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Research Article

POTENTIAL TESTING OF FATTY ACIDS FROM MANGROVE AEGICERAS CORNICULATUM (L.) BLANCO

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ABSTRACT

In present investigation fatty acids (FAs) were estimated from the leaves and stem of *Aegiceras corniculatum* (L.) Blanco. It is found that in leaves of the species the saturated FAs are more than unsaturated FAs. While in the stem saturated and unsaturated fatty acids are present nearly in equal amount. Arachidic acid, Heneicosanoic acid, Myristoleic acid, Linolelaidic acid, Linoleic acid and cis-4,7,11,14,17-Eicosapentaenoic acids are major FAs present in leaves. On the other hand Myristic acid, Palmitic acid, Linolenic acid, cis-11, 14, 17-Eicosatrienoic acid and Arachidonic acids are present in stem. The results show the presence of Arachidonic acid in the stem of *A. corniculatum,* which is considered as an essential FA. The mixture of saturated and unsaturated FAs present in the leaves and stem of *A. corniculatum* suggests that the species is rich source of FAs and therefore, it can be used as alternative source of FAs in different industries for various purposes.

Keywords: Aegiceras corniculatum, Leaves, Stem, Fatty Acids (FAs), Arachidonic acid

INTRODUCTION

Mangroves are amongst most productive ecosystems in the world. They play an important role in maintaining the quality and productivity of coastal waters. A fatty acid is a carboxylic acid, often with a long aliphatic tail, either saturated or unsaturated. Fatty acids are required in the body for cell membrane function and integrity, healthy skin, cholesterol metabolism and prostaglandin production. They are also necessary for the function of thyroid and adrenal glands. Fatty acids are used in cosmetics as emollients, thickening agents and mixed with glycerin, cleansing agents. They are also used in production of soaps, detergents and are a component of some low toxicity pesticides. The most common fatty acids are myristic acid (C14:0), palmitic acid (C16:0), stearic acid (C18:0), oleic acid (C18:1) and linoleic acid (C18:2) [1].

The present work was carried out on fatty acid extraction of the leaves and stem of *A. corniculatum.* Fatty acids can be saturated, monounsaturated or polyunsaturated. Fatty acids are the constituents of all plant cells, where they function as membrane components, storage products, metabolites, and as a source of energy [2]. Saturated FAs include butyric, capric, myristic, palmitic arachidic acids. Polyunsaturated FAs include linoleic, linolenic, Arachidonic acids. Oleic acid is an example of monounsaturated FA. Capric acid widely used in perfumes, cosmetics and creams. Myristic acid is used in the food industry as a flavoring agent. Both capric and myristic acid are used as raw material for emulsifiers, in toiletiries soaps & detergents anionic and nonionic surfactants. Palmitic acid is used in the manufacture of pharmaceuticals, cosmetics, lube oils, water proofing and food grade additives. Stearic Acid is used widely in cosmetics, candles, rubber industries, lubricants, hardening of soaps, shoe & metal polishes. Arachidic acid is used for the production of detergents, photographic materials and lubricants.

Linolenic acid is an unsaturated FA, considered essential to the human diet, which is an important component of natural drying oils such as linseed oil, and used in making paints and synthetic resins. For cosmetic products, linoleic acid is the most frequently essential FA. It prevents barrier and cornifications disorders, lowers the transepidermal water loss and increases skin moistness. Arachidonic acid is a key long chain PUFA considered as essential and is one of the most critical PUFAs, in particularly in the brain and blood vessels. Caproic, caprylic and carpric acids have similar biological activities. Both caprylic and capric acid have antiviral activity against HIV 3, 4. Caprylic acid has also been reported to have antitumour activity in mice 5. However, fewer data are available for the fatty acids of mangroves & sediments in mangrove swamps 6, 7, 8. The present piece of work was attempted to testing the fatty acids from leaves and stem of *Aegiceras corniculatum*, which shows rich source of fatty acids. These fatty acids are used as various industrial as well as pharmaceutical purposes suggesting this mangrove as a coastal bioresource.

MATERIALS AND METHODS

Extraction of fatty acids

Leaves and stem of naturally grown mangrove *Aegiceras corniculatum* were collected from west coast of Maharashtra. Fresh leaves and stem were washed and blotted to dry. Then the samples were then subjected to extraction in methanol by using Soxhlet Apparatus. To analyze fatty acids from the oil fractions by gas chromatography technique, the oil was subjected to trans-esterification to obtain the fatty acid methyl esters. The fatty acid methyl ester fraction was eluted with petroleum ether: diethyl ether= 50:50 (v/v), the fractions were redissolved in hexane and subjected to GC analysis.

GC-FID analysis

Fatty acid methyl esters were analyzed by GC-FID. A SHIMADZU GC-17-A- gas chromatograph with flame ionization detector (FID) was used. Fatty acid methyl esters were separated on CHROMOPACK WCOT 25mX 0.25 mm ID, 0.2 µm film thickness capillary column using temperature programme from 15^{0}C/5 min, 4^{0}C / min until 235^{0}C and 50 min at 235^{0}C with the following conditions: Injector temperature 260^{0}C, FID temperature 260^{0}C and carrier gas-Helium. The identification of fatty acids was done by comparison with the methyl esters of standard fatty acids.

RESULTS AND DISCUSSION

Rich source of different fatty acids are oils like sunflower, safflower, coconut, linseed, cottonseed, palm oil, olive oil etc. These different types of oils possess different properties according to their saturated and unsaturated fatty acids. Present investigations show that leaves and stem of *A. corniculatum* comprises the mixture of saturated and unsaturated FAs with no trans FAs. In the leaves, saturated FAs (53.90%) are more than unsaturated, while in the stem saturated and unsaturated fatty acids are nearly in same amount.

The leaves shows presence of Arachidic acid, Heneicosanoic acid, Myristoleic acid, Linolelaidic acid, cis-5, 8, 11, 14, 17-Eicosapentaenoic acid are in quite higher amount while Caproic acid, Oleic acid and Linolenic acid are in least amount (Table-1). Linolenic acid seems to be the major fatty acid, and arachidic acid was present in much lower amounts in fresh leaves of some mangroves [9]. But in case of leaves of *A. corniculatum* Arachidic acid is found in higher amount (42.30%). Arachidic acid is also called eicosanoic acid, is the

saturated FA with a 20 carbon chain, which mainly useful in the production of soaps, detergents, for making phographic material and also in lubricants. Leaves of *A. corniculatum* also show presence of some important PUFAs like Linolelaidic acid and Linoleic acid. PUFAs mostly referred as essential FAs, because humans cannot make these acids on their own so it must be obtained from food. Linoelaidic acid is an omega-6 trans fatty acid and is a geometric isomer of linoleic acid, it is found in partially hydrogenated vegetable oils.

Linoleic acid belongs to essential fatty acid that humans and animals must ingest for good health, because the body requires them for various biological processes, but cannot synthesize them from other food components [10]. The key function of Linoleic acid is to maintain the integrity of the skin. It is an important FA mostly used in cosmetic products. Linoleic acid has become increasingly popular in the beauty products industry because of its beneficial properties on the skin. Research points to linoleic acid's anti-inflammatory, acne reductive, and moisture retentive properties when applied topically on the skin 11, 12, 13. Thus, the leaves of *A. corniculatum* shows saturated FAs are dominant than unsaturated FAs (Fig.1). Saturated oils are more stable and do not become rancid as quickly as unsaturated oils. Saturated oils include coconut oil, cottonseed oil, olive oil and rapeseed oil.

Table 1: Fatty acids of leaves of *A. corniculatum*

S. No.	Name of the Test	Leaves of *Aegiceras corniculatum*
1.	Caproic acid methyl ester (C 6:0)	0.10%
2.	Arachidic acid methyl ester (C 20:0)	42.30%
3.	Heneicosanoic acid methyl ester (C 21:0)	11.50%
	Total of Fatty Acids : Saturated	**53.90%**
4.	Myristoleic acid methyl ester (C 14:1)	17.50%
5.	Oleic acid methyl ester (C 18:1n9c)	0.80%
	Total of Fatty Acids : Monounsaturated	**18.30%**
6.	Linolelaidic acid methyl ester (C 18:2n6t)	7.80%
7.	Linoleic acid methyl ester (C 18:2n6c)	4.30%
8.	Cis-5,8,11,14,17-Eicosapentaenoic acid methyl ester (C 20:5n3)	15.60%
	Total of Fatty Acids : Polyunsaturated	**27.70%**
	Total of Trans Fat	--

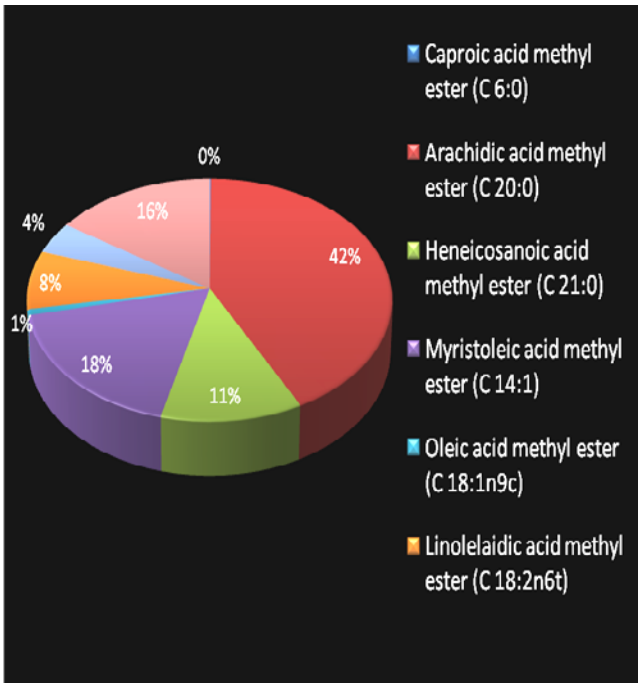

Fig. 1: Total Fatty Acid Composition Of leaves of *A. corniculatum*

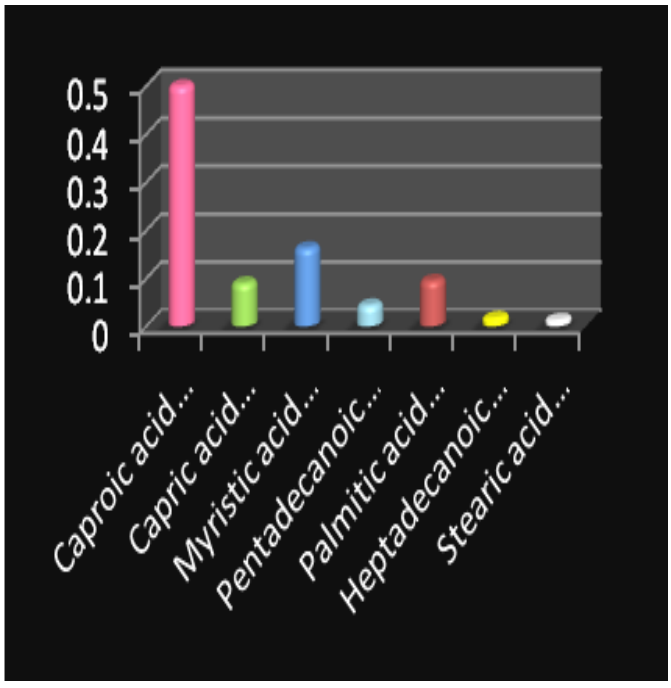

Fig. 2: Saturated Fatty Acid Composition of stem of *A. corniculatum*

The fatty acid composition of stem of *A. corniculatum* is depicted in table-2. From which Capric acid, Myristic acid, Palmitic acid, cis-11, 14, 17-Eicosatrienoic acid and Arachidonic acid are found in higher amount (Fig.2). Among all these FAs, presence of Arachidonic acid is most appreciable (29.50%). Arachidonic acid (AA sometimes ARA) is a polyunsaturated omega-6 FA [20:4(ω-6)]. In addition to being involved in cellular signaling as a lipid second messenger involved in the regulation of signaling enzymes, such as PLC-γ, PLC-δ, and PKC-α, -β, and -γ isoforms, arachidonic acid is a key inflammatory intermediate and can also act as a vasodilator [14]. Some polyunsaturated fatty acids such as linoleic acid, linolenic acid, and arachidonic acid known as vitamin F, are necessary for growth and protection of the skin [15]. Saturated FAs of stem of *A. corniculatum* include Palmitic, Capric, Myristic and Stearic acid. Myristic acid is used in the food industry as a flavoring agent. All these saturated FAs are used in different industries as a raw material.

Saturated FAs of leaves and stem of *A. corniculatum* compared with standard oils saturated FAs then the leaves shows highest amount in all except coconut oil, while stem shows next to Olive oil (Table-3) [16]. So, the present investigation justifies the use of *A. corniculatum* as a rich source of saturated fatty acids.

Table 2: Fatty acids of stem of A. corniculatum

S. No.	Name of the Test	Stem of *Aegiceras corniculatum*
1.	Caproic acid methyl ester (C 6:0)	0.50%
2.	Capric acid methyl ester (C 10:0)	9.00%
3.	Myristic acid methyl ester (C 14:0)	16.30%
4.	Pentadecanoic acid methyl ester (C 15:0)	4.40%
5.	Palmitic acid methyl ester(C 16:0)	9.50%
6.	Heptadecanoic acid methyl ester (C 17:0)	1.70%
7.	Stearic acid methyl ester (C 18:0)	1.30%
	Total of Fatty Acids : Saturated	**42.70%**
8.	Myristoleic acid methyl ester (C 14:1)	4.20%
9.	Palmitoleic acid methyl ester (C 16:1)	4.20%
10.	Oleic acid methyl ester (C 18:1n9c)	2.80%
11.	Cis-11-Eicosenoic acid methyl ester (C 20:1)	4.90%
	Total of Fatty Acids : Monounsaturated	**16.10%**
12.	Linoleic acid methyl ester (C 18:2n6c)	4.60%
13.	Cis-11,14,17-Eicosatrienoic acid methyl ester (C 20:3n3)	7.10%
14.	Arachidonic acid methyl ester (C 20:4n6)	29.50%
	Total of Fatty Acids : Polyunsaturated	**41.20%**
	Total of Trans Fat	--

Table 3: Saturated Fatty Acids of Standard oils in comparison with *A. corniculatum*

S. No.	Name of oil	Saturated (%)	Monounsaturated (%)	Polyunsaturated (%)	Trans Fat (%)
1.	Coconut oil	85.2	6.6	1.7	0
2.	Palm oil	45.3	41.6	8.3	0
3.	Cottonseed oil	25.5	21.3	48.1	0
4.	Olive oil	14	69.7	11.2	0
5.	Rapeseed oil	5.3	64.3	24.8	0
6.	**Leaves of *A. corniculatum***	**53.90**	**18.30**	**27.70**	**0**
7.	**Stem of *A. corniculatum***	**42.70**	**16.10**	**41.20**	**0**

CONCLUSION

The role of fatty acids in our body is significant, which determines and regulates proper body functions. In present study, FAs extracted from *A. corniculatum* have a great commercial value. The mixture of saturated and unsaturated FAs present in the *A. corniculatum* suggests potentiality of species, which provides alternative source of saturated FAs for various industries like soaps, detergents, cosmetics etc. Further investigations are under prob.

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