

## TABLE OF CONTENTS

|   |      |
|---|------|
| TITLE PAGE.....                         | i    |
| THESIS VALIDATION.....                  | iii  |
| PLAGIARISM-FREE STATEMENT.....          | iv   |
| DEDICATION PAGE.....                    | v    |
| FOREWORD.....                           | vi   |
| TABLE OF CONTENTS.....                  | ix   |
| LIST OF TABLES.....                     | xi   |
| LIST OF FIGURES.....                    | xii  |
| LIST OF APPENDICES.....                 | xiii |
| LIST OF ABBREVIATIONS.....              | xiv  |
| ABSTRACT.....                           | xv   |
| CHAPTER I. INTRODUCTION.....            | 1    |
| A. Research Background.....             | 1    |
| B. Problem Formulation.....             | 4    |
| C. Research Objectives.....             | 4    |
| D. Research Benefits.....               | 4    |
| E. Literature Review.....               | 4    |
| 1. Definition of Diabetes Mellitus..... | 4    |
| 2. DM Classification.....               | 5    |
| 3. Insulin Resistance.....              | 9    |
| 4. Glucose Transporter (GLUT).....      | 10   |
| 5. GLUT12 Transporter.....              | 14   |
| 6. C2C12 Muscle Cells.....              | 15   |
| 7. Palmitic Acid.....                   | 17   |
| 8. Naringenin.....                      | 17   |
| F. Theoretical Foundations.....         | 19   |
| G. Hypothesis.....                      | 21   |
| CHAPTER II. RESEARCH METHODS.....       | 22   |
| A. Research Design.....                 | 22   |
| B. Research Tools and Materials.....    | 22   |
| C. Research Subject.....                | 23   |
| D. Variable Operational Definition..... | 23   |

|  |    |
|--|----|
| E. Research Location .....   | 23 |
| F. Research Methodological .....   | 23 |
| 1. C2C12 Cell Culture .....  | 23 |
| 2. Myotube Differentiation .....   | 24 |
| 3. Cell Viability Check .....  | 24 |
| 4. Glucose Uptake Check.....   | 25 |
| 5. RNA Isolation .....   | 28 |
| 6. Total RNA And cDNA Synthesis Calculation .....  | 29 |
| 7. GLUT12 Expression Test .....  | 30 |
| G. Data Analysis .....   | 31 |
| H. Research Scheme .....   | 32 |
| CHAPTER III. RESULTS AND DISCUSSION .....  | 33 |
| A. Results.....  | 33 |
| 1. C2C12 Cell Culture and Myotube Differentiation Results.....                                     | 33 |
| 2. Viability Results of C2C12 Myotube Cells with Naringenin Treatment.....                         | 35 |
| 3. Determination of Insulin Resistance Model, C2C12 Myotube Cells through Glucose Uptake Test..... | 37 |
| 4. GLUT12 Expression .....   | 41 |
| B. Discussion .....  | 42 |
| CHAPTER IV. CONCLUSIONS AND SUGGESTIONS.....   | 53 |
| A. Conclusion .....  | 53 |
| B. Suggestion .....  | 53 |
| REFERENCES .....   | 54 |
| APPENDICES .....   | 58 |