus, and magnesium, all of which are essential for the body's metabolic activity. It is also a good source of vitamins like thiamine, riboflavin, niacin, and vitamin B6, which are necessary for the body's regular functions and the synthesis of energy from food. It is a good source of vitamin C, a natural water-soluble antioxidant. Besides these it contains a lot of fibre (Mythily et al., 2012).

MATERIALS AND METHODS

The study was carried out in the laboratory of the Department of Home Science, IIS (deemed to be University) Jaipur. Fresh watermelon, free from physical disorders, was procured from the local market ie. Muhana Mandi (fruit and vegetable mandi), and the rinds were collected after the flesh had been consumed. Other materials and chemicals were sourced from the laboratory's inventory.

Chemical analysis: Using a standard procedure (AOAC, 2016), the dried rind powder and peel powder were evaluated for moisture, ash, protein, fat, and fibre, while carbohydrate content was calculated by composite method. All determinations were made in triplicate and represented in mean and standard deviation..

Cleaning and preparing watermelon rind and custard apple peels

Watermelon peel: The watermelon was thoroughly cleansed to eliminate sand particles before being sliced with a knife. To extract the peel, the pulp was carefully scraped off (Sudhaakr et al., 2017). Peel was cut into small pieces. The pieces were blanched at 90°C for 5 minutes before drying (Dhakal and Pradhananga, 2017).

Drying of the peels:- Watermelon rind was cut into small pieces, kept in stainless steel trays in an electrically operated hot air oven at a temperature of 80^{0}C for 48 hr.

Processing of the dried peels: The dried rinds were powdered using a (mention Brand also) grinder. The obtained powder was sieved through a 355-µm mesh sieve. The obtained peel flour was stored in food grade air tight plastic pouches.

Custard apple peel: - The fruits were properly rinsed and separated from pulp. The peels were collected and blanched for 5 minutes to inactivate the polyphenol oxidase enzyme. The peel s were then sliced into small pieces and later dried.

Drying of the peels:- Custard apple peels were sliced into small pieces and kept in stainless steel trays in an electrically controlled hot air oven at 80°c for 48 hours.

Processing of the dried peels: The dried peels were reduced to powder using a grinder and sieved through a 355-m mesh sieve. The obtained peel flour was stored in food grade airtight plastic containers.

Functional properties

Bulk density:- Following the methodology and procedure provided by Okaka and Potter (Okara method,Menon, 2014), the bulk densities of the watermelon rind powder and custard apple peel powder were assessed. Weight (g)/volume = bulk density (cm3). No need to write formula

Write about other functional properties which you have assessed

Results and Discussion

The flours obtained from watermelon rind and custard apple peel were analyzed for physico-chemical properties. The results are presented in Table 1 and it was observed that the custard apple peel powder had lower moisture (5.796gm/100gm) than the watermelon rind powder (10.778gm/100gm). The watermelon rind powder had higher ash content (2.793gm/100gm) as compared to the custard apple peel powder (1.759gm/100gm). Protein content of the custard apple peel powder was found to be lower as compared to watermelon rind powder (6.778gm/100gm vs. 8.986gm/100gm). The watermelon rind powder had higher fat content (2.492gm/100gm) as compared to custard apple peel powder (1.549gm/100gm). Crude fibre content of watermelon rind powder and custard apple peel powder was found to be 4.501gm/100gm and 3.926gm/100gm respectively. Custard apple peel powder had higher carbohydrate content (80.192gm/100gm) than watermelon rind powder (70.450gm/100gm). The high ash content of watermelon rind powder indicates that it is a good source of minerals. Beside this, watermelon rind powder can be helpful for improving digestion because of the high fibre content.

Table 1: - Proximate analysis of dried peel powders of watermelon and custard apple

NUTRIENTS	Watermelon peel powder	Custard apple peel powder
Moisture (g/100g)	10.778 ±0.46	5.796±0.33
Ash (g/100g)	2.793±0.48	1.759±0.21
Crude Fiber (g/100g)	4.501±0.76	3.926±0.31
Protein (g/100g)	8.986±1.28	6.778±0.66
Crude Fat (g/100g)	2.492±0.37	1.549±0.50
Carbohydrate (g/100g)	70.45±0.25	80.192±0.26

Value ±SD of triplicate determinations, Difference is significant ($p<0.05$)

Functional properties:-The functional properties i.e. bulk density; water absorption capacity, oil holding capacity and swelling capacity of the watermelon rind powder and custard apple peel powder are shown in Table 2. Bulk density of watermelon rind powder and custard apple peel powder was 0.925% and 0.902% respectively. The high bulk density can help to increase the weight of peel powder supplemented foods without changing the volume. Water absorption capacity of the watermelon rind powder (7.131%) differed significantly from that of the custard apple peel powder (4.366%). It indicated that watermelon rind powder absorbs more water as compared to custard apple peel powder to form standard dough. From Table 2, it can be noticed that the water absorption capacity of watermelon rind powder was higher than custard apple peel powder. Oil absorption capacity of watermelon rind powder was 1.65% and custard apple peel powder was 1.27%. The absorption of oil by food product improves mouth feel and flavour retention .The high oil absorption capacity suggested the lipophilic nature of peel powder. Swelling capacity of the powder of watermelon rind and custard apple peel were 8.43% and 5.0% respectively. The values of swelling capacity indicated the time required by powder to reach its wetness.

Table 2:- Functional properties of Watermelon rind and Custard peel flour

Functional Properties	Watermelon peel powder	Custard apple peel powder
Bulk Density (%)	0.925±0.013	0.902±0.013
Water absorption capacity (%)	7.131±0.21	4.366±0.24
Oil absorption capacity (%)	1.65±00	1.27±01
Swelling capacity (%)	8.43±0.07	5.0 ± 0.04

Value ±SD of triplicate determinations, Difference is significant ($p<0.05$)

CONCLUSION

The major findings from this study was that the watermelon rind and custard apple peel are generally discarded as waste after the consumption of the pulp, both of them possess functional properties and can be used for food formulations. There was a significant amount of crude protein, ash, crude fibre and less amount of carbohydrate. According to the results of proximate analysis; dried watermelon rind and custard apple peel flour are good sources of nutrients, and the plant might be used as a supplement in both animal and human food.

REFERENCES

A.O.A.C.(2016). Official Method Of Analysis. Association Analytical Chemist (15th Edn), Washington DC .15.

Alaekwe, I.O. and Mojekwu, O.E. 2013. Proximate composition and utilization of Napoleona imperialis fruits. Journal of Natural Sciences Research 3(6): 160- 165.

Dhaka, D. and Pradhananga, M. L. (2017). Utilization of Watermelon Rind (Byproduct) in Preparation of Candy and its Quality Evaluation. *International Journal of Multidisciplinary Papers*, 2 (1), 1–6

Dosumu, O.O. Oluwaniyi, O.O., Awolola, G.V. and Okunola, M.V. 2009. Stability studies and mineral concentration of some Nigeria packed fruits juices, concentrate and local beverages. African Journal of Food Science 3(3): 82-85.

Dimari, G.A and Hati, S.S. 2010. Vitamin C composition and mineral content of some Nigerian packaged juices drinks. Journal of the Life and Physical Sciences 3(2): 129-134.

Gwana, A. M., Bako, M. M., Bagudu, B. Y., Sadiq, A. B. and Abdullahi, M. M. 2014. Determinations of phytochemical, vitamin, mineral and proximate compositions of varieties of watermelon seeds cultivated in Borno State, North-Eastern Nigeria. International Journal of Nutrition and Food Sciences 3(4): 238 – 245.

Goda, M. 2007. Diversity of local genetic resources of watermelon Citrullus lanatus (Thunb.). Matsum and Nakai in Sudan. Swedish Biodiversity centre, Uppsala, Sweden: Uppsala University, MSc thesis

Hoque , M .M ., Iqbal , A . (2015). , Drying of Watermelon Rind and Development of Cakes from Rind Powder. International Journal of Novel Research in Life Sciences, 2,14- 21.

L.G. Hassan, N.A. Sanni, S.M. Dangoggo, M.J. Ladan, Nutritional value of bottle gourd (Lagenaria siceraria) seeds. Global J. Pure & Applied Sci., Vol.4 No. 3, 2008, 301-306.

Ngoddy, P.O., and Ihekeronye, A.I. 1985. Integrated Food Science and Technology. 1st ed. London: Macmillan Publisher Limited.

Okwu, D.E and Emenike I.N. 2006. Evaluation of the phytonutrients and vitamin C content of citrus fruits. International Journal of Molecular Medicine and Advance Sciences 2: 1-6.

Onibon, V.O., Abulude, F.O. and Lawal, L.O. 2007. Nutritional and anti-nutritional composition of some Nigerian fruits. International Journal of Molecular Medicine and Advance Sciences 5(2): 120-122

Perkins-Veazie, P., Collins, J.K, (2004). Flesh quality and lycopene stability of fresh-cut watermelon. Journal of Postharvest Biology and Technology, 31, 159–166.

Pamplona-Roger, G.D. 2008. Healthy Foods. 1st ed. San Fernando de Henares, Madrid, Spain: Editorial Safeliz S. L

Rolls, B.J., Ello-martin, J.A. and Johill, B.C. 2004. What can intervention studies tell us about the relationship between fruits and vegetable consumption to weight management? Nutrition Review 62:1-17.

World Health Organization (WHO) and Food and Agriculture Organization of the United Nations (FAO). 2003. Diet, nutrition and the prevention of chronic diseases. Report of a joint WHO/FAO expert consultation. Geneva: WHO.