



UNIVERSITI PUTRA MALAYSIA

**EFFECTS OF MALAYSIAN COCOA POWDER CONSUMPTION ON
BIOCHEMICAL PARAMETERS STATUS OF HEALTHY SUBJECTS AT
UNIVERSITI PUTRA MALAYSIA, SERDANG**

SURYATI MUHAMMAD ALINAFIAH

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**By
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Chairman: Professor Amin Ismail, PhD

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In most of developing countries, cardiovascular disease (CVD) will be the leading cause of death worldwide. By the year of 2030, almost 23.6 million people will die from CVD, mainly heart diseases and stroke, which also representing 29% of all global health. Dietary intervention revealed that the plants-derived food is negatively correlated with the risk of CVD. The consumption of cocoa (*Theobroma cacao L*) and its products has been often hypothesized to reduce the cardiovascular risk due to their polyphenols and antioxidant content. Polyphenols is a phytochemical that could play important role in attenuating the development of non-communicable diseases such as diabetes, atherosclerosis, cardiovascular disease, rheumatoid arthritis, ageing and certain cancers. Cocoa powder is rich in polyphenols compound compared to other food products. Malaysian cocoa

beans have been reported to contain the highest phenolic content compared to Sulawesi, Ghanaian and Ivorian Coast beans. Hence this study may contribute to the crucial knowledge on the health benefits of Malaysian cocoa, which believed to have positive effects on delaying the risk of cardiovascular diseases. This cross over study was conducted to investigate the effect of Malaysian cocoa beverage (CB) consumption on biochemical parameters among healthy subjects in UPM. There were 37 subjects who consisted of 20 women and 17 men aged between 25-45 years consisted of UPM staff volunteered for the study. This study was carried out for ninth weeks and the subjects were randomized into two groups; Group 1 (n=19) and Group 2 (n=18). In the first four weeks, Group 1 was a treatment group whereas Group 2 was a control group. Subjects in treatment group were assigned to receive 18 g CB (contained 1260 mg polyphenols) daily for four weeks whereas the subjects in control group did not receive any beverage to be consumed. After the washout period (1 week), Group 2 was a treatment group and Group 1 acted a control group. Ten milliliters of fasting blood of the subjects was taken to measure cardiovascular biomarkers (plasma lipid profiles, antioxidant status and enzymes, glucose level, high sensitive-CRP and malondialdehyde). Other parameters (bodyweight changes and blood pressure levels changes) were also measured. The present study observed an improvement of lipid profiles levels and antioxidant enzymes of subjects after the consumption of Malaysian cocoa powder for 4 weeks. The total cholesterol (TC) concentrations reduced significantly by 7.29% ($p < 0.05$).

The low density lipoprotein (LDL-C) and triglycerides (TG) and high density lipoprotein (HDL-C) had improved but not with significant changes at the end of the study. The present study also showed improvement in antioxidant status and enzymes of the subjects. The levels of glutathione peroxidase (GPx) increased significantly by 68.64% ($p < 0.05$). The level of total antioxidant status (TAS) and Superoxidase Dismutase (SOD) also improved but not with significant changes between the two groups. There were no significant changes on high sensitive-CRP (hs-CRP) and melondialdehyde (MDA) of the subjects at the end of the study. Consumption of 18 g CB daily for 4 weeks had also improved blood pressure levels and caused no toxicity effects in healthy subjects. In conclusion, several improvements in biomarkers associated with cardiovascular health following consumption of CB were observed in healthy individuals involved in the study. Malaysian CB may possibly use as functional foods to help in preventing the promotion of oxidative stress linked diseases.

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

**KESAN PENGAMBILAN SERBUK KOKO MALAYSIA KE ATAS
PARAS STATUS BIODOKIMIA SUBJEK SIHAT DI UNIVERSITI
PUTRA MALAYSIA, SERDANG**

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Penyakit kardiovaskular merupakan penyebab kematian utama di kebanyakan negara membangun di dunia. Menjelang tahun 2030, hampir 23.6 juta penduduk dunia akan mati disebabkan penyakit kardiovaskular terutamanya jantung dan strok, iaitu mewakili 29% jumlah kematian di dunia. Intervensi pemakanan menunjukkan bahawa makanan berasaskan tumbuhan adalah berkait secara negatif dengan risiko kardiovaskular. Pengambilan koko (*Theobroma Cocoa L*) and produknya lazimnya dihipotesiskan dapat mengurangkan risiko kardiovaskular disebabkan kandungan polifenol dan antioksidannya. Polifenol adalah bahan fitokimia yang memainkan peranan penting dalam mengurangkan perkembangan penyakit tidak berjangkit seperti kencing manis, atherosclerosis, penyakit kardiovaskular, rheumatoid arthritis, penuaan dan kanser. Serbuk koko mengandungi kompaun polifenol yang tinggi berbanding dengan produk

makanan lain. Kajian menunjukkan biji koko Malaysia mengandungi fenolik yang tinggi jika dibandingkan dengan biji koko yang terdapat di Sulawesi, Ghana dan Ivory Coast. Oleh itu, kajian ini diharapkan dapat menyumbangkan maklumat penting berkenaan kebaikan produk koko Malaysia yang dipercayai mempunyai kesan positif dalam mengurangkan risiko penyakit kardiovaskular. Kajian ini adalah kajian silang yang dijalankan bagi menentukan kesan pengambilan minuman koko Malaysia ke atas paras biokimia yang terpilih subjek sihat di UPM. Subjek yang sihat berumur 25-45 tahun (20 wanita dan 17 lelaki), terdiri daripada staf UPM telah dipilih sebagai sampel kajian. Kajian ini dijalankan selama 9 minggu dan subjek telah dibahagikan secara rawak kepada dua kumpulan; Kumpulan 1 (n=19) dan (n=18) pada awal kajian. Pada 4 minggu di awal kajian, Kumpulan 1 bertindak sebagai subjek kumpulan rawatan manakala Kumpulan 2 menjadi kumpulan kawalan. Subjek kumpulan rawatan telah diberi 18 g CB (mengandungi 1260 mg polifenol) untuk diminum setiap hari selama 4 minggu manakala kumpulan kawalan tidak menerima sebarang produk kajian. Selepas fasa 'washout' selama 1 minggu, Kumpulan 2 telah menjadi kumpulan rawatan manakala Kumpulan 1 telah menjadi kumpulan kawalan. 10 mililiter sampel darah berpuasa telah diambil pada minggu 1, 4, 6 dan 9 bagi mengukur perubahan paras biokimia darah subjek (profil lipid, status antioksidan dan enzim, malondialdehyde, highly sensitive-CRP dan paras gula dalam darah). Selain dari itu, kesan perubahan berat badan dan paras tekanan darah subjek juga diukur. Kajian

ini didapati menunjukkan kesan positif ke atas perubahan profil lipid dan paras enzim antioksidan dalam darah subjek selepas mengambil minuman koko selama 4 minggu. Paras total kolesterol (TC) turun secara signifikan sebanyak 7.29% ($p < 0.05$). Paras lipoprotein berketumpatan rendah (LDL-C), trigliserida (TG) dan paras lipoprotein berketumpatan tinggi (HDL-C) mengalami perubahan yang baik tetapi tidak signifikan pada akhir kajian. Kajian ini juga menunjukkan perubahan baik bagi paras status antioksidan dan enzim subjek. Pada akhir kajian, paras enzim antioksidan dalam darah subjek rawatan, Glutathione Peroksidase mengalami kenaikan signifikan sebanyak 68.64% ($p < 0.05$). Paras status antioksidan (TAS) dan Superoxidase Dismutase (SOD) mengalami perubahan yang baik tetapi tidak signifikan di antara kumpulan rawatan dan kawalan tanpa menyebabkan perubahan signifikan ke atas berat badan dan paras gula dalam darah subjek. Tiada perubahan signifikan diperhatikan bagi paras high sensitive-CRP (hs-CRP) dan melondialdehyde (MDA) bagi kedua-dua kumpulan rawatan dan kawalan kajian. Pengambilan CB selama 4 minggu didapati berjaya memperbaiki paras tekanan darah dan tidak menyebabkan kesan toksik ke atas subjek yang terlibat dalam kajian. Kesimpulannya, pengambilan minuman koko Malaysia (CB) selama 4 minggu ke atas subjek yang sihat telah memberi kesan positif ke atas beberapa parameter biokimia yang berkait dengan penyakit kardiovaskular. Minuman koko Malaysia (CB) berpotensi sebagai makanan berfungsi bagi membantu mengelakkan penyakit yang berkait dengan oksidatif stress.

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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 any other institution.



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