UNIVERSITI PUTRA MALAYSIA

THE INFLUENCE OF DIETARY ENERGY, PROTEIN AND COPPER LEVELS ON THE SULPHUR AMINO ACID REQUIREMENTS OF BROILER CHICKENS

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FPV 1994 3

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By

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Dissertation Submitted in Fulfilment of the Requirements for
The Degree of Doctor of Philosophy in the Faculty
of Veterinary Medicine and Animal Science
Universiti Pertanian Malaysia

October 1994

ACKNOWLEDGEMENTS

I wish to express my appreciation and sincere gratitude to my chairman, Associate Professor Dr. Kassim bin Hamid for his invaluable guidance and advice throughout the course of study and in the thesis preparation.

I also would like to express my appreciation and sincere gratitude to many individuals and organizations who had help in numerous ways towards my accomplishment, namely:

Professor Dato' Dr. Syed Jalaludin bin Syed Salim, Vice Chancellor of Universiti Pertanian Malaysia (UPM), for his immeasurable kindness and assistance for the study at UPM.

Associate Professor Dr. Boonlom Cheewa-issarakul, Deputy Dean, Faculty of Agriculture, Chiang Mai University, Thailand, for her helpful comments, suggestions and assistance.

Associate Professor Ramlah Abd. Hamid, and Dr. Abd. Razak Alimon, Department of Animal Sciences, Faculty of Veterinary Medicine and Animal Science, UPM, for providing the laboratory facilities, helpful comments and suggestions.

Department of Animal Sciences, Faculty of Veterinary Medicine and Animal Science ,Universiti Pertanian Malaysia, for providing the research facilities.

The Southeast Asian Regional Centre for Graduate Study and Research in Agriculture (SEARCA) for providing scholarship to study at UPM.

Faculty of Agriculture, Rajamangala Institute of Technology, Ministry of Education, Thailand, for the permission to take the study leave.

Finally, my family, friends and students in Thailand for their encouragement, moral support and love.

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LIST OF ABBREVIATIONS

ME	– Metabolisable Energy	SAS	– Statistical Analysis System
PE	– Productive Energy	ppm	– Parts Per Million
P:E	– Protein:Energy	h	– Hour(s)
E:P	– Energy:Protein Ratio	d	– Day
CP	– Crude Protein	wk	– Week(s)
DM	– Dry Matter	g	– Gramme(s)
BW	– Body Weight	mg	– Milligramme(s)
ADG	– Average Daily Gain	kg	– Kilogramme(s)
FCR	– Feed Conversion Ratio	kcal	– Kilocalorie(s)
EAA	– Essential Amino Acid	MJ	– Megajoule(s)
SAA	– Sulphur Amino Acid	Cu	– Copper

TSAA– Total Sulphur Amino Acid

NRC – National Research Council

AOAC – Association Official Agricultural Chemists

Abstract of the dissertation submitted to the Senate of Universiti Pertanian Malaysia in fulfilment of the requirements for the Degree of Doctor of Philosophy

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October 1994

Chairman: Assoc. Prof. Dr. Kassim Hamid

Faculty : Veterinary Medicine and Animal Science

Three experiments were conducted with male broiler chicks to determine the influence of dietary metabolisable energy (ME), crude protein (CP) and copper (Cu) levels on the total sulphur amino acid (TSAA) requirement of broilers both during the starter (0-3 wk) and the grower periods (4-6 wk) reared in the tropics. In all the experiments the parameters used to evaluate the TSAA requirements are body weight gain, feed:gain ratio and carcass composition.

In the first experiment, two factorial arrangements of three ME levels (3000, 3200 and 3400 kcal/kg) x four levels of TSAA (0.73, 0.83, 0.93 and 1.03%) and the same three ME levels (3000, 3200 and 3400 kcal/kg) x four levels of TSAA (0.65, 0.72, 0.79 and 0.86%) were used for the starter and the grower

periods, respectively. The results showed significant differences ($p<.05$) in body weight gain and feed:gain ratio of the broilers with increasing dietary TSAA levels both in starter and grower periods. There were no significant interaction ($p<.05$) between dietary ME and TSAA levels for the performance, with the exception for feed intake of starter broilers. It indicated that for the starter period, a TSAA of 0.93% produced the best performance regardless of energy levels while for the grower period the requirement of TSAA at both 0.79 and 0.86% were suggested. The results further showed that dietary energy levels had no effect on the TSAA requirement of the broilers.

In the second experiment, two factorial arrangements of four CP levels (16, 18, 20 and 23%) x three levels of TSAA (0.83, 0.93 and 1.03%) and three CP levels (16, 18 and 20%) x three levels of TSAA (0.72, 0.79 and 0.86%) were examined for the starter and grower periods, respectively. The results showed significant influence ($p<.05$) of dietary CP levels on body weight gain and feed:gain ratio in both starter and grower periods. No significant interaction between dietary CP and TSAA levels was noted for the performance of the broilers. The results suggested that the requirement of TSAA of broiler chickens during the starter period was 0.93% and during the grower period was 0.79-0.86%. However, the requirement for TSAA per unit of diet was not affected by dietary protein levels.

In the third experiment, studies were also carried out with two factorial arrangements of four Cu levels (0, 125, 250 and 375 mg/kg) x three TSAA levels (0.73, 0.83 and 0.93%) and the same levels of Cu (0,125, 250 and 375 mg/kg) x three levels of TSAA (0.72, 0.79 and 0.86%) were used during the starter and the grower periods, respectively. The results indicated that supplementation of Cu at the level of 375 mg/kg significantly decreased ($p<.05$) feed intake of the chicken in both of the two growing periods. This resulted in significant reduction ($p<.05$) of the growth rate and interference with the TSAA requirement of the starter broilers. However, the results showed that in grower broilers revealed no effect of Cu at the levels used to increase the TSAA requirement of the chicken. Dietary copper had no influence on carcass, meat and skin composition of the broilers.

The results of the present studies clearly indicated that under tropical conditions the NRC (1984) recommendation for TSAA requirements of 0.93% for starter broilers is adequate but the recommended level of 0.72% for grower broilers is less than the level of 0.79-0.86% suggested from the results of this study. In addition, the TSAA requirements of broilers per unit of diet were not affected by dietary ME and CP levels. Although, dietary copper level examined had the interference for TSAA requirements of starter broilers, there were no effects on the grower broilers.

Abstrak dissertasi yang dikemukakan kepada Senat Universiti Pertanian Malaysia bagi memenuhi syarat untuk mendapatkan ijazah Doktor Falsafah

PENGARUH ARAS TENAGA, PROTEIN DAN KUPRUM DIET KEATAS KEPERLUAN ASID AMINO SULFUR OLEH AYAM PEDAGING.

Oleh

SOMCHAI SUWANPRADIT

Oktober 1994

Pengerusi: Prof. Madya Dr. Kassim Hamid

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Tiga eksperimen telah dijalankan ke atas anak ayam pedaging jantan bagi menentukan pengaruh aras tenaga metabolik (TM), protein kasar (PK) dan kuprum atas keperluan jumlah asid amino sulfur (JAAS) pada ayam pedaging di peringkat permulaan (0-3 minggu) dan pembesaran (4-6 minggu) dipelihara dalam kawasan tropika. Dalam semua eksperimen parameter yang digunakan untuk menilai keperluan jumlah asid amino sulfur ialah kenaikan berat badan, nisbah makanan:berat badan dan komposisi karkas.

Di dalam eksperimen pertama, susunan dua faktorial bagi tiga aras TM (3000, 3200 dan 3400 kcal/kg) x empat aras JAAS (0.73, 0.83, 0.93 dan 1.03%) dan tiga aras TM yang sama (3000, 3200 dan 3400 kcal/kg) x empat aras JAAS (0.65, 0.72, 0.79 dan 0.86%) telah digunakan masing-masing untuk peringkat permulaan

dan pembesaran. Keputusan menunjukkan perbezaan ketara ($p<.05$) untuk kenaikan berat badan dan makanan:kadar kenaikan pada ayam pedaging bila tahap JAAS dalam diet meningkat antara peringkat permulaan dan pembesaran. Tiada interaksi ketara ($p<.05$) antara aras diet TM dan JAAS terhadap prestasi, kecuali pengambilan makanan ayam pedaging pemula. Ia menunjukkan bahawa pada peringkat permulaan, 0.93% JAAS memberi kesan prestasi terbaik di semua tahap tenaga, sementara pada peringkat pembesaran pula keperluan JAAS pada tahap 0.79% dan 0.86% dicadangkan. Keputusan kajian menunjukkan bahawa pada peringkat permulaan, 0.93% JAAS memberi kesan prestasi terbaik di semua tahap tenaga sementara pada peringkat pembesaran pula keperluan JAAS pada tahap 0.79 dan 0.86% dicadangkan. Keputusan selanjutnya menunjukkan bahawa aras tenaga diet tidak mempunyai kesan keatas keperluan JAAS oleh ayam pedaging.

Di dalam eksperimen kedua, susunan dua faktorial bagi empat aras PK (16, 18, 20 dan 23%) x tiga aras JAAS (0.83, 0.93 dan 1.03%) dan tiga aras PK (16, 18 dan 20%) x tiga aras JAAS (0.72, 0.79 dan 0.86%) telah dikaji masing-masing untuk peringkat permulaan dan pembesaran. Keputusan menunjukkan pengaruh yang ketara ($p<.05$) aras diet PK keatas kenaikan berat badan dan kadar makanan: kenaikan berat bagi kedua-dua tempoh permulaan dan pembesaran. Tiada interaksi yang ketara ($p<.05$) di antara diet PK dan aras JAAS yang dilihat bagi prestasi ayam

pedaging. Keputusan ini mengesyorkan keperluan JAAS bagi ayam pedaging di peringkat permulaan ialah 0.93% dan bagi peringkat pembesaran ialah 0.79% - 0.86%. Walaubagaimanapun, keperluan JAAS seunit diet tidak terjejas oleh aras diet protein.

Di dalam eksperimen ketiga, kajian dijalankan mengikut susunan dua faktorial di mana empat aras kuprum (0, 125, 250 dan 375 mg/kg) x tiga aras JAAS (0.73, 0.83, dan 0.93%) dan bagi aras kuprum yang sama (0, 125, 250 dan 375 mg/kg) x tiga aras JAAS (0.72, 0.79 dan 0.86%) masing-masing untuk peringkat permulaan dan pembesaran. Hasil kajian menunjukkan bahawa tahap kandungan kuprum sehingga 375 mg/kg dapat mengurangkan pengambilan makanan oleh ayam di kedua-dua peringkat pemeliharaan. Ini menyebabkan penurunan yang bererti ($P<.05$) di dalam kadar pertumbuhan dan juga menyebabkan gangguan terhadap keperluan JAAS bagi ayam pedaging permulaan. Di sebaliknya, keputusan terhadap ayam pedaging pembesaran menunjukkan tidak ada kesan kuprum pada aras yang digunakan bagi meningkatkan keperluan JAAS oleh ayam. Diet Kuprum tidak mempunyai pengaruh ke atas komposisi karkas, daging dan kulit ayam pedaging.

Kesimpulannya , kajian pada masa ini dengan jelas menunjukkan bahawa cadangan NRC (1984) bagi keperluan JAAS pada kadar 0.93% bagi ayam pedaging di peringkat permulaan adalah mencukupi tetapi keperluan pada kadar 0.72% bagi peringkat pembesaran adalah kurang dari kadar 0.79%-0.86% yang dicadang-

kan di dalam kajian ini. Sebagai tambahan, keperluan JAAS oleh ayam pedaging bagi seunit diet adalah tidak terjejas oleh aras diet TM dan PK. Walaupun aras diet Kuprum yang dikaji mempunyai gangguan keatas keperluan JAAS bagi ayam pedaging peringkat permulaan, tetapi tidak keatas ayam pedaging peringkat pembesaran.