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COMPARISON OF THE NUTRITIONAL AND PHYSIOCHEMICAL PROPERTIES OF THE PULP AND SEED OIL OF PAWPAW AND WATERMELON

OLUSAYO JOSEPH OGUNYEMI[*], OLUWATOYIN ALETOR[*], LUKMAN BIDEMI BELLO[*], OLUWATOSIN EMMANUEL DARAMOLA[*]

ABSTRACT

The nutritional composition, antioxidant activity and polyphenol oxidase activity of watermelon and pawpaw pulp was studied, and the physiochemical properties of the oil extracted from both seed was determined. The activities of several antioxidants were tested, including the Total Phenolic Content (TPC), Total Flavonoid Content (TFC), Ferric Reducing Antioxidant Power (FRAP), 2,2-diphenyl-1-picrylhydrazyl (DPPH). The proximate composition in term of moisture, ash,crude fibre, protein and carbohydrate were determined. The moisture, ash content, crude protein, fat , crude fibre and carbohydrate by differences were found to be 88.50 %, 0.91 %, 0.57 %, 0.14 %, 0.89 % and 8.99 % for the pawpaw pulp and 92.82 %, 0.79 %, 0.46 %, 0.20 %, 0.15 % and 5.69 % for the watermelon pulp respectively. The pawpaw pulp showed a high antioxidant activity in terms of TPC, TFC, FRAP, DPPH when compared to the watermelon while the watermelon pulp shows a high polyphenol oxidase activity (49.1 $s^{-1}mg^{-1}$) than the pawpaw pulp (14.5 $s^{-1}mg^{-1}$). The physiochemical properties of the extracted oil from the seed shows that watermelon seed has a higher saponification, acid value, iodine value and density with values corresponding to 179.25 mgKOH/100g, 2.58 mgKOH/g, 128.82 meq/kg and 0.81g/cm^3 when compared to the pawpaw seed with values corresponding to 95.70 mgKOH/100g, 2.48 mgKOH/g, 76.26 meq/kg and 0.68 g/cm^3 respectively.

KEYWORDS: Nutritional Composition, Watermelon, Pawpaw, Antioxidant And Physiochemical Properties.

INTRODUCTION

Humans' have demonstrated great ability to adapt physiologically to various types of foods. Nutritional science has further shown that foods like fruits and vegetables cannot be eliminated. Fruits consumption has been recommended because of their vitamins, antioxidants, minerals and fibre content. A lot of research have evaluated the importance and impacts of fruits on human well-being, indicating that consumption of vegetables and fruits reduces the risk of stroke and certain cancers, and help in enhancing of the bowel function, [1].

[*]Chemistry Department, Federal University of Technology, PMB 704, Akure, Nigeria.
Correspondence E-mail Id: editor@eurekajournals.com

Antioxidant refers to various compounds which protect the body against free radicals. Although, the body produces its own antioxidants, if adequate dietetic antioxidants are not available, the free radicals generated would cause stress on the body system. Most fruits are known to contain high vitamins, fibre, antioxidants and mineral contents in their seeds, rinds and pulps. The Pawpaw (*Carica papaya L*.) is regarded as one the most important fruit in the *Caricaceae* family, and different species of this family have shown potency in treating various kinds of diseases. The increasing demand for pawpaw is due to its high vitamin and sodium content; also, pawpaw contain basically no starch [2]. Pawpaw also contains papain and other proteolytic enzymes, which have various uses in brewing, meat tendering, digestive medicine and other skin care applications [3].

Watermelon (*Citrullus lanatus*) is a fruit belonging to the *cucumbitacea* family. The watermelon fruit is round, contain a lot of seeds, and is commonly in the south. It has high vitamin contents, which is common to various kind of fruits and vegetables. Watermelon is rich in carotenoids, some of which include phytofluene, beta-carotene, lycopene, lutein, and neurospnene. The pawpaw and watermelon fruit is a seasonal fruit frequently consumed in Africa and other part of the world. Both fruits are known for their similar nutritional composition, and a lot of argument had been raised in respect to their physiochemical properties and antioxidant activity. Hence, this work aim at comparing the physiochemical properties and antioxidant activities of the watermelon and papaw pulps, as well the oil obtained from both seeds.

MATERIALS AND METHODS

SAMPLE PREPARATION

The watermelon fruit and pawpaw fruits were bought from Oja Oba, Akure, Ondo state, Nigeria. The fruits were washed, dried and peeled. The seeds were removed and dried, and the pulp were cut into uniform sizes and then blended into a puree. The blended puree was transferred into a cheese cloth in order to allow the juice drain out until no further liquid is obtained from the pulp. The pulps of both samples were then poured on a drying tray and sun dried for 5 hrs to give a firm soft texture. The dried pulps of the pawpaw and watermelon were spread on different tray uniformly and divided into a four different sizes. A quartile of each of the dried pulp was then used for analysis.

PROXIMATE ANALYSIS

DETERMINATION OF PROXIMATE ANALYSIS

Proximate analysis is the routine analysis carried on food samples. This involves the determination of the moisture, crude fibre, fat, protein, ash content, and carbohydrate content of the food. These analyses were carried out in triplicate using methods described in [4].

ANTIOXIDANT ACTIVITY

EXTRACTION OF ANTIOXIDANT

The pawpaw and watermelon fruits were peeled, cut and crushed in a food processor in order to produce uniform slurries. In order to preserve the antioxidant to be extracted, the slurry was prepared fresh. About 1 g of the prepared slurries was weighed in universal bottles, and 10 mL of 50 % methanol solvent was added. The samples were then homogenized using homogenizer at 24,000 rpm for 1 min. All the extracted samples were centrifuged for 10 min. The supernatants obtained were then collected and kept for further analysis.

TOTAL PHENOL CONTENT (TPC)

The Total Phenolic Contents (TPC) of the pawpaw and watermelon extracts was carried out using Folin-Ciocalteu method as described by [5].

TOTAL FLAVONOID CONTENT (TFC)

The Total Flavonoid Content (TFC) of the pawpaw and watermelon extract was determined by the colorimetric method as described by [6].

DPPH RADICAL SCAVENGING ACTIVITY

The free radical scavenging activity of the pawpaw and watermelon extract was determined by following the DPPH method [7].

FERRIC REDUCING ANTIOXIDANT POWER (FRAP)

The Ferric Radical Antioxidant Power (FRAP) of the pawpaw and watermelon extract was conducted using the procedure of [8].

DETERMINATION OF THE POLYPHENOL OXIDASE ACTIVITY

PREPARATION OF CRUDE ENZYME

About 120 g of the pawpaw and watermelon pulp was homogenized differently in 360 ml of 25 Mm ice-cold phosphate buffer containing 10 mM ascorbic acid by using a blender for three minutes. The mixture was filtered using layers of cheesecloth. The filtrate was then centrifuge in a centrifuge at 6000 rpm for 30mins in a refrigerator. The supernatant was stored in the refrigerator and used as the crude extract.

PARTIAL PURIFICATION OF THE POLYPHENOL OXIDASE

About 200 ml of the crude extracts of both crude extract was brought into saturation with 80% $(NH_4)_2SO_4$. The precipitated polyphenol oxidase was separated by centrifugation at 6000 rpm for 30 mins. The precipitate was dissolve in 0.1M phosphate buffer and dialyzed in the same buffer for 72hours. The dialyzed sample was used as the polyphenol oxidase enzyme source for this investigation.

ACTIVITY ASSAY

About 1 mL of the diluted enzyme solution was mixed with 4.6 mL of 1 M of the buffer (pH 4.0–8.5). After 5 min, at a temperature of 22 °C, about 0.4 mL of 0.2 M catechol substrate was added to the mixture. The PPO activity was then determined at 22 °C at 420 nm using method [9]

PHYSIOCHEMICAL PROPERTIES OF THEWATERMELON AND PAWPAW SEED OIL

EXTRACTION OF OIL

The pawpaw and watermelon seeds were dried in an oven at a temperature of 50°C for about of 20 hrs. Then, the seeds were grinded with the aid of a mortar and pestle. The oil was extracted from the grinded seeds with the aid of Soxhlets apparatus using a non-polar solvent (n-Hexane).

THE PHYSIOCHEMICAL PROPERTIES OF THE PAWPAW AND WATERMELON SEED OIL

The physicochemical properties of oil was determined by the method described in [4]. This was employed in determining the saponification value, acid value, iodine value, refractive index and the density of the pawpaw and watermelon seed oil.

RESULT AND DISCUSSION

Table 1.Proximate analysis composition (g /100 g) of the fresh pawpaw and watermelon pulp

Samples	Mc	Cp	Cf	Fat	Ash	Nfe	Ge(kcal/g)
Pawpaw pulp	88.50±0.05	0.91±0.10	0.57±0.25	0.14±0.18	0.89±0.20	8.99±0.14	0.40 ±0.10
Watermelon pulp	92.82±0.25	0.79±0.15	0.46±0.10	0.20 ±0.08	0.15±0.05	5.69±0.37	0.27 ±0.12

Value is a mean of three determination ± standard deviation

Where: MC = Moisture Content; CP = Crude Protein; CF = Crude Fibre; NFE = Nitrogen Free Extract (Carbohydrate); GE= Gross Energy.

PROXIMATE ANALYSIS OF THE PAWPAW AND WATERMELON PULP

The proximate composition of the pawpaw pulp and watermelon pulp were shown in Table 1. The moisture, ash content, crude protein, fat , crude fibre and carbohydrate by differences was determined to be 88.50%, 0.91%, 0.57%, 0.14%, 0.89% and 8.99% for the pawpaw pulp; and 92.82%, 0.79%, 0.46%, 0.20%, 0.15% and 5.69% for the watermelon pulp respectively as regards to the proximate composition parameters. The moisture content is a proximate parameter used in the determination of the shelf life of any food product and is used to estimate the storage ability of the food without the growth of microorganism. The pawpaw and watermelon pulp both have high moisture content which is a measure of their water content and is observed to be higher in the case of the watermelon pulp. The watermelon pulp can also serve as source of water during dehydration because of its high water content [10]. Hence, in comparison, watermelon pulp has the higher moisture content (92.82%) when compared to the pawpaw pulp (88.50%) and hence prone to spoilage at a short period of time when exposed. The ash content is a measure of the total inorganic content in the food sample. It was observed that the total ash content was higher in the pawpaw pulp (0.91%) when compared to the watermelon pulp (0.79%). This shows that the pawpaw pulp contains a higher percentage of minerals than watermelon. The crude protein is observed to be higher in the pawpaw pulp (0.57%) than the watermelon (0.46%) which indicate that the pawpaw pulp is richer in protein and contains more amino acid. The fat content of both pulp are low indicating that both the pawpaw and watermelon pulp cannot be considered as a source of oil extraction but in terms of comparison, the fat content is higher for the watermelon (0.20) than the pawpaw pulp (0.14%). Table 1 also shows that the pawpaw pulp contains more crude fibre (0.89%) as compared to the watermelon (0.15%). The carbohydrate composition of pawpaw pulp (8.99%) is interestingly higher than that of the watermelon pulp (5.69%) indicating that pawpaw is a rich source of carbohydrate and energy if consumed when compared with the watermelon. The gross energy calculated for the pawpaw (0.40 kcal/kg) is much greater than that of the watermelon (0.27 kcal/kg) indicating that pawpaw is a better source of energy when compared to the watermelon.

Table 2.The mineral composition (mg/L) of the pawpaw and watermelon pulp

Parameters	K	Fe	pb	mg	ni	cu	ca
Pawpaw pulp	18.0822 ±0.13	4.3206±0 .11	0.2414 ±0.24	2.0516 ±0.18	1.0376 ±0.27	0.0051 ±0.31	0.2277 ±0.10
Watermelon pulp	18.1958± 0.21	5.4435 ±0.16	0.2980 ±0.91	3.4518 ±0.65	0.8707 ±0.48	0.0381 ±0.51	0.2558 ±0.70

Value is a mean of three determination ± standard deviation

Where K = Potassium; Fe = Iron; Pb = Lead; Mg = Magnesium; Ni = Nickel; Cu = Copper; Ca = Calcium

THE MINERAL COMPOSITION (MG/L) OF THE PAWPAW AND WATERMELON PULP

The mineral composition of the pawpaw and watermelon pulp is expressed in Table 2. From the table, the mineral composition of both fruit was observed to be similar. The mineral composition of both pulp expressed in this study include the iron, potassium, lead, magnesium, nickel, copper and calcium in mg/L. From Table 2, the mineral composition of both pulps are relatively similar, but the watermelon pulp is slightly higher in iron, potassium, magnesium lead, copper content when compared to the pawpaw pulp. Both pulps contain low calcium but an appreciable magnesium content which indicates that both pulps can still play a vital role

in the development of bone, teeth, co-factor enzymatic reaction and nerve impulse transmission [11]. Also, iron is needed for blood formation, normal functioning of the central nervous system and energy metabolism in the body. Copper in trace concentrations is very important for the regulation of many biochemical process in the body. Potassium is the most abundant major element in both samples. Potassium which is very high in both pulps is the principal cation of intracellular fluid and is involved in protein synthesis.

Table 3.The antioxidant activities of the pawpaw and watermelon pulp

Parameters	Pawpaw Pulp	Watermelon Pulp
TPC (mg/100g)	34.52±0.12	25.18±0.18
TFC (mg/100g)	30.17±0.10	21.91±1.05
DPPH (%)	91.46±1.08	33.58±1.13
FRAP (mMfrap/g)	35.91±0.32	28.72±0.28
PPO ($s^{-1}mg^{-1}$)	14.50±0.15	49.10±0.25

Value is a mean of three determination ± standard deviation
Where TPC = Total Phenolic Content; TFC = Total Flavonoid Content; DPPH = Free Radical Scavenging Activity; FRAP = Ferric Reducing Antioxidant Power; PPO= Polyphenol Oxidase.

THE ANTIOXIDANT ACTIVITY AND POLYPHENOL OXIDASE CONTENT OF PAWPAW AND WATERMELON PULP

The antioxidant capacity of the pawpaw and watermelon pulp was evaluated by determining the DPPH radical-scavenging activity, Ferric Reducing Antioxidant Power, Total Phenolic Content and Total Flavonoid content. From Table 3, it was observed that the pawpaw pulp has a higher total phenolic content (34.52mg/100g) when compared to the watermelon pulp (25.15mg/100g). However, agro climate change, post-harvest storage conditions and fruit maturity are known to affect polyphenols content in fruits [12]. Flavonoids are group of polyphenol compounds that are found in different vegetables and fruits [13]. The amount of flavonoids extracted from the papaya and watermelon pulp was observed to be (30.17 mg/100g) and (21.91 mg/100g). The study showed that the pawpaw pulp contain a high total flavonoid content when compared to the watermelon pulp indicating that pawpaw pulp has more flavour than the watermelon pulp. The DPPH radical scavenging ability of compound is the ability of the compound to scavenge free radicals which are generated independently by any enzymatic process. The antioxidants react with DPPH, which is a stable free radical and convert it to 1, 1-diphenyl-2-2, 4, 6-trinitrophenyl hydrazine, and the scavenging activity of the antioxidant compound is measured by the degree of discoloration. As shown in Table 4.3, the activity was higher in the pawpaw pulp (91.46%) when compared with the watermelon pulp (33.58%). The Ferric Reducing Antioxidant Power (FRAP) showed that the pawpaw pulp had higher reducing power (35.91 mMfrap/g) than the watermelon pulp (28.72 mMfrap/g). The polyphenol oxidase activity of the pawpaw and watermelon pulp were determined and expressed in Table 3. It was observed that the watermelon has a higher polyphenol oxidase activity (49.1 $s^{-1}mg^{-1}$) when compared to the pawpaw pulp (14.5 $s^{-1}mg^{-1}$). This shows that watermelon is prone to enzymatic browning and enzymatic action at a very short period of time, which is related to its high moisture content providing an environment for the enzymes. Hence, the watermelon pulp is prone to lose its taste at a short time and change it colour (Browning reaction) when compared to the pawpaw pulp.

Table 4.Physiochemical properties of the pawpaw and watermelon seed oil

Parameters	Pawpaw seed	Watermelon seed
Saponification (mgkoh/100g)	95.70±0.12	179.25±0.23
Acid avlue (mgkoh/g)	2.48±0.20	2.580±0.14
Iodine value(meq/kg)	76.26±0.10	128.82±0.08
Refractive index	1.52±0.02	1.39±0.01
Density (g/cm3)	0.68±0.05	0.81±0.03

Value is a mean of three determination ± standard deviation.

PHYSIOCHEMICAL PROPERTIES OF THE PAWPAW AND WATERMELON SEED OIL

The physiochemical property of the pawpaw and watermelon seed oil is expressed in Table 4 shows that the watermelon seed is rich in oil when compared to the pawpaw seed. The watermelon seed has a higher saponification value (179.25 mgKOH/100g), acid value (2.58 mgKOH/g), iodine value (128.82 meq/kg) and density (0.81 g/cm^3) when compared to the pawpaw seed with saponification value (95.70 mgKOH/100g), acid value (2.48 mgKOH/g), iodine value (76.26 meq/kg) and density (0.68 g/cm^3) respectively. The acid value for the pawpaw is low compared to that of the watermelon seed oil. This low result can enhance their use in alkyd preparation and other industrial applications. A high saponification value indicates short chain fatty acids while low saponification value shows that the fatty acids present are of longer length. The degree of unsaturation is one of the factor affecting the properties of oil, and it is determined from the iodine value. Oils are divided into three groups depending on their iodine values and can be classified as: drying oil, semi-drying oil and non-drying oils. If the iodine value is higher than 130, the oil is known as a drying oil. The iodine value is between 90 and 130 for semi-drying oil, while oil with iodine value less than 90 is called non-drying oil. Hence the pawpaw seed oil is a non-drying oil since its iodine value is smaller than 90 but the watermelon seed oil is a semi-drying oil since its iodine value is between 90 and 130. The refractive index of the pawpaw seed (1.52) is higher than that of the watermelon (1.39) which means that light faster in the watermelon seed oil when compared to the pawpaw seed oil.

CONCLUSION

Overall, the comparative study on the properties of the pawpaw and watermelon pulp as demonstrated in this research shows that the two fruit pulp have high proportion of water which is determined by their moisture content, but is significantly higher in the case of the watermelon pulp indicating its spoilage ability when stored over a long period. The watermelon pulp shows a high polyphenol oxidase activity than the pawpaw pulp. The pawpaw pulp shows a high antioxidant activity in comparison to the watermelon pulp. Both fruit pulp also contains relatively similar mineral composition which is required at the proper proportion by the body. This research work is an indication that great potential exists for the use of pawpaw and watermelon seed instead of throwing them away as waste after consuming the pulp. This seeds could be used in infant food formulation and the seed- oil could also be a useful source of oil for both domestic and industrial uses instead of depending solely on palm oil and peanut oil that are scarce and costly.

REFERENCES

[1]. Pamplona-roger, G. D. (2008): Healthy Foods. 1st. Edition, San Fernando de Henares, Madrid, Spain: European Union.

[2]. Wall, M., M.F Hermus. (2006). Ascorbic acid, vitamin A, and mineral composition of

banana (Musa sp.) and papaya (Carica papaya) cultivars grown in Hawaii. *Journal of Food Composition and Analysis.* 19: 434-445.

[3]. Paull, R. E.; Nishijima, W.; Reyes, M.; Cavaletto, C (1997). Postharvest handling and losses during marketing of papaya (Carica papaya L.). *Postharvest Biol. Technol.* 11: 165-179.

[4]. AOAC (1990).Official methods of analysis, 15th edition. Washington DC, USA: Association of Official Analytical Chemists.

[5]. Singleton, V.L., R. Orthofer and R.M. Lamuela-Raventos, 1999. Analysis of total phenols and other oxidation substrates and antioxidants by means of Folin-Ciocalteu reagent. Methods Enzymol., 299: 152-178.

[6]. Abu Bakar, M.F., M. Mohamed, A. Rahmat and J. Fry, 2009. Phytochemicals and antioxidant activity of different parts of bambangan mangifera pajang and tarap Artocarpus odoratissimus. Food Chem., 113(2): 479-483.

[7]. Musa, K.H., A. Abdullah, K. Jusoh and V. Subramaniam, 2011. Antioxidant activity of pink-flesh guava (*Psidium guajava* L.): Effect of extraction techniques and solvents. Food Anal. Methods, 4(1): 100-107.

[8]. Muller, L., K. Frohlich and V. Bohm, 2011. Comparitive antioxidant activities of carotenoids measured byFerric Reducing Antioxidant Power (FRAP), ABTS bleaching assay (alpha-TEAC), DPPH assay and peroxyl radical scavenging assay. Food Chem., 129: 139-148.

[9]. Cheng, G.W.W. and Crisosto, C.H. 1995. Browning potential, phenolic composition, and polyphenoloxidase activity of buffer extracts of peach and Nectarine skin tissue. J.Am. Soc. Hort. Sci. 120: 835–838.

[10]. Braide N and Ogbulie (2006). Antimicrobial, antidiabetic and phytochemical properties of some traditional species. *Nigerian. J. microbial* 20(3): 1301- 1308.

[11]. Bouanga-Kalou, G. Kimbonguila, A. Nzikou, J.M., Ganongo P, F. B., Panyoo-Akdowa, E., Siliou, T., and Desobry, S. 2011. Extraction and characteristics of the seed oil from papaya (*Carica papaya*) in Congo Brazzaville. *Asian Journal of Agricultural Sciences* 3 (2): 132-137.

[12]. Mahattanatawee, K.; Manthey, J. A.; Luzio, G.; Talcott, S. T.; Goodner, K.; Baldwin, E. A (2006). Total antioxidant activity and fiber content of select Florida-grown tropical fruits. *J. Agric. Food Chem. 54*: 7355-7363.

[13]. Sun, T. and Ho, C.T. (2005). Antioxidant activities of buckwheat extracts. *Food Chem*. 90: 743–749.

