

***In vitro* COMPARATIVE ASSESSMENT OF THE  
PHYTOCHEMICAL, ANTIOXIDANT, ANTIDIABETIC AND  
ANTIOBESITY ACTIVITIES OF SELECTED MEDICINAL PLANTS**

**OGUNDIPE, ADEBANKE ELIZABETH**

**Matriculation Number: 14CP017651**

**B.Sc. Biochemistry, Covenant University, Ogun State**

**SEPTEMBER, 2021**

***In vitro* COMPARATIVE ASSESSMENT OF THE  
PHYTOCHEMICAL, ANTIOXIDANT, ANTIDIABETIC AND  
ANTIOBESITY ACTIVITIES OF SELECTED MEDICINAL PLANTS**

**BY**

**OGUNDIPE, ADEBANKE ELIZABETH  
Matriculation Number: 14CP017651  
B.Sc. Biochemistry, Covenant University, Ogun State**

**A DISSERTATION SUBMITTED TO THE DEPARTMENT OF  
BIOCHEMISTRY, COLLEGE OF SCIENCE AND TECHNOLOGY,  
COVENANT UNIVERSITY, OTA, OGUN STATE, NIGERIA IN  
PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE  
AWARD OF MASTER OF SCIENCE (M.Sc.) DEGREE IN  
BIOCHEMISTRY.**

**SEPTEMBER, 2021.**

## **ACCEPTANCE**

This is to attest that this dissertation is accepted in partial fulfilment of the requirements for the award of Master of Science (M.Sc.) degree in Biochemistry in the Department of Biochemistry, College of Science and Technology, Covenant University, Ota.

**Mr. John A. Philip**  
(Secretary School of Postgraduate Studies)

.....  
**Signature & Date**

**Prof. Akan B. Williams**  
(Dean, School of Postgraduate Studies)

.....  
**Signature & Date**

## **DECLARATION**

**I, OGUNDIPE, ADEBANKE ELIZABETH with matriculation number 14CP017651,** affirm that this research was carried out by me under the supervision of Prof. Ogunlana O. Olubanke of the Department of Biochemistry, Covenant University. I attest that the dissertation has not been presented either wholly or partly for the award of any degree elsewhere. All the sources of materials and scholarly publications used in the dissertation have been duly acknowledged accordingly.

**OGUNDIPE, ADEBANKE ELIZABETH**

.....  
**Signature & Date**

## CERTIFICATION

I certify that this dissertation titled “*in vitro* comparative assessment of the phytochemical, antioxidant, antidiabetic and antiobesity activities of selected medicinal plants’ is an original work carried out by **OGUNDIPE, ADEBANKE ELIZABETH** with the matriculation number **14CP017651** in the Department of Biochemistry, College of Science and Technology, Covenant University, Ota, Ogun State, Nigeria, under the supervision of Prof. Ogunlana, Olubanke. We have examined and found the work acceptable for the award of a Master of Science (M.Sc.) degree in Biochemistry.

**Prof. Olubanke Ogunlana**  
Supervisor

.....  
**Signature & Date**

**Prof. I.S. Afolabi**  
Head of Department

.....  
**Signature & Date**

**Prof. J. Ajele**  
External Examiner

.....  
**Signature & Date**

**Prof. Akan B. Williams**  
Dean, School of Postgraduate Studies

.....  
**Signature & Date**

## **DEDICATION**

This report is dedicated to the Almighty God for life, supernatural provision, divine wisdom and favour all through this Masters programme.

Also to my world best parents (Mr. and Deaconess E.A. Ogundipe) and amazing siblings for their sacrificial love, care, unending support towards my success and progress in life. May God continue to strengthen you and you shall both eat the fruit of your labour in Jesus' name.

## **ACKNOWLEDGMENTS**

I am ever grateful to Almighty God for His unfailing love, life, wisdom, provision and divine favour all through my journey throughout this Masters programme.

My sincere appreciation goes to my parents and siblings for their unlimited love, care, prayers, support and encouragements. May God continue to strengthen you and grant you all your heart desires in Jesus' name.

My gratitude goes to the Head of Department Biochemistry, for his advice and support towards the success of the programme.

I sincerely appreciate my supervisor for her sacrifices, motherly advise, support, patience and care during the course of this project. I pray the divine favour of God locate you and your family in Jesus' name.

I am ever grateful to all the faculty and staff in the department of Biochemistry for their support towards the success of this project.

Finally, I thank my course mates, friends and to all my loved ones for their contributions and encouragements throughout my Masters programme. May you continue to experience good things in your all endeavours in Jesus' name.

## TABLE OF CONTENTS

<b>ACCEPTANCE</b>	<b>iii</b>
<b>DECLARATION</b>	<b>iv</b>
<b>CERTIFICATION</b>	<b>v</b>
<b>DEDICATION</b>	<b>vi</b>
<b>ACKNOWLEDGEMENTS</b>	<b>vii</b>
<b>TABLE OF CONTENTS</b>	<b>viii</b>
<b>LIST OF FIGURES</b>	<b>x</b>
<b>LIST OF TABLES</b>	<b>xii</b>
<b>LIST OF ABBREVIATIONS</b>	<b>xiii</b>
<b>ABSTRACT</b>	<b>xiv</b>
<b>CHAPTER ONE</b>	<b>1</b>
<b>INTRODUCTION</b>	<b>1</b>
<b>1.1 Background to the study</b>	<b>1</b>
<b>1.2 Statement of problem</b>	<b>4</b>
<b>1.3 Justification of the study</b>	<b>6</b>
<b>1.4 Aim</b>	<b>8</b>
<b>1.5 Specific objectives</b>	<b>9</b>
<b>CHAPTER TWO</b>	<b>9</b>
<b>LITERATURE REVIEW</b>	<b>9</b>
<b>2.1 Diabetes mellitus</b>	<b>9</b>
<b>2.2 Obesity</b>	<b>25</b>
<b>2.3 Oxidative stress</b>	<b>34</b>
<b>2.4 Antioxidants</b>	<b>36</b>



<b>2.5 Phytochemistry of medicinal plants</b>	<b>41</b>
<b>CHAPTER THREE</b>	<b>57</b>
<b>MATERIALS AND METHODS</b>	<b>57</b>
<b>3.1 Equipment and materials</b>	<b>57</b>
<b>3.2 Plants collection</b>	<b>58</b>
<b>3.3 Phytochemical screening</b>	<b>58</b>
<b>3.4 Gas chromatography mass spectrometry (GC-MS)</b>	<b>60</b>
<b>3.5 Total protein content</b>	<b>61</b>
<b>3.6 Antioxidant activity</b>	<b>61</b>
<b>3.7 Enzyme inhibition study</b>	<b>64</b>
<b>CHAPTER FOUR</b>	<b>66</b>
<b>RESULT</b>	<b>66</b>
<b>4.1 Voucher reference and extraction yield of the selected plants</b>	<b>66</b>
<b>4.2 Quantitative phytochemical and total protein estimation</b>	<b>66</b>
<b>4.3 GC-MS analysis</b>	<b>68</b>
<b>4.4 <i>In vitro</i> antioxidant activity</b>	<b>73</b>
<b>4.5 <i>In vitro</i> enzyme inhibitory activity</b>	<b>78</b>
<b>CHAPTER FIVE</b>	<b>81</b>
<b>5.1 Discussion</b>	<b>81</b>
<b>CHAPTER SIX</b>	<b>83</b>
<b>6.1 Summary of findings</b>	<b>83</b>
<b>6.2 Conclusion</b>	<b>83</b>
<b>6.3 Contribution to knowledge</b>	<b>83</b>

<b>6.4 Recommendation</b>	<b>83</b>
<b>REFERENCES</b>	<b>84</b>
<b>APPENDIX</b>	<b>100</b>

## LIST OF FIGURES

<b>FIGURES</b>	<b>TITLES</b>	<b>PAGES</b>
2.1	Pathophysiology and pathogenesis of diabetes mellitus	10
2.2	Potential target for therapeutic intervention of T1DM	13
2.3	Formation of free radicals	36
2.4	<i>Phyllanthus amarus</i> leaves	52
2.5	<i>Moringa olifera</i> leaves	53
2.6	<i>Ficus exasperata</i> leaves	55
2.7	<i>Brophyllum pinnatum</i> leaves	56
4.1	Graph of DPPH scavenging activity	73
4.2	Graph of ABTS scavenging activity	75
4.3	Effect of plants extracts on alpha amylase activity	78
4.4	Effect of plant extracts on pancreatic lipase activity	79

## LIST OF TABLES

<b>Tables</b>	<b>Titles</b>	<b>Pages</b>
4.1	Phytochemical screening and total protein of selected plant extracts	66
4.2	Bioactive compounds identified using GCMS from plant samples	68
4.3	Mean $\pm$ SEM of FRAP and TAC antioxidant assay	76
4.4	IC <sub>50</sub> values of selected medicinal plants	76

## ABBREVIATIONS

ROS	Reactive oxygen species
RSS	Reactive sulphur species
T1DM	Type 1 diabetes mellitus
T2DM	Type 2 diabetes mellitus
FFA	Free fatty acids
TAC	Total antioxidant capacity
DPPH	2,2-diphenyl-1-picrylhydrazyl
ABTS	2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid
FRAP	Ferric reducing antioxidant power
NO	Nitric oxide
BSA	Bovine serum albumin
ADA	American Diabetes Association
IDF	International Diabetes Federation
BHT	Butylated hydroxyanisole
NO <sub>x</sub>	oxides of Nitrogen
FFA	Free fatty acids
GCMS	Gas Chromatography Mass Spectrometry
BHA	Butylated hydroxyanisole
GAE	Gallic acid equivalent
F-C	Folin–Ciocalteu

## ABSTRACT

Diabetes mellitus is a metabolic disorder characterised by hyperglycaemia, and obesity occurs due to excessive fats accumulation in the adipose tissue. Oxidative stress has been linked to the pathogenesis of these metabolic disorders. This study is aimed to investigate the phytochemical, antioxidant, antidiabetic and antiobesity activities of the aqueous ethanol extracts (AEEs) of the leaves of *Bryophyllum pinnatum*, *Ficus exasperata*, *Moringa oleifera*, and *Phyllanthus amarus*. *In vitro* phytochemicals screening, gas chromatography-mass spectrometry (GC-MS) analysis, antioxidant activity, and carbohydrate and lipid inhibitory enzymes study were assessed using the established biochemical methods. The phenolic, tannin and protein contents of *P. amarus* were highest ( $p < 0.05$ ), whereas *B. pinnatum* was shown to have high alkaloid content compared with other plants. GC-MS spectra identified the presence of 57, 48, 45, 40 compounds in *B. pinnatum*, *P. amarus*, *M. oleifera* and *F. exasperata* extracts, respectively. A few of the similar compounds identified are alpha terpineol, hexahydrofarnesyl acetone, 3,7,11,15-Tetramethyl-2-hexadecen-1-ol and n-Hexadecanoic acid. The 50% inhibition concentration ( $IC_{50}$ ) value 0.00000475 mg/mL and 0.0242 mg/mL of *F. exasperata* in diphenyl-2-picrylhydrazyl (DDPH) and nitric oxide assay respectively showed that it has strong antioxidant power to scavenge free radicals. This study showed *P. amarus* to have the highest inhibitory(%) activity in 2,2-azino-bis(3-ethylbenzotiazolin)-6-sulfonic acid (ABTS), ferric reducing antioxidant power (FRAP), total antioxidant capacity (TAC) scavenging assays. However, the order of the enzyme inhibitory activity of the plants is *M. oleifera* > *B. pinnatum* > *F. exasperata* > *P. amarus* for alpha-amylase activity. The inhibitory (%) activity for pancreatic lipase are in the order *M. oleifera* > *P. amarus* > *F. exasperata* > *B. pinnatum*. This study validates the use of *M. oleifera* as an effective plant-based antidiabetic and antiobesity agents for the treatment of diabetes and obesity in comparison with other selected medicinal plants.

**Keywords:** Antioxidant, oxidative stress, antiobesity, antidiabetics, medicinal plants