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A STUDY ON THE ANTI-HYPERGLYCEMIC POTENTIAL OF BRAN EXTRACTS OF COCONUT, RICE AND SELECTED BEANS

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PENGESAHAN

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ABSTRACT

The diabetic patient is increasing year by year. The need in reducing the diabetic patient is not easy even though there are many ways in diabetes management. This is partly due to the side effect of the using drugs in controlling blood glucose level. The side effect may reduce by consuming organic products. Anti-hyperglycemic and antioxidant properties of bran extracts of coconut (*Cocos nucifera*), some selected beans (*Phaseolus vulgaris*) and rice (*Oryza sativa*) were investigated. Result showed that rice bran extracts was the most potential organic product that can be used to inhibit the α-amylase activity (96.180%). Meanwhile, red bean bran extract were the most potential to inhibit α-glucosidase activity (39.567%). Red bean bran extract contain the highest phenolic content (0.122 mg/g), while red kidney bean bran extract was potential organic product that can be used as antioxidant power (75.943 µg/ml). Meanwhile for ABTS and DPPH free radical scavenging, different dose of concentration were studied. The highest potential in ABTS free radical for scavenging 50 µg/ml of bran extract is rice bran extract (39.027 µmol/g), for 100 µg/ml of bran extract is white bean bran extract (47.050 µmol/g) and for 200 µg/ml of bran extract is coconut bran extract (49.850 µmol/g). Meanwhile, the highest potential in scavenging free radical DPPH for 50 µg/ml of bran extract is coconut bran extract (91.197 µmol/g) and for 100 and 200 µg/ml of bran extract is white bean bran extract (112.203 µmol/g; 117.243 µmol/g). Thus, all of the bran extracts have potential to be used in controlling blood glucose level for diabetic patient.

ABSTRAK

Pesakit diabetes semakin bertambah setiap tahun. Pesakit diabetes sukar untuk dikurangkan walaupun mempunyai pelbagai cara untuk mengawalnya. Ia disebabkan oleh kesan sampingan yang dialami oleh pesakit yang mengambil ubat-ubatan untuk mengurangkan kandungan gula di dalam darah. Kesan sampingan dapat dikurangkan dengan pengambilan bahan organik. Sifat-sifat anti-hiperglisemia dan antioksida bagi ekstrak bran kelapa (*Cocos nucifera*), beberapa jenis kekacang (*Phaseolus vulgaris*) dan beras (*Oryza sativa*) telah dikesan melalui ujikaji ini. Keputusan kajian menunjukkan ekstrak bran beras ialah bahan organik yang paling berpotensi untuk menghalang aktiviti enzim α-amilase (96.180%). Manakala, ekstrak bran kacang merah paling berpotensi bagi menghalang aktiviti enzim α-glucosidase (39.567%). Ekstrak bran kacang merah mempunyai komponen fenolik yang paling banyak (0.122 mg/g), manakala ekstrak bran kacang buah pinggang merah berpotensi sebagai bahan organik untuk digunakan sebagai kuasa antioksida (75.943 µg/ml). Bagi memerangkap radikal bebas ABTS dan DPPH, dos yang berbeza telah diuji. Bahan organik yang paling berpotensi dalam memerangkap radikal bebas ABTS dalam 50 µg/ml ialah ekstrak bran beras (39.027 µmol/g), bagi kepekatan 100 µg/ml ialah ekstrak bran kacang putih (47.050 µmol/g) dan bagi kepekatan 200 µg/ml ialah ekstrak bran kelapa (49.850 µmol/g). Manakala bahan organik yang paling berpotensi bagi memerangkap radikal bebas DPPH dalam 50 µg/ml ialah ekstrak bran kelapa (91.197 µmol/g) dan bagi kepekatan 100 and 200 µg/ml pula ialah ekstrak bran kacang putih (112.203 µmol/g; 117.243 µmol/g). Kesimpulannya, semua ekstrak bran berpotensi bagi mengawal kandungan gula di dalam darah pesakit diabetes.

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LIST OF ABBREVIATIONS

ABTS	2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid)
α	Alpha
α-A1	Isoform of alpha amylase inhibitor
C	Coconut
DNS	3,5-dinitrosalicyclic acid
DPPH	2,2-diphenyl-1-picrylhydrazyl
et al.	and others
FeCl3	Iron (III) chloride
Fig	Figure
FRAP	Ferric reducing antioxidant power
g	Gram
h	Hour
M	Molar
min	Minute
mg	Milligram
mg/g	Milligram per gram
ml	Milliliter
mM	MilliMolar
mmol	Millimole
mU/ml	Milliunit per milliliter
µg	Microgram
µg/ml	Microgram per milliliter
µl	Microliter
µM	MicroMolar
µmol	Micromole
Na2CO3	Sodium carbonate
nm	Nanometer
$p < 0.05$	Statistically significant
$p > 0.05$	Statistically unsignificant
R	Rice
RB	Red bean
RKB	Red kidney bean
SAS	Statistical Analysis System
TPC	Total phenolic content
TPTZ	2,4,6-tripyridyl-s-triazine
W	White bean
w/w	Weight per weight
%	Percentage
ºC	Degree celcius
>	Bigger than
=	equal to
10:1:1	10 ratio to 1 ratio to 1

CHAPTER 1

INTRODUCTION

Diabetes mellitus is a serious metabolic disease which characterized by hyperglycemia that can be occur due to the deficiency in insulin secretion, insulin action or both which promoting the disturbance of carbohydrate, protein and fat metabolism (Shabana *et al*., 2012; Sales *et al.*, 2012). In 2013, 187 million deaths were attributable to diabetes as 44% occurred under the age of 60 (Chan *et al.*, 2014). Insufficient insulin secretion will results in an increase of blood glucose level. There are several complications that might occur due to the long term effect of the diabetes for example retinopathy, neuropathy and increased the risk of cardiovascular disease (Laar *et al.,* 2005; Cheng *et al.*, 2005).

There are many strategies to treat the diabetes for example stimulation of insulin secretion, enhancement of the action of insulin at the target tissue and inhibition of the degradation of oligo and disaccharides (Funke & Melzing, 2006). The common drugs that usually used in clinic to control diabetes as well as to lower the level of blood glucose are insulin, glucosidase inhibitors, insulin-like growth factor and aldose reductase inhibitor (Cheng & Fantus, 2005; Inzucchi, 2002; Chakrabarti & Rajagopalan, 2002). By decreasing the post-prandial glucose level, diabetes type 2 also can be treated as the absorption of glucose is retard through the inhibition of carbohydrates-hydrolysing enzymes, α-amylase and α-glucosidase (Laar *et al*., 2005; Inzucchi, 2002).

Consumption of grains and cereals are usually recommended as diet for diabetic patient to control the level of blood glucose (Lee *et al.*, 2004; Yao *et al.*, 2008). According to Barrett and Udani (2011), white bean (*Phaseolus vulgaris*) contains the properties of alpha-amylase inhibitor, while kidney bean (*Phaseolus vulgaris*) can be used to inhibit α-amylase enzyme (Le Berre-Anton *et al*., 1997). Red bean (*Phaseolus vulgaris*) possess higher antioxidant activity and concentration of phenolic contents compared to the other common beans (Xu *et al.*, 2007) which can be used for health promotion (Zou & Chang, 2014). Rice bran also has high potential to be used as food supplement for diabetic patient as contain anti-amylase, anti-glycation and antioxidant properties (Premakumara *et al.*, 2013).

There are many parts of coconut (*Cocos nucifera*) that has been used by people for example coconut shell, coconut oil, coconut leaves and many more. The parts of its fruits such as tender coconut water and coconut kernel have medicinal properties for example antioxidant, hypoglycemia, antibacterial and many more (DebMandal & Mandal, 2011). There is a study shows that coconut kernel protein has potent anti-diabetic activity through reversal of glycogen levels and activities of carbohydrate metabolizing enzymes (Salil *et al*, 2011). However, there is hardly any report about the uses of coconut testa in inhibiting alpha amylase which make this study rational to improve the human health.

Objectives:

1. To identify the anti-hyperglycemic properties of bran extracts of coconut, beans and rice.
2. To investigate the antioxidant properties of bran extracts of coconut, beans and rice.

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