



**UNIVERSITI PUTRA MALAYSIA**

**LYCOPENE AND RED PALM OIL EFFECTS ON HYPOGLYCEMICS AND  
ANTIOXIDANT IN STREPTOZOTOCIN-INDUCED DIABETIC RATS**

**SEYED MORTEZA EBADI**

**FPSK(m) 2011 3**

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**MASTER OF SCIENCE  
UNIVERSITI PUTRA MALAYSIA  
2011**

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**Thesis submitted to the School of Graduate Studies, Universiti Putra Malaysia, in  
Fulfilment of the Requirements for the Degree of Master of Science**

**January 2011**

## **DEDICATION**

*This thesis is dedicated to the memory of my mother who continued to learn, grow and develop and who had been a source of encouragement and inspiration to me throughout my life.*



Abstract of thesis presented to the senate of Universiti Putra Malaysia in fulfilment of  
the requirement for the degree of Master of Science

**LYCOPENE AND RED PALM OIL EFFECTS ON HYPOGLYCEMICS AND  
ANTIOXIDANT IN STREPTOZOTOCIN-INDUCED DIABETIC RATS**

By

**SEYED MORTEZA EBADI**

**January 2011**

**Chairman: Professor Asmah Rahmat, PhD**

**Faculty: Medicine and Health Sciences**

Diabetes mellitus is found to be associated with oxidative damage which co-exists with a reduction in the antioxidant status and may contribute to the pathogenesis of type 2 diabetes by increasing insulin resistance or impairing insulin secretion. The objective of this study was to verify the potential hypoglycemic and antioxidative effects of lycopene and red palm oil on antioxidant status and antioxidant enzymes activities in streptozotocin-induced diabetic rats and to determine free radical scavenging capacity of lycopene and red palm oil. Lycopene and red palm oil of two dosages (10 and 20 mg/kg body weight) were administered to streptozotocin induced diabetic rats. The rats were force-fed with the supplements once daily for six weeks. For induction of diabetes to rats injected 55 mg/kg body weight of STZ (Streptozotocin) dissolved in 0.05 M citrate buffer (pH 4.5). Compared to the normal group, the treatment of rats with a single dose of

STZ revealed a significant decrease ( $p<0.05$ ) in total antioxidant status (TAS), activity of antioxidant enzymes catalase (CAT) and superoxide dismutase (SOD), plasma insulin level and body weight. The results of this study showed that red palm oil had higher scavenging activity as compared to lycopene. After six weeks of treatment, the rats treated with lycopene and red palm oil at both dosages (10 and 20 mg/kg body weight) have lower fasting glucose levels (27.7% reduction in lycopene 10 mg/kg bw; 34.5% in lycopene 20 mg/kg bw; 32.3% in red palm oil 10 mg/kg bw; 28.4% in red palm oil 20 mg/kg bw) compared to the baseline. SOD activities were found to be significantly ( $p<0.05$ ) elevated in diabetic groups treated (25.2% increase in lycopene 10 mg/kg bw; 30.5% in lycopene 20 mg/kg bw; 44.8% in red palm oil 10 mg/kg bw; 46.2% in red palm oil 20 mg/kg bw) as compared to the baseline. CAT activities were found to be significantly ( $p<0.05$ ) increased in diabetic groups treated (21% elevation in lycopene 10 mg/kg bw; 37% in lycopene 20 mg/kg bw; 33.8% in red palm oil 10 mg/kg bw; 35.9% in red palm oil 20 mg/kg bw) as compared to pre-treatment. The lycopene and red palm oil at both dosages showed increase in total antioxidant status (25% increase in lycopene 10 mg/kg bw; 31% in lycopene 20 mg/kg bw; 26% in red palm oil 10 mg/kg bw; 37% in red palm oil 20 mg/kg bw) after six weeks administration as compared to baseline. Insulin level increased in treated groups with lycopene and red palm oil at both dosages (36% increase in lycopene 10 mg/kg bw; 52% in lycopene 20 mg/kg bw; 40.61% in red palm oil 10 mg/kg bw; 61.6% in red palm oil 20 mg/kg bw) as compared to pre-treatment. The administration of lycopene and red palm oil markedly prevented body weight loss starting from 3<sup>rd</sup> week of lycopene and red palm oil administration in diabetic treated rats. The data of this investigation exhibited that lycopene and red palm oil might possess hypoglycemic activity. These findings suggest that lycopene and red

palm oil may have substantial therapeutic potentials as an antioxidant in diabetes mellitus that increase total antioxidant status. Therefore, lycopene and red palm oil possesses antioxidant properties which work against the oxidative damage in diabetic subjects. These findings indicate antidiabetic capability of lycopene and red palm oil.



Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai  
memenuhi keperluan untuk ijazah master sains

**KESAN LIKOPEN DAN MINYAK KELAPA SAWIT KE ATAS  
HIPOGLISEMIA DAN ANTIOKSIDAN PADA TIKUS TERARUH  
STREPTOZOTOCIN**

Oleh

**SEYED MORTEZA EBADI**

**Januari 2011**

**Pengerusi: Profesor Asmah Rahmat, PhD**

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Penyakit kencing manis (Diabetes mellitus) didapati berkaitan dengan kerosakan oksidatif yang wujud apabila terdapat penurunan dalam status antioksidan dan berkemungkinan akan menyebabkan patogenesis diabetes jenis 2 apabila berlakunya peningkatan penebatan insulin atau kerosakan pengeluaran insulin. Objektif kajian ini adalah untuk mengesahkan potensi hipoglisemik dan kesan antioksidan oleh likopen dan minyak kelapa sawit ke atas status dan aktiviti enzim antioksidan pada tikus diabetes teraruh streptozotocin serta menentukan aktiviti pemerangkapan radikal bebas oleh likopen dan minyak kelapa sawit. Dua dos likopen dan minyak kelapa sawit (10 and 20 mg/kg berat badan) diberikan kepada tikus diabetes teraruh streptozotocin. Tikus-tikus dipaksa mengambil suplemen sebanyak sekali sehari selama 6 minggu. Bagi tujuan

pengaruhan diabetes ke atas tikus, 55 mg/ kg berat badan streptozotocin (STZ) telah dilarutkan dalam 0.05 M bufer citrate (pH4.5) dan disuntik pada tikus.

Apabila dibandingkan dengan kumpulan normal, tikus yang disuntik dengan satu dos STZ menunjukkan penurunan yang signifikan ( $p<0.05$ ) dalam jumlah status antioksidan, aktiviti enzim antioksidan catalase (CAT) dan superoxide dismutase (SOD), paras insulin dalam plasma darah dan berat badan. Hasil kajian ini menunjukkan bahawa minyak kelapa sawit telah menunjukkan pemerangkapan aktiviti radikal yang lebih tinggi berbanding likopen. Selepas 6 minggu tempoh rawatan suplemen, tikus yang dirawat dengan likopen dan minyak kelapa sawit pada kedua-dua dos menunjukkan penurunan dalam paras gula dalam darah (27.7% penurunan dalam 10 mg/kg berat badan likopen; 34.5% dalam 20 mg/kg berat badan likopen; 32.3% dalam 10 mg/kg berat badan minyak kelapa sawit; 28.4% dalam 20 mg/kg berat badan minyak kelapa sawit) apabila dibandingkan dengan sebelum rawatan. Aktiviti SOD menunjukkan peningkatan yang signifikan ( $p<0.05$ ) dalam kumpulan diabetes selepas rawatan suplemen(25.2% peningkatan dalam 10 mg/kg berat badan likopen; 30.5% dalam 20 mg/kg berat badan likopen; 44.8% dalam 10 mg/kg berat badan minyak kelapa sawit; 46.2% dalam 20 mg/kg berat badan minyak kelapa sawit) apabila dibandingkan dengan sebelum rawatan. Aktiviti CAT juga menunjukkan peningkatan yang signifikan ( $p<0.05$ ) dalam kumpulan diabetes yang dirawat(21% peningkatan dalam 10 mg/kg berat badan likopen; 37% dalam 20 mg/kg berat badan likopen; 33.8% dalam 10 mg/kg berat badan minyak kelapa sawit; 35.9% dalam 20 mg/kg berat badan minyak kelapa sawit) apabila dibandingkan dengan sebelum rawatan. Likopen dan minyak kelapa sawit pada kedua-dua dos menunjukkan peningkatan dalam jumlah status antioksidan (25% peningkatan dalam 10 mg/kg berat badan likopen; 31% dalam 20 mg/kg berat badan likopen; 26% dalam 10

mg/kg berat badan minyak kelapa sawit; 37% dalam 20 mg/kg berat badan minyak kelapa sawit) selepas 6 minggu rawatan suplemen berbanding sebelum rawatan. Selain itu, paras insulin juga meningkat dalam kumpulan rawatan dengan likopen dan minyak kelap sawit pada kedua-dua dos (36% peningkatan dalam 10 mg/kg berat badan likopen; 52% dalam 20 mg/kg berat badan likopen; 40.61% dalam 10 mg/kg berat badan minyak kelapa sawit; 61.6% dalam 20 mg/kg berat badan minyak kelapa sawit) apabila dibandingkan dengan sebelum rawatan. Pemberian likopen dan minyak kelapa sawit dengan nyata telah menghalang penurunan berat badan bermula pada minggu ketiga rawatan suplemen ke atas tikus kumpulan diabetes. Data dari hasil kajian ini menunjukkan likopen dan minyak kelapa sawit berupaya memberikan kesan aktiviti hipoglisemik. Selaian itu, kajian ini juga menunjukkan likopen dan minyak kelapa sawit berupaya memberikan potensi terapeutik yang tinggi sebagai antioksidan dengan meningkatkan paras jumlah status antioksidan dalam darah. Oleh itu, likopen dan minyak kelapa sawit berupaya memberikan sifat antioksidan yang boleh menghalang kerosakan oksidatif ke atas subjek diabetes. Kajian ini juga menunjukkan keupayaan likopen dan minyak kelapa sawit sebagai antidiabetik.

## **ACKNOWLEDGEMENTS**

In the Name of Allah, the Most Benevolent and the Most Merciful.

First and foremost deepest gratitude and appreciation is expressed to my supervisor Prof Dr. Asmah Rahmat, for her ideas, support, guidance and patience towards completing the research.

I am also indebted to member of my supervisory committee and I wish to express my deepest thanks to Dr. Huzwah Khazaai for her invaluable suggestions that had enable me to carry on with my project successfully.

Finally my gratitude's to my lovely wife (Hanieh) and my parents who are my inspiration, who give support, and trust in whatever I do. I would like to express my appreciation to the laboratory staff (Mr. Abul, Mrs. Lina, Mrs. Safarina, Mr. Ehsan and Mr. Andy) and to everyone who helped me directly or indirectly throughout this project.

I certify that a Thesis Examination Committee has met on 12 January 2011 to conduct the final examination of Seyed Morteza Ebadi on his Master degree thesis entitled "Lycopene and Red Palm Oil Effects on Hypoglycemics and Antioxidant in Streptozotocin-Induced Diabetic Rats" in accordance with the Universities and University College Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A)106] 15 March 1998. The committee recommends that the student be awarded the Master of Science.

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## **DECLARATION**

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at other institutions.

**SEYED MORTEZA EBADI**

Date: 12 January 2011

## TABLE OF CONTENTS

	Page
<b>DEDICATION</b>	ii
<b>ABSTRACT</b>	iii
<b>ABSTRAK</b>	vi
<b>ACKNOWLEDGEMENTS</b>	ix
<b>APPROVAL</b>	x
<b>DECLARATION</b>	xii
<b>LIST OF TABLES</b>	xvi
<b>LIST OF FIGURES</b>	xvii
<b>LIST OF ABBREVIATIONS</b>	xviii
CHAPTER	
1 <b>INTRODUCTION</b>	1
1.1 Background	1
1.2 Problem Statement	5
1.3 Research Objectives	7
2 <b>LITERATURE REVIEW</b>	8
2.1 Diabetes Mellitus	8
2.1.1 Definition	8
2.1.2 Classification	8
2.1.3 Diagnosis	10
2.1.4 Complications	11
2.1.5 Prevalence of Diabetes in the World	13
2.1.6 Prevalence of Diabetes in Asia	14
2.2 Free Radical	15
2.2.1 ROS and RNS	15
2.3 Oxidative Stress	16
2.3.1 Oxidative Stress and Diabetes	16
2.3.2 Oxidative Stress and Insulin	18
2.4 Antioxidant	19

2.4.1	Definition	20
2.4.2	Enzymatic Antioxidants	20
2.4.3	Non-enzymatic Antioxidant	21
2.4.4	Antioxidants as a Defence System	21
2.4.5	Antioxidants and Diabetes	22
2.4.6	Antioxidant, Oxidative Stress and Diabetes	24
2.5	Lycopene	26
2.5.1	Definition	26
2.5.2	Recommended Lycopene Intakes	27
2.5.3	Lycopene Sources	27
2.5.4	Lycopene Bioavailability	28
2.5.5	Lycopene as an Antioxidant	28
2.5.6	Singlet oxygen quenching mechanism	30
2.5.7	Lycopene level and Oxidative Stress	31
2.5.8	Lycopene Effects on Oxidative Stress in Diseases	32
2.5.9	Lycopene and Diabetes	34
2.5.10	Carotenoids and Insulin Level	37
2.6	Red Palm Oil	39
2.6.1	Bioavailability of β-carotene from Red Palm Oil	41
2.6.2	Bioavailability of Vitamin A from Red Palm Oil	41
2.6.3	Antioxidants in Red Palm Oil	42
2.6.4	Red Palm Oil and Diabetes	47
2.6.5	Vitamin E and Insulin	51
<b>3</b>	<b>MATERIALS AND METHODS</b>	<b>53</b>
3.1	Chemicals	53
3.2	Free Radical Scavenging assay (DPPH)	53
3.3	Experimental Animals	54
3.4	Experimental Design	55
3.5	Induction of Experimental Diabetes	57
3.6	Treatment Administration	57
3.7	Cardiac Puncture Blood Sampling	58
3.8	Body weight Record	58
3.9	Biochemical Investigations	59
3.9.1	Estimation of Glucose Level	59
3.9.2	Estimation of Catalase (CAT) Activity	59
3.9.3	Estimation of Superoxide Dismutase Activity (SOD)	60
3.9.4	Estimation of Total Antioxidant Status (TAS)	63
3.9.5	Estimation of plasma Insulin level	64
3.10	Statistical analysis	66

<b>4</b>	<b>RESULTS</b>	<b>67</b>
4.1	Free Radical Scavenging assay (DPPH)	67
4.2	Experimental Diabetes and Normal Rats	68
4.2.1	Fasting Blood Glucose	68
4.2.2	SOD and CAT activities	69
4.2.3	Plasma Insulin Level	69
4.2.4	TAS	70
4.3	Effects of Lycopene and Red palm oil on Body Weight	71
4.4	Effects of Lycopene and Red palm oil on Glucose Level	73
4.5	Effects of Lycopene and Red palm oil on Superoxide Dismutase (SOD)	75
4.6	Effects of Lycopene and Red palm oil on Catalase (CAT)	77
4.7	Effects of Lycopene and Red palm oil on Total Antioxidant Status (TAS)	79
4.8	Effects of Lycopene and Red palm oil on Plasma Insulin Level	81
<b>5</b>	<b>DISCUSSION</b>	<b>83</b>
5.1	Induction of Experimental Diabetic Rats	83
5.2	Free Radical Scavenging assay (DPPH) of lycopene and red palm oil	85
5.3	Effects of Lycopene and Red palm oil on Body Weight	86
5.4	Effects of Lycopene and Red palm oil on Glucose Level	88
5.5	Effects of Lycopene and Red palm oil on SOD and CAT	90
5.6	Effects of Lycopene and Red palm oil on TAS	95
5.7	Effects of Lycopene and Red palm oil on Insulin Level	97
<b>6</b>	<b>CONCLUSION AND RECOMMENDATIONS</b>	<b>101</b>
6.1	Conclusion	101
6.2	Recommendations	106
	<b>REFERENCES</b>	<b>108</b>
	<b>APPENDICES</b>	<b>131</b>
	<b>BIODATA OF STUDENT</b>	<b>137</b>