

## DETERMINATION OF FATTY ACIDS IN *SOLANUM SURATTENSE* BURM. F. BY USING GAS CHROMATOGRAPHY

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### ABSTRACT

**Objective:** This study aims to document the fatty acid composition of *Solanum surattense* Burm. f. collected from hot desert of India, Rajasthan.

**Methods:** The fatty acid analysis was performed by gas chromatography-flame ionization detector (GC-FID). The operating conditions used to examine methyl esters of fatty acids are as follows. Fatty acids were converted into methyl esters (FAMES) before GC analysis according to the standard methods by Ranganna (1986). Quantitative determinations of FAMES were conducted using GC-FID and capillary column HP-88 Agilent Technologies.

**Results:** The most abundant fatty was palmitic acid (13.2%), oleic acid (22.9%), and linoleic acid (11.9%). This plant is good source of important fatty acids including all the groups of saturated, monounsaturated, and polyunsaturated fatty acids (MUFAs and PUFAs) and can be used as a commercial source of fatty acids especially MUFAs and PUFAs.

**Conclusion:** The plant is well studied for various pharmacological activities such as antiasthmatic, anticancer, cardiovascular, and hepatoprotective. Determination of fatty acid profiles in nutritional and clinical research with precision and fastness has become popular for human health and basic research.

**Keywords:** Desert, Fatty acid profiling, Gas chromatography, *Solanum surattense*.

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### INTRODUCTION

*Solanum surattense* Burm. f. commonly known as Kantkari, belongs to family Solanaceae (Fig. 1). It is distributed to plains and lower hills of India. It is a herbaceous spiny perennial herb with prominent nodes and internodes. Roots are almost cylindrical and tapering. Flowers are purple colored and in few-flowered axillary cymes with glabrous, globular berry which is green when young and turns yellow at maturity. Seeds are smooth, compressed, and reniform with bitter taste. It is known for its traditional medical value, and recent scientific studies have emphasized the possible use of this plant in modern medicine system. India is rich with its biodiversity and knowledge of rich ancient traditional systems of medicine such as Ayurveda, Siddha, Unani, Amchi, and local health traditions [1]. Wild plants serve as an indispensable constituent of the human diet. They supply with minerals, vitamins, protein, and certain hormone precursors [2-4]. However, there is need to study the inexpensive nutritive value of these wild plants so that these can be exploited for their pharmaceutical preparations.

*S. surattense* Burm. f. contains alkaloids, flavonoids, amino acids, sterols, proteins, etc. All the aspects of the plant are well studied previously by many workers. However, the fatty acids profiling of the plant is not yet studied. Hence, the present investigation is undertaken. Each fatty acid has its own discrete biological activity [5,6]. There are many methods to identify fatty acids and their derivatives (fatty acid methyl esters [FAME]) such as gas chromatography-mass spectrometry (GC-MS), GC-flame ionization detector (GC-FID), high-performance chromatography (HPLC), nuclear magnetic resonance spectroscopy, and silver performance liquid chromatography. GC is widely adopted as a highly applicable tool in microscale analytical work in analysis of fatty acids. GC analysis of fatty acids require derivatization as the boiling point of the fatty acids is very high which makes them difficult to evaporate and has low FID response [7]. GC coupled with FID is widely used, as it is a rapid and efficient method. Moreover, separation, quantification, and

identification of long chain fatty acids mixture, which is done by GC-FID, are utilized to acquire the information about various biological functions. Determination of fatty acid profiles in nutritional and clinical research with precision and fastness has become popular for human health and basic research.

### METHODS

*S. surattense* Burm. f. was collected from Bikaner district of Rajasthan and voucher specimens were submitted in the Herbarium, Department of Botany, Punjabi University, Patiala (PUN). Identification of plant was done by Botanical Survey of India, Jodhpur, Rajasthan. Plant materials were washed with water and shade dried at room temperature. The dried plants were crushed into powder for further analysis.

HPLC grade n-hexane, toluene, activated sodium sulfate, and GR grade petroleum ether were purchased from Merck. Suprapur sulfuric acid and pestanal grade methanol from Sigma. Trans methylene mixture (15 ml methanol, 7 ml toluene, and 0.75 ml sulfuric acid) was used. Certified reference material FAME-37 MIX SUPELCO was purchased from Sigma-Aldrich Chemical Company, containing methyl esters of fatty acids including key monounsaturated and polyunsaturated fatty acids (MUFA and PUFA).

### Preparation of methyl esters of fatty acids and GC analysis of flames

The preparation of trans-methyl mixture was carried out by mixing 150 ml of methanol and 70 ml of toluene and then, adding 7.5 ml of concentrated sulfuric acid to it. 10-12 mg of fat was added to 10 ml of transmethylation mixture. This mixture was heated in a water bath under reflux for 90 minutes. After cooling, 10 ml of petroleum ether (40-60°C) and 10 ml of water was added. The mixture was shaken well, and the layers were allowed to separate. The aqueous layer was pipetted. The washing was repeated using 10 ml of water. Afterward, 2-3 g of anhydrous sodium sulfate was added to remove the moisture.

Decanted the clear ether layer and evaporated to dryness. Residue was dissolved the residue in 0.3 ml of petroleum ether for GC.

FAMES before GC analysis according to the standard methods by Ranganna (1986). Quantitative determinations of FAMES were conducted using GC-FID and capillary column HP-88 Agilent Technologies (100 mm × 0.25 mm × 0.20 μ). The injection volume was 1.0 μL, with split mode of injection, oven temperature was kept at 250°C, and helium was used as carrier gas. The temperature program increased from 40°C to 140°C. The retention time of the FAMES was compared with that of the standards (FAME-37 MIX SUPELCO) for the identification and quantification.

**Fatty acid analysis**

Fatty acid profiling of the whole plant of *S. surattense* Burm. f. collected from wild localities of Rajasthan is studied. Fatty acids were identified as methyl esters in the methylated samples. Saturated fatty acids (SFAs), MUFAs, and PUFAs were analyzed separately (Table 1). GC-FID chromatogram of all the fatty acids was generated. The resolution of the peaks is very high, the peaks of saturated and unsaturated fatty acids do not coincide, and full picture of analysis of fatty acids is clear (Fig. 1).

The amount of MUFAs and PUFAs was higher than SAFs. The principle fatty acid among saturated fatty (SFAs) acid was palmitic acid (13.2%)

followed by myristic acid (5.89%) and behenic acid (3.8%); among MUFAs its oleic acid (22.9%) followed by Cis-11-eicosenoic acid (8.4%) and among PUFAs acid linoleic acid (11.9%) followed by linolenic acid (11.44%) (Figs. 2 and 3). The most abundant PUFAs were linolenic acid and linoleic acid. Cardiovascular diseases such as hypertension, aneurysm, and thrombosis are responsible for 30% of deaths according to 2005 data of the World Health Organization. Cigarette consumption, low physical activity, obesity, and malnutrition constitute the risk factors for cardiovascular diseases.



Fig. 1: Field picture of *Solanum surattense* Burm. f.

Table 1: Total fatty acid content of *Solanum surattense* Burm. f.

S. No.	Fatty acid	Composition (%)
<b>A. SFA</b>		
1.	Butyric acid	Nd
2.	Caproic acid	0.067
3.	Caprylic acid	0.117
4.	Caproic acid	0.172
5.	Undecanoic acid	0.517
6.	Lauric acid	1.161
7.	Tridecanoic acid	Nd
8.	Myristic acid	5.894
9.	Pentadecanoic acid	0.750
10.	Palmitic acid	13.263
11.	Heptadecanoic acid	1.386
12.	Stearic acid	1.810
13.	Arachidic acid	Nd
14.	Heneicosanoic acid	0.398
15.	Behenic acid	3.806
16.	Tricosanoic acid	1.038
17.	Lignoceric acid	5.342
<b>B. MUFA</b>		
1.	Myristoleic acid	0.096
2.	Cis-10 pentadecenoic acid	Nd
3.	Palmitoleic acid	2.553
4.	Cis-10 heptadecenoic acid	0.338
5.	Oleic acid	22.951
6.	Cis-11-eicosanoic acid	8.406
7.	Erucic acid	Nd
8.	Nervonic acid	Nd
<b>C. PUFA</b>		
1.	Linoleic acid	11.922
2.	Y-linoleic acid	4.553
3.	Linolenic acid	11.441
4.	Cis-11,14-eicosadienoic acid	Nd
5.	Cis-8,11,14-eicosatrienoic acid	Nd
6.	Cis-11,14,17-eicosatrienoic acid	0.309
7.	Arachidonic acid	1.147
8.	Cis-13,16-docosadienoic acid	Nd
9.	Cis-5,8,11,14,17-ecosapentenoic acid	Nd
10.	Cis-4,7,10,13,16,19-docosahexanoic acid	0.564
<b>D. Trans fatty acid</b>		
1.	Trans elaidic acid	Nd
2.	Trans linolelaidic acid	Nd

SFA: Saturated fatty acid, MUFA: Monounsaturated fatty acid, PUFA: polyunsaturated fatty acid

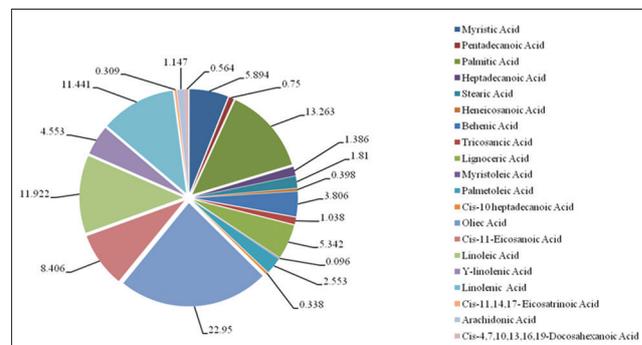


Fig. 2: Diagrammatic representation of the total fatty acid content of wild *Solanum surattense* Burm. f. collected from hot desert of India

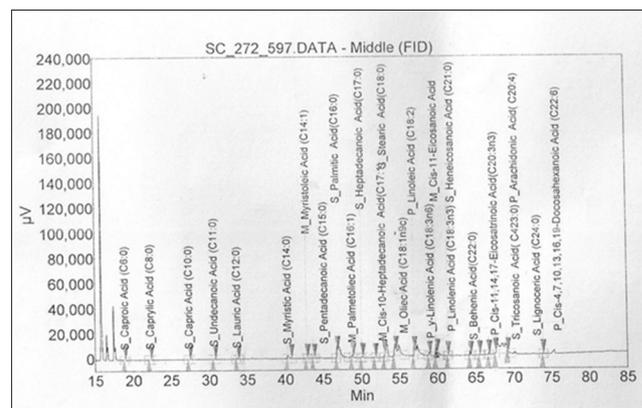


Fig. 3: Gas chromatography-flame ionization detector chromatogram of fatty acid profiling in *Solanum surattense* Burm. f.

MUFAs are naturally present in whole fat milk products, red meat, nuts and dry fruits, olives, and avocados. PUFAs are found in grapes, almonds, oils (coconut, safflower, olive, rice bran oil, and hemp oil), pumpkin seeds, and wheat germ. These are also present in mushrooms and algal organisms. Jayasree *et al.* [8] reported 64.86% of SFAs; 8.36% MUFAs, and 26.6% PUFAs in red algae. Fatty acid composition of *Pleurotus eous* was studied by Suseem and Saral [9].

#### DISCUSSION

PUFAs have a very diverse effect on human health. These help in the prevention of cardiovascular diseases, cancer, and coronary heart diseases. Their non-substitutable roles in many biological pathways are crucial [10,11]. These are also very helpful in the treatment of diabetes type two, hypertension, autoimmune diseases, renal diseases, and rheumatoid arthritis. The fatty acids profile plays a prominent role in exploitation. Earlier there are no reports of fatty acid profiling of this plant. The present research is undertaken to study the total fatty acid profiling of *S. surattense* the results suggest that this plant is a good source of important fatty acids including all the groups of SFAs, MUFAs, and PUFAs and can be used as a commercial source of fatty acids especially MUFAs and PUFAs. *S. surattense* can be used as a new potential source of fatty acids.

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#### REFERENCES

1. Pandey MM, Rastogi S, Rawat AK. Indian herbal drug for general healthcare: An overview. *Internet J Altern Med* 2008;6:1.
2. Edmonds JM, Chweya JA. Promoting the Conservation and Use of Under-Utilized and Neglected Crops: Black Nightshades (*Solanum nigrum* L.) And Related Species. Rome, Italy: International Plant Genetic Resources Institute; 1997. p1-90.
3. Fleuret A. The role of wild food plants in the diet. A case study from Lushoto, Tanzania. *Ecol Food Nutr* 1979;8:87-93.
4. National Academy of Science. Recommended Dietary. Washington, DC: National Academy of Science; 2000.
5. Department of Health. Nutritional Aspects of Cardiovascular Diseases. H. M. Stationery Office. London. Reports on Health and Social Subjects Number. 46; 1994.
6. Rochforta S, Parkerb AJ, Dunsheac FR. Plant bioactives for ruminant health and productivity. *Phytochemistry* 2008;69(2):299-322.
7. Laakso TS, Laakso I, Hiltunen R. Analysis of fatty acids by gas chromatography, and its relevance to research on health and nutrition. *Ann Chim Acta* 2002;465:39-62.
8. Jayasree N, Aneesh T, Prabhakar V, Anandan R. GC-MS, HPLC and AAS analysis of fatty acids, amino acids and minerals in red algae *Amphiroa anceps*. *Int J Pharm Pharm Sci* 2011;4(1):187-90.
9. Suseem SR, Saral AM. Analysis on essential fatty acid esters of mushroom *Pleurotus eous* and its antibacterial activity. *Asian J Pharm Clin Res* 2013;6(1):188-91.
10. Abedi E, Sahari MA. Long chain polyunsaturated fatty acid sources and evaluation of their nutritional and functional properties. *Food Sci Nutr* 2014;2(5):443-63.
11. De Caterina R, Liao JK, Libby P. Fatty acid modulation of endothelial activation. *Am J Clin Nutr* 2000;71(1):213-23.