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Sugar, physicochemical properties and fatty acid composition of velvet tamarind *(Dialium guineense)* pulp and oil

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Abstract
The sugar, physicochemical properties and fatty acid of velvet tamarind *(Dialium guineense)* pulp and oil were studied. The sample was high in maltose (1.72 mg sugar in 5ml sample) followed by D-ribose (1.27mg sugar in 5ml sample), lactose (1.05mg sugar in 5ml sample), fructose (1.04mg sugar in 5ml sample) and glucose (1.00 mg sugar in 5ml sample). The results also showed that the sample contained the following physico chemical properties: refractive index (1.690), acid value (16.55mg/KOH/g), saponification value (330.7mg/KOH/g), iodine value (14.10mgI_2/100g), peroxide value (4.200mgEquiv.O_2/kg), free fatty acid (0.200%) and specific gravity of 0.790 g/cm^3. The fatty acids in the oil were: palmitic acid, palmitoleic acid, myristic acid and stearic acid. Lauric acid was highly concentrated while linoleic acid was least concentrated.

Keywords: Sugar, physico chemical, fatty acid, velvet, pulp, oil.

1. Introduction:
There are lots of efforts that have been made to increase the production and consumption of legumes in growing populations with gross under nutrition. Despite the facts that legumes are considered healthy foods since they contain high dietary fibre, protein and energy contents in the epidemiology point of view. There is drastic decrease in its consumption due to globalization and urbanization of the food trade [1, 2]. Velvet tamarind (*Dialium guineense*) belongs to the family *"Leguminosae"*. Legumes are plants in the pea family which provide pods which dehisce, meaning that they split open naturally along a seam, resulting to a neat row of seeds. Velvet tamarind (*Dialium guineense*) is a tall, tropical, fruit bearing tree, native to southern Thailand and Malaysia. The pod of velvet tamarind contains the seed and sweet sour juicy pulp that can be used to flavor a variety of foods. It takes a lot of shelling to yield sufficient pulp for a recipe. For commercial production, the entire pod is boiled to soften the outer shell, then ground with water and strained such that the pulp separates from the shell and seed. The pulp may be canned for marketing and can be added to sweeten food products.

2. Materials and Methods
Velvet tamarind (*Dialium guineense)* fruits were purchased from Oja Oba market in Ikere-Ekiti, Ekiti State, South west Nigeria in Africa. The pulps were removed from the seeds and crushed using mortar/pestle and further sun dried for easy blending into fine flour. Oil was later extracted from the pulp flour using soxhlet extractor.

2.1 Determination of sugar
The sugars were determined by the method of Shaffer-Somogyi sugar-thiosulfate equivalent which was described [3]. 2.5g of the sample flour was dissolved in 20ml distilled water and hydrolysed in the presence of 20ml 0.l M H_2S0_4. 5ml of the resulting solution was pipetted into 25 x 200mm test tube and then 5ml.of Shaffer-Somogyi carbonate 50 reagent was added and thoroughly swirled. The test tube was placed in boiling water bath and heated for required minutes, while the test tube was removed carefully and put under a cooled water bath and allowed to cool for 4 minutes. The cap on the test tube was removed and 2ml KI-$K_2C_20_4$ were also added gently into the test tube. The mixture was mixed thoroughly to

ensure that Cu_20 is dissolved and allowed to stand in cold water bath for 5 minutes with mixing done twice during the period. The remaining mixture was later titrated with 0.005M $Na_2S_20_3$ using starch indicator. The blank was equally run as described above and then the test solution titre value subtracted from that of blank. The titration was repeated until two concordant results were obtained. The amount of sugar was calculated according to Shaffer-Somogyi's equation. For glucose, the heating time was 15 minutes;

$Y = 0.1099x + 0.048$

Where Y = mg sugar in 5ml and x = Titre value (ml) of 0.005M $Na_2S_2O_3$

2.2 Physico chemical analysis

2.2.1 Determination of saponification value

A 2.0ml of the oil sample was added to the 20ml of ethanolic potassium hydroxide in 500ml round bottom flask. The flask with its content was refluxed for 30 minutes. 2ml of phenolphthalein indicator was added and the hot solution was allowed to cool and later titrated against the 0.5M hydrochloric acid. A blank titration was carried out using the same procedure [4, 5, 6].

$$\text{Saponification value} = \frac{56.1N\,(V_1 - V_2)}{W}$$

Where:
N = Normality of hydrochloric acid.
V_1 = volume of HCl used in the test.
V_2 = volume of HCl used in the blank.
W = weight of sample.

2.2.2 Determination of peroxide value

A 2.0g of the oil sample was weighed into the 200ml conical flask containing 20ml of petroleum ether and heated for 30 seconds in a water bath. 20ml of 50% aqueous solution of potassium iodide and 25ml of distilled water were added. The resulting mixture was titrated with 0.002M sodium thiosulphate solution. During the titration a milky white precipitate was observed and the total disappearance of the precipitate indicated the end point of the titration. The peroxide value of the sample oil was estimated on the basis of the equation below. The same procedure was repeated for the blank.

$$\text{Peroxide value} = \frac{100\,(T_B - T_S)\ \text{mgEquiv.}O_2/\text{kg}}{\text{Weight of sample}}$$

Where**:**
N = normality of thiosulphate
T_S = volume of thosulphate used in the sample test.
T_B = volume of thiosulphate used in the blank.

2.2.3 Determination of acid value

A 5g of the sample oil was weighed into a 250 ml conical flask. 50 ml of hot neutralized alcohol was measured into the flask. The content in the flask was boiled on a water bath, after which 5 drops of phenolphthalein indicator was added into the content of the flask. The mixture was then titrated with 0.1M sodium hydroxide solution until a pink colour was observed, indicating the end point.

$$\text{Acid value} = \frac{N \times T_B - T_S}{\text{Weight of sample}}$$

Where**:**
N = normality of sodium hydroxide.
T_S = Titre value of the sample.
T_B = Titre value of the blank

2.2.4 Determination of Iodine value

A 0.2g of the sample oil was transferred into a flask containing 10ml carbon tetrachloride. 25ml of Wijs solution was added into the flask containing the sample (Wijs solution consists of iodine monochloride in glacial acetic acid). Blank was also prepared. The mixture was stored in a dark place for 30 minutes at temperature of 25 ^oC after which 15ml potassium iodine solution was added along with 100ml of distilled water. The resulting mixture was titrated with 0.1M sodium thiosulphate solution using 2ml of 1% starch indicator. The titration was continued until the blue colour just disappeared, indicating the end point.

The iodine value was calculated on the basis of the following equation:

$$\text{Iodine value} = \frac{12.692\,(T_B - T_S) \times N}{\text{Weight of sample oil}}$$

Where:
N = normality of the solution.
T_S = Titre value of the sample.
T_B = Titre value of the blank

2.2.5 Determination of refractive index: The moisture was removed from the oil by drying and 2 drops of the oil was put on the lower prism of the equipment and the prism was closed in the jacket. The running water was allowed to pass through the jacket at 45 ^oC. The jacket was adjusted until the temperature of 40 °C was achieved. The light was then adjusted and the compensator was moved until a dark border line was observed on the cross wire and the reading on the equipment was recorded.

2.2.6 Determination of specific gravity: A 40ml of oil extracted from the sample was homogenized and carefully poured into the 500ml measuring cylinder, caution was taken to avoid air bubbles under a controlled temperature. Hydrometer was lowered into the oil gently and when the hydrometer was stable, the reading was taken

2.3 Fatty acid profile

The fatty acid profile was determined using a method described [7]. The fatty esters analyzed using a PYE Unicam 304 gas chromatography fitted with a flame ionization detector and PYE Unicam computing integrator. Helium was used as carrier gas. The column initial temperature was 150 ^oC rising at 5 $^oC\ min^{-1}$ to a final temperature of 200 ^oC respectively. The peaks were identified by comparison with those of standard fatty acid methyl esters.

3. Results and Discusssion

Table 1: Sugar content (mg sugar in 5ml sample) velvet tamarind pulp

Parameters	
L-Arabinose	0.92
Fructose	1.04
D-galactose	0.93
Glucose	1.00
Lactose	1.05
Maltose	1.72
D-mannose	0.72
D-ribose	1.27
L-sorbose	0.86
D-xylose	0.78

Table 1 presents the individual sugar in the carbohydrate as mg sugar in 5ml of velvet tamarind pulp. Maltose is a disaccharide and found to be most predominant sugar in velvet tamarind pulp with the value of 1.72mg/5ml. The values of D-ribose (1. 27mg/5ml), lactose (1.05mg/5ml), glucose (1.00mg/5ml) and fructose (1.04mg/5ml) were also high. This makes it useful in malted beverage industry. The value of D-ribose (1.27mg/5ml) was higher than that of pearl millet with the value of 1.13mg/5ml reported [5]. Velvet pulp also contains glucose (1.00mg/5ml) and fructose (1.04mg/5ml).The fairly high values of glucose and fructose make the sample useful in beverages industry. These are important sugars that can give a variable glycaemic responses mainly related to the very low glycaemic index [5, 8]. It implies that velvet pulp may not be recommended for maturity onset diabetic patients.

Table 2: Physicochemical properties of velvet tamarind oil

Parameters	
Colour	Dark green
State @ room temperature	Liquid
Refractive index	1.690
Acid value (mgKOH/g)	16.55
Saponification value (mgKOH/g)	330.7
Iodine value (mg I_2/100g)	14.10
Peroxide value (mgEquiv.O_2/kg)	4.200
% free fatty acid (FFA)	0.200
Specific gravity (g/cm^3)	0.790

The physiochemical properties of velvet tamarind pulp oil were shown in Table 2. The colour of velvet tamarind was dark green. The state of the oil at room temperature was liquid. The specific gravity was 0.790 g/cm^3. The specific gravity of the oil was lower than those of bottle gourd oil (0.940 g/cm^3) and calabash seed oil (0.900 g/cm^3) [9]. The specific gravity of 0.790 g/cm^3 indicates that the oil is less dense than water. The oil had acid value of 16.55mgKOH/g. This value was in close agreement with those reported for castor oil (15.00mgKOH/g) and palm kernel oil (16.60mgKOH/g) [10] but the value was higher than those of *Plukenetia conophora* (11.5mgKOH/g) [11] and melon seed (l1.40mgKOH/g) [10]. The high acid value indicates that the oil would be suitable as resin in industrial manufacture of paints [12]. The saponification value of 330.7mgKOH/g was lower than those values reported for some oil seeds such as coconut (338.20mgKOH/g) and groundnut (360.20mgKOH/g) [13] but higher than that of *Terminalia catappa* (207 mgKOH/g) [6]. There is inverse relationship between saponification value and mean molecular masses of the oil. Dosumu and Ochu [14] observed that oils that contain high number of fatty acids of low mean molecular masses, can be employed in the manufacture of soap, lather, shaving creams and shapoo [15,16]. The iodine value of 14.10mgI_2/100g was lower than those of *citrullus vulgaris* oil with the value of 38.50mgI_2/100g [13], castor oil with the value of 38.70mgI_2/100g [17] and palm kernel oil (33.32mgI_2/l00g) [10]. The peroxide value was 4.200mgEquiv.O_2/kg. This value was higher than those of coconut oil (4.00 mgEquiv. O_2/kg) [13], castor oil (2.270mgEquiv.O_2/kg) [10], melon seed (2.021mgEquiv.O_2/kg) reported [18], kidney bean oil (2.90 mgEquiv.O_2/kg) [19] and quinoa (2.44 mgEquiv.O_2/kg) [5]. The high peroxide value of oil makes it not easily become

rancid. It can be deduced that the velvet tamarind oil would store for a long time without deterioration. The free fatty acid of velvet tamarind oil was 0.200%. This value was lower than that obtained for groundnut seed oil (0.250%) [10]. It has been shown that it is desirable to ensure that free fatty acid content of cooking oil lies within the limits of 0.0-3.0% [20]. Therefore, the low level of % free fatty acid indicates that the sample oil is edible and would not spoil easily via oxidative rancidity. Fatty acids can be either saturated or unsaturated. The iodine value gives a hypothetical amount of the unsaturated fatty acids present in the oil. The knowledge of the level of unsaturated components via the iodine value will invariably provide a compositional idea of the saturated fatty acid components [5].Therefore, high iodine value of oil indicates high level of unsaturated fatty acids. Velvet oil had low iodine value indicating low level of unsaturated fatty acids and high level of saturated fatty acids. This reveals that the velvet tamarind oil would be less liable to oxidative rancidity as earlier reported through the peroxide value.

Table 3: Fatty acid profile of velvet tamarind oil

Fatty acid		%
Lauric	($C_{12:0}$)	11.9
Myristic	($C_{14:0}$)	10.8
Palmitic	($C_{16:0}$)	0.76
Stearic	($C_{18:0}$)	1.00
Oleic	($C_{18:1}$)	1.02
Linoleic	($C_{18:2}$)	0.27

Table 3 presents the fatty acid profile of velvet tamarind oil. The functionality of food products depends on physico chemical properties such as fatty acid composition (FAC) which is often used to characterize oil and fats [21]. Lipid consists mainly triglycerides. They are the essential nutrients and energy sources for human and animal feeds [22]. The state of the oil is liquid at room temperature. Thus it can be used as vegetable oil and when hydrogenated, it can be used as margarine. FAC provides information about the total content of both saturated and unsaturated fatty acids, which often used as health indicator [22] and to determine the oxidative stability of oil and fats [23]. Lauric acid was the highest fatty acid with the value of 11.9%, myristic acid was the second with 10.8% and oleic acid (1.02%) was in the third position. The value of lauric acid was higher than that of *Adenopus breviflorus* benth oil (0.02%) reported [24]. The quantities of palmitic (0.76%) and stearic (1.00%) acids in the sample were lower than those of *Adenopus breviflorus* benth oil [24] and soy oil [25]. Linoleic, palmitic, oleic and stearic were present in small amounts. It implies that the oil contains more of saturated than unsaturated fatty acids, which makes it undesirable for eating as it may pose high health risk by elevating serum cholesterol. The saturated fatty acids such as lauric, myristic and palmitic acids have been reported as the most important dietary risk factors in CHD [26, 27, 28].

4. Conclusion

It can be concluded that velvet tamarind *(Dialium guineense)* has good quality oil and low sugar which makes it nutritionally good for diabetic patients but the oil contains high amount of saturated fatty acids and this makes the oil undesirable for cooking and frying.

5. References

1. Lintas C, Cappelloni M. Effect of processing on legume resistant starch. Eur J Clin Nutr 1992; 46(suppl 2):S103-S104.
2. Tovar J, Granfeldt Y, Bjorck I. Effect of processing on blood glucose and insulin responses to starch in legumes. J Agric Food Chem 1992; 40:1846-1851.
3. AOAC. Official methods of analysis, 18th ed. Association of Official Analytical Chemistry, Washington DC 2005.
4. Pearson D. Chemical analysis of foods, 7th ed. Churchill Livingstone, London, 1976.
5. Ogungbenle HN. Nutritional evaluation of quinoa flour. International Journal of Food Science and Nutrition 2003; 54:153-158.
6. Nzikou JM, Tsieri M, Pambou Tobi NPG, Ndangui CB, Kimbongui A, Silou TH. Proximate composition and physic chemical characteristics of seed and seed oil from*Terminalia catappa L.* and the kinetic of degradation of the oil during heating. Austr J. Basic Appl. Sci. 2010; 4:2039-2047.
7. Hall GM. Silage from tropical fishes: Lipid behavior. J Food Technol. 1982; 21:45-54.
8. Oshodi AA, Ogungbenle HN, Oladimeji MO. The Chemical composition and nutritionally valuable minerals of benniseed, pearl millet and quinoa flours. Int. J. Food Science and Nutri. 1999; 50:325 – 331.
9. Olaofe O, Ogungbenle HN, Akhadelor BE, Idris, AO, Omojola OV, Omotehinse OT. Physico chemical and fatty acids composition of oils from some legume seeds. IJBPAS 2012; 1:355-363.
10. Ekpa DA, Ekpe UJ. Melon Effect of oil concentration of air exposure to the acidity of oil. Global of pure and Applied Chemistry 1995; 5(3): 337-342.
11. Akintayo ET, Bayer E. Characteristion and some possible uses of *Plukenetia conophora* and *Adenopus breviflorus* seeds and seed oils. Bioresour. Technol. 2002; 85:95-97.
12. Devine J, Williams PN. The Chemistry and technology of edible oils and fats (1st edn.). London: Pergamon Press, 1961.
13. Oladimeji MO, Adebayo AO, Adegbesan AH. Psychochemical properties of Hausa melon seed flour. Ultra Sci. 2001; 13:374-377.

14. Dosumu MI, Ochu C. Physicochemical properties and fatty acid composition of lipid extracted from some Nigerian fruits and seeds. Global Journal Pure and Appl. Science 1995; (1):45-50.
15. Eka OU. Properties and potentials of rubber seeds oils. West Africa J. Biological and Applied Chemistry 1980; 20:45-53.
16. Ajiwe VIE, Okeke CA, Hu Agbo, Ogunleye GA, Ekwuozor SC. Extraction, characterization and Industrial uses of velvet tamarind and nicker nut seed oils. Biosources Tech 1996; 57(3):297-299.
17. Achinewhu SC. Thiamin, riboflavin and niacin content of fermented fluted pumpkin (*Telfaria occidentales*) and castor seed (*Ricinus communis*). Nigeria J. Nutri. Sci. 1987; 8(1):51-61.
18. Ojeh O. Effects of refining on the physical and chemical properties of cashew kernel oil. J. Fats and Oils Tech. 1981; 16:513-517.
19. Olaofe O, Famurewa JAV, Ekwagbere AO. Chemical functional properties of kidney bean seed flour. Inernational Journal of Chemical Sciences 2010; 3:51-69.
20. Bassir O. Hand book of practical Biochemistry 2nd edition Ibadan: Ibadan Univ. Press, 1971.
21. Gee PT. Analytical characteristics of crude and refined palm oil and fractions. European Journal of Lipid Science and Technology 2007; 109:373-379.
22. Rubina Saleem, Razia Sultana and Ambrat. Quality evaluation and fatty acid composition of palm oil cultivation in two regions of Pakistan. Pak. J. Sci. Ind. Res. 2010; 53(5):239-245.
23. (http://iseo.org/foodfatsandoil,2006).
24. Oshodi AA. Amino acid and Fatty acid composition of *Adenopus breviflorus* benth seed flour and protein concentrate. Food Chem. 1996; 45:79-83.
25. Paul AA, Southgate DAT. McCance and Widdowson's The composition of Foods, 4th edition. The Royal Society of Chemistry, HMSO, London, UK 1985.
26. Bender A. Meat and products in Human Nutrition in Developing Countries. FAO Food and Nutrition paper 53.Rome, FAO 1992.
27. Hegsted DM. Calcium and Phosphorus. In Modern Nutrition in Health and Disease, ch. 6, sect. A. Lea and Febiger. Philadelphia, PA, 1993.
28. Ogungbenle HN, Memenada OH. Physico chemical and fatty acid composition of Nigerian periwinkle. Elixir Applied Chem. 2013; 65:19973-19975.