GC-MS ANALYSIS OF FATTY ACIDS AND ESTERS IN THE ETHANOLIC

EXTRACT OF Sphenocentrum jollyanum

BY

AKWAGWA SHERIFF CLIFFORD

BMS2101377

A PROJECT SUBMITTED TO THE DEPARTMENT OF MEDICAL BIOCHEMISTRY, SCHOOL OF BASIC MEDICAL SCIENCES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD

OF BACHELOR OF SCIENCE, B.Sc. (HONS) MEDICAL BIOCHEMISTRY, OF THE UNIVERSITY OF BENIN, BENIN CITY

NOVEMBER, 2025

GC-MS ANALYSIS OF FATTY ACIDS AND ESTERS IN THE ETHANOLIC

EXTRACT OF Sphenocentrum jollyanum

BY

AKWAGWA SHERIFF CLIFFORD

BMS2101377

A PROJECT SUBMITTED TO THE DEPARTMENT OF MEDICAL BIOCHEMISTRY, SCHOOL OF BASIC MEDICAL SCIENCES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF SCIENCE, B.Sc. (HONS) MEDICAL BIOCHEMISTRY, OF THE UNIVERSITY OF BENIN, BENIN CITY

NOVEMBER, 2025

CERTIFICATION

We the undersigned hereby certify that AKWAGWA SHERIFF CLIFFORD (BMS2101377) carried out this research in the Department of Medical Biochemistry, University of Benin, Benin city and thereby approve same as adequate in scope and quality for the award of Bachelor of Science Degree (B.Sc) in Medical Biochemistry.

..... **.....**

Prof. F.E. Olumese **(Date)**

(Project Supervisor

..... **.....**

.

Dr. N.B. Aguebor-Ogie **(Date)**

(Head of Department)

…… **…….**

.

External Examiner **(Date)**

DEDICATION

This project is dedicated to Almighty God, the giver of life who has made it possible to complete my Bachelor of Science Degree (B.Sc) program in the Department of Medical Biochemistry and my entire family for their tender care and love for me.

ACKNOWLEDGEMENT

My gratitude goes for Almighty God for his grace in all my endeavors, unto him is all the glory. My sincere appreciation goes to my amiable supervisor Prof. F.E. Olumese, alongside the Head of Department, Dr. N. B. Aguebor-Ogie, as well as other lecturers in the department for their words of wisdom and encouragement.

ABSTRACT

38

27

23

Sphenocentrum jollyanum is a highly valued West African medicinal plant traditionally used for

fever, inflammation, and as a stimulant. While previous research focused on its alkaloids, this study

aimed to characterize the lipophilic fraction, specifically fatty acids and their esters, in the

ethanolic stem extract using Gas Chromatography-Mass Spectrometry (GC-MS). The analysis

identified nineteen fatty acids and ester constituents, confirming that this fraction accounts for

approximately 75% of the total measured semi-volatile content. The major components were

derivatives of C18 fatty acids, occurring as native glycerides and alkyl esters. Key compounds

identified included the triglyceride 9-Octadecenoic acid, 1,2,3-propanetriyl ester (triolein,

13.46%), the diglyceride Octadecanoic acid, 2-hydroxy-1,3-propanediyl bis(ester) (distearin,

11.92%), and (E)-9-Octadecenoic acid ethyl ester (9.93%). The presence of numerous ethyl esters

was attributed to transesterification catalyzed by the ethanol solvent during extraction. The profile

is notably rich in monounsaturated oleic acid derivatives. This high concentration of anti

inflammatory lipids provides a strong biochemical justification for the plant's traditional use in

managing inflammatory conditions. The findings significantly expand the phytochemical

knowledge of S. jollyanum and establish a foundational chemical profile essential for the quality

control and standardization of its herbal preparations.

20

vi

vii

TABLE OF CONTENTS

25

54

70

73

79

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Natural products continue to be an indispensable reservoir for novel therapeutic agents, largely

due to their extensive chemical diversity and broad-spectrum biological activities (Elshafie et al.,

2023). The pharmacological properties of medicinal plants are attributed to their rich repertoire of

secondary metabolites, including alkaloids, flavonoids, terpenoids, and crucially, lipid-soluble

compounds such as fatty acids and esters (Singh et al., 2024; Shrivastava & Mishra, 2019). While

many studies focus on polar bioactive constituents, the lipophilic fraction, particularly fatty acids

and their ester derivatives, has gained significant attention for its role in anti-inflammatory,

antimicrobial, and neuroprotective activities, as well as its nutritional importance (Vaou et al.,

2022).

Sphenocentrum jollyanum, commonly known as Akerejupon or Ewe Oku, is a valuable medicinal

plant of the Menispermaceae family, predominantly found in the tropical rainforests of West

Africa. The plant is easily recognized by its distinctive bright red fruits and is highly esteemed in

ethnomedicine (Odukoya et al., 2021). Traditionally, various parts of the plant, especially the roots

and leaves, are employed in decoctions or infusions for the treatment of malaria, fever,

inflammatory conditions, and as a general stimulant (Olurinde et al., 2023). Previous

phytochemical investigations have predominantly highlighted the presence of isoquinoline

alkaloids, which are credited for its analgesic and antipyretic properties. However, the lipophilic

profile, specifically the composition of fatty acids and esters, remains largely unexplored despite

its potential contribution to the plant's overall therapeutic efficacy (Bello et al., 2024).

1

A comprehensive characterization of these non-polar constituents is essential for the

standardization of herbal formulations, the validation of ethnomedicinal claims, and the discovery

of novel bioactive lead compounds (Iyoha et al., 2025; Ogbuagu et al., 2022). Among modern

analytical techniques, Gas Chromatography-Mass Spectrometry (GC-MS) stands as a powerful

and reliable tool for the separation, identification, and quantification of volatile and semi-volatile

compounds, including fatty acids and their ester derivatives (Chiaia et al., 2025). The application

of GC-MS in phytochemical analysis not only facilitates the precise identification of individual

components but also supports quality control by detecting adulterants and ensuring batch-to-batch

consistency in plant-based products (Zhang et al., 2023). Given the ethnopharmacological

significance of S. jollyanum and the documented bioactivity of fatty acids, a dedicated GC-MS

analysis of its fatty acid and ester content is warranted to fill a critical knowledge gap and unlock

its full phytotherapeutic potential.

47

1.2 Aim of the Study

The aim of this study is to identify and characterize the fatty acids and ester constituents present

48

in the ethanolic extract of Sphenocentrum jollyanum roots using Gas Chromatography-Mass

Spectrometry (GC-MS).

21

1.3 Objectives of the Study

To achieve the stated aim, the following specific objectives were pursued:

1.

2.

3.

To collect, authenticate, and prepare the stem sample of Sphenocentrum jollyanum.

To obtain the crude ethanolic extract of the prepared stem sample.

To perform GC-MS analysis on the derivatized sample to separate and identify the constituent fatty acids and esters.

2

4.

28

To identify the individual compounds by comparing their mass spectral fragmentation patterns with reference spectra in the National Institute of Standards and Technology (NIST) library database.

1.4 Justification of the Study

This research provides comprehensive profile of fatty acids and esters in the ethanolic extract of

Sphenocentrum jollyanum stem. The findings will significantly contribute to the existing

phytochemical database of this important medicinal plant, offering a scientific basis for some of

its traditional uses, particularly those related to inflammatory and infectious diseases where fatty

acids are known to play a role. Furthermore, identifying these lipophilic compounds could reveal

novel molecules with potential applications in nutraceutical and pharmaceutical industries, thereby

adding value to the plant beyond its known alkaloidal content. The study also establishes a

foundational protocol for the quality control of S. jollyanum-based herbal products.