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FEED FATTY ACIDS AND THEIR UTILIZATION IN THE GIANT PANDA (Ailurupoda melanoleuca)

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FEED FATTY ACIDS AND THEIR UTILIZATION IN THE GIANT PANDA

(Ailurupoda melanoleuca)

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CERTIFICATION

It is hereby certified that we have read this project paper entitled "Feed Fatty Acids and their Utilization in Giant Panda (*Ailurupoda melanoleuca*)", by Nur Aishah binti Abdullah and in our opinion it is satisfactory in terms of scope, quality and presentation as partial fulfilment of the requirement for the course VPD 4999 project.

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“There is no accident. Things happened for a reason. Keep striving because if you only do what you can do, you’ll never be better than what you are.”

To my powerful mother....

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This thesis is dedicated to my beautiful mother, Nur Azah Khadijah Koh binti Abdullah for her concern and understanding during my absence at home as I need to dedicate more time for this project. I would also want to acknowledge Dr. Maehdi Ebrahimi and Puan Rosmawati Mohd Hanipah for their patience in assisting me to perform the total lipid extraction procedures. Without them, I won't be able to get through this adventurous journey starting from sampling, laboratory work up and till the day of completing this project.

Not to forget, sincere thanks to every single soul that involved directly and indirectly in making this happened as well as for being my pillar of strength through the years.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF ABBREVIATION

%	percentage
FAME	Fatty Acid Methyl Ester
GLC	Gas Liquid Chromatography
FID	Flame Ionization Detector
µl	microlitre
µm	micrometre
ml	millilitre
°C	degrees celcius
Rpm	revolutions per minute
A.melanoleuca	Ailuropoda melanoleuca
v/v	volume/volume
EFA	essential fatty acid
UFA	unsaturated fatty acid
SFA	saturated fatty acid
TSFA	total saturated fatty acid
TUFA	total unsaturated fatty acid
PUFA	polyunsaturated fatty acid
MUFA	monounsaturated fatty acid
n-3	fatty acid with 3 carbon chain
n-6	fatty acid with 6 carbon chain

ABSTRAK

Abstrak daripada kertas projek yang dikemukakan kepada Fakulti Perubatan Veterinar untuk memenuhi sebahagian daripada keperluan kursus VPD 4999

ASID LEMAK DAN PENGGUNAANNYA PADA *AILURUPODA MELANOLEUCA*

Oleh

Nur Aishah binti Abdullah

2017

Penyelia : Profesor Madya Dr. Goh Yong Meng

Penyelia Bersama : Dr. Hafandi Ahmad

Beruang Panda memperolehi hampir kesemua keperluan nutrien daripada bahan tumbuhan. Bahan makanan ini tidak dapat dimanfaatkan sepenuhnya memandangkan tumbuhan mempunyai kandungan asid lemak yang lebih rendah, serta ciri sistem pencernaan Beruang Panda yang lebih mirip kepada haiwan karnivor. Analisa asid lemak tinja merupakan pendekatan yang boleh digunakan untuk menerangkan fungsi fisiologi salur penghadaman Beruang Panda. Kajian ini dilakukan memandangkan Beruang Panda merupakan haiwan herbivor yang unik. Tambahan pula, dapatan kajian ini berpotensi untuk menyumbang kepada repositori data saintifik Beruang Panda yang terhad pada masa ini. Kajian ini menggunakan sampel tinja dari dua ekor Beruang Panda (A. melanoleuca) dewasa serta anak mereka yang berumur 2 tahun 6 bulan. Sampel tinja telah diperolehi untuk analisis daripada 9 Januari sehingga 20 Februari 2017 di Zoo

Negara, Malaysia. Analisis asid lemak juga dilakukan ke atas empat spesies buluh serta bahan makanan harian lain yang dimakan oleh Beruang Panda tersebut. . Tahap asid lemak dalam diet telah ditentukan selepas asid-asid lemak tersebut diekstrak dan dianalisis menggunakan kromatografi gas.

Keputusan menunjukkan bahawa asid palmitik (16:0) merupakan asid lemak yang paling banyak dijumpai pada batang buluh dan asid α-linolenik (18:3 n-3) bertumpu pada daun buluh. Peratusan asid lemak tepu adalah yang tertinggi pada kesemua empat spesies buluh diikuti oleh asid lemak politaktepu n-3, asid lemak politaktepu n-6 dan akhir sekali asid lemak monotaktepu. Keputusan juga menunjukkan bahawa Beruang Panda mampu mensistesis asid lemak berantai panjang menggunakan asid lemak daripada makanan mereka. Ini bermakna Beruang Panda mempunyai enzim desaturase dan elongase yang membolehkan proses desaturasi dan pemanjangan rantai asid lemak dijalankan dalam badan mereka.

Kata kunci: *A.melanoleuca*, analisa asid lemak, analisa nutrisi, ,buluh tempatan, n-3, n-6, penggunaan

ABSTRACT

An abstract of the project paper presented to the Faculty of Veterinary Medicine in partial fulfilment of the course VPD 4999 Project

FEED FATTY ACIDS AND THEIR UTILIZATION IN THE GIANT PANDA (*Ailurupoda melanoleuca*)

By

Nur Aishah binti Abdullah

2017

Supervisor: Associate Prof. Dr. Goh Yong Meng

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The Giant Panda derived most of its nutritional needs from plant materials. Dietary utilization of these plant materials is complicated by the comparatively lower plant fatty acid contents, and fact that the digestive system of the Giant Panda has characteristics that are consistent with carnivores. In the absence of other body fluids and tissues, faecal fatty acid profiles of the Giant Panda provide an important hint to explain the functions of its digestive system. These are crucial to understand how Giant Panda's acquire energy and other nutritional needs from its herbivorous diet. The aims of this research were to study the fatty acid profiles of bamboo plants in the Giant Panda's diet, and to determine the faecal fatty acid profiles of Giant Pandas. This information would provide insights into how Giant Pandas are able to fulfil their fatty acid requirements, especially the long chained fatty acids that are crucial for the

various physiological functions of the body. Four local species of bamboo plants, and faecal samples of two adult Giant Pandas (*A.melanoleuca*) and their cub were obtained for analysis. The study was conducted from 9th January until 20th of February 2017 at Zoo Negara Malaysia. Identification and quantification of fatty acid content was done by using gas liquid chromatography (GLC) following the procedure of total lipid extraction and fatty acids methyl esters (FAME).

Results showed that palmitic acid (16:0) was the dominant fatty acids in the shoots of bamboo plants, while α-linolenic acid (18:3 n-3) is the major fatty acid found in leaves. Total saturated fatty acids (TSFA) were consistently high followed by the unsaturated fatty acids comprising of the PUFA n-3, n-6 and MUFA. Faecal fatty acid profiles showed the presence of very long chain n-3 and n-6 fatty acids which are important for cellular functions. In conclusion, the current study showed that while bamboo lacked the longer chain essential fatty acids, the Giant Pandas were able to satisfy their physiological requirements through *de novo* synthesis. This indicates that the Giant Panda do have the ability, as well as the specific enzymes for the elongation and desaturation of fatty acids, a feature found in most herbivorous and omnivorous animals.

Keywords: *A.melanoleuca*, fatty acid analysis, local bamboos, n-3, n-6, nutritional preferences, utilization

1.0 INTRODUCTION

The Giant Panda (*A.melanoleuca*) also known as Panda Bear or simply Panda is a native animal to south central China. Even though it belongs to the order Carnivora, the Giant Panda's diet is over 99% bamboo (Schaller et al., 1989). According to World Wide Fund of Nature (WWF) update on 2016, they stated that there are only 1,864 Giant Pandas left in the wild. As a result of farming, deforestation, and other development, the Giant Panda has been driven out of the lowland areas where it once lived and listed as an endangered species in International Union of Conservation of Nature (IUCN) red list.

Anatomically, this animal exhibits characteristics which are consistent with their dietary preference. Giant Pandas in the wild will occasionally eat other grasses, wild tubers, or even meat in the form of birds, rodents or carrion. In captivity, they may receive honey, eggs, fish, yams, shrub leaves, oranges, or bananas along with specially prepared food. Their diets consist mainly of bamboo leaves despite its carnivorous-like digestive tract and its ability to digest cellulose and acquire energy from its diet has received attention from the scientific community (Dierenfeld et al., 1982 as cited by Zhu et al, 2011). The aims of this research were to study the fatty acid profiles of bamboo plants in the Giant Panda's diet, and to determine the faecal fatty acid profiles of Giant Pandas. This information would provide insights into how Giant Pandas are able to fulfil their fatty acid requirements, especially the long chained fatty acids that are crucial for the various physiological functions of the body.

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