

# Comparative Study of Antimicrobial Potentials of Seed Oils of *Jatropha Curcas* and *Tamarindus Indica*

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## ABSTRACT

Oils of the dry seeds of *Jatropha curcas* and *Tamarindus indica* plants grown in Nigeria were obtained by maceration using n-Hexane. GC/MS analysis was performed using a Shimadzu QP2010plus series gas chromatography coupled with Shimadzu QP2010 mass spectroscopy detector. Characterization of constituents was done by comparison with the MS library (NIST) and further confirmed by interpreting the observed fragmentation pattern. Comparison of the mass spectra with the database on MS library revealed about 90-95% match.

The antimicrobial screening of the oils were also performed for oils from the species: *Jatropha curcas* (Jatropha seeds) which was active against *Aspergillus niger* and *Tamarindus indica* (Tamarind) which showed antimicrobial activity against staphylococcus and Escherichia coli

The most common major constituents of the fixed oils: were 14-methyl pentadecanoic acid methyl ester 13.71%, 11-octadecanoic acid methyl ester 23.68%, Heptacosanoic acid methyl ester 10.22% and 9, 12-octadecadienoic acid methyl ester 17.44% for the Tamarindus indica While for Jatropha seeds oil 14- methylpentadecenoic acid methyl ester 12.31%, Hexadecanoic acid methyl ester 7.75%, 11- octadecanoic acid methyl ester 43.32% and 9-octadecenoic acid methyl ester 21.98% were obtained. Minimum inhibition concentrations of 12.50mg/ml were recorded for all test organisms by Jatropha seeds oil except for Escherichia coli which showed 6.25mg/ml. Both Tamarindus indica and Jatropha curcas showed minimum bactericidal activities at 12.50mg/ml were evaluated for all the samples. Recommendations for further research were also proffered.

**Keywords :** Comparative Study Tamarindus Indica, Jatropha Curcas Antimicrobial Potentials

## I. INTRODUCTION

The beneficial uses of seed oil plants have been known since time immemorial. Apart from their uses as food items, oils extracted from seeds are also used for different purposes ranging from medicinal to biofuels. Their chemical compositions, physical and chemical properties generally determine their applications for different purposes. Many microbial diseases worldwide have become a serious threat to human health because of the emergence of drug

resistant or multi-drug resistant (MDR) microbial strains (Tabassum et, al., 2013). Emergence of resistance to the existing drugs (Rios and Recio, 2005) led the scientists to search for the new alternatives including seed oil producing plants and their oil, which are known for their antimicrobial properties. Several *in vitro* studies have been published confirming the effect of seed oils and their major compounds on pathogenic microbes (Burt, 2004). However, there are only limited data available on the

antifungal activity of these seed oils against fungal pathogens.

Essential (volatile) oils from aromatic and medicinal plants have been known since antiquity to possess biological activity, notably antibacterial, antifungal, and antioxidant properties (Baratta *et al.* 1998; Cosentino *et al.* 1999; Bounatirou *et al.* 2007). Biological activity of essential oils depends on their chemical composition, which is determined by the plant genotype and is greatly influenced by several factors such as geographical origin and environmental and agronomic conditions (Rota *et al.* 2004; Yesil Celiktas *et al.* 2007). However, plants possess antioxidants, which have certain degree of resistance to oxidation (Marinova *et al.*, 2002). Plant oils are used for the prevention of some human diseases such as atherosclerotic cardiovascular diseases, cancer and degenerative eye diseases (Bendini *et al.*, 2002; Kaur and Kapoor, 2002; Marinova *et al.*, 2002; Alamni and Cossu, 2003; Bonaclorisis *et al.*, 2003).

Plant volatile oils are variable mixtures of essential terpenoids, specially monoterpenes (C10) and sesquiterpenes (C15), although diterpenes (C20) may also be present, and of a variety a low molecular-weight aliphatic hydrocarbons, acids, alcohol, aldehydes, phenolic compounds, acyclic esters, or lactones (Rota *et al.* 2004). Many species and herbs exert antimicrobial activity due to their essential oil fractions. Some scientists reported the antimicrobial activity of essential oils from oregano, thyme, sage, rosemary, clove, coriander, garlic, and onion against both bacteria and molds. The composition, structure, as well as functional groups of the oils play an important role in determining their antimicrobial activity (Omidbeygi *et al.*, 2007; Yesil Celiktas *et al.*, 2007). The compounds containing phenolic groups are usually most effective (Dorman and Deans 2000; Holley and Patel, 2005).

### *Jatropha curcas*



Plant



Seeds

*Jatropha curcas* linn (Physic nut or Barbados nut) is a perennial poisonous shrub or tree belonging to the Euphorbiaceae family. It is a drought resistant species that is widely cultivated in the tropics as living fence in fields and settlements. This is mainly because cuttings, densely planted for this purpose, can easily propagate it and because this specie is not browsed by cattle (Heller, 1996). It is a small tree or shrubs with smooth gray bark that exudes whitish colored watery, latex when cut or injured (Heller, 1996). Normally, it grows between three and five meter in height, but can attain a height of about eight to ten meters under favorable conditions (Lele, 2008). The seeds are blackish, oblong and resemble small castor seeds. The oil seeds are processed into oil that may be directly used to fuel combustion engines or may be subjected to trans esterifications to produce bio-diesel. The oil is used as an illuminant in lamps as it burns without emitting smoke. It is also used as fuel in place of kerosene or along with kerosene in stoves (Lele, 2008).

*Jatropha curcas* originated in Central America and has become naturalized in many tropical and subtropical

areas of the world (Fairless, 2007). Today, the interest on this oil seed crop has grown in leaps and bounds owing to the fact that the oil from the seed of *Jatropha curcas* can serve as fuel for diesel engines (Ishii and Takeuchi, 1987; Ishii et al., 1987 and Munch and Kiefer, 1989). *Jatropha curcas* seed contains viscous oil which is highly suitable for cooking, lighting and soap – making by itself and for the production of biodiesel (along with other compounds), indicating its potential as a renewable energy source (Heller, 1996). The potential impact of biodiesel is immense for countries with no indigenous fossil fuels and for regions remote from source of supply. The use of biodiesel is better still, environmentally friendly in that sulphur dioxide (SO<sub>2</sub>) is absent in exhaust from diesel engines run on *J. curcas* oil (Kandpal and Madan, 1995). *J. curcas* oil is used for the manufacture of candles and cosmetics (Akbar et al., 2009).

Over the years, man has acquired extensive knowledge regarding the utilization of plants around him as food and medicine. These plants exhibit a wide range of biological and pharmacological activities such as anti-inflammatory, diuretic, laxative, anti-spasmodic, antihypertensive and antimicrobial functions, (Okwu and Nnamdi 2008). These functions are performed due to the phytochemicals available in the plants. Phytochemicals are the chemical extracted from plants. Plants are well endowed with a variety of phytochemicals. The phytochemicals are vital in both health promotions and disease prevention (Okwu, 2004, 2005). Phytochemicals are mainly natural bioactive compounds from plants with general benefits to human health. The secondary metabolites of plants provide humans with numerous biological active products that have been used extensively as food additives, flavors, colors, insecticides, drugs, fragrances and other chemicals. (Zhao, 2007). These secondary metabolites include terpenoids, flavonoids, alkaloids, sterols and phenolic compounds have diverse chemical structures and exist widely in *Jatropha curcas*. The young leaves may be safely eaten

when steamed or stewed (Duke, 1985). The nuts are sometimes roasted and eaten, although they are purgative. The seeds and the nuts are used as contraceptives while the oil has been used for illumination, soap and candle production as well as adulteration of olive oil and preparation of Turkey red oil. It is used in formulating lubricants, softeners and dyeing assistants (Duke, 1985; Heller, 1996, Lele, 2008). The latex of *Jatropha curcas* contains an alkaloid known as *Jatrophine*, which is believed to have anti-cancerous properties. (Heller, 1996; Lele 2008). It is also used as an external application for skin diseases, rheumatism and sores and in treating domestic animals (Heller, 1996). Preparation of all parts of the plant including seeds, leaves and barks are used in herbal medicine and for veterinary purposes (Heller, 1996). The juices of the leaves are used as an external application for piles. The roots are reported to be used as an antidote for snake bites. The oil has a strong purgative action and is widely used for skin diseases, and to soothe pain such as that caused by rheumatism. A decoction of the leaves is used against cough and as an antiseptic after birth (Heller, 1996). Branches are used as a chewing stick in Nigeria (Isawumi, 1978). The sap or exudates from the stem is used to arrest bleeding of wounds (Heller, 1996). Nath and Dutta (1992) demonstrated the wound healing properties of curcain, a photolytic enzyme isolated from the latex. The latex has anti-microbial properties against *Escherichia coli*, *Klebsiella pneumoniae*, *Staphylococcus aureus*, *Streptococcus pyogenes* and *Candida albicans* (Thomas, 1989). *Jatropha curcas* extract has coagulating effects on blood plasma (Kone-Bamba, et al 1987). The fruits extract showed pregnancy terminating effects in rats (Goonasekora, et al 1995). The methanol extract of *Jatropha curcas* leaves exhibited moderate protection for human lymphoblast cells against the cytopathic effects of human common deficiency virus (Muanza et al, 1995). The leaves extracts showed potent cardiovascular action in guinea pigs and might be a possible source of beta-blocker agent (Adebowale and Adedire, 2006).

All parts of the plant exhibited insecticidal properties (Adebowale and Adedire, 2006).

Research on the phytochemical constituent of *Jatropha curcas* showed the presence of flavonoids, flavones, flavonone, alkaloids, phenolic compounds and saponins (Adebowale and Adedire, 2006). These phytochemicals exhibits a wide range of biological activity. Several types of polyphenols show anti-carcinogenic and anti-mutagenic effects (Okwu and Morah, 2007a). Polyphenols might interfere in several of the steps that lead to the development of malignant tumors, in activating carcinogens, inhibiting the expression of mutagens (Okwu, 2004, Okwu and Morah, 2007b). Several studies have shown that in addition to their antioxidant protective effects, poly phenols, particularly flavonoids inhibit the initiation, promotion and progression of tumor (Okwu, 2004, Okwu and Morah, 2007b) Naturally occurring phytochemicals are potentially anti-allergic, anti-fungal, anti-bacterial and anti-oxidant agents (Okwu, 2004, Okwu and Morah, 2007 b).

### *Tamarindus indica*



Tree



Pods



Seeds

*Tamarindus indica* belongs to the Dicotyledonous family in the sub- family Caesalpiniaceae, which is the third largest family of flowering plants with a total of 727 genera and 19, 327 species (Lewis *et al.*, 2005 ; Zaidi, 1998). *Tamarindus indica* fruit pulp is used for the preparation of beverages in different regions of the world. Some of the wild nuts and seeds used as food in several parts of the world have considerable promise as protein source (Amubode and Fetuga, 1983). Large segments of human population and animals in developing countries suffer from protein, malnutrition (Conway and Toenniessen, 1999). They are playing an important role in human nutrition mainly in developing countries (Mohamed and Rangappa, 1992; Yanez *et al.*, 1995). *Tamarindus indica* contain high levels of crude protein (31.08%) than the levels reported earlier (Ishola *et al.*, 1990 ; Bhattacharya *et al.*, 1994; Siddhuraju *et al.*, 1995). *Tamarindus indica* also contains a high level of protein with many essential amino acids which help to build strong and efficient muscles. *T. indica* is also high in carbohydrate, which provides energy, rich in the minerals, potassium, phosphorus, calcium and magnesium. *T. indica* can also provide smaller amounts of iron and vitamin A. The flower and leaf are eaten as vegetables (Prakash, 1988). *T. indica* is a plant widely used in traditional medicine in Africa for the treatment of many diseases such as fever, dysentery, jaundice, gonococci and gastrointestinal disorders (Kheraro and Adam, 1974; Ferrara, 2005). Pharmacological investigations on *T. indica* extracts reported them to have antibacterial and antifungal activities (Pousset, 1989).

## II. METHODS AND MATERIAL

Plants seeds were collected from around Katsina, Nigeria and authenticated by direct comparison with authentic samples.

A Shimadzu QP2010 plus series gas chromatography coupled with Shimadzu QP2010 plus mass spectroscopy detector (GC-MS) system was used.

### GC-MS analysis

Oils from *Tamarindus indica* and *Jatropha curcas* were studied. The oils were extracted by maceration (Handa et, al., 2008), In GC-MS analysis, the temperature program was set up from 70°C to 280°C. Helium gas was used as carrier gas. The injection volume was 2 µL with injection temperature of 250°C and a column flow of 1.80 ml/min for the GC. For the mass spectroscopy ACQ mode scanner with scan range of 30-700 amu at the speed of 1478 was used. The mass spectra were then compared with the NIST05 mass spectral library (NIST, 2012)

### Antimicrobial screening

In cup plate agar diffusion bioassay, seed oils from the plants were assessed for antimicrobial activity (Hammer et, al., 1999), the antimicrobial activity was assessed against six standard pathogenic microbes. The microbes were obtained from the Department of Medical Microbiology, ABU Teaching Hospital, Shika, Zaria.

0.5g of the oil from each sample was weighed and dissolved in 10ml of DMSO to obtain a concentration of 50mg/ml. This was the initial concentration of the oil used to check the antimicrobial activities. Diffusion method was the method used for screening the oil. Mueller Hinton and Sabouraud dextrose agars were the media used as the growth media for the bacteria and the fungus respectively. The media were prepared according to the manufacturer's instructions, sterilized at 121°C for 15 minutes, poured into sterile Petri dishes and were allowed to cool and solidify.

The sterilized media were sealed with 0.1ml of the standard inoculums of the test microbe (Mueller Hinton agar was sealed with the bacteria and Sabouraud dextrose agar sealed with the fungus). The inoculums were spread over the surface of the medium by the use of a sterile swab. By the use of a standard cork borer of 6mm in diameters, a well was cut at the centre of each inoculated medium. (0.1ml) of the oil (concentration of 50mg/ml) was then introduced into the well on the inoculated medium. Incubation of the inoculated medium was made at 37°C for 24 hours for the bacteria and at 30°C and for 4 days for the fungus. After incubation each plate of the medium was observed for the growth inhibition zone. The zone was measured with a transparent ruler and the results were recorded in millimeters.

### Minimum Inhibition Concentration

The minimum inhibition concentrations of the oils were determined using the broth dilution method. Mueller Hinton and Sabouraud dextrose broth were prepared, 10mls of each broth was dispensed into test tubes and was sterilized at 121°C for 15 minutes, and the broth was allowed to cool. Mc-Farlands turbidity standard scale number 0.5 was prepared to give turbid solution. Normal saline was prepared. 10mls solutions were dispensed into sterile test tubes and the test microbes inoculated and incubated at 37°C for 6 hours. Dilution of the test microbe was done in the manual saline until the turbidity matched that of Mc-Farland's scale by visual comparison, at this point the test microbe concentration was about  $1.05 \times 10^8$  cfu/ml.

Two-fold serial dilution of the oil was in the sterile broth to obtain the concentrations at 50mg/ml, 25mg/ml, 12.5mg/ml, 6.25mg/ml, 3.13mg/ml and 1.56mg/ml. The initial concentration was obtained by dissolving 0.5g of the oil in 10mls of the sterile broth.

Having obtained the different concentrations of the oil in the sterile broth, 0.1ml of the test microbe in the normal saline was then introduced into the

different concentration. Incubation was made at 37°C for 24 hours for the bacteria and at 30°C for the fungus, then the test tubes was observed for turbidity (growth). The lowest concentration of the oil in the broth which shows no turbidity was regarded as the minimum inhibition concentration.

**Minimum bactericidal and fungicidal concentrations**

MBC/MFC was carried out to determine whether the test microbes were killed or only their growth was inhibited. Mueller Hinton and Sabouraud dextrose agars were prepared, sterilized at 121°C for 15 minutes, poured into sterile Petri dishes and were allowed to cool and solidify.

The content of the mixture in the serial dilution were then sub-cultured onto the prepared media. The bacteria were cultured onto the Mueller Hinton agar and the fungus on the Sabouraud dextrose agar. Incubation was made at 37°C for 24 hours for the bacteria and at 30°C for 4 days for the fungus after which the plates of the media were observed for colony growth, MBC/MFC were the plates with lowest concentration of the oil without colony growth.

**III. RESULTS AND DISCUSSION**

**GC-MS analysis of Plants seeds oil**

Oils from Tamarindus indica and Jatropha curcas seeds were studied. The oils were extracted by maceration and then identified and quantified by GC-MS analysis. Characterization of constituents was initially accomplished by comparison with the MS library (NIST) and further confirmed by interpreting the observed fragmentation pattern. Comparison of the mass spectra

**Plants oils**

Plants oils were studied by GC-MS. The total ion chromatogram were displayed in Fig.1 and 6 while

the constituents of the oil are shown in Table 1 and 2 for Jatropha and Tamarin respectively..

**Jatropha curcas**

Jatropha curcas oil was studied by GC-MS. The total ion chromatogram is displayed in Fig.1, while the constituents of the oil are shown in Table 1

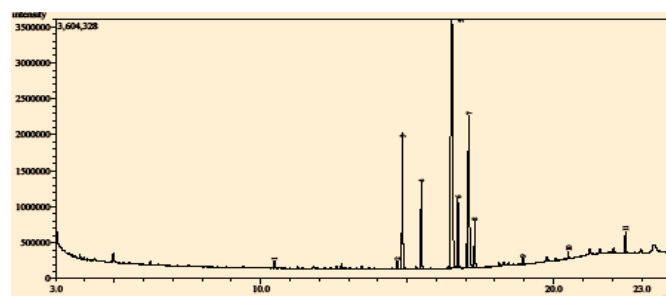


Fig.1: Total ion chromatogram

Table1: Consituents of the oil

Peak#	R.Time	I.Time	F.Time	Area	Area%
1	10.463	10.425	10.533	234535	0.68
2	14.658	14.625	14.733	237611	0.69
3	14.839	14.792	14.925	4221829	12.31
4	15.479	15.425	15.567	2638654	7.75
5	16.535	16.442	16.667	14062351	43.32
6	16.732	16.667	16.890	1998541	5.71
7	17.110	17.050	17.233	7539845	21.98
8	17.309	17.233	17.383	1411603	4.11
9	18.957	18.908	19.033	249414	0.73
10	20.503	20.458	20.563	222667	0.65
11	22.451	22.400	22.525	709595	2.07
				<b>3438265</b>	<b>100.00</b>

Major constituents are discussed below:

**14-Methyl-pentadecanoic acid methyl ester (12.31%)**

The EI mass spectrum of 14-methyl-pentadecanoic acid methyl ester is shown in Fig.2. The peak at m/z 270, which appeared at R.T. 14.839 in total ion chromatogram, corresponds to M<sup>+</sup>[C<sub>17</sub>H<sub>34</sub>O<sub>2</sub>]<sup>+</sup>.

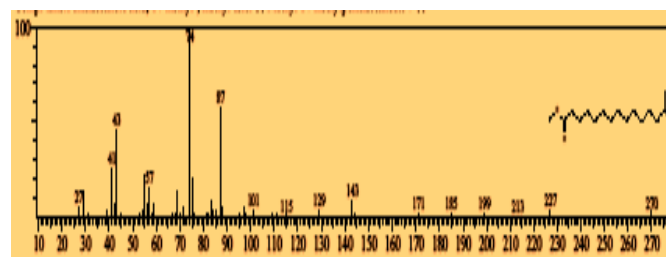


Fig.2: Mass spectrum of 14-methyl-pentadecanoic acid methyl

**Hexadecanoic acid methyl ester (7.75%)**

The EI mass spectrum of hexadecanoic acid methyl ester is shown in Fig. 3. The peak at m/z 270, which appeared at R.T. 15.479 in total ion chromatogram, corresponds to  $M^+[C_{17}H_{34}O_2]^+$ . The peak at m/z 239 corresponds to loss of a methoxyl function.

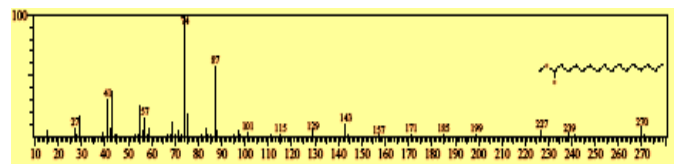


Fig.3.: Mass spectrum of hexadecanoic acid methyl ester

**11-Octadecenoic acid methyl ester (43.32%)**

The EI mass spectrum of 11-octadecenoic acid methyl ester is shown in Fig.4. The peak at m/z 296, which appeared at R.T. 16.535 in total ion chromatogram, corresponds to  $M^+[C_{19}H_{36}O_2]^+$ . The peak at m/z 264 corresponds to loss of a methoxyl function.

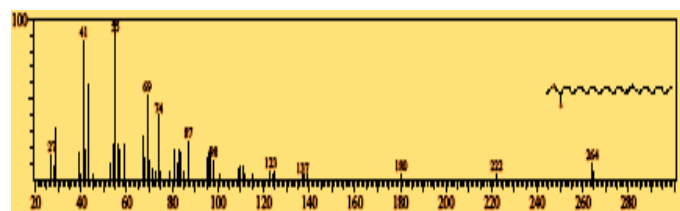


Fig.4: Mass spectrum of 11-octadecenoic acid methyl ester

**9-Octadecenoic acid methyl ester (21.98%)**

The EI mass spectrum of 9-octadecenoic acid methyl ester is shown in Fig. 5. The peak at m/z 296, which appeared at R.T. 17.11 in total ion chromatogram, corresponds to  $M^+[C_{19}H_{36}O_2]^+$ . The peak at m/z 265 corresponds to loss of a methoxyl function.

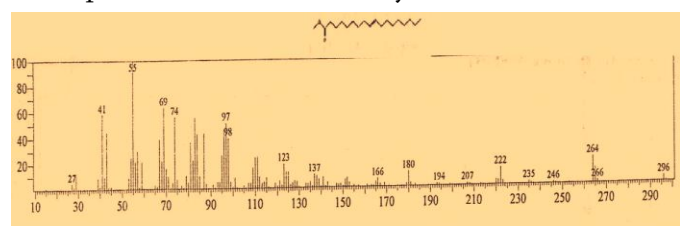


Fig.5: Mass spectrum of 9-octadecenoic acid methyl ester

**Tamarindus indica**

*Tamarindus indica* oil was studied by GC-MS. The total ion chromatogram is displayed in Fig.6, while the constituents of the oil are shown in Table 2.

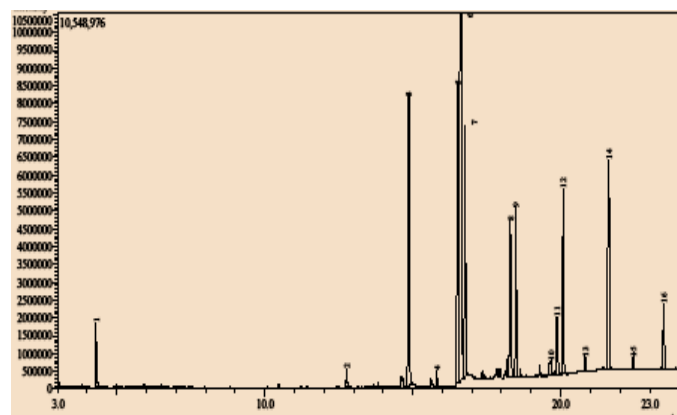


Fig.6: Total ion chromatogram

Table 2: Constituents of the oil

Peak#	R.Time	I.Time	F.Time	Area	Area%
1	4.298	4.258	4.400	4346319	1.98
2	12.761	12.717	12.825	1211405	0.55
3	14.871	14.792	14.983	30097548	13.71
4	15.813	15.775	15.867	910333	0.41
5	16.547	16.450	16.567	38275704	17.44
6	16.627	16.567	16.717	51980142	23.68
7	16.766	16.717	16.867	18218991	8.30
8	18.297	18.250	18.383	11892113	5.42
9	18.483	18.442	18.550	10879198	4.96
10	19.674	19.550	19.733	2679946	1.22
11	19.871	19.733	19.983	5812339	2.65
12	20.082	19.983	20.158	12726651	5.80
13	20.825	20.783	20.875	913213	0.42
14	21.622	21.542	21.708	23425046	10.22
15	22.456	22.408	22.517	1338385	0.61
16	23.475	23.400	23.558	5788778	2.64
				219496111	100.00

Major constituents are discussed below:

**14-Methyl-pentadecanoic acid methyl ester (13.71%)**

The EI mass spectrum of 14-methyl-pentadecanoic acid methyl ester is shown in Fig.7. The peak at m/z 270, which appeared at R.T. 14.871 in total ion chromatogram, corresponds to  $M^+[C_{17}H_{34}O_2]^+$ .

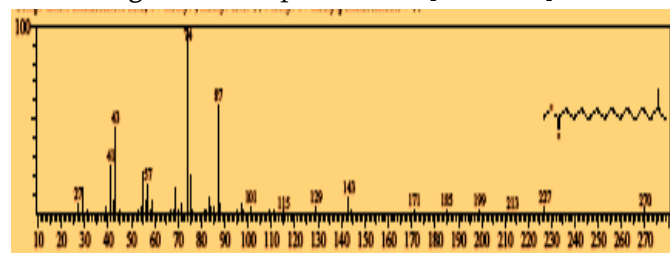


Fig.7: Mass spectrum of 14-methyl-pentadecanoic acid methyl ester

**9, 12-Octadecadienoic acid methyl (17.44%)**

The EI mass spectrum of 9,12-octadecadienoic acid methyl ester is shown in Fig.8. The peak at m/z 294, which appeared at R.T. 16.547 in total ion chromatogram, corresponds to  $M^+[C_{19}H_{34}O_2]^+$ . The peak at m/z 263 corresponds to loss of a methoxyl function.

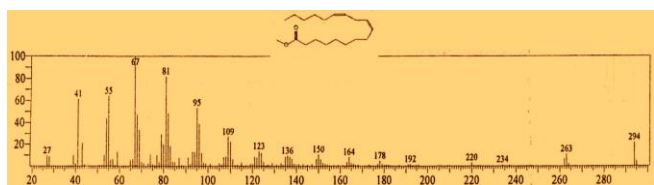


Fig. 8: Mass spectrum of 9, 12-octadecadienoic acid methyl ester

**11-Octadecenoic acid methyl ester (23.68%)**

The EI mass spectrum of 11-octadecenoic acid methyl ester is shown in Fig.9. The peak at m/z 296, which appeared at R.T. 16.627 in total ion chromatogram, corresponds to  $M^+[C_{19}H_{36}O_2]^+$ . The peak at m/z 264 corresponds to loss of a methoxyl function.

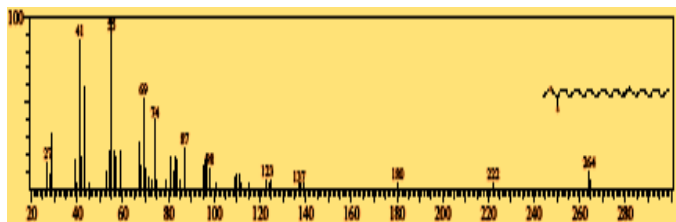


Fig.9: Mass spectrum of 11-octadecenoic acid methyl ester

**Heptacosanoic acid methyl ester(10.22%)**

The EI mass spectrum of heptacosanoic acid methyl ester is shown in Fig.10. The peak at m/z 424, which appeared at R.T. 21.622 in total ion chromatogram, corresponds to  $M^+[C_{28}H_{56}O_2]^+$

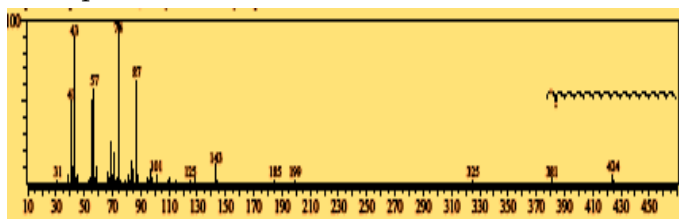


Fig.10: Mass spectrum of heptacosanoic acid methyl ester

**Antimicrobial activity**

In disc diffusion bioassay *Jatropha curcas* showed strong antimicrobial potency against *Staphylococcus aureus* while *Tamaridus indica* doesn't. (Tables 3. and 4). Of the test oils, only the *Tamindus indica* oils showed strong activity against the bacterial strain *Escherichia coli*. *Tamaridus indica* was inactive against the fungal species *Aspergillus niger* while *Jatropha curcas* was active. Significant antifungal potency against the yeast *Candida albicans* was observed for *Tamaridus indica* and not *Jatropha curcas* oils (Table3).

Table 3: Antimicrobial activity of target species

Test organism	Tamaridus indica	Jatropha curcas
Staphylococcus aureus	R	S
Bacillus careus	S	S
Escherachia coli	S	R
Vibro cholaraeae	R	S
Salmanella typhi	S	R
Candida albicans	S	R
Aspergillus niger	R	S

Table 4: Diameter of inhibition zones (mm)

Test organism	Tamaridus indica	Jatropha curcas
Staphylococcus aureus	0	25
Bacillus careus	20	20
Esgherachia coli	24	0
Vibro cholaraeae	0	22
Salmanella typhi	25	0
Candida albicans	21	0
Aspergillus niger	0	20

The minimum inhibition concentration is displayed in Table 5. *Jatropha curcas* oils showed a minimum inhibition concentration at 12.50 mg/ml. for all test organisms except for *Escherichia coli* which showed a minimum inhibition concentration at 6.25mg/ml. *Balanites aegyptica* and *Glycine max* oils showed



minimum inhibition concentration at 12.5mg/ml (6.25mg/ml).  
 except for *Escherichia coli* and *Salmonella typhi*

Table 5 : Minimum inhibition concentration – *Tamarindus indica*

Test organism	50mg/ml	25mg/ml	12.5mg/ml	6.25mg/ml	3.13mg/ml	1.56mg/ml
Staphylococcus aureus						
Bacillus careus	-	-	0 <sup>+</sup>	+	++	+++
Esgherachia coli	-	-	-	0 <sup>+</sup>	+	++
Vibro cholareae						
Salmanella typhi	-	-	-	0 <sup>+</sup>	+	++
Candida albicans	-	-	0 <sup>+</sup>	+	++	+++
Aspergillus niger						

Table 6: Minimum inhibition concentration - *Jatropha curcas*

Test organism	50mg/ml	25mg/ml	12.5mg/ml	6,25mg/ml	3.13mg/ml	1.56mg/ml
Staphylococcus aureus	-	-	-	0+	+	++
Bacillus careus	-	-	0+	+	++	+++
Esgherachia coli						
Vibro cholareae	-	-	0+	+	++	+++
Salmanella typhi						
Candida albicans						
Aspergillus niger	-	-	0+	+	++	+++

Table 7: Minimum bactericidal concentration- *Tamarindus indica*

Test organism	50mg/ml	25mg/ml	12.5mg/ml	6.25mg/ml	3.13mg/ml	1.56mg/ml
Staphylococcus aureus						
Bacillus careus	0+	+	++	+++	+++	+++
Esgherachia coli	-	-	0+	+	++	+++
Vibro cholareae						
Salmanella typhi	-	-	0+	+	++	+++
Candida albicans	0+	+	++	+++	+++	+++
Aspergillus niger						

Table 3.32: Minimum bactericidal concentration- *Jatropha curcas*

Test organism	50mg/ml	25mg/ml	12.5mg/ml	6.25mg/ml	3.13mg/ml	1.56mg/ml
Staphylococcus aureus	-	-	0+	+	++	+++
Bacillus careus	0+	+	++	+++	+++	+++
Esgherachia coli						
Vibro cholareae	0+	+	++	+++	+++	+++
Salmanella typhi						
Candida albicans						
Aspergillus niger	0+	+	++	+++	+++	+++

#### IV.CONCLUSION

Volatile oils and fixed oils of the dry seeds of some medicinal plants grown in Nigeria were obtained by maceration using n-hexane. GC/MS analysis was performed. Characterization of constituents was done by comparison with the MS library (NIST) and further confirmed by interpreting the observed fragmentation pattern.

The most common major constituents of the fixed oils were :9-octadecenoic acid (elaidic acid) (21.54-52.40%), 9, 12-octadecadienoic acid (linolelaidic acid) (17.44-63.71%), octadecenoic acid (stearic acid), (26.33-54.88%) and hexadecanoic acid (palmitic acid) (17.29-27.32%).

The minimum inhibition concentrations and minimum bactericidal/fungicidal activities were evaluated for all the samples.

#### V. RECOMMENDATIONS

1. Research should be intensified in unveiling the diverse medicinal potentials in plants owing to plants diversity and abundance over the world.
2. Synergy between herbal traditional medicine and modern medicine should be ensured so that there would be complimentary efforts towards prevention of outbreaks.

3. There is the need for collaborative efforts between ethno medical stake holders and researchers in various communities in order to improve and fast track breakthroughs in the development of medicines for some prevalent diseases.
4. There should be appreciable input from genetic engineers to develop plants species which will be less affected by climatic factors so as to improve the quantity and quality of products required for use in the affected industries.

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