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Research Article

Isolation of some non polar constituents from the fruits of *Faidherbia albida* (Del.) A. Chev.

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ABSTRACT

Faidherbia albida, also known as *Acacia albida* is a pod-bearing medicinal plant that has been reported to possess several medicinal uses and invariably some bioactives. In this study, the isolation, characterization and identification of some bioactives from the petroleum ether-soluble portion of the methanol extract of the fruits was carried out. This was achieved using techniques, such as extraction, partitioning, fractionation, chromatography, separation and purification to afford five major partially purified fractions. GC-MS of two of these fractions revealed the presence of some saturated and unsaturated fatty acids and fatty acid esters. Further purification of the two fractions led to the isolation of four non-polar compounds that were characterized based on physical, chemical, spectral and literature search. The compounds were identified as stearic acid, oleic acid, linoleic acid, methyl ester and linolenic acid, methyl ester, all reported for the first time from the fruits of *F. albida*.

Keywords: *Faidherbia albida*, non-polar compounds, spectroscopy, fatty acids and fatty acid esters

INTRODUCTION

Medicinal plants over the decades have been shown to have a scientific basis for their use in primary health care in the prevention and treatment of various diseases by several scientists. Such therapeutic uses of such plants have been proved to be as a result of the presence of various anti-nutritive factors, also known as bioactives or phytoconstituents, which act individually or synergistically in such plants. Therefore, the continuous search for such secondary metabolites in plants cannot be undermined. A medicinal plant, such as *Faidherbia albida*, also known as *Acacia albida* of the Mimosaceae/Leguminosae/ Fabaceae (pod-bearing) family; commonly known as Apple ring- Acacia (English), Oju Ologbo (Yoruba), Gawo (Hausa) and Anya-nwona (Igbo) is a thorny, deciduous tropical African tree with deep penetrating root. The leaves are bi-pinnate, bluish -green in color with straight whitish thorns, while, the bark is grey, rough and scaly, when old. It possesses pale cream-colored, long-spiked flowers and has fruits that are twisted, glabrous, and shiny, ranging in color from orange to brown. The fruits are soft and fleshy with narrow wings that extend about three quarters way round the body with a corky and knobby flesh surrounding a hard woody shell [1]. Within the fruits are pod-bearing seeds which are orange-brown in color, twisted in shape, containing almost 10-30 dark, shiny brown ovoid seeds and a tough seed coat; usually eaten by animals [2, 3, 4]. Traditionally, the plant is used in the treatment of diarrhea [5, 6], skin diseases and asthma[7]. The plant is also useful as an anti-inflammatory, anti-haemorrhagic and ophthalmic agent [5]. Locally, the seeds of the plant are eaten by humans as foods during famine [5, 8], while powdered pods and seeds are widely used to poison fish in pools [9]. Biologically, the plant's usefulness as anti-microbial [10], anti-diarrheric, anti-pyretic, anti-inflammatory [11], anti-trypanosomiasis [12], anti-diabetic [13], anti-malarial [14], anti-fungal [15] and nematicidal agent [16] has been reported. Agriculturally, the plant is a nitrogen fixer [17] and has reportedly been used to improve fertility and hence, increase crop yield of crops planted around it [18]. Phytochemically, the presence of saponins, tannins, alkaloids, flavonoids, phytates, oxalates, carbohydrates and glycosides has been

reported in the plant [11,13, 19-21]. Extraction and characterization of the seed oil of the plant revealed that it is quite rich in saturated and unsaturated fatty acids, such as myristic, palmitic, stearic, palmitoleic, oleic and linoleic acid [22]. GC-FID and GC-MS analysis of the composition of essential oils from the stem bark of the plant revealed the presence of thirty-seven constituents, with α-pinene (a terpene) being the most abundant [23]. In view of the absence of much information on the bioactives of the fruits of *F. albida*, the continuous search for secondary metabolites in plants has therefore prompted the extraction, isolation and characterization of more constituents from the fruits of *faidherbia albida*

MATERIALS AND METHODS

Collection and Identification of Plant Material

Fruits of *Faidherbia albida* were collected from Madari, Jigawa Local Government Council of Kano State, Nigeria; in the month of December, 2014. Identification and authentication was carried out by Dr. (Mrs.) Jemilat Ibrahim of the Department of Medicinal Plant Research and Development (MPR&TM) of National Institute for Pharmaceutical Research and Development, Idu (NIPRD) and a voucher deposited (NIPRD/H/6151).

Extraction of Plant Material

Air-dried powdered fruits of *Faidherbia albida* (700 g) were extracted exhaustively by macerating with 80% methanol. The filtrate was decanted, filtered and concentrated *in vacuo*. Dried extract was weighed and coded crude methanolic extract of fruits of *F. albida* (M).

Partitioning of Crude Extract (M)

The extract, M, was suspended in 500 ml of distilled water, shaken vigorously and set aside for 2 h. The homogenous reddish-brown mixture obtained was then partitioned with petroleum ether (60-80^{o}C, 7x100 ml) and the resulting mixture concentrated *in vacuo*, and evaporated to dryness to obtain an extract coded petroleum ether-soluble portion of methanol extract of *A. albida* (Mp).

Fractionation of Petroleum ether-soluble Portion (Mp)

Two grams of portion Mp was solubilized in petroleum ether (little quantity) and adsorbed onto silica gel (little quantity). It was evaporated to dryness and the homogeneous mixture subjected to fractionation by flash column chromatography using silica gel (mesh 230-400, 60 g) and petroleum ether (60-80^{o}C) by the slurry method. Elution was carried out with varying proportions of petroleum ether: $CHCl_3$ and eluates monitored by TLC (pre coated). Spots on chromatograms were detected using sunlight, UV light and iodine crystals. Identical fractions were pooled and concentrated in vacuo to afford 5 major fractions, of which fractions obtained from solvent systems petroleum ether: $CHCl_3$ (4:1) and petroleum ether: $CHCl_3$ (1:1) were the most promising, with well resolved spots on TLC. These two fractions were evaporated to dryness and coded Mp-1 and Mp-2 respectively.

GC-MS of Fractions Mp-1 and Mp-2

The identification of the compounds present in both fractions Mp-1 and Mp-2 using gas chromatography coupled with mass spectroscopy (GC-MS) was based on direct comparison of the retention times and mass spectral data with those for standard compounds and by computer matching with the Wiley 229, NIST 107 and NIST 21 libraries as well as by comparison of the fragmentation patterns of the mass spectra with those reported in the literature [24, 25]. Major constituents present in both fractions are presented in Tables 1 and 2 respectively.

Isolation of Compounds Mp-1a and Mp-1b

TLC of fraction Mp-1 using petroleum ether: EtOAc (9:1) as the mobile phase revealed two major and a minor spot. These were resolved by subjecting the fraction (240 mg) to further purification using flash chromatography (silica gel, mesh 230-400, 30 g). Elution was carried out with varying proportions of petroleum ether and EtOAc. Sub-fraction from solvent mixture petroleum ether: EtOAc (19:1) yielded two major spots that were resolved by further purification using preparative thin layer chromatography (1.00mm, petroleum ether: $CHCl_3$, 9: 1). This gave rise to 2 major bands that were scrapped and triturated with acetone, individually. Concentration of band 1 *in-vacuo* afforded a waxy mixture, which on further purification using PTLC (petroleum ether: $CHCl_3$, 4: 1) afforded a single spotted compound, coded Mp-1a. The concentration of band 2 *in-vacuo* yielded an oily substance with some minor impurities at the origin. The oil was washed severally with methanol, yielding a methanol-insoluble fraction, which on TLC afforded a single spotted compound, coded Mp-1b.

Isolation of Compounds Mp-2a and Mp-2b

TLC of fraction Mp-2 using petroleum ether: EtOAc (4:1) as the mobile phase revealed five major spots which were resolved by subjecting the fraction (225 mg) to further purification using flash chromatography (silica gel, mesh 230-400, 30g). Elution was carried out with varying proportions of petroleum ether and EtOAc. Sub-fraction (114 mg) from solvent mixture petroleum ether: EtOAc (9:1)

was further purified over column (silica gel, mesh 230-400, 30 g, hexane: $CHCl_3$) to afford 4 major sub-fractions. Further purification of sub-fraction from hexane: $CHCl_3$; 3:7 (83 mg) using column (silica gel, mesh 230-400, 30 g, hexane: EtOAc) afforded a single spotted compound each, coded Mp-2a and Mp-2b from solvent systems hexane: ethyl acetate (9:1) and hexane: ethyl acetate (6:4) respectively.

Characterization of Isolated Compounds

Spots on chromatograms were detected using sunlight, UV light and iodine crystals. Chromogenic reagents such as: (i) vanillin-sulphuric acid, heated at 105°C, and (ii) 5% alc. $KMnO_4$ were also used as spot detectors. UV and IR were both recorded in $CHCl_3$ using UV spectra (T60 UV-Visible spectrophotometer) and FTIR (Spectrolab MB 3000) respectively; while GC-MS was recorded using GCMS-QP 2010 plus Shimadzu. ^{1}H-NMR, ^{13}C-NMR (proton-decoupled) and DEPT-135 spectra were taken in $CDCl_3$ on JEOL LA spectrometer operating at 500 MHz. Boiling point was determined using the Siwoloboff's method [26], while melting points were uncorrected.

RESULTS AND DISCUSSION

GC-MS of partially purified fractions Mp-1 and Mp-2 revealed that both fractions were made up of fatty acids and fatty acid esters as shown in both Tables 1 and 2. It was shown that the monounsaturated fatty acid, MUFA (oleic acid) was of higher content in fraction Mp-1 than the saturated fatty acids (stearic acid and palmitic acid), while; only a trace amount of a saturated fatty acid methyl ester, FAME (stearic acid methyl ester) was present in the fraction (Table 1). The spectrum of fraction Mp-2 revealed the presence of only fatty acid methyl esters, FAMEs, of which three were unsaturated (linoleic-, linolenic- and oleic acid methyl ester), while; two were saturated (palmitic and eicosanoic acid methyl ester) as shown in Table 2, an indication that both fractions are richer in the unsaturated than saturated fatty acids/fatty acid esters.

Fatty acids (FAs) are long aliphatic/hydrocarbon chain containing a carboxylic acid moiety at one end. They are formed by the base-induced ester hydrolysis of fats and oils (saponification). They exist as both saturated and unsaturated fatty acids, in which the unsaturated could be monounsaturated (MUFA) or poly unsaturated fatty acid (PUFA). They are all a common occurrence in plants and animals [27, 28, 29]. Fatty acid methyl esters (FAMEs) are also long aliphatic chains, like their fatty acid counterparts, but have their hydrogen group in the COOH moiety being replaced by a $–CH_3$ group. They are derived by trans-esterification of fats/oils with methanol [30]. They also exist as saturated or unsaturated FAMEs.

Structural Elucidation of Isolated Compounds

Stearic acid (Compound Mp-1a)

Physical and spectral characterization of compound Mp-1a revealed the following: white waxy solid (17.8 mg), melting point 68.6 -70.4°C (lit: 69.3°C), soluble in hexane and chloroform; slightly soluble in acetone and ethanol; insoluble in water, indicating that it is an apolar organic compound. TLC, single spotted, R_f 0.61 (no color under sunlight; UV active; golden brown in iodine; blue with vanillin-sulphuric acid + heat and deep brown with 5% alc. $KMnO_4$).

IR (ν max, cm^{-1}): 3208.21 (OH of an acid), 2857.6 (C-H), 1722.33 (CO of an acid).

UV (λ max, nm): 199 (saturated COOH).

^{1}H-NMR (δ ppm): 10.8 (weak singlet, H-1 of OH), 2.20-2.18 (weak triplet, H-2), 1.53-1.50 (weak multiplet, H-3), 1.27 (sharp singlet, H-4 to H-16), 1.30-1.28 (weak multiplet, H-17) and 0.95-0.92 (weak triplet, H-18).

^{13}C-NMR analyzed with DEPT 135 (δ ppm): revealed nine proton de-coupled peaks at 176.4 (C-1), 34.3 (C-2), 24.1 (C-3), 28.2 (C-4), 28.5 (C-5 and C-15), 28.8 (C-6 to C-14), 30.3 (C-16), 21.9 (C-17) and 14.0 (C-18), of which there are; one quartenary (C-1), sixteen methylene (C-2 to C-17), one methyl (C-18) and no methine groups.

GC-MS (m/z peaks): 284[M^+, $C_{18}H_{36}O_2]^+$, 241[$C_{15}H_{29}O_2]^+$, 199[$C_{12}H_{23}O_2]^+$, 185 [$C_{11}H_{21}O_2]^+$, 171 [$C_9H_{19}O_2]^+$, 143 [$C_8H_{15}O_2]^+$, 129 [$C_7H_{13}O_2]^+$, 115 [$C_6H_{11}O_2]^+$, 98[$C_7H_{14}]^+$, 85[$C_6H_{13}]^+$, 83[$C_6H_{11}]^+$, 73[base peak, $C_5H_{13}]^+$, 57[$C_4H_9]^+$, 55[$C_4H_7]^+$, 43[$C_3H_6]^+$ and 41[$C_3H_5]^+$. GC-MS revealed its molecular formula and weight as $C_{18}H_{36}O_2$ and 284 gmol^{-1} respectively.

Compound Mp-1a, was revealed to be a non-polar compound possessing no double bond and has a carboxylic acid functional group at C-1. It was identified as stearic acid (Fig. 1), a common saturated fatty acid (18:0) that has been reported and isolated in several medicinal plants [31- 35].

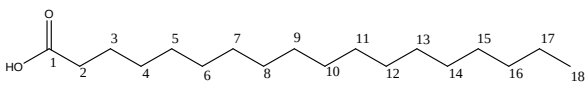

Fig. 1
Structure of Stearic acid /*n*-Octadecanoic acid/Octanedecane carboxylic acid

Oleic acid (Compound Mp-1b): A yellow viscous oil with a slight odor (15.7 mg), melting point 12.4-14.6°C (lit: 13.5°C), boiling point 358-359°C (lit: 360°C), soluble in benzene, chloroform, dichloromethane and diethyl ether; slightly soluble in acetone, methanol and ethanol; insoluble in water, indicating that it is also an apolar compound. Spot on TLC, R_f 0.52 (no color under sunlight; UV active; golden brown in I_2 crystals; deep blue with vanillin-sulphuric acid, heated at 105°C for 5 minutes and brown with 5% alc. $KMnO_4$).

IR ν max (cm^{-1}): 3219.1 (OH of an acid), 2993.2 (C-H, aliphatic), 1714.4 (CO of an acid), 1638.7 (C=C).

UV λ max (nm): 172 (C=C), 202 (unsaturated COOH)·

^{1}H-NMR (δ ppm): 10.7 (weak singlet, H-1); 5.32-5.25 (weak doublet, H-9 and H-10), 2.10-2.04 (weak triplet, H-2), 1.91-1.86 (weak multiplet, H-8 and H-11), 1.52-1.55 (weak multipet, H-3), 1.34 (slightly sharp singlet, H-7, H-12 and H-17), 1.30 (very sharp singlet, H-4, H-5, H-6, H-13, H-14, H-15 and H-16) and 1.01-0.94 (weak triplet, H-18).

^{13}C-NMR analyzed with DEPT 135 (δ ppm): revealed thirteen proton-decoupled peaks at 172.7 (C-1), 133.2 (C-9 and C-10), 35.8 (C-2), 30.7 (C-16), 29.8 (C-7 and C-12), 29.3 (C-6, C-13 and C-14), 29.0 (C-5), 28.9 (C-15), 28.7 (C-4), 26.5 (C-8 and C-11), 24.7 (C-3), 21.6 (C-17) and 13.8 (C-18); of which there are: one quaternary (C-1), one methyl (C-18), fourteen methylene (C-2 to C-8 and (C-11 to C-17) and two methine (C-9 and C-10) groups.

GC-MS (m/z): 282 [M^+, $C_{18}H_{34}O_2$] $^+$, 283 [M +1, $C_{18}H_{35}O_2$] $^+$, 264 [$C_{18}H_{33}O$] $^+$, 127 [C_9H_{19}] $^+$, 98 [C_7H_{14}] $^+$, 97 [C_7H_{13}] $^+$, 83 [C_6H_{11}] $^+$, 69[C_5H_9] $^+$, 55 [base peak, C_4H_7] $^+$, 43 [C_3H_7] $^+$, 41[C_3H_5] $^+$, 29 [C_2H_5] $^+$ and 27 [C_2H_3] $^+$. Its molecular formula and weight by GC-MS was found to be $C_{18}H_{34}O_2$ and 282$gmol^{-1}$ respectively. The various data obtained for compound Mp-1b revealed that it is a monounsaturated fatty acid (MUFA) possessing a single double bond at positions C-9 and C-10 and a carboxylic acid functional group at C-1. Compound Mp-1b (Fig. 2) identified as oleic acid (18:1, ω-9/*cis*-Δ^9) is the most common monoenoic fatty acid in plants [28] and has been reported and isolated in several medicinal plants [32, 33, 36].

Linoleic acid, methyl ester (Compound Mp-2a): Physical and spectral characterization of compound Mp-2a revealed the following: Pale yellow oil (16.5mg), melting point -33 to -31.6°C (lit: -35°C), boiling point 207-209°C (lit: 208°C), soluble in hexane, chloroform and diethyl ether; partially soluble in acetone, methanol and insoluble in both hot and cold water, also an apolar compound. TLC, single spotted, R_f 0.55 (no color under sunlight; UV active; golden brown in iodine; blue with vanillin-sulphuric acid + heat and deep brown with 5% alc. $KMnO_4$).

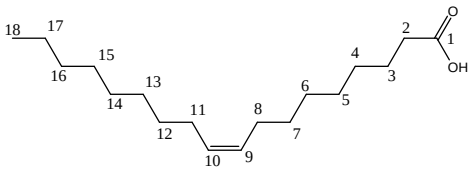

Fig 2
Structure of Oleic acid/*cis*-Oleic acid/9-Octadecenoic acid (Z)/*cis*-9-Octadecenoic acid

IR (ν max, cm^{-1}): 3012.38 (=CH), 2950.1 (-CH_3), 1749.22 (CO of an ester), 1645.33 (C=C) and 1202.62 (O-C-C of an ester).

UV (λ max, nm): 214 (2x C=C), 211 (unsaturated ester).

^{1}H-NMR (δ ppm): 5.50-5.42 (weak multiplet, H-9, H-10, H-12 and H-13), 3.70 (sharp singlet, H-1'), 2.65-2.62 (weak triplet, H-11), 2.2-1.98 (weak triplet, H-2), 1.95-1.92 (weak doublet of a triplet, H-8 and H-14), 1.70-1.68 (weak pentet, H-3), 1.40-1.36 (multiplet, H-7, H-15 and H-17), 1.34-1.31 (multiplet, H-4, H-5, H-6 and H-16) and 1.00-0.97 (weak triplet, H-18).

^{13}C-NMR analyzed with DEPT 135 (δ ppm): revealed sixteen proton de-coupled peaks at 171.6 (C-1), 130.8 (sharp, C-9 and C-13), 125.2 (sharp, C-10 and C-12), 50.7 (C-1'), 31.8 (C-2), 30.4 (C-16), 29.8(C-7), 29.5 (C-6), 29.4 (C-15), 29.2 (C-5), 28.8 (C-4), 26.7 (sharp, C-8 and C-14), 25.4 (C-11), 25.0 (C-3), 21.9 (C-17) and 13.9 (C-18); of which there are: one quaternary (C-1), two methyl (C-18 and C-1'), twelve methylene (C-2 to C-8, C-11, C-14 to C-17) and four methine (C-9, C-10, C-12 and C-13) groups.

GC-MS (m/z peaks): 294[M^+, $C_{19}H_{34}O_2$]$^+$, 263[$C_{18}H_{31}O_2$]$^+$, 164[$C_{11}H_{16}O$]$^+$, 150[$C_{10}H_{14}O$]$^+$, 136[$C_9H_{12}O$]$^+$, 123[$C_8H_{10}O$]$^+$, 109[C_7H_9O]$^+$, 95[C_7H_{11}]$^+$, 81[C_6H_9]$^+$, 67[base peak, C_5H_7]$^+$, 55 [C_4H_7]$^+$and 41[C_2H_3]$^+$. GC-MS revealed its molecular formula and weight as $C_{19}H_{34}O_2$ and 294$gmol^{-1}$ respectively. The various peaks obtained for

compound Mp-2a revealed that it is a diene fatty acid methyl ester possessing two double bonds at positions C-9, C-10, C-12 and C-13 and a methyl carboxylate functional group at C-1. Compound Mp-2a (Fig. 3) identified as linoleic acid, methyl ester (18:2, ω-6/ω-9, *cis*, *cis*-Δ^9, Δ^{12}), an omega-6 polyunsaturated fatty acid, PUFA derivative of linoleic acid, one of the most common dienoic fatty acids, also known as an essential fatty acid [28]. Linoleic acid, methyl ester has been reported and isolated in several medicinal plants [37-40].

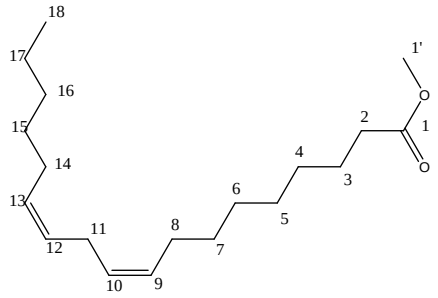

Fig. 3
Structure of Linoleic acid, methyl ester/9, 12-Octadecadienoic acid (Z, Z) methyl ester/Methyl *cis, cis*-9, 12-Octadecadienoate/ Methyl linoleate

Linolenic acid, methyl ester (Compound Mp-2b)

Physical and spectral characterization of compound Mp-2b revealed the following: A colorless viscous oil (18.1mg), melting point -56.2 to -53.1°C (lit: -57 °C), boiling point 180.5-181.7 °C (lit: 182°C), soluble in hexane, chloroform and diethyl ether; partially soluble in acetone, methanol and insoluble in both hot and cold water. TLC, single spotted, R_f 0.58 (no color under sunlight; UV active; golden brown in iodine; blue with vanillin-sulphuric acid + heat and deep brown with 5% alc. $KMnO_4$).

IR (ν max, cm^{-1}): 3162.38 (=CH), 1743.29 (CO of an ester) 1648.74 (C=C) and 1216.34 (O-C-C of an ester).

UV (λ max, nm): 221 (3xC=C), 220 (unsaturated ester).

^{1}H-NMR (δ ppm): 5.46-5.35 (weak multiplet, H-9, H-10, H-12, H-13, H-15 and H-16), 3.67-3.66 (sharp singlet, H-1'), 2.64-2.61 (weak multiplet, H-11 and H-14), 2.29-2.25 (weak triplet, H-2), 2.05-1.99 (weak multiplet, H-17), 1.95-1.91 (weak multiplet, H-8), 1.71-1.67 (weak pentet, H-3), 1.37-1.32 (weak pentet, H-7), 1.30-1.27 (weak multiplet, H-4, H-5 and H-6) and 1.09-1.04 (weak triplet, H-18).

^{13}C-NMR analyzed with DEPT 135 (δ ppm): revealed seventeen proton de-coupled peaks at 172.8 (C-1), 131.4 (C-9), 129.7 (C-16), 129.5 (sharp, C-12 and C-13), 129.1 (C-15), 128.6 (C-10), 51.2 (C-1'), 34.8 (C-2), 31.1 (C-7), 29.9 (C-6), 29.6 (C-5), 29.0 (C-4), 28.3 (C-8), 26.1(sharp, C-11 and C-14), 25.7 (C-3), 19.8 (C-17) and 13.9 (C-18); of which there are: one quaternary (C-1), two methyl (C-18 and C-1'), ten methylene (C-2 to C-8, C-11, C-14 and C-17) and six methine (C-9, C-10, C-12, C-13, C-15 and C-16) groups.

GC-MS (m/z peaks): 292[M^+, $C_{19}H_{32}O_2]^+$, 261 $[C_{18}H_{29}O]^+$, 149$[C_{10}H_{13}O]^+$, 135$[C_9H_{11}O]^+$, 121$[C_8H_9O]^+$, 108$[C_7H_8O]^+$, 93$[C_7H_9]^+$, 79[base peak, $C_6H_7]^+$, 67$[C_5H_7]^+$, 55$[C_4H_7]^+$ and 41$[C_3H_5]^+$. GC-MS revealed its molecular formula and weight as $C_{19}H_{32}O_2$ and 292$gmol^{-1}$ respectively. The spectral data obtained for compound Mp-2b revealed that it is a tri-unsaturated/triene fatty acid methyl ester possessing three double bonds at C-9, C-10, C-12, C-13, C-15 and C-16. It has a methyl carboxylate functional group at C-1, like compound Mp-2a. Compound Mp-2b (Fig. 4) identified as linolenic acid, methyl ester (18:3, ω-3/ω-6/ω-9, *cis*, *cis*, *cis*-Δ^9, Δ^{12}, Δ^{15}) is an omega-3 polyunsaturated fatty acid, PUFA derivative of α-linolenic acid, one of the most common trienoic fatty acids, also known as an essential fatty acid [28]. Linolenic acid, methyl ester has also been reported and isolated in several medicinal plants [38, 40, 41].

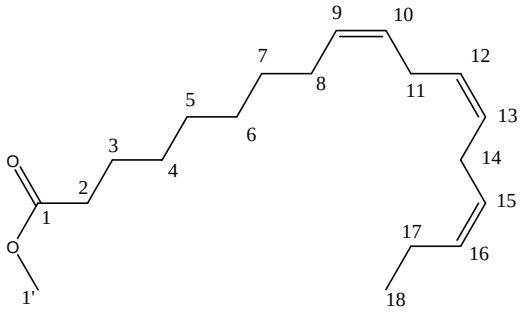

Fig. 4
Structure of Linolenic acid, methyl ester/9, 12, 15-Octadecatrienoic, (Z, Z, Z) methyl ester/ Methyl-all-cis-9, 12, 15-octadecatrienoate, Methyl linolenate

The result of this study indicated that the petroleum ether-soluble portion of the methanol extract of the fruits is a rich source of polyunsaturated fatty acids (PUFAs) as well as monounsaturated fatty acids (MUFAs). Moreover, these fatty acids play important role in human growth and development and are positively associated with health and the prevention and treatment of heart disease, arthritis, inflammatory and autoimmune diseases and cancer [42, 43]. For instance, edible oils which are rich in unsaturated fatty acids especially, monounsaturated fatty acids are known to lower total and LDL cholesterol,

triglycerides, increase HDL cholesterol, help controlling blood pressure, impart antithrombotic properties and help improve insulin sensitivity and thus help in reducing the oxidative stress in the human body[42, 43]. They are known to reduce the risk of cardiovascular diseases and to have an immunomodulatory effect on conditions such as rheumatoid arthritis[42, 43].

CONCLUSION

Fractionation, purification and chromatographic separation of the petroleum ether-soluble portion of the methanol fruit extract of *Faidherbia albida* led to the isolation, characterization and structural elucidation of stearic acid (saturated free fatty acid, FFA), oleic acid (unsaturated monoenoic fatty acid, MUFA), linoleic acid, methyl ester (unsaturated dienoic fatty acid methyl ester, FAME) and linolenic acid, methyl ester (unsaturated trienoic fatty acid methyl ester, FAME) from the plant. This is the first report of isolation and characterization of these non-polar compounds from the fruits of the plant. Further work will focus on the isolation and characterization of polar secondary metabolites from the plant and the bioassay of such isolates will also be determined.

Table 1
Fatty acids and fatty acid ester identified in fraction Mp-1 of petroleum ether-soluble portion of fruits of *F. albida*

S No	Name of compound	Molecular formula	Molecular weight ($gmol^{-1}$)	Base peak	% Abundance
1	Oleic acid	$C_{18}H_{34}O_2$	282	55.05	52.73
2	Stearic acid	$C_{18}H_{36}O_2$	284	73.05	18.93
3	Palmitic acid	$C_{16}H_{32}O_2$	256	88.10	16.88
4	Stearic acid, methyl ester	$C_{19}H_{38}O_2$	298	74.05	3.83

Table 2
Fatty acid esters identified in fraction Mp-2 of petroleum ether-soluble portion of fruits of *F. albida*

S No	Name of compound	Molecular formula	Molecular weight ($gmol^{-1}$)	Base peak	% Abundance
1	Linoleic acid, methyl ester	$C_{19}H_{34}O_2$	294	67.05	26.78
2	Linolenic acid, methyl ester	$C_{19}H_{32}O_2$	292	79.10	11.07
3	Palmitic acid, methyl ester	$C_{17}H_{34}O_2$	270	74.05	9.53
4	Oleic acid, methyl ester	$C_{19}H_{36}O_2$	296	55.05	1.50
5	Eicosanoic acid, methyl ester	$C_{21}H_{42}O_2$	326	74.05	1.08

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