

# **An experimental study of the therapeutic effect of *Nigella sativa* aqueous extract and chitosan nanoparticles on *Acanthamoeba* keratitis**

## **Thesis**

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﴿بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ﴾

قُلْ إِنْ صَلَّيْتُ وَنُسَكِيْتُ وَمَحْيَايَ  
وَمَمَاتِي لِلَّهِ رَبِّ الْعَالَمِينَ ﴿١٦٢﴾  
لَا شَرِيكَ لَهُ وَبِذَلِكَ أُمِرْتُ وَأَنَا أَوَّلُ  
الْمُسْلِمِينَ ﴿١٦٣﴾

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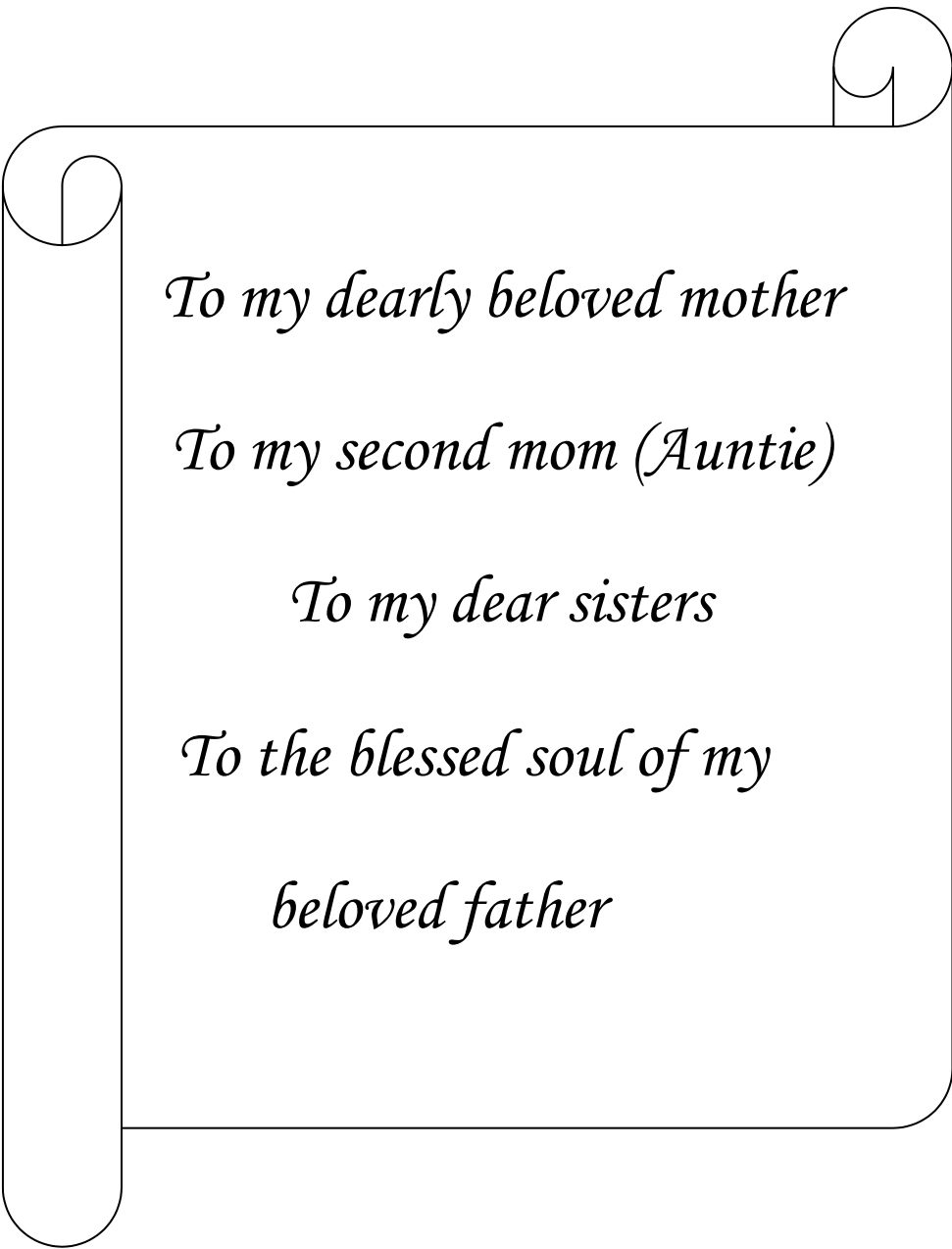
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*To my dearly beloved mother*

*To my second mom (Auntie)*

*To my dear sisters*

*To the blessed soul of my*

*beloved father*

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## LIST OF ABBREVIATIONS

|                                      |                                     |
|--------------------------------------|-------------------------------------|
| <i>A. astronyxis</i>                 | <i>Acanthamoeba astronyxis</i>      |
| <i>A. castellanii</i>                | <i>Acanthamoeba castellanii</i>     |
| <i>A. culbertsoni</i>                | <i>Acanthamoeba culbertsoni</i>     |
| <i>A. divionensis</i>                | <i>Acanthamoeba divionensis</i>     |
| <i>A. glebae</i>                     | <i>Acanthamoeba glebae</i>          |
| <i>A. hatchetti</i>                  | <i>Acanthamoeba hatchetti</i>       |
| <i>A. healyi</i>                     | <i>Acanthamoeba healyi</i>          |
| AIDS                                 | Acquired Immune Deficiency Syndrome |
| <i>A. palastiniensis</i>             | <i>Acanthamoeba palastiniensis</i>  |
| <i>A. polyphaga</i>                  | <i>Acanthamoeba polyphaga</i>       |
| <i>A. rhyodes</i>                    | <i>Acanthamoeba rhyodes</i>         |
| AK                                   | <i>Acanthamoeba</i> keratitis       |
| ALT                                  | Alanine Transferase                 |
| AM                                   | Amniotic membrane                   |
| AMT                                  | Amniotic membrane transplantation   |
| AP                                   | Alkaline phosphatase                |
| ATP                                  | <i>Adenosine triphosphate</i>       |
| β-cell                               | Beta cell                           |
| bp                                   | Base pair                           |
| °C                                   | Degree Celsius                      |
| CaCl <sub>2</sub> ·2H <sub>2</sub> O | Calcium chloride dihydrate          |
| CD                                   | Cluster of differentiation          |
| CFW                                  | Calcofluor White                    |
| Ch                                   | Chlorhexidine                       |
| cm                                   | Centimeter                          |
| CNS                                  | Central Nervous System              |
| Co.                                  | Company                             |
| COX                                  | Cyclooxygenase                      |
| CS                                   | Chitosan                            |
| CSF                                  | Cerebrospinal fluid                 |
| CS NPs                               | Chitosan nanoparticles              |

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*List of Abbreviations*

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|                                      |                                                          |
|--------------------------------------|----------------------------------------------------------|
| CT                                   | Computerized tomography                                  |
| dH <sub>2</sub> O                    | Deionized water                                          |
| DNA                                  | Deoxyribonucleic acid                                    |
| dNTP <sub>s</sub>                    | deoxynucleotide triphosphates                            |
| DD                                   | Degree of deacetylation                                  |
| DW                                   | Distilled water                                          |
| <i>E. coli</i>                       | <i>Escherichia coli</i>                                  |
| EDTA                                 | Ethylene-diamine-tetra-acetic acid                       |
| E.I.P.I.CO.                          | Egyptian International Pharmaceutical Industries Company |
| g                                    | Gram                                                     |
| GAE                                  | Granulomatous Amoebic Encephalitis                       |
| GGT                                  | Gamma-glutamyl transferase                               |
| HIV                                  | Human Immunodeficiency Virus                             |
| HPLC                                 | High performance liquid chromatography                   |
| Hr                                   | Hour                                                     |
| Hrs                                  | Hours                                                    |
| IgA                                  | Immunoglobulin A                                         |
| IgE                                  | Immunoglobulin E                                         |
| IgG                                  | Immunoglobulin G                                         |
| IgM                                  | Immunoglobulin M                                         |
| IFN- $\gamma$                        | Interferon-gamma                                         |
| IFN- $\alpha$                        | Interferon-alpha                                         |
| Inc.                                 | Incorporation                                            |
| kDa                                  | Kilodalton                                               |
| Kg                                   | Kilogram                                                 |
| KH <sub>2</sub> PO <sub>4</sub>      | Potassium di-hydrogen phosphate monobasic                |
| KOH                                  | Potassium hydroxide                                      |
| LO                                   | Lipoxygenase                                             |
| Ltd.                                 | Limited                                                  |
| MBP                                  | Mannose-binding protein                                  |
| mg                                   | milligram                                                |
| MgCl <sub>2</sub>                    | Magnesium chloride                                       |
| MgSO <sub>4</sub> .7H <sub>2</sub> O | Magnesium sulphate heptahydrate                          |

---

*List of Abbreviations*

|                                  |                                      |
|----------------------------------|--------------------------------------|
| min                              | Minutes                              |
| MIC                              | Minimal inhibitory concentration     |
| ml                               | milliliter                           |
| MLC                              | Minimal lethal concentration         |
| mM                               | millimole                            |
| MQ                               | Macrophage                           |
| MRI                              | Magnetic resonance imaging           |
| MW                               | Molecular weight                     |
| NA                               | Nutrient agar                        |
| NaCl                             | Sodium chloride                      |
| Na <sub>2</sub> HPO <sub>4</sub> | Di-sodium hydrogen phosphate dibasic |
| <i>nCs</i>                       | Chitosan nanoparticles               |
| NK                               | Natural killer                       |
| nm                               | nanometer                            |
| NNA                              | Non nutrient agar                    |
| No.                              | Number                               |
| NPs                              | Nanoparticles                        |
| <i>Ns</i>                        | <i>Nigella sativa</i>                |
| <i>N. sativa</i>                 | <i>Nigella sativa</i>                |
| ODNs                             | oligodeoxynucleotides                |
| PAS                              | Page Amoeba Saline                   |
| PCR                              | Polymerase chain reaction            |
| pH                               | Power of Hydrogen                    |
| PHMB                             | Polyhexamethylene biguanide          |
| PMNs                             | Polymorphonuclear cells              |
| pmol                             | picomole                             |
| PMSF                             | Phenyl methyl sulfonyl fluoride      |
| ppm                              | Parts per million                    |
| RBC                              | Red blood cell                       |
| RIO                              | Research Institute of Ophthalmology  |
| rRNA                             | Ribosomal ribonucleic acid           |
| rpm                              | Revolutions per minute               |
| sIgA                             | Secretory immunoglobulin A           |