UNIVERSITI PUTRA MALAYSIA

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MASTER OF SCIENCE

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By

SEYED MORTEZA EBADI

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

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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 oflycopene 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 (pH4.5).Compared to thenormal group, the treatment of rats with a single dose of

STZ revealed asignificant 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 oftreatment, therats 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.CATactivities 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 inlycopene 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 markedlyprevented body weight loss starting from 3rd week of lycopene and red palm oil administration in diabetic treated rats.The data of this investigationexhibited 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

Fakulti: Perubatan dan Sains Kesihatan

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 dibadingkan 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 dibadingkan 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 dibadingkan 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 teraputik 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.

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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.

Members of the Examination Committee are as follows:

Zuraini bt Hj Ahmad, PhD
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Date:

This thesis was submitted to the senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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Dr. Huzwah Khazaai, PhD
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Professor and Dean
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Date:

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

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