



UNIVERSITI PUTRA MALAYSIA

**EFFECTS ON GUT MORPHOLOGY AND MICROFLORA OF BROILER
CHICKEN FED WITH DIFFERENT LEVELS OF FERMENTED PALM
KERNEL CAKE**

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**EFFECTS ON GUT MORPHOLOGY AND MICROFLORA OF BROILER CHICKEN
FED WITH DIFFERENT LEVELS OF FERMENTED PALM KERNEL CAKE**

BY

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A project report submitted to Faculty of Agriculture, Universiti Putra Malaysia, in fulfillment of the requirement of SHW 4999 (Final Year Project) for the award of the degree of Bachelor of Agriculture (Animal Science)

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CERTIFICATION

This project report entitled is prepared by Nisa Nadirah Binti Mohd Bazari and submitted to the Faculty of Agriculture in fulfillment of the requirement of SHW 4999 (Final Year Project) for the award of the degree of Bachelor of Agricultural (Animal Science).

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TABLE OF CONTENT

CONTENTS	PAGE
CERTIFICATION.....	i
ACKNOWLEDGEMENT.....	ii
TABLE OF CONTENT.....	iii
LIST OF TABLES.....	v
LIST OF FIGURES.....	vi
ABSTRAK	vii
ABSTRACT.....	ix
CHAPTER 1 INTRODUCTION.....	1
1.1 Significance of Research.....	2
1.2 Hypothesis.....	3
1.3 General Objective.....	3
1.4 Specific Objectives.....	3
CHAPTER 2 LITERATURE REVIEW.....	4
2.1 Palm Kernel Cake.....	4
2.2 PKC utilization in Poultry Feed.....	5
2.3 Intestines of Poultry.....	6
2.4 Gut Microflora of Poultry.....	7
2.5 Effect of Fibre Intake on Gut Morphology.....	8
CHAPTER 3 MATERIALS AND METHOD.....	9
3.1 Location of Experiment.....	9
3.2 Preparation of Feed.....	9
3.3 Management of Birds.....	11
3.4 Sampling of Digesta and Small Intestine.....	11
3.5 Faecal LAB and ENT counts.....	11

3.6 Villus Height and Crypt Depth.....	12
3.6 Statistical Analysis.....	12
CHAPTER 4 RESULTS AND DISCUSSION.....	13
4.1 Faecal LAB and ENT counts.....	13
4.2 Villus Height and Crypt Depth.....	16
CHAPTER 5 CONCLUSION.....	19
REFERENCES.....	20
APPENDICES.....	25



LIST OF TABLES

TABLE	PAGE
Table 1: Feed Ingredients of Dietary Treatments.....	10
Table 2: Villi Height and Crypt Depth of Small Intestine of Dietary Treatments.....	18



LIST OF FIGURES

FIGURE	PAGE
Figure 1: Enumeration of LAB on MRS-Agar.....	14
Figure 2: Enumeration of ENT on EMB-Agar.....	14
Figure 3: Faecal LAB and ENT counts of Dietary Treatments.....	15



ABSTRAK

Bahan buangan hasil pertanian seperti isirong kelapa sawit boleh digunakan untuk menggantikan kandungan makanan komersil seperti jagung dan kacang soya untuk makanan unggas. Isirong kelapa sawit sangat berserat dan tinggi kandungan polisakarida-tidak berkanji. Penggunaan isirong kelapa sawit kepada haiwan monogastrik terbatas kerana kumpulan haiwan ini kurang enzim yang berfungsi untuk mencerna bahan serat di dalam sistem pencernaanya. Walaubagaimanapun, kandungan nutrisi isirong kelapa sawit dapat diperbaiki melalui proses fermentasi-pepejal oleh mikrob selulolitik. Dengan proses tersebut, kandungan protein kasar meningkat dan kandungan serat kasar menurun. Isirong kelapa sawit yang telah difermentasi yang digunakan di dalam eksperimen ini difermentasikan oleh bakteria *P. polymyxa* ATCC 842. Kecekapan proses pencernaan dan penyerapan nutrisi oleh unggas bergantung kepada populasi mikroflora di dalam usus. Pemakanan telah terbukti menjadi salah satu faktor utama yang mempengaruhi aktiviti mikroorganisma di dalam usus unggas. Bakteria asid laktik dan Enterobakteria adalah mikroflora yang wujud di dalam sistem pencernaan unggas yang dijumpai di bahagian duodenum, ileum dan sekum. Bakteria asid laktik adalah bakteria gram-positif, tidak menghasilkan spora dan merupakan bakteria anaerobik yang berguna kepada kesihatan haiwan. Bakteria ini memainkan peranan yang penting dalam proses fermentasi bahan kaji yang akan menghasilkan asid laktik dan hidrogen peroksida sebagai produk akhir. Peningkatan saiz dan tinggi vilus usus menunjukkan penyerapan nutrisi berlaku dengan cekap. Suatu kajian telah dijalankan untuk mengkaji kesan penggunaan isirong kelapa sawit yang difementasi ke atas pembedakan struktur usus dan juga bilangan mikroflora. Sebanyak 270 ekor ayam pedaging jantan dibela di dalam 54 sangkar. Bermula pada hari ke-21 sehingga hari ke-42, ayam-ayam tersebut diberi makan mengikut

rawatan yang tertentu. Makanan yang diberikan berbeza peratusan kandungan isirong kelapa sawit dan isirong kelapa sawit difermentasi daripada 5%, 10%, 15% sehingga 20%. Hasil kajian mendapati isirong kelapa sawit difermentasi yang dijadikan sebagai sebahagian bahan makanan unggas, dapat meningkatkan populasi bakteria asid laktik dan mengurangkan Enterobakteria di dalam usus haiwan tersebut.



ABSTRACT

Agricultural byproducts such as Palm kernel cake (PKC) could be used to substitute commercial feed ingredients such as maize and soybeans in poultry diets. PKC is very fibrous and have high levels of non-starch polysaccharides (NSP_s). Simple stomach of monogastric animal limit the use of PKC in their feeds due to lo fiber digestive enzyme in the gastrointestinal tract. However, the PKC nutritive quality can improve by cellulolytic microbes through Solid State Fermentation (SSF). Through the method, the concentration of crude protein has increased while the crude fibre has decreased. The fermented PKC (FPKC) used in the experiment was fermented by using *P. polymyxa* ATCC 842. The digestion and absorption of nutrients efficiency in poultry are depends on the microflora in the gut. Diet has been shown to be one of the major factors that influence the microbial activity in gastrointestinal tract of poultry. Lactic acid bacteria (LAB) and *Enterobacteriaceae* (ENT) have been reported to be the normal flora that lives in the gastrointestinal tract and mainly found in the duodenum, ileum and caecum. LAB are gram positive, non-spore forming and predominantly anaerobic bacteria, occurring as beneficial microflora in gastrointestinal tract in the avian species. LAB plays a major role to ferment carbohydrates or starch to produce lactic acid and hydrogen peroxide as an end product. Increase in size and height of intestinal villi shows that the nutrient absorption in the gastrointestinal is more effective. A study was conducted to examine the effects of feeding fermented palm kernel cake (FPKC) on gut morphology and microflora counts of broiler chicken. Two hundred and seventy of day-old male chicks were randomly assigned into 54 cages. From days 21 to 42, broiler chickens were fed based on the dietary treatments. Treatment 1 (T1) was kept as a control, Treatment 2 (T2), Treatment 3 (T3), Treatment 4 (T4) and Treatment 5 (T5) containing 5%, 10%, 15% and 20%

of PKC respectively. Treatment 6 (T6), Treatment 7 (T7), Treatment 8 (T8) and Treatment 9 (T9) containing 5%, 10%, 15% and 20% of FPKC respectively. The faecal LAB counts had significantly more in the birds from T7 ($P<0.05$) among all the dietary treatments while faecal ENT counts for the birds from T6 was the lowest ($P<0.05$) as compared to other treatments. Birds fed with FPKC showed increase in villus height and crypt depth of small intestines (duodenum, jejunum and ileum). Increase in LAB counts, villus height and crypt depth results in efficient nutrients absorption. From this study, it can be concluded that inclusion of FPKC in the broiler diets could increase the population of LAB and reduces the ENT population in the gastrointestinal tract, increase in villus height and crypt depth of the small intestines.

CHAPTER 1

INTRODUCTION

Poultry industry in Malaysia always wanted to bring improvement in feed effectiveness. Poultry are mostly dependent on imported feedstuffs such as soybean meal, fish meal, corn gluten meal and mineral sources. This has resulted in feed cost for livestock 80% of the total cost of production. Agro-waste or agro by-product such as palm kernel cake (PKC) could be used to replace the commercial feed ingredients in livestock mainly poultry diets because of their low pricing and availability. PKC is the residue from the process of oil extraction from the fruit kernels of the oil palm tree. PKC contains a moderate level of protein and high level of fibre, therefore it is suitable and mostly being used only for ruminant feeds. The usages of PKC in poultry feeding were not been very much encouraged because of its low digestibility.

The nutrients content of PKC can be improved through physical, chemical or biological treatments. Solid-state fermentation (SSF) can improve the nutrients value of PKC by using fungus. The fermented feed ingredients of PKC under SSF conditions can be done through low technology application, and there will be no any waste disposal at the end because the whole product may be used directly in the animal feeds (Iluyemi *et al.*, 2006). Besides that, PKC from SSF processed produces a product that contains high protein content and low hemicelluloses and cellulose concentration. The levels of unsaturated fatty acids increase while the levels of saturated fatty acids decrease (Iluyemi *et al.*, 2006).

The normal microflora in the gut is essential in the digestion and absorption of nutrients in poultry (Coates *et al.*, 1975). Microflora metabolizes both dietary and endogenous residues and, has bacterial action in the large intestine, which is beneficial for the syntheses of vitamin B and vitamin K (McDonald *et al.*, 1995). It is well documented that the structure and morphology of villi play a substantial role in the digestion and absorption of nutrients in the gastrointestinal tract (Titus and Fritz, 1971). Studies have shown that non-starch polysaccharides may have profound influence on gut microflora population and activity in the gastrointestinal tract in chicken (Choct *et al.*, 1996).

Normal microorganism population can be maintained due to the low pH, which then will prevent the growth of pathogens such as *Salmonella* in the gastrointestinal tract. The slow rate of passage of fibre should allow for better feed digestion and microbial fermentation hence limit the food borne pathogen colonization.

Hence, an experiment had been conducted to find out the optimal level of fermented PKC (FPKC) in broiler ration and also if at this level there would be an effect on the microflora count and small intestine morphology.

1.1 Significance of Research

The good effects of FPKC inclusion in feeds on the gastrointestinal tract of broilers can encourage the farmers and feed millers to formulate FPKC in the poultry diets. This is also could cut off the 70-80% total cost of production because PKC is easy to get and the price is much lower compare to the imported commercial feeds nowadays.

1.2 Hypothesis

It is believed that feeds containing fermented PKC could increase the counts of beneficial bacteria in both caecum and ileum, the population of microflora increase and higher and wider villi of duodenum, ileum and columns of the caecum segment.

1.3 General Objective

To determine the effects of substitute fermented PKC in broiler diets on broiler chicken's performance

1.4 Specific Objective

1. To identify which inclusion level of fermented PKC suitable in broiler diets
2. To examine the effects of feeding fermented PKC on gut morphology of broiler chicken
3. To examine the effects of feeding fermented PKC on gut microflora counts of broiler chicken

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