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Effect of *Ginkgo Biloba* on Hypercholesterolemic Rats

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Thesis

In Partial Fulfilment of PhD. Degree in Specific Education

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ACKNOWLEDGMENT

*First of all, great thanks are due to **ALLAH**, Who helps me to accomplish this work.*

*I am greatly honored to express sincere thanks, deep gratitude and sincere appreciation to Prof. Dr. **Ekbal Mahmoud Mohamed**, Professor of Nutrition in Home Economics Dept., Faculty of Specific Education, Ain Shams University, for her direct supervision, guidance the course of this study, great help, continuous encouragement and sincere advice during preparation and completion of this work.*

*Great appreciations and deepest thanks are due to **Prof. Dr. Emily Tawfik Hanna,** consultant of Biochemistry in Nutrition Biochemistry and Metabolism Dept., National Nutrition Institute, for her kind supervision and suggestions, cooperation, valuable participation in drawing the out lines and endless helps during the laboratory work, arrangement, preparation and writing of the manuscript.*

*I would like to express my deep and sincere gratitude to **Prof. Dr. Hanan Mohamed Kamal El Sayed,** Professor of Nutrition in Home Economics Dept., Faculty of Specific Education, Ain Shams University, for her faithful and continuous encouragement, supervision, cooperation, valuable suggestions that supported me.*

*My sincere gratitude and appreciation are also extended to **Dr. Hewaida Abdel Fattah El-said Fadel,** Physiology lecturer in Nutrition Biochemistry and Metabolism Dept., National Nutrition Institute, for her help in the biochemistry analysis.*

*Finally, I would like to express my deep thanks to **my Family** especially **my mother, my father, my sisters, my brother, my husband, and my kid** for their continuous patience and great help throughout this work.*

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Abstract

Hypercholesterolemia has been implicated in causation of coronary heart disease. Ginkgo biloba has been used in some countries as a hypolipidemic agent. Accordingly, this study aimed to study the effect of different doses of Ginkgo biloba extract (GBE) on lipid profile, liver and kidney functions in hypercholesterolemic rats. Forty eight rats were divided into six groups. The first group was fed on standard diet only as negative control. Second group was fed on hypercholesterolemic diet as positive control. The other four groups were fed on hypercholesterolemic diet for four weeks to induce hypercholesterolemia, then these groups were fed on standard diet and orally administrated different levels of GBE (25, 50, 75 and 100 mg/kg B.W/day) for 28 days. Also GBE was applied in functional food by making biscuits fortified with this extract with the four doses (25, 50, 75 and 100 mg/kg) used in this experiment. Results showed that using four levels of GBE in treating hypercholesterolemic rats led to significant improvement in lipid profile. Levels of 50, 75 and 100 GBE mg/kg B.W induced significant decrease in serum triglycerides

and cholesterol in hypercholesterolemic groups, as compared to positive control and GBE 25 mg/kg B.W groups. All treated groups with different levels of GBE produced an improvement in serum ALT, AST, uric acid and creatinine levels, as compared to positive control group. Histological examination of liver tissues indicated progress in morphological changes occurred in hypercholesterolemic rats via ingestion of GBE. It was found that biscuits supplemented with 25 mg of GBE then sample supplemented with 50 mg of GBE tended to have the best taste and overall acceptable among all supplemented samples. So it can be recommended to consume biscuits fortified with 50 mg of GBE for their health benefits and acceptability by panels.

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Abbreviation	Meaning
AD	Alzheimer's disease
ALP	Alkaline phosphatase
ALT	Aspartate Amine Transferase
AST	Alanine Amine Transferase
Aβ	Amyloid beta peptide
CAD	Coronary artery disease
CVD	Cardiovascular disease
GBE	Ginkgo biloba extract
GBLP	Ginkgo biloba leaf polysaccharide
HDL-C	High density lipoprotein cholesterol
HFD	High fat diet
LDL-C	Low density lipoprotein cholesterol
MDA	Malonialdhyde
NAFLD	Nonalcoholic fatty liver disease
ROS	reactive oxygen species
T.G	Triglycerides
T.C	Total cholesterol
VLDL-C	Very low density lipoprotein cholesterol
WHO	World Health Organization

INTRODUCTION

Every day, thousands of people have heart attacks and strokes, and more than 1 million others continue to live with various forms of rheumatic and congestive heart disease **(Nix, 2013).** Of all causes of death, coronary heart disease, cancer, and stroke are the leaders **(AHA, 2010).**

The World Health Organization (WHO) reported that 17.5 million people die each year from CVDs, an estimated 31% of all deaths worldwide **(WHO, 2016).** More than 75% of CVD deaths occur in low-income and middle-income countries. Up to 80% of all CVD deaths are due to heart attacks and strokes **(WHO, 2015).**

Hyperlipidemia is acknowledged to be a major risk factor for cardiovascular events. The major component of total serum cholesterol that is associated with increased risk is low density lipoprotein cholesterol (LDC-c). In contrast, there is an inverse relationship between symptomatic atherosclerosis and high density lipoprotein cholesterol (HDL-c) levels **(Dominiczak, 1998; NCEP, 2001).**

NCEP (2001) guidelines stated that lowering LDL cholesterol is the primary objective of coronary heart disease risk reduction. Consequently, there is increasing demand for a medical treatment for this problem.

The Ginkgo biloba extract (GBE) has been reported to

have a wide range of health benefits in traditional Chinese medicine **(Cheng *et al.*, 2013).** Since the early 1990s, extract of Ginkgo leaves, has become the most popularly used dietary supplement for treating vascular circulation problems and improving memory **(Lim *et al.*, 2011).**

In Chinese folk medicine the leaves of Ginkgo biloba are used for the treatment of cardiovascular diseases and to alleviate asthma **(Gupta and Jain, 2006)**.

Ginkgo biloba L. (Ginkgoaceae), known as the 'maidenhair tree', is the best-selling herbal remedy in the USA. Traditionally, the fruits and seeds of Ginkgo have been used in Oriental medicine to improve chronic cough or enuresis. Since the early 1990s, a standardized extract of Ginkgo leaves, has become the most popularly used dietary supplement for treating vascular circulation problems and improving memory **(Lim *et al.*, 2011).**Ginkgo biloba extract functions as a natural substantial antioxidant and hypolipidemic **(Yao *et al.*, 2007).**

Phytochemical studies have shown that the leaves of *Ginkgo biloba* contain active components including terpenoids (ginkgolides, bilabolide), flavonoids (catechins, flavones, biflavones) flavonols (kaempferol, quercetin or isorhamnetin), steroids (sitosterol, stigmasterol) and carotenoids **(Woerdenbag and Van Beek, 1997).**