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Physicochemical Properties and Fatty Acid Composition of Tamarindus Indica Seeds Oil

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ABSTRACT

A research work was carried out on the physicochemical properties and fatty acid composition of *Tamarindus indica* seeds oil using standard Analytical methods and PYE Unican 304 Gas Chromatography. The physicochemical properties results for seed oil were: acid value (5.10), peroxide value (9.60), free fatty acid (2.05), iodine value (82.50), saponification value (279.20), refractive index (1.467) and specific gravity (0.8423).The results indicated that the oils of *Tamarindus indica* seed might be useful for domestic consumption due to low acid value, free fatty acid and peroxide value. The fatty acids compositions showed that seed oil contained higher unsaturated fatty acids (74.0%) and low saturated fatty acid (26.0%) with most abundant acid being linoleic acid methyl ester (44.967%), thus making it more nutritionally important.

Keywords: *Tamarindus indica* seeds oil, physicochemical pr*operties, fatty acid composition.*

Introduction

In recent times, the desire to minimize the resources spent on importation of oil for domestic and industrial use gave a renewed impetus in the search for novel so urces to compliment the traditional ones. There has been a focus on non-utilized seeds for possible development and use [1]. Thus, attention has been shifted to these under-utilized seeds for possible development and applications as they are many in Nigeria. There are various under-utilized plant seeds in Nigeria. They are important source of domestic, industrial and medicinal importance.

Tamarindus indica of the *Fabaceae*, sub-family *Caesalpinioideae*, is significant nourishment in the tropics. It is a multipurpose tree of which every part finds probably some utilization [2] either healthful or therapeutic. Tamarind is indigenous to tropical Africa yet it has been presented and naturalized worldwide in more than 50 nations. Africa does not produce tamarind on a bus iness scale; however, it is generally utilized by the neighbourhood individuals. Minor producing countries in Africa are Senegal, Gambia, Kenya, Tanzania and Zambia [3].*Tamarindus Indica* stem is extended from the base, can arrive at 12-25m in stature, with thick foliage that doesn't permit the daylight to channel through, with the goal that no different plants develop at its foot. The leaves a-re substitute, made out of 7 to 12 sets of handouts, of light green shading, the blossoms are yellow-orange, regularly striped or spotted of purple-

red [4] The organic products age in winter and have a dark coloured bark, while the youthful ones have the shade of greenish bark: they are pendulous cases, with a woody coat, marginally bended, 5 to 15cm long, containing from 4 to 7 seeds for each case [5].

It has been indicated that the almond organization of tamarind seeds is fundamentally the same as oat seeds and is an incredible wellspring of nourishment [5]. This study was carried out to analyze the physicochemical properties and fatty acid composition of oil seeds in order to know their suitability for edible purpose and industrial applications.

MATERIALS AND METHODS

Collection of *Tamarindus Indica*Seed.

Tamarindus Indica seeds were purchased from a major market (Mile 12) in Kosofe local Government Area of Lagos state, Nigeria. The seeds were carefully removed from pods, thoroughly washed, sun-dried, ground into powder and kept in an air-tight container prior to analysis. The seed oils were extracted separately using the continuous Soxhlet extraction method with petroleum ether (40-60^{o}C) for 7 hours. The solvent was removed completely and oils obtained were used for both fatty acid determination and physicochemical properties analysis.

Physicochemical properties

The physicochemical properties of the seed oils such as acid value, peroxide value, free fatty acid, iodine value and saponification values were determined using the Standard Analytical Method recommended by [6]. Also, the specific gravity and refractive index were determined according to method described by *Codex standards* [7]

Fatty Acid Profile

The fatty acid profile was determined using the standard method described by [6]. The fatty esters analyzed using a PYE Unican 304 Gas Chromatography filled with a flame ionization detector and PYE Unican computing integrator. Helium was used as carrier gas. The column initial temperature was 150^{o}C rising at 5^{o}C per min to a final temperature of 200^{o}C. The peaks were identified by comparison with the standard spectral libraries.

Statistical Analysis

Statistical analysis was carried out using SPSS software version 17.0

RESULTS AND DISCUSSION

Table 1 presents the physicochemical properties of *Tamadrindus indica* oil. The oil is yellowish in colour with a specific gravity of (0.8423) indicating they were less dense than water. The refractive index was (1.467) and this was in close range with that of (1.462) for *B. sapida* oil reported by [.8]This showed that the oils were less thick when compared with most drying oils whose refractive indexes were between 1.475 and 1.485[9] The saponification values (279.20 mgKOH/g) was significantly higher than the value (72.93 mgKOH/g) for *E.gigas* seed oil [10] coconut oil (253 mgKOH/g), palm kernel oil (247 mgKOH/g) and butter fat (225mgKOH/g) [11]This suggested that the oil might be useful in the production of liquid soap, shampoos and lather shaving creams. The acid value and free fatty acid value

are used as indicator for edibility of oil. The acid value (2.05mgKOH/g) obtained in this study was significantly lower when compared with the *plukeniti aconophora* (11.5 mg/KOH/g) reported by [12] and (19.04 mg/KOH/g) reported for *Hura Crepitan* seed oil [13]. The recommended acid value for edible oil was 3.0mg/KOH/g. However, low value obtained in this study suggested that the oil was edible and good for consumption The iodine value measures degree of unsataturaion of oil and a parameter for the determination of the amount of double bonds present in oil which in turn reflects its susceptibility to oxidation [14].The iodine value (82.501_2/g) in this study was significantly higher than (20.811_2/g) reported for *Hura crepitan* seed oil [13] The high iodine value in this study suggested the amount of double bonds and unsaturated fatty acids present in the oils which reflects the susceptibility of oil to oxidation and this places those oils as non-dying oils groups. This may be useful in the manufacture of vegetable oil based ice creams [15]. .

The peroxide value (9.60) was below the range of 20.0-40.0mg/ for rancid oil [13]. This showed oil was not rancid and considered stable [16].

TABLE 1: PhysicochemicaL Properties of *Tamadrindus indica* oil

Oil parameters	Tamarind seed
Acid Value (mgKOH/g)	2.05±0.25
Peroxide Value (mEq/Kg)	9.60±0.34
Iodine Value (mg 1_2/g)	82.50±0.16
Saponification Value (mgKOH/g)	279.20±0.42
Unsaponification Value (g/kg)	3.01±0.31
Free Fatty Acid (% OLEIC)	1.10±0.53
Refractive Index @ 40°C	1.467±0.42
Specific Gravity @40°C	0.8423±0.17

Values are mean ± standard deviation of triplicate determinations.

Table 3 presented the fatty acid composition of *Tamadrindus indica seed* oil. The predominant fatty acids are Linoleic acid (44.967%), oleic acid (18.732%) and palmitic acid (16.606%) oils respectively. However, higher percentage of unsaturated fatty acids present in the oil (74.0%) and low percentage of saturated fatty acids (26.0%) suggested that the oil is edible and is of high nutritional values.

Other fatty acids present were; Myristic Acid (0.205%%), Palmitoleic Acid(0.315%), Margaric Acid(0.325%), Stearic Acid(5.291%), Linolenic Acid(0.618%), Arachidic Acid (3.748%), Arachidonic Acid(0.496%), Behenic Acid(4.397%), Erucic Acid(0.207%) and Lignoceric Acid(4.831%). The relatively high contents of unsaturated fatty acids are known to be desirable in food compared with their saturated fatty acids because they help lowering cholesterol and improve heart health [17].The linoleic acid (44.967%) in this study was slightly higher than (42.6%) reported for *Ceiba pentandra* seed oil [18]. and significantly higher than (7.85%) for *C.bonduc* seed oil [10].Oleic acid which is the mono unsaturated fatty acid playing a role of anti-inflammatory fatty acid, and in the activation of different pathways of immune competent cells [19]..

The oleic acid (18.732%) was significantly higher than (10.00%) reported for *Abroma augusta* refined seed oil [20] and significantly lower than 89.95% reported for *Blighia sapida* seed oil [21].. However, this value was in agreement with %) reported for *E. gigas* seed oil [10]. Owing to the high concentration of monounsaturated fatty acids, it is expected that the oil would be stable against oxidation [22].Linolenic acid derivatives serve as structural components of the plasma membranes and are precursors of some metabolic regulatory compounds (Ajayi *et.al*, 2004)) The Linolenic Acid (0.618%) was lower than (4.10%) and (1.50%) reported for Baobab (*Adansonia digitata*) seed oil [23].. Arachidonic acid (0.496%) was lower than 4.3% and 2.8% reported for *Annona squamosa* seed oil (Mondal *et.al*, 2015).The presence of oleic acid and linolenic acid made the seed oil nutritionally valuable. Palmitoleic Acid (0.315%) reported in this study was lower than 0*:*78 ± 0.8 % reported for Baobab (*Adansonia digitata*) seed oil (Upendo *et.al* 2020.).The palmitic acid (16.606%) was significantly lower than 43.16 % reported for *D.edulis* seed oil [24].
However, the value reported in this study was in agreement with 13.80% reported for *Annona squamosa* (Mondal *et.al*, 2015). The myristic acid (0.205 %%) was lower than 2.2%% for *Bombax ceiba* seed oil (Mondal *et.al*, 2015). Stearic Acid (5.291%), Behenic Acid (0.356 %) and Lignoceric Acid (0.960%) were significantly lower than the report of *C.bonduc* seed oil [10].The high amount of unsaturated fatty acids (%) and low amount of saturated fatty acids suggested that the oil was good for consumption and of high nutritional value However, higher percentage of unsaturated fatty acids present in the oil (74.0%) and low percentage of saturated fatty acids (26.0%) suggested that the oil is edible and is of high nutritional values [25].

TABLE 2: Free Fatty Acid Present inTamarind Seed oil

Fatty Acids	Tamarind Seed (wt %)
Caprylic Acid Methyl Ester (C8:0)	0.000±0.00
Capric Acid Methyl Ester (C10:0)	0.000±0.00
Lauric Acid Methyl Ester (C12:0)	0.000±0.00
Myristic Acid Methyl Ester (C14:0)	0.205±0.24
Palmitic Acid Methyl Ester (C16:0)	16.606±1.54
Palmitoleic Acid Methyl Ester (C16:1)	0.315±0.04
Margaric Acid Methyl Ester (C17:0)	0.325±0.21
Stearic Acid Methyl Ester (C18:2)	5.291±1.25
Oleic Acid Methyl Ester (C18:1)	18.732±2.20
Linoleic Acid Methyl Ester (C18:2)	44.967±3.24
Linolenic Acid Methyl Ester (C18:3)	0.618±0.12
Arachidic Acid Methyl Ester (C20:0)	3.748±1.24

Arachidonic Acid Methyl Ester (C20:4)	0.496±0.14
Behenic Acid Methyl Ester (C22:1)	4.397±1.22
Erucic Acid Methyl Ester (C22:1)	0.207±0.23
Lignoceric Acid Methyl Ester (C24:0)	4.831±1.17
Totals:	100.000

Values are mean ± standard deviation of triplicate determinations.

CONCLUSION

The the result of physicochemical properties ind icated that the oil will be moreuseful for domestic and industrial purposes.The fatty acid analysis revealed the presence of high amounts of linoleic acid, an unsaturated Omega-9-fatty acid in *Tamarindus indca* seed oil . The high levels of unsaturated fatty acid and low levels of saturated fatty acid indicated low cholesterol oil The results in this study indicated that the oils of *Tamarindus indca* seed might be useful for domestic consumption as well as industrial applications

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