UNIVERSITI TEKNOLOGI MARA

THE POTENTIAL USE OF PALM KERNEL MEAL IN THE PACIFIC WHITE SHRIMP (*Penaeus vannamei*) FEED

NOR SYAFINAZ SHAMSUDDIN

Thesis submitted in fulfilment
of the requirements for the degree of
Master of Science

MSc

August 2017

ABSTRACT

Utilisation of plant proteins to replace fish meal in shrimp feeds has become an important consideration because fish meal has becoming more expensive due to global demand increment in aquaculture. The potential use of palm kernel meal (PKM) in this study to substitute fish meal in Pacific white shrimp (*Penaeus vannamei*) diets was evaluated by conducting a 90-day feeding trial. Shrimps individuals (750 juveniles) with an initial average weight of 0.4g, protein content of 10.74%±0.70 were randomly distributed into five treatments in triplicates. Five isonitrogenous (35% protein) diets were formulated to contain 0% (D0), 25% (D25), 50% (D50) and 75% (D75) of PKM replacement and a commercial feed served as control treatment (Control). The juveniles were hand fed twice daily at 7% of their biomass (50% at 0800 hrs and 50% at 1630 hrs). Results from this study revealed that shrimps fed D25 were comparable with those fed with Control as there was no significant difference ($p > 0.05$) in weight gain and specific growth rate (SGR) between the groups. Levels of PKM inclusion above 50% showed detrimental effects on growth performance. The proximate analysis was accomplished according to the standard AOAC (Association of Analytical Communities) methods. The highest total protein percent was observed in shrimp tissues fed with D25 (67.59%±0.87) and D75 showed the lowest protein among treatments (57.4%±0.63) ($p < 0.05$). Total lipid content was observed high in shrimps fed with Control (4.33%±2.96) and decreased with PKM replacement levels. Highest carbohydrate was found in shrimps fed with D75 (16.75%±0.04) and the lowest was found in shrimps fed with D25 (14.67%±0.07). Highest accumulation of total ash was found in shrimps fed on D75 (10.12±0.12) and the lowest total ash was found in D25 (7.34±0.34). Total ash in shrimp tissue showed a significant difference between all treatments ($p < 0.05$). Highest total moisture was found in shrimp fed on D75 (13.66±0.31) and lowest in D25 (6.07±0.09). However, there was no significant difference in total lipid, moisture and carbohydrate in shrimp tissues ($p < 0.05$). Total lipid, total carbohydrate and total ash contents in shrimp tissues showed positive relationships with growth performance. However, total moisture in shrimp tissue was found to displayed a negative relationship with the growth of shrimps. These results indicate that fish meal can be replaced with PKM in shrimp diets with minimal effects on shrimp nutritional composition.

ACKNOWLEDGEMENT

Firstly, I thank God for giving me the opportunity to embark on my study and for completing this long and challenging journey successfully. I would like to convey my heartful gratitude to my respected supervisor Assoc. Prof Norsila binti Daim for her tremendous encouragement, enthusiasm and constructive comments during this study. I am also indebted to my co-supervisor Nawwar Zawani binti Mamat for her unlimited advices, care and supports throughout this work. I would also like to acknowledge the Fishery Research Institute Pulau Sayak Kedah, and FELDA Palm Kernel Crushing Factory who generously sponsored *Penaeus vannamei* shrimps and PKM.

I would like to express my special thanks to all Marine Technology, Nutrition and Dietetics Department Laboratories staff of UiTM, for the facilities in the laboratories. Not to mention my colleagues, Mohd Helfi, Adilah, Ashiqin, and Zulkifli who have helped me with my work. Special thanks to all Applied Sciences members and staffs.

I would also like to extend my sincere thanks to all my friends, particularly Najwa, Hidayah, Athirah, Rifhan, and Aishah. I really appreciate their readiness to anything at anytime. I feel so blissful to have such friends like them. Last but not least, a special thank you to my parents, Mr. Shamsuddin and Mrs. Kamariah for their love, unconditional support and encouragement throughout my study. Also thanks to my brothers and sister, Syahiran, Syahir and Syafeera for their constant support. Alhamdulillah.

TABLE OF CONTENTS

CHAPTER ONE
INTRODUCTION

1.1 THESIS OUTLINE

The present study explains the use of palm kernel meal to replace fish meal in formulated feeds for the Pacific white shrimp (*Penaeus vannamei*). In order to get an optimal replacement of fish meal with palm kernel meal, it is imperative to investigate the replacement effect on growth performance and proximate composition of the shrimp. This thesis contains five chapters.

Chapter 1 describes the general information on aquaculture sector globally and statistically. The section is then narrowed down into shrimp farming in Malaysia. It also includes the information about feeding behaviour of Pacific white shrimp in natural environment and their nutritional requirement. Furthermore, this chapter also describes the rationale of replacing fish meal protein with palm kernel meal in shrimp feeds followed by the specific objectives of the study.

Chapter 2 provides an overview of previous work related to this study on shrimp aquaculture of feeds and feeding. The first part of chapter 2 reveals more details about the behaviour of penaeid shrimps and their nutritional requirement. This includes *P. vannamei* phylum, subphylum and feeding behaviour according to different life cycles. Chapter 2 also reports on alternative protein sources used for animal and fish feeding. This covers plant-based replacers including palm kernel meal into formulated feeds for fishes and shrimps.

Chapter 3 explains the steps in formulating feeds using palm kernel meal at different replacement levels. It also describes the experimental setup for 90-day feeding trial, sampling, growth parameter measurements and proximate analysis in feeds and shrimps. The last part of this chapter states the uses of statistical tests in data analysis.

Results of the study are presented in Chapter 4 in the form of tables and figures. The analysed data are also discussed in the same chapter. The discussion covers the effect of all feeding treatments on growth parameters and nutritional value in Pacific white shrimps after the feeding trial.