IMPACT: International Journal of Research in Applied, Natural and Social Sciences (IMPACT: IJRANSS)
ISSN (P): 2347–4580; ISSN (E): 2321–8851
Vol. 9, Issue 5, May 2021, 23–32

PROXIMATE COMPOSITION OF SOME SELECTED FRUITS PEELS IN NIGERIA

Nyoyoko, Veronica Fabian, Obong, Utom John, Christopher & Mary Anthony

Research Scholar, Department of Microbiology, University of Nigeria, Nsukka, Nigeria, West Africa

Research Scholar, AkwaIbom State Polytechnic, AkwaIbom State, Nigeria, West Africa

Research Scholar, AkwaIbom State University, Uyo, AkwaIbom State, Nigeria, West Africa

Research Scholar, AkwaIbom State University, Uyo, AkwaIbom State, Nigeria, West Africa

Received: 12 May 2021 **Accepted:** 15 May 2021 **Published:** 31 May 2021

ABSTRACT

Fruit is a mature ovary, essential for human diet. Fruits peels represent almost 30 % of the total weight and are of primary by-product. This study aimed to investigate the proximate composition of fruits peels: orange (Citrus sinensis), Banana (Musa paradisiaca) and lemon (Citrus limen) peels. Proximate analysis was done according to standard procedures, fruits peels were removed and analysed for the nutrient content. The result showed the range; lipid content was 6.47±0.02 to 8.31±0.02 %, crude protein was 7.34±0.02 to 8.63±0.08 %, ash content was 7.07±0.17 to 12.54±0.06 %, crude fibre was 11.69±0.09 to 14.27±0.03 %, carbohydrate was 46.42±0.05 to 50.44±0.51 %, dry matter was 80.29±0.11 % to 89.33±0.03 %, and moisture content 10.68±0.03 % to 13.71±0.11 %. Peels contain important nutrient needed for growth and development for both man and animal.

KEYWORDS: *Fruit, Nutrient, Diet, Peels, Proximate*

INTRODUCTION

Fruits are crucial for human diet. They have crucial role in supplying valuable nutrients like folate, potassium and vitamins. Which help to prevent cancer, heart disease, birth defects, anaemia and cognitive decline? Aid to reduce blood pressure and water retention, protect against stroke and help to prevent osteoporosis and kidney and also helps in the growth and repair of tissues in all parts of the body, heals wounds and form scar in tissue. Help in the absorption of iron. All these nutrients help in the maintaining human health (Ravayshedet al., 2013). Interestingly, the seed and the peels of some fruits have the higher vitamins, fibres, minerals and other essential nutrients activity than the pulp fractions (Letermeet al., 2006).

Fruit peel is basically the outer skin or the covering of the fruit. In general, the peels in some tough skinned fruits such as pomegranate, passion fruit, mangos teen is known as peel where as in citrus which include as orange, lemon and grapes are known as zest (Letermeet al., 2006; Ezejiofor et al., 2011). While other outer cover protect the fruit from environmental factors, macro and microorganisms (Ravayshedet al., 2013). Fruit peels are very rich in essential oils, which give characteristic aroma to the fruit (Lagha and Madaniet al., 2013).

Fruit waste which include core seeds, pomace, and peels contain large amount of water and are in a wet and easily fermentable form, if not processed, produces odour, soil pollution, harbourage for insects and can give rise to serious environmental pollution(Shalini and Gupta, 2010). Approximately, more than 40 % of the oranges produced globally are utilized in processing to make different commercial products, such as dehydrated citrus products or marmalades, jams, fresh juice and flavouring agents for beverages. Some attempts were made to use agro waste essentially for livestock feed and fuel purposes (Sharma et al., 2017). Recently, Scientists were able to develop high value product from these by-product such as cosmetics, medicines and the recovery seems to be economically attractive (Ashoush and Gadallah, 2011). These by-products are a source of fiber, dried pulp, essential oils, Dlimonene, pectin, seed oil, ascorbic acid and flavonoids (main flavonoids in citrus species are hesperidin, narirutin, naringin and eriocitrin) (Sharma et al., 2017).

The idea of utilizing fruit by-product mainly the peels which in some fruits represent almost 30 % of the total weight have slowly gaining popularity especially, researchers have found that peels possessed better biological activity than other part of the fruit (Moon and Shibamoto, 2009). Recently, there is an increased in the interest for natural sources of bioactive compounds and the popularity of the concept of functional foods, food product enriched fruit peels are being developed (Babikeret al., 2013). However, the potential application of fruit peels in food supplementation depends on their application of fruit peels in food supplementation depends on the chemical composition (Altunkayaet al., 2013). Asides the mineral composition of the fruit peels, researchers have shown that the peels contain some amount of basic nutrients such as Crude protein, Lipid, Crude Fibre, Ash as well as Carbohydrate. Banana has the highest composition of Crude Protein, Lipid and Ash followed by Pineapple and Mango (Naseemet al., 2012; Omutubgaet al., 2012). However, Crude Fibre and Carbohydrate are more abundant in Mango than Pineapple and Banana respectively (Romelleet al., 2016). The average daily requirement of dietary fibre is 21-25 g per day for women and 30-38 g per day for men (Food and Nutrition Board, Institute of Medicine). Nassaret al., (2008) suggested that 15 % of Citrus sinensispeels and pulp could be incorporated as an ingredient in making biscuit, as they are suitable source of dietary fibre with associated bioactive compounds (Flavonoids, carotenoids).

It is necessary to evaluate the nutritional and anti-nutritional content of these fruit and their waste materials so that the knowledge derived can be used to encourage adequate consumption of fruits and reutilization of seed and peels in possible value added application in addition to medical significance.

AIM OF THE STUDY

To study proximate composition of some selected fruit peels of orange, banana and lemon.

MATERIALS AND METHODS

The study adopted the experimental design. Samples were collected at random from five different markets in EssienUdim Local Government area, AkwaIbom State. The samples were authenticated by botanist, after which the samples were taken to the laboratory for analysis. Foreign particles were carefully separated from the samples. The samples were grinded into fine powder using a steel blended electric grinder module (306) Japan and stored in an air tight container. The containers were carefully labelled for easy identification, before using it for the different analysis (AOAC, 2000).

Proximate Analysis

All chemical used were of analytical grade. Proximate analysis was done according to standard procedures

Determination of Crude Protein

Determination of crude protein was done using Kjeildahl method.

Five grams of air dried samples was weighed into 500 ml long necked Kjeildahl flask and 10 ml distilled water added to moisten the sample. One spatula full of Kjeildahl catalyst (mixture of I part selenium + 10 parts $CuSO_4$ + 100 parts Na_2SO_4) was added, followed by 2 ml concentration of H_2SO_4. The solution was digested until clear and colourless. The flask was allowed to cool; the fluid decanted into a 100 ml volumetric flask and made up to the mark with the distilled water, an aliquot of 10 ml fluid from the digested sample by means of a pipette was transferred into Kjeildahl distillation flask. Ninety ml of distilled water was added to make it up to 100 ml in the distillation flask. Twenty ml of 40 % sodium hydroxide was added to the content of the distillation flask. Distillate was collected over 10 ml of 4 % boric acid and 3 drops of methyl red in 200 ml conical flask. The presence of nitrogen gave light blue colour. The collected distillate (about 100 ml) was titrated with 0.1 N HCl till the blue colour changed to grey and finally to pink colour (Kjeildahl, 2000).

Determination of Lipid Content

Five grams of fruit peels sample were weighed in a porous thimble of a soxhlet apparatus. The thimble was placed in an extraction chamber, which was suspended above a pre weighed resenting flask containing petroleum ether. The flask was heat on a heating mantle for 8 hours to extract the crude lipid. After the extraction, the thimble was removed from the soxhlet apparatus and the solvent distilled off. The flask containing the crude lipid as heated in the oven and 100°C for 30 minutes to evaporate the solvent, and then cooled in desiccators, and reweighed. The difference in weight was expressed as percentage crude lipid content

% lipid = $\underline{W_8 - W_7}$

W_9 x 100 %

W_7 = weight of clean dry flask

W_8 = weight of flask with oil

W_9 = weight of sample

Determination of Ash Contents

Five grams of fruit peels sample was accurately weighed in a platinum crucible and recorded as W_4, this was transferred to muffle furnace at the temperature of 5500°C for 8 hours until a white ash obtained. The platinum crucible was removed and placed in a desiccator to cool and weighed, the value was recorded at W_5, percentage ash was calculated as;

% ash = $\underline{W_4 - W_5}$

Weight of sample used x 100

Determination of Crude Fibre Content (Weende Method)

Crude fibre was estimated by acid-base digestion with 1.25 % H_2SO_4 (prepared by diluting 7.2ml of 94 % concentration acid of specific gravity 1.835g/ml per 1000ml distilled water) and 1.25 % NaOH (12.5g per 1000ml distilled water) solution. The residue after crude lipid extraction was put into 200ml of boiling 1.25 % sulphuric acid added. The content was boiled for 30 minutes under reflux, cooled, filtered through a filter paper and the residue was washed with boiling until washings were no longer acidic.

The washed residue was returned to the digestion flask and further digested by boiling in 200ml of 1.25 % Sodium hydrochloride for 30 minutes. The digest was filtered through a porous crucible to obtain the residue. This was washed with boiling water and finally with 15mls of 95 % ethanol. The washed residue was dried in an oven at 110°C to constant weight and cooled in a desiccator. The residue was scrapped into a reweighed porcelain crucible weighed, ashed at 550°C for 30 minutes, cooled in a desiccator and reweighed. Crude fibre content was expressed as percentage loss in weight on ignition.

Determination of Carbohydrate

The carbohydrate content of the samples was estimated as the difference obtained after subtracting the values of organic protein, ash content, fat or oil, crude fibre and moisture content from 100 (AOAC, 2000).

Carbohydrate % = 100 – (moisture % + protein % + ash % + lipid % + crude fiber %).

Determination of Moisture Content

A crucible was accurately weighed, after which 5.0 grams of sample was added and reweighed and the weight recorded as (W_1). Moisture content was determined after oven drying to a constant weight at 105 °C.The moisture content calculated as follows:

$$\text{Moisture content}=\frac{W1-W2}{W3}\times 100$$

W_1 = Weight of crucible + sample

W_2 = Weight of crucible + sample after drying

W_3 = Weight of sample

RESULTS AND DISCUSSIONS

The result of the proximate composition of Musa paradisiaca, Citrus sinensis and Citrus limon peels (banana, orange and lemon) are presented in table.

Figure 4 represent comparative study of the composition of Musa paradisiaca, Citrus sinensis and Citrus. The study reveals that the yield of peels in studied fruits ranged from 10.68 ± 0.03 to 1371± 0.11%. When the fruit peels were analysed for carbohydrate content, highest concentration were found in Citrus lemon; 50.94 ± 0.81 %, followed by Citrus sinensis; 50.44 ± 0.83 %, least concentration ion was found in Musa paradiasiaca; 46.42 ± 0.05 %. This shows significant amount of carbohydrates in the fruit peels and hence they can be utilized as a source of carbohydrates. Musa paradiasiaca and Citrus sinensis peels also contain significant amount of carbohydrate as estimated by Aahwangeet al., (2009) and Osarunwenseet al., (2013), respectively.

The lipid content of the fruit peels ranged from 6.47± 0.02 to 8.31 ± 0.02 % with Citrus lemon peels having the lowest content and Musa paradiasiaca was having the highest level content of lipids. The study agrees with the work of the following researchers, Magda et al., (2008), Mungutiet al., (2006), Wachirasiriet al., (2009). Magda et al., (2008) study the lipids content in Citrus sinensispeel and find out to contain 9.52 % lipids content. Mungutiet al., (2006) and Wachirasiriet al., (2009) determine lipid content of Musa paradiasiacapeel to contained 7.90 % and 13.1± 0.2 %, respectively. This might be due to either the difference in varieties or geographical factors.

The ash content of fruit peels under study ranged were, 7.07± 0.17 in Citrus sinensis peel, 12.54 ± 0.06 % in Musa paradiasiaca peels. Similar observation was made by Emaga et al., (2007) who reported that the ash content in different Musa paradiasiaca ranged from 6.4 ± 0.12 to 8.0 ± 0.0 % ash content in different Musa paradiasiaca peels. Also lower than the ash content in Musa paradiasiaca as reported by Tartrakoonet al., (1999) as 14.58 %.

The moisture content was lowest and highest in Citrus lemon and Musa paradiasiaca peels with the values of 10.68 ± 0.03 % and 13.73 ± 0.11 %, respectively, agree with the work of Phatcharaporm et al., (2009) who evaluate the moisture content of Musa paradiasiaca peels to contain the value of 13.1 %.

The protein content ranges from 7.34 ± 0.02 to 8.68 ± 0.089 %. The minimum and maximum value level was found in Musa paradiasiaca and Citrus sinensispeels, respectively. The protein content values in Musa paradiasiaca were higher than that reported by Tartrakoonet al., (1999) as 4.77 %.

The dry matter content ranged from 86.29 ± 0.11 % in Musa paradiasiaca to 89.33 ± 0.03 % in Citrus lemon peel. The value for Citrus lemon peels was higher than that reported by Figuerolaet al., (2005) as 68.3 g/100 g dry weight. Banana (Musa paradiasiaca) peels dry matter content value observed was 86.29 ± 0.11 % which agree with the research of Wachirasiriet al., (2009). Wachirasiriet al., (2009) reported values ranged of 83.0 to 89.35 g/100 g dry weight to dry matter content in Musa paradiasiaca.

The crude fibre content ranged from 11.69 ± 0.09 % in Musa paradiasiaca peel to 14.27 ± 0.03 % in Citrus sinensispeels. This result from the nutritive composition showed Citrus sinensispeels as a promising source of crude fibre.

Table 1: Proximate Composition of Banana, Lemon and Orange Peels Samples

Sample	Moisture Content (%)	Dry Matter (%)	Ash Content (%)	Crude Protein (%)	Lipid Content (%)	Crude Fibre (%)	Carbohydrate Content (%)
Banana peel	13.71 ± 0.11	86.29 ± 0.11	12.54 ± 0.06	7.34 ± 0.02	8.31 ± 0.02	11.69 ± 0.09	46.42 ± 0.05
Lemon peel	10.68 ± 0.03	89.33 ± 0.03	9.03 ± 0.27	8.53 ± 0.04	6.47 ± 0.02	13.87 ± 0.03	50.94 ± 0.81
Orange peel	12,23 ± 0.55	87.75 ± 0.55	7.07 ± 0.17	8.68 ± 0.08	7.33 ± 0.03	14.27 ± 0.03	50.44 ± 0.83

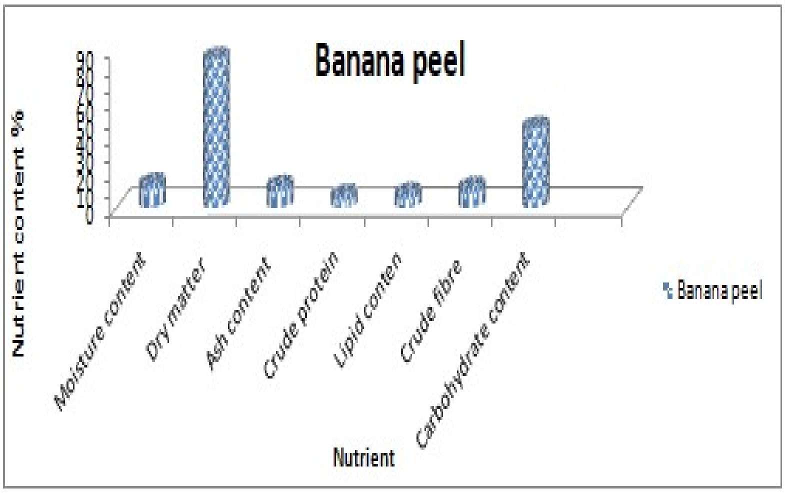

Figure 1: Composition of Musa Paradisiaca.

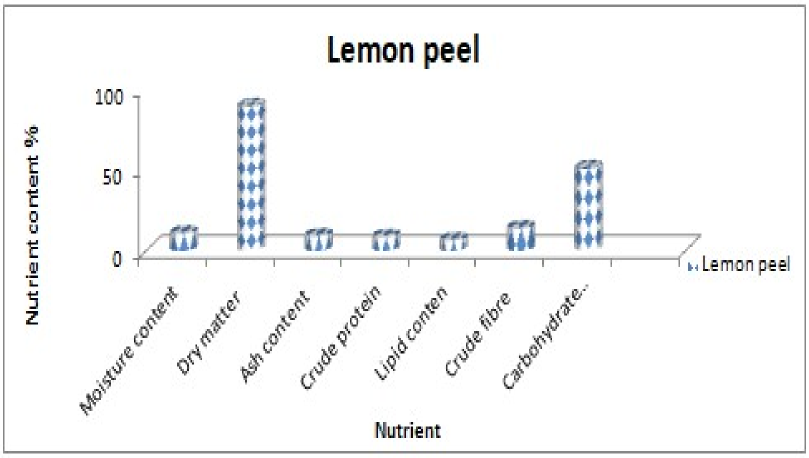

Figure 2: Composition of Citrus Lemon.

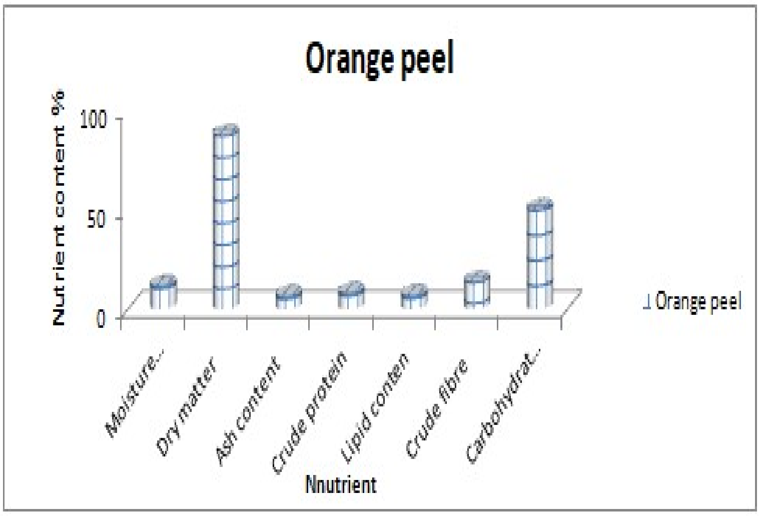

Figure 3: Composition of Citrus Sinensis.

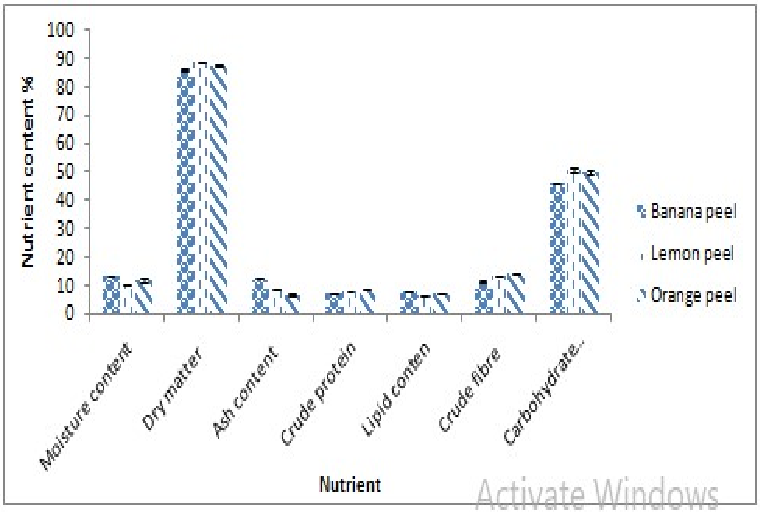

Figure 4: Comparative Study of the Composition of Musa Paradisiaca, Citrus Sinensis and Citrus.

CONCLUSIONS

The study aids in understanding the nature of various components and their level in different fruit peels provide insight on better usage of fruit waste. Thus, peels and seed of several fruits are effective resources of antioxidant which can be effectively utilized in food, pharmaceutical and agricultural industries. Banana, lemon and orange have important proportion of peels; those peels are sources of nutrient (lipid, protein carbohydrate). Therefore, peels of these fruits can be used as good ingredients in formulation of health benefits food products. Further studies on the identification, isolation, characteristics and elucidation nutrient in fruit peels should be done instead of wasting them.

RECOMMENDATIONS

Peels contain important nutrient needed for growth and development for both man and animal. Therefore is recommended for enlightenment, to encourage and create awareness for the consumption of fruit and peels.

Government should encourage the fruit processing industries to further process their by-products especially peels which can be used to develop high value product such as cosmetics and medicines instead of considering them as waste.

ACKNOWLEDGEMENTS

We thank AkwaIbom State Polytechnic for giving us the opportunity to carry out the research and we also appreciate Rev. Fr. Prof. Vincent Nyoyoko, for funding the research.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

REFERENCES

1. *Anhwange, B.A., Ugye, T. J. and Nyiaatagher, T. D. (2009) Chemical composition of Musa sapientum (banana) peels, Electronical Journal of Environmental, Agricultural and food chemistry, 8 (6), 437- 442.*
2. *Altunkaya, A., Hedegaard, R. V., Brimer, L., Gökmen and Skibsted L. H. (2013) Antioxidant capacity versus chemical safety of wheat bread enriched with pomegranate peel powder, Food Function, 4, 722-727.*
3. *AOAC (2000) Official Methods of Analysis (17th ed.), Association of Official Analytical Chemists, Arlington, VA., USA.*
4. *Ashoush, I. S. and Gadallah, M.G.E (2011) Utilization of mango peels and seed kernels powders as sources of phytochemicals in biscuit, World Journal of Dairy and Food Sciences, 6 (1), 35-42.*
5. *Babiker, W. A. M., Sulieman, A. M. E., Elhardallou, S. B. and Khalifa, E. A. (2013) Physicochemical properties of wheat bread supplemented with orange peel by-products, International Journal of Nutrition and Food Sciences, 2(1), 1-4.*
6. *Emaga, T. H., Andrianaivo, R. H., Wathelet, B., Tchango, J. T. and Paquot, M. (2007) Effects of the stage of maturation and varieties on the chemical composition of banana and plantain peels, Food Chemistry, 103, 590-600.*

7. *Ezejiofor, T. I. N., Eke, N. V., Okechukwu, R. I., Nwoguikpe, R. N., Duru, C. M. (2011). Waste to wealth industrial raw materials potential of peels of Nigerian sweet orange (Citrussinensis). African Journal of Biology. 10(33): 6257-6264.*

8. *Figuerola, F., Hurtado, M.L., Estevez, A.M., Chiffelle, I., Asenjo, F., 2005. Fibre concentrates from apple pomace and citrus peel as potential fibre sources for food enrichment. Food Chem. 91, 395– 401.*

9. *Kjaidahl, J. (2000). Determination of protein nitrogen in food products.Food Science. 6: 439-441.*

10. *Lagha-Benamrouche, S., Madani, K. (2013). Phenolic content and antioxidants activity of orange varieties (Citrus sinensisL. and Citrus auruntium L.) cultivated in Algeria, peels and leave. Industrial Crop and Product. 50: 723-730.*

11. *Leterme, P., Buldgen, A., Estrada, F., Londona, A. M. (2006).Mineral content of tropical fruits and unconventional foods of the Andes and the rain forest of Colombia.Food Chemistry.95: 644- 652.*

12. *Magda, R. A., Awad, A. D. and Selim, K. A. (2008) Evaluation of Mandarin and Orange Navel peels as natural sources of antioxidant in biscuits, Alexandria Journal of Food Science and Technology, Special volume conference, 75-82.*

13. *Moon, J.K and Shibamoto, T (2009). Antioxidant assays for plant and food components, Journal of Agricultural and Food Chemistry, 57, 1655-1666.*

14. *Munguti, J. M., Liti, D. M., Waidbacher, H., Straif, M. and Zollitsch, W. (2006) Proximate composition of selected potential feedstuffs for Nile tilapia (Oreochromisniloticus Linnaeus) production in Kenya, Die Bodenkultur, 57 (3), 131-141.*

15. *Naseem, U., Javid, A., Farhat, A. K., Muhammad, K., Arshad, H., Inayat-ur-Rahman, Zia-urRahman and Shafqatullah (2012) Proximate Composition, minerals content, antibacterial and antifungal activity evaluation of pomegranate (Punicagranatum L.) peels powder, Middle-East Journal of Scientific Research, 11 (3), 396-401.*

16. *Nassar AG, Abdel Hamied AA and El Naggar EA (2008).Effect of citrus by-products flour incorporation on chemical, rheological and organolepic characteristics of biscuits. World Journal of Agricultural Science, 4(5): 612-616.*

17. *Omutubga, S. K., Ashifat, A. A., Kehinde, A. S., Olayinke, O. O. and Edugbola, G.O. (2012) Proximate evaluation of nutritional value of Mango (Mangiferaindica), International Journal of Research in Chemistry and Environment, 2 (4), 244-245.*

18. *Osarumwense PO, Okunrobo LO, Uwumarongie-Ilori E.(2013) Phytochemical screening,proximate and elemental analysis of Citrus sinensis peels (l.) Osbeck. J ApplSci Environ Manage.;17(1):47-50.*

19. *Ravayshed, G., Salama, A., Abul-Fadl, M., Akila, S., Hamza, A. M. E. (2013). Nutritional and chemical evaluation for pomegranate (Punicagranatum L.) fruit peels and seeds pauders by product. Middle East Journal of Applied Science. 3: 169-179.*

20. *Romelle, F.D; Rani P.A and Manohar, R.S. (2016). Chemical composition of some selected fruit peels; European Journal of Food Science and Technology; Vol.4, No.4, pp.12-21,*

21. *Shalini, R and Gupta, D.K. (2010). Utilization of Pomace from apple processing industries: a review, Journal of Food Science and Technology, 47 (4), 365-371.*

22. *Sharma, K., Mahato, N., Cho, M.H., Lee, Y.R., Converting citrus wastes into value added products: Economical and environment-friendly approaches, Nutrition, 34, 2017, 29-46.*

23. *Tartrakoon T, Chalearmsan N, Vearasilp T, Meulen UT.(1999). The nutritive value of banana peel (Musa sapieutum L.) in growing pigs. Berlin: DeutscherTropentag, 1–4.*

24. *Wachirasiri, P., Julakarangka, S. and Wanlapa, S. (2009) The effects of banana peel preparations on the properties of banana peel dietary fibre concentrate, Songklanakarin Journal of Science and Technology, 31 (6), 605-611.*