UNIVERSITI PUTRA MALAYSIA

COMPARATIVE STUDIES ON THE RESPONSES OF RED JUNGLE FOWL AND COMMERCIAL BROILERS TO NUTRITIONAL MANIPULATIONS

IMAN RAHAYU HIDAYATI SOESANTO

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By

IMAN RAHAYU HIDAYATI SOESANTO

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DEDICATION

To my mother, Hj. Hatidjah Saman and
my father, Soenari Prajitno Soesanto (alm)
for their help and prayers .....

To my husband, Abang Pallawarukka and my sons,
Muhamad Nasrul Pradana and Muhamad Tahfizul Ramadhani
for their love, understanding, prayers and patience .....

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirements for the degree of Doctor of Philosophy.

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June 2000

Chairman: **Associate Professor Dr. Zulkifli Idrus, Ph. D.**

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Experiments were conducted to compare the responses of the red jungle fowl (RJF) and commercial broiler chicken (CB) to choice feeding and dietary palm kernel cake (PKC). Traits measured were growth performance, protein and energy intakes, carcass characteristics, behaviour, heterophil/lymphocyte ratio, gut microflora and intestinal morphology.

Evaluation of carcass characteristics at a common body weight (800 g) showed that RJF had heavier whole breast, thigh and drumstick than CB. Similarly, the muscle weight and muscle to bone ratio of those portions were greater in the former. The muscles of the breast and leg portions of RJF were of better quality than CB in term of protein, fat and cholesterol contents at a common body weight and at a common age (56 days old). Intense selection for growth may have caused an increase in

the weight of abdominal fat, fat and cholesterol contents of breast and leg muscles in CB. The protein content, however, was lower in CB as compared to RJF.

The choice feeding setting to meet the birds' own energy and protein requirements among basal diet, corn and soybean is acceptable for RJF but the growth performance was reduced in CB. In the choice feeding group, although both breeds consumed more basal diet, RJF consumed more soybean than corn and the opposite was noted for CB. The ratio of energy to protein intake for maximum growth of RJF up to Day 49 and CB up to Day 56 was calculated as 141 and 156, respectively. Among the CB fed CSC and LSC, the feed cost was reduced by 11.4% and 12.2% as compared to those provided a single diet (control). However the feed cost of RJF was not influenced by diet. Diet had no influence on behavioural parameters (eating, drinking, resting, walking, standing, bird-to-bird pecking and pecking of objects), however the heterophil to lymphocyte ratios (H/L) of choice fed birds were higher than those provided a single diet. The RJF were observed to be more active and agile compared to CB. The H/L ratio of RJF was higher than CB on Days 28 and 56, indicating that the confined RJF were more stressed than CB.

PKC, a by-product of oil palm extraction could be incorporated up to 25% in the finisher ration without any adverse effect on the performance of RJF and CB. The performances of RJF and CB were similar when fed control diet, diet containing 25% PKC and the choice between them. The

weight gain, total feed consumptions, and FCR of RJF and CB from Day 21 to 56 were 241 g and 2043 g; 956 g and 4700 g; 3.9 and 2.3, respectively. Dietary PKC reduced the fat and cholesterol contents of breast and leg muscles in both RJF and CB .

PKC as non-starch polysaccharides in the diet had altered the gut microflora and intestinal surface. The present findings showed an increase in the population of microflora (*Lactobacillus* sp. and *Streptococcus* sp.) and an increase in length and width of the intestinal villi in birds fed with 25% PKC. Irrespective of diet, CB had more anaerobic microflora in the caecum and ileum as compared to RJF. The intestinal villi were longer and wider in the former.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan memperolehi ijazah Doktor Falsafah

KAJIAN PERBANDINGAN KEATAS GERAK BALAS AYAM HUTAN MERAH DAN AYAM PEDAGING KOMERSIAL TERHADAP MANIPULASI PEMAKANAN

Oleh

IMAN RAHAYU HIDAYATI SOESANTO

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Pengerusi: **Profesor Madya Dr. Zulkifli Idrus**

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Beberapa eksperimen telah dijalankan untuk membandingkan gerak balas ayam hutan merah (RJF) dan ayam pedaging komersial (CB) terhadap makanan secara pilihan dan makanan asas yang mengandungi hampas isi rung kelapa sawit (PKC), Ciri-ciri yang diamati meliputi prestasi pertumbuhan, protein dan tenaga yang dimakan, sifat-sifat karkas, tingkah laku, nisbah heterofil:limfosit, mikroflora dan morfologi permukaan usus.

Penilaian sifat-sifat karkas pada berat badan yang sama (800 g) menunjukkan RJF lebih berat dari segi keseluruhan karkas dibandingkan dengan CB. Berat otot dan nisbah otot kepada tulang bagi bahagian tersebut juga lebih tinggi pada RJF. Otot-otot bahagian dada dan paha RJF mempunyai mutu yang lebih baik dari segi kandungan protein, lemak dan kolesterol pada umur dan berat badan yang sama (56 hari, 800 g) dibandingkan dengan CB. Pemilihan ciri-ciri pertumbuhan menyebabkan

peningkatan berat lemak abdomen, kandungan lemak dan kolesterol dari daging dada dan daging paha pada CB. Walau bagaimanapun, kandungan proteinnya lebih rendah pada CB dibandingkan dengan RJF.

Pemilihan makanan bagi memenuhi keperluan tenaga dan protein berasaskan diet asas, jagung dan kacang soya sesuai untuk RJF, tetapi menyebabkan kerendahan prestasi pertumbuhan bagi CB. Dari segi pemilihan makanan, meskipun kedua-dua jenis ayam memakan lebih banyak diet asas, RJF lebih menyukai kacang soya daripada jagung dan hal ini berlawanan untuk CB. Nisbah pengambilan tenaga kepada protein untuk mencapai kadar pertumbuhan maksimum pada RJF sehingga ke hari 49 dan pada CB sehingga ke hari 56 masing-masingnya 141 dan 156. Makanan pilihan CSC dan LSC pada CB dapat mengurangkan kos makanan masing-masing sebanyak 11.4% dan 12.2% berbanding dengan makanan tunggal (kawalan). Tetapi kos makanan RJF tidak dipengaruhi oleh jenis makanan. Makanan pilihan tidak mempunyai kesan ke atas parameter tingkah laku (memakan, minum, berehat, berjalan, berdiri, mematuk antar ayam dan mematuk terhadap benda-benda) tetapi nisbah heterofil : limfosit (H/L) meningkat daripada yang diberi makan makanan tunggal. RJF lebih aktif dan tangkas berbanding CB. Nisbah H/L RJF adalah lebih tinggi pada hari ke 28 dan ke 56 berbanding CB. Ini menunjukkan berbanding CB, RJF mengalami lebih tekanan semasa di dalam kurungan.

PKC, hasil sampingan ekstrak kelapa sawit dapat digunakan sehingga ke aras 25% dalam diet penyudah tanpa menyebabkan kesan terhadap prestasi RJF dan CB. Tiada perbezaan dikesan dari segi prestasi RJF dan CB yang diberi makan rangsum A, B atau C. Pertambahan berat badan, total rangsum yang dimakan dan FCR daripada RJF dan CB dari umur 21 hari sehingga ke hari 56 adalah 241 g dan 2043 g; 956 g dan 4700 g; 3.9 dan 2.3. Diet yang mengandungi PKC boleh merendahkan kandungan lemak dan kolesterol di dalam kedua-dua daging karkas RJF dan CB.

PKC sebagai "non-starch polysaccharides" di dalam makanan boleh mengubah keadaan mikroflora di dalam perut dan morfologi permukaan usus. Hasil kajian ini menunjukkan peningkatan populasi mikroflora (*Lactobacillus* sp. and *Streptococcus* sp.) dan bertambah ukuran panjang dan lebar villi usus ayam yang diberikan diet yang mengandungi 25% PKC. Tanpa bergantung kepada jenis pemakanan, CB memberikan jumlah mikroflora yang lebih di dalam sekum dan ileum berbanding dengan RJF. Keadaan villi usus ayam lebih panjang dan lebar pada CB daripada RJF.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF ABBREVIATIONS

AA	Arbor Acre
ANOVA	Analysis of Variance
AOAC	Association Official Agricultural Chemists
B.C.	Before Christ
Ca	Calcium
CB	Commercial Broiler
CF	Crude Fibre
cfu	Colony forming unit
CP	Crude Protein
cm	Centimetre (s)
cm^2	Centimetre square (s)
^0C	Degree Celsius
DCP	Di Calcium Phosphate
EDTA	Ethylene Diamine Tetra Acetate
EE	Ether Extract
e.g.	Exempli gratia (for example)
FCR	Feed Conversion Ratio
g	Gram (s)
GDP	Gross Domestic Bruto
GLM	General Linear Model
h	Hour (s)
IU	International Unit (s)