UNIVERSITI PUTRA MALAYSIA

NUTRITIONAL COMPOSITION AND HYPOCHOLESTEROLEMIC EFFECT OF *CANARIUM ODONTOPHYLLUM* MIQ. FRUIT IN RABBITS

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MASTER OF SCIENCE
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Thesis submitted to the School of Graduate Studies, Universiti Putra Malaysia in Fulfilment of the requirements for the Master of Science

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NUTRITIONAL COMPOSITION AND HYPOCHOLESTEROLEMIC EFFECT OF *CANARIUM ODONTOPHYLLUM* MIQ. FRUIT IN RABBITS

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March 2011

Chairman : Azrina binti Azlan, PhD

Faculty : Medicine and Health Sciences

The main objective of this study was to determine nutrient composition, antioxidant properties of *Canarium odontophyllum* Miq. (CO) fruit and its effect on selected cardiovascular biomarkers in hypercholesterolemic and normocholesterol rabbits. Proximate composition of CO fruit pulps was determined in this study. For powdered full-fat, the fruit was rich in fat, total dietary fiber (TDF) and carbohydrate. For powdered defatted pulp, the fruit was rich in TDF and carbohydrate. CO fruit was also rich in minerals such as potassium, magnesium and calcium. Pulp and kernel oils were rich in palmitic acid and oleic acid. Total phenolic content (TPC) of samples (fruit parts and oil extracts) were determined using spectrophotometer. The TPC of the oils were in the order of; pulp oil (with skin) > pulp oil (without skin) > kernel oil. Meanwhile, the TPC of the different parts of CO was in order of skin (S) > flesh with skin (SF) > flesh (F) > kernel (K). Antioxidant capacities of the different parts of CO (S, SF, F and K) was measured using three different assay; β-carotene bleaching assay, scavenging activity on DPPH and ferric reducing/antioxidant power (FRAP) assay. The antioxidant activities of fruit extracts were in the order of: S > SF

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> F > K except for DPPH assay. The lipid lowering effect of CO fruit parts was investigated in hypercholesterolemic rabbits (Study I) and normocholesterol rabbits (Study II). The parameter used in this studies are plasma lipid profile [Total cholesterol (TC), low density lipoprotein-cholesterol (LDL-C), high density lipoprotein-cholesterol (HDL-C), plasma malondialdehyde (MDA), antioxidant enzymes [glutathione peroxidase (GPx), superoxide dismutase (SOD), catalase (CAT)], total antioxidant status (TAS) and toxicity test [aspartate aminotransferase (AST), alanine aminotransferase (ALT) and gamma-glutamyl transpeptidase (GGT)]. The percentage of lesion of atheroma plaque was determined in this study. In Study I, supplementation of defatted pulp of CO in hypercholesterolemic rabbits showed the greatest lipid lowering effects and increased antioxidant status. The presence of high dietary fiber content and high antioxidant activity in the defatted pulp was the possible factors contributing to the retardation of atherosclerosis and reducing the risk of coronary artery disease (CHD). However, no significant effects of pulp and kernel oils of CO were found in the hypercholesterol study. Thus, the effect of oils of CO was tested in normocholesterol rabbits (Study II). In Study II, supplementation of pulp and kernel oils of CO were found beneficial in reducing the CVD risks. Consumption of pulp oil in rabbits resulted in significant increased of plasma TC and HDL-C levels and lowered plasma LDL-C level. Pulp oil resulted in increased TAS level, erythrocyte GPx and SOD activities, and reduced plasma lipid MDA levels. There were elevation in ALT, AST and GGT activities in pulp oil supplemented group as compared to control. In this study, supplementation of kernel oil of CO was found beneficial in reducing CVD risk factors as it resulted in significant reduction of plasma TC, increased HDL-C, lowered LDL-C and TG. However, the LDL-C to HDL-C ratio was significantly higher in animal fed-kernel oil compared to animal

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fed normal diet. No toxic effect was found in relation to consumption of the kernel oil. As conclusion, defatted pulp and oil extracted from CO showed protective effect towards the CVD biomarkers. The protective effects could be due to high phenolic content and high antioxidant activity in the fruits.

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Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan ijazah Master Sains

KOMPOSISI NUTRIEN DAN KESAN HIPOKOLESTEROLEMIK BUAH *CANARIUM ODONTOPHYLLUM* MIQ. KE ATAS ARNAB

Oleh

FARIDAH HANIM BINTI SHAKIRIN

Mac 2011

Pengerusi : Azrina Azlan, PhD

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Objektif utama kajian ini adalah untuk menentukan komposisi nutrien, aktiviti antioksida buah *Canarium odontophyllum* (CO) dan kesannya ke atas parameter kardiovaskular dalam arnab teraruh kolesterol dan arnab normokolesterol. Komposisi proksimat serbuk isi kaya lemak, isi tanpa lemak dan isi segar buah CO telah ditentukan dalam kajian ini. Berdasarkan kandungan serbuk isi kaya-lemak, buah ini kaya dengan lemak, gentian diet (TDF) dan karbohidrat. Berdasarkan serbuk isi tanpa lemak, buah ini kaya dengan TDF dan karbohidrat. Buah CO juga kaya dengan mineral seperti kalium, magnesium, dan kalsium. Kedua-dua minyak isi dan biji kaya dengan asid palmitik dan asid oleik. .Jumlah kandungan fenolik dalam minyak yang diekstrak dari buah CO adalah dalam susunan: minyak isi buah (dengan kulit) > minyak isi buah (tanpa kulit) > minyak biji. Sementara itu, jumlah kandungan fenolik dalam bahagian berbeza buah CO adalah dalam susunan: kulit (S) > isi dengan kulit (SF) > isi (F) > biji (K). Kapasiti antioksida bagi bahagian-bahagian berbeza buah CO (ekstrak S, SF, F dan K), telah ditentukan melalui tiga assai berbeza; assai pelunturan β-karoten, aktiviti perencatan radikal bebas DPPH dan

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kuasa penurunan/antioksida ferik (FRAP). Berdasarkan kapasiti antioksida, kulit menunjukkan aktiviti antioksida tertinggi. Aktiviti antioksida ekstrak buah tersebut adalah dalam turutan: S > SF > F > K dalam semua assai antioksida kecuali aktiviti perencatan radikal bebas (DPPH). Kesan hipokolesterolemik bahagian-bahagian buah CO telah dikaji dalam arnab teraruh kolesterol (Studi I) dan normokolesterol (Studi II). Parameter yang dugunakan dalam kajian ini adalah lipid profil, lipid peroksida, enzim antioksida, status total antioksida (TAS) dan ujian toksisiti [aspartate aminotransferase (AST), alanine aminotransferase (ALT) and gamma-glutamyl transpeptidase (GGT)]. Peratusan pembentukan ateroma telah ditentukan dalam kajian ini. Dalam Studi 1, pemberian isi buah tanpa lemak telah menunjukkan kesan penurunan lemak paling tinggi dan peningkatan status antioksida. Kehadiran gentian diet dan aktiviti antioksida yang tinggi di dalam isi buah tanpa lemak adalah faktor yang mungkin telah menyumbang kepada perencatan atherosklerotik dan penurunan risiko penyakit koronari arteri (CHD). Walau bagaimanapun, tiada kesan signifikan terhadap pengambilan minyak isi dan biji buah CO dalam studi hiperkolesterol. Oleh itu, kesan pengambilan minyak isi dan biji telah dikaji dalam arnab normalkolesterol dalam studi II. .Dalam studi ini, pengambilan minyak isi dan biji buah CO oleh arnab normokolesterol didapati berfaedah untuk mengurangkan risiko CVD (penyakit kardiovaskular). Pengambilan minyak isi menyebabkan peningkatan paras TC dan lipoprotein ketumpatan tinggi-kolesterol (HDL-C) yang signifikan. Penurunan signifikan plasma LDL-C dengan tiada perubahan signifikan nisbah LDL-C kepada HDL-C telah dikesan dalam kumpulan ini. Minyak ini telah menyebabkan peningkatan TAS secara signifikan, erittrosit GPx dan SOD dan penurunan plasma MDA. Terdapat peningkatan paras alanina transamina (ALT), aspartat transamina (AST) dan gamma-glutamil trasamina (GGT) dalam kumpulan

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minyak isi. Dalam kajian ini, minyak isi telah dikenalpasti sebagai bahan yang bermanfaat dan boleh melindungi daripada penyakit CVD kerana ia telah meningkatkan paras TAS, aktiviti enzim eritrosit GPx dan SOD dan menurunkan paras plasma MDA secara signifikan. Pengambilan minyak biji buah CO dalam arnab normokolesterol telah menyebabkan penurunan signifikan plasma TC, sedikit peningkatan HDL-C dan sedikit penurunan plasma LDL-C dan TG. Nisbah LDL-C kepada HDL-C dalam kumpulan ini telah meningkat secara signifikan berbanding kumpulan kawalan. Tiada kesan toksik ditunjukkan oleh kumpulan NK. Kesan yang baik yang ditunjukkan oleh bahagian buah CO disebabkan oleh kandungan fenolik dan aktiviti antioksida yang tinggi dalam bahagian buah tersebut.

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I certify that a Thesis Examination Committee has met on 8 March 2011 to conduct the final examination of Faridah Hanim binti Shakirin on her thesis entitled "Nutritional Composition and Hypocholesterolemic Effect of *Canarium odontophyllum* Miq. Fruit in Rabbits" 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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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fullfilment of the requirement for the degree. The members of the Supervisor Committee are as follows:

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DECLARATION

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

FARIDAH HANIM BINTI SHAKIRIN

Date: 8 March 2011

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