UNIVERSITI PUTRA MALAYSIA

POTENTIAL OF Channa striatus BLOCH BISCUIT AS HEALTH FOOD PRODUCT

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By

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Thesis submitted to the school of graduate studies, Universiti Putra Malaysia, in Fulfillment of requirements for the Degree of Master of Science

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DEDICATION

I dedicate this thesis to my beloved Father and Mother who are my inspiration

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the requirement for the degree of Master of Science

POTENTIAL OF *Channa striatus* BLOCH BISCUIT AS HEALTH FOOD PRODUCT

By

PARASTOO SAFA

February 2013

Chair: Professor. Abdul Manan bin Mat Jais, PhD

Faculty: Medicine and Health Science

In these days, natural products are widely consumed as supplement and alternative medicine. These products have different variety and ranging from plants to animal's sap. Animal's oil, extracts and by-products are some of the examples. *Channa striatus* (Haruan) is a carnivorous and freshwater fish using traditionally for post-operative pains in Malaysia. The aim of the current study is to introduce and evaluate different health benefits of *Channa striatus* biscuit as a new health product. It will be difficult for many individuals to consume the fish as medicine due to its sharp smell or taste, it has to be processed into more acceptable and ready to eat product. Having a natural base, balanced nutrients, and proper processing are the three important criteria for a healthy food that *Channa striatus* biscuit met them. The biscuit baked based on cookies formulation, supplemented with 25% of *Channa striatus* traditional extract. Proximate and biochemical analysis, microbial profile, metabolic evaluation and market survey were performed to determine different health characteristics of this new product. Proximate analysis of the biscuit was performed using semi-micro Kjeldhal method for

the protein, air oven method for moisture and the Soxhlet extraction for lipid. The biscuit was contained 14.65 % protein, 18.30 % lipid, 7.5 % moisture, 0.14% fibers and 2.20 % ash. Minerals were analyzed using Atomic Absorption Spectrophotometer method and results showed that biscuit was contained 4.93 µg/g zinc, 80.60 mg/100 potassium, 51.33 mg/100 calcium, 4.27 µg/g iron, 0.51 µg/g cupper, 25.7 mg/100 magnesium, 0.10 µg/g chromium and 6.74 µg/g selenium. Amino acid and fatty acid compositions of dough and biscuit were analyzed using High Performance Liquid Chromatography and Gas Chromatography, respectively. Dough and *Channa striatus* biscuit were contained 17 essential amino acids which highest percentage in dough and biscuit was belonged to isolecucine acid with 4.81±0.26 and 3.60±0.41 mg/g, respectively. In regarding to fatty acid, the highest percentage in the dough and biscuit were palmitic acid and oleic acid with 33.11% and 33.50%, respectively. Three indexes of metabolic rate including body weight, urine volume, and feces mass of rats fed by different products of *Channa striatus* were measured and compared together. Results showed that none of different *Channa striatus* products had any effect on the body weight of animals. However, urine and feces outputs of animals fed by HTE based pellets 10% and 20% were significantly ($p<0.05$) higher than animals fed by normal pellets. Results also showed that none of fish products affect blood glucose and cholesterol concentrations of animals. In the last step market survey including taste, shape, smell, size, flavor, crispiness, price, health characteristics and overall acceptability of the product were performed using 60 member of panel in Universiti Putra Malaysia. Almost 60% of volunteers were familiar with *Channa striatus* but only 5% consume as regular food. Based on survey, almost everyone agreed that taste is

good, biscuit is crispy enough, and it not have bad smell of raw fish. Although, it seems that baking process may reduce protein content of biscuit in comparison with pure HTE, but results showed that biscuit was still contained significant amount of essential amino and fatty acids. On the other hand, this new products, without any bacterial and fungal contamination, had no any significant effect on the metabolic performance of rats. As the conclusion it seems that *Channa striatus* biscuit can be considered as a new health food, but more clinical studies are required to ensure about safety and health benefits on human being.

Abstract tesis yang dikemukan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Sarjana Sains

POTENSI *Channa striatus* BIOCH BISKUT SEBAGAI PRODUK MAKANAN KESIHATAN

Oleh

PARASTOO SAFA

Februari 2013

Pengerusi: Professor. Abdul Manan Mat Jais, Phd

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Pada hari ini, produk semula jadi secara meluas digunakan sebagai tambahan dan perubatan alternatif. Produk-produk ini terdiri daripada pelbagai sumber termasuk tumbuh-tumbuhan dan sap haiwan. Minyak, ekstrak haiwan dan produk adalah adalah contohnya. Channa striatus (Haruan) adalah sejenis karnivor dan ikan air tawar digunakan secara tradisional di Malaysia untuk melegakan sakit selepas pembedahan. Tujuan kajian ini adalah untuk memperkenalkan dan menilai manfaat kesihatan biskut Haruan sebagai makanan kesihatan. Ramai individu yang sukar untuk mengambil ikan dalam bentuk ubat kerana bau atau rasa yang tajam, maka kajian ini perlu bagi memprosesnya menjadi produk yang lebih diterima dan sedia untuk dimakan. Sebagai asas semulajadi, khasiat yang seimbang dan cara pemprosesan yang betul adalah tiga kriteria penting untuk menghasilkan makanan kesihatan daripada biskut Haruan. Biskut Haruan ini dibakar berdasarkan formulasi 'cookies' yang ditambah dengan 25% ekstrak tradisional Haruan. Analisis proksimat dan biokimia, profil mikrob, penilaian metabolik dan kajian pasaran telah dijalankan untuk menentukan ciri-ciri kesihatan yang berbeza

daripada hasil produk baru ini. Analisis menggunakan proksimat daripada biskut ini telah dijalankan dengan menggunakan kaedah Kjeldhal separa mikro untuk menetukan kandungan protin, kaedah udara ketuhar untuk menentukan kelembapan dan Soxhlet pengekstrakan untuk lemak. Biskut ini mengandungi 14.65% protin, lemak 18.30%, kelembapan 7.5%, serat 0.14% dan abu 2.20%. Analisis keatas mineral telah dijalankan menggunakan kaedah penyerapan atomik kaedah spektrofotometer dan keputusan menunjukkan bahawa biskut Haruan mengandungi 4.93 μg / g zink, 80.60 mg/100 kalium, 51.33 mg/100 kalsium, 4.27 μg / g besi, 0.51 μg / g cupper, 25.7 mg/100 magnesium, 0.10 μg / g chromiumand 6.74 μg / g selenium. Komposisi asid amino dan asid lemak yang terkandung dalam doh dan biskut masing-masing dianalisis menggunakan Kromatografi Cecair Prestasi Tinggi dan Kromatografi Gas. Doh dan biskut Haruan terkandung 17 jenis asid amino dan peratusan tertinggi di dalam doh dan biskut adalah isolecucine asid dengan 4.81 ± 0,26 dan 3.60 ± 0,41 mg / g, masing-masing. Manakala kandungan asid lemak , peratusan tertinggi dalam doh dan biskut masing-masing adalah asid Palmitic dan asid oleik dengan 33.11% dan 33.50%. Tiga indek bagi menetukan kadar metabolik termasuk jisim berat badan, jumlah air kencing dan najis tikus yang diberi makan oleh produk yang berbeza dari Haruan diukur dan dibandingkan bersama. Keputusan menunjukkan bahawa tiada kesan perubahan ke atas berat badan haiwan oleh produk dari Haruan yang berbeza. Walau bagaimanapun, hasil air kencing dan najis haiwan yang diberi makan oleh hte berdasarkan pelet adalah 10% dan 20% perbezaan ketara ($p < 0.05$) lebih tinggi daripada haiwan yang diberi makan oleh pelet biasa. Keputusan juga menunjukkan bahawa tiada produk dari ikan ini mempengaruhi kepekatan glukosa darah dan kolesterol haiwan. Langkah terakhir adalah

kajian pasaran termasuk rasa, bentuk, bau, saiz, rasa, kegaringan, harga, ciri-ciri kesihatan dan penerimaan keseluruhan produk telah dilakukan dengan menggunakan 60 ahli panel di Universiti Putra Malaysia. Hampir 60% daripada sukarelawan biasa dengan Haruan tetapi hanya 5% individu mengambilnya sebagai makanan biasa. Hasil kaji selidik, hampir semua orang bersetuju bahawa rasanya adalah baik, biskut cukup rangup dan ia tidak mempunyai bau hanyir ikan. Walaupun proses pembakaran biskut ini dianggap boleh mengurangkan kandungan protein biskut tetapi dalam perbandingan dengan hte tulen, keputusan menunjukkan bahawa biskut masih mengandungi sejumlah besar asid amino dan asid lemak penting. Sebaliknya, produk baru ini, menunjukkan tiada sebarang pencemaran bakteria dan kulat serta tidak mempunyai apa-apa kesan ketara kepada prestasi metabolik tikus. Sebagai kesimpulan, biskut Haruan ini boleh dianggap sebagai makanan kesihatan baru, tetapi kajian klinikal secara mendalam amat perlu untuk memastikan keselamatan dan manfaat kepada kesihatan manusia.

.

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I certify that a Thesis Examination Committee has met on Date to conduct the final examination of Parastoo Safa on her thesis entitled Potential of *Channa Striatus* biscuit as Health food products 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 Thesis Examination Committee were as follows:

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

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DECLARATION

I declare the thesis is my original work except for quotation 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.

PARASTOO SAFA

Date: 14 February 2013

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LIST OF ABBREVIATIONS

AA	Arachidonic acid
AABA	α-amino butyric acid
AOAC	Association of official analytical chemists
B	Boron
Ca	Calcium
C.s	*Channa striatus*
Cl	Chlorine
Cu	Copper
DHA	Docohexanoic acid
DW	Dry weight
EPA	Eicosapentanoic acid
FAME	Fatty acid methyl ester
Fe	Iron
FID	Flame ionization detection
G	gram
GC	Gas Chromatography
Hcl	Hydrochloride acid
HPLC	High performance liquid choromatography
HTE	Haruan (*Channa striatus*) Traditional Extract
K	Potassium
LCD	Lethal Concentration Dose

M	Meter
Mg	Milligram
Min	Minutes
ml	Milliliter
Mn	Manganese
Mo	Molybdenum
MUFA	Monounsaturated fatty acid
N	Nitrogen
Na	Sodium
ND	Not detected
Ni	Nickel
nm	Nanometer
P	Phosphorus
PUFA	Polyunsaturated fatty acid
ROS	Reactive oxygen species
S	Sulphur
SD	Standard deviation
SDA	Sabouraud Dextrose Agar
SF	Specific factor
SFA	Saturated fatty acid
SPSS	Scientific package of social science
v/v	Volume to volume ratio
WW	Wet weight

W/V	Weight to volume ratio
WHO	World Health Organization
Zn	Zinc
%	Percentage
µg/g	Microgram to gram
Ω/ω	Omega
°C	Degree Celsius
°F	Degree Fahrenheit
µm	micro meter

CHAPTER1

INTRODUCTION

1.1. Introduction

Ethno-pharmacology is the scientific study of what an ethnic group or society use as medication (Gertch, 2009). Even though it is predominantly linked to plant use; however, it includes utilizing animals as natural product for delivery of pharmaceuticals (Johnson and Sargent, 1996). Health foods products are categorized as a branch of ethno-pharmacology and include foods that not only and be consumed as a main meal or snacks but also they would deliver the important requirements to the body. Vitamins or minerals supplemented foods and organic products are some examples of health food products. Other classes of health food products are the snacks that deliver the body's essential needs from other sources such as plants or animal. Essential fatty acids or amino acids could be transferred to the body in form of biscuits or tonics to transport plants or animal useful ingredients while eliminating the sharp taste of the original source such as bad odor of fish meat. In Malaysia, natural or health products are widely consumed or utilized as supplement and alternative medicine. However, the Malay traditional medicine is quite new compared to those well established in China or India. Nevertheless, Malaysia's bests natural products that could be offered in term of food, supplement and alternative medicine shouldn't be underrated (Ling, 1977; Mat Jais, 1991). Many processes should be performed in order to get a health product ready for consumption such as boiling for several hours or undergoing special preparation

condition. *Channa striatus* can be used not only as an ethno-pharmacology for wound healing, but also as a food containing high protein, low fat and good profile of dietary minerals (Mat Jais, 1997). *Channa striatus* is a Malaysian native fish and is consumed by many to provide all the nutritional ingredients for wound healing, tissue repairs and growth (Mat Jais *et al*., 1994). Furthermore, the aforementioned fish have shown a very high tendency to provide the entire fundamental elements required for human body as well as a promising candidate to supply a healthy diet to prevent chronic illnesses (Mat Jais, 1995).

1.2. Problem statement

Despite the well-known property of *Channa striatus* in wound healing, but people mostly are not interested to eat the fish just like that for various different reasons. For some reasons including sharp smell and taste *Channa striatus* is not yet accepted as a daily food. Considering the fact that many individuals are not ready to consume the fish as medicine due to its sharp smell or taste, it has to be processed into more acceptable and ready to eat product. Hence in this investigation, biscuit was produced as health product based on a cookie recipe as tool to delivery *Channa striatus* fish beneficial ingredients to the body.

1.2.1. Justification of study

Due to the several problems associated with the consumption of raw *Channa striatus* fish, this study is aimed to provide a health based product out *Channa striatus* in a form of biscuit with benefits of Easy consumption which carries the whole benefits of fish in form of *Channa striatus* based product biscuit, a less smelly and odorless *Channa striatus* based product compared to the *Channa striatus* fish, easy to take the product anywhere for daily usage, and finally better form and texture that will attract more users for consumption.

1.3. Objectives

1.3.1. Main objective

To produce a formulation of *Channa striatus* biscuit

1.3.2. Specific objectives

1. To assess the proximate and biochemical composition of the *channa striatus* biscuit and dough
2. To determine the effects of different concentration Haruan traditional extract (solid and liquid phase) products on body weight, urine, feces, glucose and cholesterol levels in rats

3. To evaluate public acceptance using a market survey

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