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Original Article

FATTY ACID COMPOSITION OF THE FRUITS OF *SYZYGIUM ZEYLANICUM* (L.) DC. VAR. *ZEYLANICUM*

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ABSTRACT

Objective: Wild indigenous fruits are believed to be extremely nutritious, contributing a great deal to the general health of the tribal and rural population. To validate this claim, systematic studies are required to estimate their nutritional composition. The objective of the study was to analyze the fatty acid composition of *Syzygium zeylanicum* (L.) DC. var. *zeylanicum.*

Methods: The fatty acid composition of *S. zeylanicum* var. *zeylanicum* fruits were analysed by GC-MS/MS.

Results: The major fatty acids were cis-oleic acid (43.47±0.62 %) and linoleic acid (31.14±0.35%). Total monounsaturated fatty acids in the sample was 44.21%. Omega-6, omega-7 and omega-9 fatty acids were detected. The polyunsaturated fatty acids in thefruits were linoleic acid (31.14±0.35 %) and arachidonic acid (0.15±0.22 %), whereas 24.51 % of the total fatty acids were saturated. The ratio of unsaturated to saturated fatty acids was approximately 3:1. The order of abundance of fatty acids, in some of the healthiest oils, *viz*. olive, canola, peanut oils is, Oleic acid>Linoleic acid>Palmitic acid>Stearic acid and the same order was observed in the present study.

Conclusion: Fruits of *S. zeylanicum* var. *zeylanicum* too shows a healthy balance between unsaturated and saturated fats.

Keywords: Fatty acids, GC-MS/MS, Wild fruits, PUFA, MUFA

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INTRODUCTION

The Western Ghats is a vast repository of plant and animal life. It has been recognized as one of the hottest hot-spots of biodiversity. Of particular interest, among the diverse flora of Western Ghats are the fruit-bearing indigenous trees. Nazarudeen (1999) reported 218 wild, edible fruit trees from forests of Kerala. In addition to fruits, the indigenous trees are a source of fire wood and timber [1]. These have wide adaptability and high degree of tolerance. The rural populace is familiar with many of these trees and their products, but the urban population is largely unaware of its benefits.

These are rarely cultivated or subjected to selection. The fruits are picked from the wild during the season. They are believed to be extremely nutritious; even more so than the favoured, cultivated varieties. This claim however requires validation. In fact to popularize these fruits in urban centres, scientific studies have to be undertaken to estimate their nutritional value.

For the current study, the *zeylanicum* variety of *Syzygium zeylanicum* was chosen. *Syzygium zeylanicum* (L.) DC. var. *zeylanicum* (family Myrtaceae) is a wild fruit yielding tree found in Indian states such as Maharashtra, Mysore, Kerala, Orissa and the Andamans [2]. It has opposite, stalked leaves that are purplish pink when young, green and glossy when mature. Flowers are white and faintly fragrant, found in clusters, at the ends of branches or axils of leaves. The fruits are small white berries, with a single greenish seed and thin pulp. The trunk is reddish brown and papery-flaky in mature specimens. The plant is hardy and tolerates poor soils and salt spray [3].

Almost all parts of the plant are useful. The plant is reported to be a stimulant and antirheumatic; a decoction of leaves and root is used as a vermifuge. The bark is a source of black dye. The wood is reddish or brown and used for rafts, construction and agricultural implements [2]. The leaves are used as a vegetable in Vietnam. The essential oil of leaves of *S. zeylanicum* is a very potent mosquito larvicide [4]. Methanolic extracts of *S. zeylanicum* leaves have shown high α-glucosidase inhibitory activity and high polyphenol content [5]. The actual compound responsible for these activities was found to be Zeylaniin A, a new macrocyclic ellagitanin [6].

The aim of the present study was to profile the lipid fraction of the fruit; fat being an essential macronutrient of our diets.

MATERIALS AND METHODS

The fruits of *Syzygium zeylanicum* var. *zeylanicum* (*SZZ*) were collected during the fruiting season from, JNTBGRI, Palode, Thiruvananthapuram and University of Kerala, Karyavattam campus, Thiruvananthapuram. The fruits were washed to remove dirt and patted dry with paper towels. After removing seeds, the fruits were lyophilized.

The lyophilized samples were extracted with petroleum ether. The fatty acids in the lipid fraction were esterified to fatty acid methyl esters (FAMEs) using methanol. FAMEs were identified and quantified by gas chromatography (GC).

The fatty acid profile was generated through Gas Chromatography-Mass Spectrometry/Mass Spectrometry Electron Ionisation Mode. The GC-MS/MS used was a Scion 436-GC Bruker model coupled with a Triple Quadruple mass spectrophotometer with fused silica capillary BR-5MS coloumn (30 mm x 0.25 mm i.d.,0.25 µm film thickness). The carrier gas used was helium (99.999%), at a constant flow rate of 1 ml/min. The injection volume was 2 µl. The coloumn oven temperature program was as follows: 110 °C hold for 3.5 min, upto 200 °C at the rate of 10 °C/min–No hold, upto 280 °C at the rate of 5 °C/min–9 min hold, Injector temperature 280 °C and total GC running time was 37.5 min. MS was operated in the positive electron ionization mode. The ionization energy was 70 eV. The solvent delay was 0-3.5 min. The inlet temperature was set at 290 °C, source temperature at 250 °C. MS Workstation 8 was used to handle mass spectra and chromatograms.

Table 1: Mean fatty acid profiles of *S. zeylanicum* var. *zeylanicum* fruits

Fatty acids	% total fatty acids
Lauric Acid (C12:0)	0.21±0.04
Myristic Acid (C14:0)	0.60±0.11
Palmitoleic Acid (C16:1)	0.18±0.06
Palmitic Acid (C16:0)	18.82±0.21
Linoleic Acid (C18:2)	31.14±0.35
cis-Oleic Acid (C18:1)	43.47±0.62
Stearic Acid (C18:0)	3.80±0.14
cis-11-Eicosenoic Acid (C20:1)	0.56±0.23
Arachidic Acid (C20:0)	1.08±0.16
Arachidonic Acid (C20:4)	0.15±0.22
Total Saturated fatty acids	24.51
Total Monounsaturated fatty acids	44.21
Total Polyunsaturated fatty acid	31.29

Values are mean±standard error (n=3)

RESULTS

The fatty acid profile of *SZZ* fruits is shown in table 1. The predominant fatty acid was cis-oleic acid (43.47±0.62%). The linoleic acid content of the sample was 31.14±0.35%. The third most abundant fatty acid was Palmitic acid (18.82±0.21%). Stearic acid and Arachidic acid showed, 3.80±0.14 % and 1.08±0.16% respectively. Trace amounts of Lauric acid, Myristic acid, Palmitoleic acid, cis-11-Eicosenoic acid and Arachidonic acid were also detected. Total saturated fatty acids in the sample was 24.51%. Monounsaturated fatty acids added up to 44.21%. The polyunsaturated fatty acids (Linoleic acid and Arachidonic acid) showed an aggregate of 31.29%. The ratio of saturated to unsaturated fatty acids was 75.5:24.5 which is roughly 3:1. Fig. 1 shows the GC-MS/MS chromatogram of *SZZ* fruit.

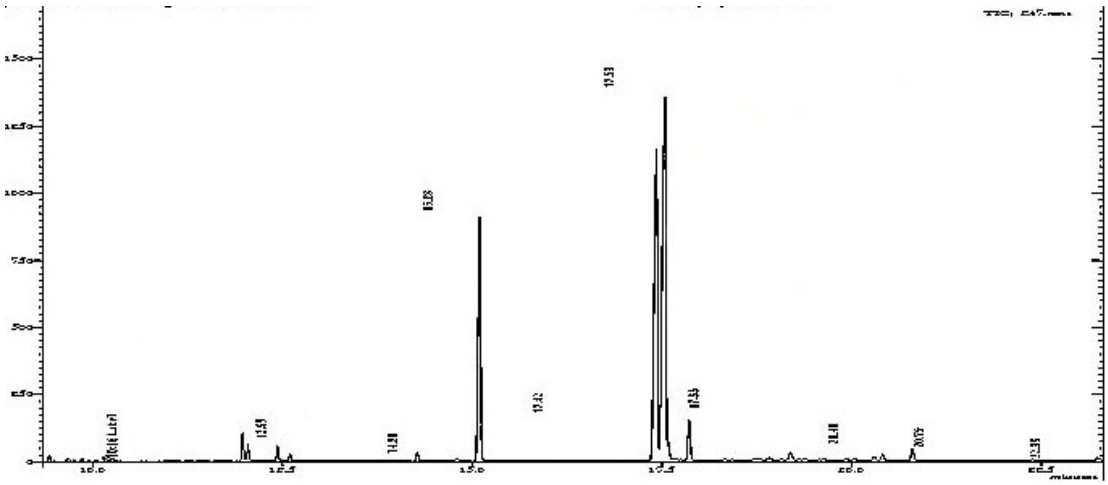

Fig. 1: GC-MS/MS chromatogram of *S. zeylanicum* var. *zeylanicum* fruit

DISCUSSION

Fatty acids that have only single bonds in their carbon chain are called monounsaturated fatty acids (MUFAs). The total MUFA content of *S. zeylanicum* var. *zeylanicum* fruit was 44.21%. MUFAs are known to have numerous health benefits. Dietary intake of MUFA improves the blood lipid profile and helps lower blood glucose levels [7]. The incidence of breast cancer was observed to be considerably lower when the diet was rich in MUFA [8]. MUFA helps lower blood pressure and decreases the chance of developing coronary heart disease [9].

Olives and peanuts are good sources of MUFA, especially cis-oleic acid. The oleic acid content of olives and peanut are 75 % and 48 % respectively [10]. The most abundant fatty acid in *SZZ* fruit was cis-oleic acid, whose relative composition was 43.47±0.62 %. Apart from being hypotensive, oleic acid also lowers the chance of developing ulcerative colitis [11]. It is known that obesity causes insulin resistance and type II diabetes. Vassilou *et al.* in 2009 reported that oleic acid reverses insulin resistance brought on by obesity and has a positive effect on type II diabetes [12]. The role of oleic acid in brain function was established by Hussain *et al.* in 2013 [13]. Lipid peroxidation is a degenerative process that eventually destroys the integrity of biological membranes and releases products that are harmful to the cell [14]. Oleic acid is less susceptible to lipid peroxidation than polyunsaturated fatty acids [15]. Polyunsaturated fatty acids (PUFAs) have more than one double bond in their carbon chain. The ratio of cis-oleic acid-PUFA in *SZZ* fruits was 43.47:31.29. A high ratio between oleic acid and polyunsaturated fatty acids protects lipids from peroxidation and oxidative damage [16].

The ratio of monounsaturated to polyunsaturated fatty acid in *SZZ* fruits was 44.21:31.29, which is approximately 7:5. According to studies, a high MUFA to PUFA ratio benefits the heart and keeps cardiovascular diseases at bay [17, 18].

The major PUFA in the analysed material was Linoleic acid. It is an omega-6 fatty acid essential for the maintenance of healthy skin. Linoleic acid prevents loss of water from the skin and forms a barrier of sorts to undesirable chemicals in the environment [19]. The deficiency of linoleic acid manifests itself in the form of dry, scaly skin [20]. In a study conducted by Ando *et al.* in 1998, linoleic acid was found to have a skin lightening effect [21].

The fatty acid profile of *SZZ* fruits shows a 3:1 ratio of unsaturated to saturated fatty acids. The inclusion of saturated fatty acids (the fatty acids that lack double bonds in their structure) in the diet has negative implications on health. Substituting saturated fats in the diet with unsaturated fatty acids, improves lipid profile of the blood and decreases the risk of cardiovascular diseases [22]. The results of this study differs from a previous report by Shilpa and

Krishnakumar (2015), in terms of the composition and proportion of fatty acids [23]. The current study has focused on the variety *zeylanicum* of *S. zeylanicum*, where as the earlier report does not mention the variety.

Table 2: Comparison of fatty acid composition of some common fruits [10] with *S. zeylanicum* var. *zeylanicum*

Plants	Fatty acids			
	C16:0	C18:0	C18:1	C18:2
Syzygium zeylanicum var. *zeylanicum*	18.82	3.8	43.47	31.14
Olive (*Olea europea*)	11	2	76	8
Canola (*Brassica napus*)	4	2	59	21
Peanut (*Arachis hypogea*)	10	2	48	34
Sunflower (*Helianthus annuus*)	7	3	21	69
Coconut (*Cocos nucifera*)	9	3	6	2
Soyabean (*Glycine max*)	11	4	24	54
Palm (*Elaeis guineensis*)	46	4	38	10

C16:0 Palmitic acid, C18:0 Stearic acid, C18:1 Oleic acid, C18:2 Linoleic acid

Table 2 compares the fatty acid composition of some commonly used oils with *SZZ.* The order of abundance of fatty acids, in some of the healthiest oils, *viz*. olive, canola, peanut oils is, Oleic acid>Linoleic acid>Palmitic acid>Stearic acid. *SZZ* also follows this order. In *SZZ* palmitic acid content is quite high at 18.82±0.21%, but it is compensated by much higher concentrations of unsaturated fatty acids. Like the other recommended oils, *SZZ* too shows a healthy balance between unsaturated and saturated fats.

CONCLUSION

The present study reveals that *S. zeylanicum* var. *zeylanicum*is a good source of beneficial fatty acids. It is suggested that the consumption of the fruits be encouraged and efforts be taken to popularize the fruits. Owing to high Linoleic acid content, the fruits may find use in the cosmetic industry.

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CONFLICTS OF INTERESTS

All authors have none to declare

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