UNIVERSITI PUTRA MALAYSIA

A STUDY ON THE EFFECTS OF HIGH ENERGY PALM OIL SUPPLEMENTED DIETS ON BROILERS GROWTH UNDER TROPICAL ENVIRONMENT

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By

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LIST OF ABBREVIATIONS

BE - Bioavailable Energy

NE - Net Energy

ME - Metabolisable Energy

AME - Apparent Metabolisable Energy

AME_n - Apparent Metabolisable Energy Corrected to zero nitrogen retention

P:E - Protein:Energy Ratio

E:P - Energy:Protein Ratio

C:P - Calorie:Protein Ratio

CRD - Chronic Respiratory Disease

FCR - Feed Conversion Ratio

SFA - Saturated Fatty Acid

PUFA - Polyunsaturated Fatty Acid

NRC - National Research Council

AOAC - Association of Official Agricultural Chemists

BHT - Buterated Hydroxy Toluene

UGF - Unknown Growth Factor

ASS - Acidulated Soybean-oil Soapstock

FAME - Fatty Acid Methyl Ester

DEGS - Diethylene Glycol Succinate

GLC - Gas-liquid Chromatography

SAS - Statistical Analysis System

LSD - Least Significant Difference

N	-	Normality
d	-	Day
g	-	Gram(s)
kg	-	Kilogram(s)
kcal	-	Kilocalorie(s)
h	-	Hour(s)
min	-	Minute(s)
m	-	Metre(s)
cm	-	Cetrimetre(s)
mm	-	Millimetre(s)
ml	-	Millilitre(s)
µl	-	Microlitre(s)
v/v	-	Volume per Volume
w/w	-	Weight per Weight

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

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Supervisor : Professor Dr. Syed Jalaludin bin Syed Salim

Faculty : Veterinary Medicine and Animal Science

A series of experiments were conducted to study the effects of fat added high energy diets on the performance of broilers under the warm humid environment. Two types of fat namely palm oil and soybean oil, either singly or mixed, were incorporated in the test diets at varying levels (0 to 8%). Feeds were provided *ad libitum* and data on voluntary feed intake, growth rate, feed conversion and carcass composition were measured.

Increasing palm oil level resulted in corresponding rise in the dietary energy concentrations, it was found that broilers fed on higher energy diets improved feed and energy consumption, daily weight gain and feed conversion ratio. Total carcass fat content was found to increase at higher levels of palm oil inclusions. When the level of protein was adjusted to maintain the calorie:protein ratio, the carcass fat content remained relatively constant regardless of palm oil levels added into the diets.

Fatty acid composition in the body was found to be influenced greatly by dietary fat. When soybean oil was used instead of palm oil, the amount of linoleic and linolenic acids in the carcass was also increased proportionately.

The results from these studies demonstrated the beneficiary effects of added fat high energy diets to broilers in the tropics. In spite of the adverse climatic conditions, the broilers especially those on high fat diet were able to sustain higher productivity in terms of growth rate and feed coversion ratio. This was only possible if the heat increment of broilers was reduced as a consequence of the presence of fat in the diet.

Abstrak tesis dikemukakan kepada Senat Universiti Pertanian Malaysia bagi memenuhi syarat ijazah Doktor Falsafah

SATU KAJIAN KE ATAS KESAN MAKANAN TENAGA TINGGI TAMBAHAN MINYAK KELAPA SAWIT KEPADA PERTUMBUHAN AYAM PEDAGING DI BAWAH SEKITARAN TROPIKA

Oleh

Paichok Panja

September 1991

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Fakuti : Kedoktoran Veterinar dan Sains Peternakan

Satu rangkaian ujikaji telah dijalankan untuk mengkaji kesan-kesan makanan tenaga tinggi tambahan lemak ke atas prestasi ayam pedaging di kawasan panas lembab. Dua jenis lemak iaitu minyak kelapa sawit dan minyak kacang soya, sama ada sendirian atau digabungkan, dicampurkan bersama makanan ujian pada berbagai aras (0 hingga 8%). Makanan diberi *ad libitum* dan data mengenai pengambilan makanan, kadar pertumbuhan, pertukaran makanan dan komposisi karkas diukur.

Peningkatan penambahan aras minyak kelapa sawit menghasilkan peningkatan yang serupa dalam kepekatan tenaga makanan. Adalah didapati iaitu ayam pedaging diberi makan makanan tenaga tinggi memperbaiki pengambilan makanan dan tenaganya, penambahan berat harian dan kadar pertukaran makanan. Jumlah kandungan lemak karkas adalah didapati meningkat pada aras yang tinggi penambahan minyak kelapa sawit. Apabila aras protein diubahsuai dengan mengekalkan kadar

kalori:protein, kandungan lemak karkas adalah lebih kurang dan tidak bergantung kepada aras tambahan minyak kelapa sawit kepada makanan.

Komposisi asid lemak dalam badan dipengaruhi oleh lemak makanan. Apabila minyak kacang soya digunakan daripada minyak kelapa sawit, jumlah asid linoleik dan asid linoleneik di dalam karkas juga bertambah mengikut kadar tambahan dalam makanan.

Keputusan kajian menunjukkan kesan baik makanan tenaga tinggi tambahan lemak kepada ayam pedaging di tropika. Walaupun keadaan iklim yang tidak baik, ayam pedaging terutama yang memakan makanan lemak tinggi mampu mengekalkan pengeluaran tinggi dari segi kadar pertumbuhan dan kadar pertukaran makanan. Ini hanya mungkin sekiranya penambahan haba ayam pedaging dikurangkan disebabkan kehadiran lemak dalam makanan.

CHAPTER I

INTRODUCTION

The broiler industry in the tropics is rapidly expanding and is relatively efficient. However, the full genetic potential of the broilers is seldom achieved due to adverse climatic conditions. The high environmental temperature may reduce production efficiency and retard growth. Under such circumstances, profitability of broiler production is reduced.

The effects of climatic stress on broiler growth has, to a certain extent, been overcome by feeding high energy diet. It is not very clear how high energy diet brings about this change. In order to formulate high energy poultry rations for broiler, oil or fat of animal or plant origin is added since ordinary feedstuffs cannot furnish sufficient energy to the required level.

The fats usually used in poultry feeds are tallow and vegetable oils such as soybean oil, rapeseed oil, coconut oil or corn oil, depending on the cost and location where these oils are available.

Malaysia produces a large amount of palm oil. Palm oil is relatively cheaper compared to other imported fats and it possesses many good qualities such as a high level of saturated fatty acids as well as vitamin E (antioxidant agent), which make it more stable.

The addition of fat or oil to grower diets can improve efficiency and increases digestibility of both broiler and pig. For laying hen, the addition

of some fat in layer's diets increases egg production and improves feed efficiency.

Although much work have been done on the utilization of animal and vegetable fats, reports on the use of palm oil in poultry feeds are limited.

Very little information is available on the use of palm oil as a source of energy for improving growth performance and carcass composition, especially under the warm climate. There is thus a need to study (i) the role of high energy diet for broiler production in the tropics and (ii) to evaluate the relative advantage of different types of vegetable oil as an energy source.

CHAPTER II

LITERATURE REVIEW

Broiler Production in the Tropic

Poultry eggs and meat provide the cheapest source of animal protein for the population. When compared to other livestock, poultry has, by far, the quickest and highest rate of turnover. The consumption of poultry meat is higher than other kinds of meat. Over the past two decades, poultry farming has been developed on commercial lines and has contributed very significantly to the overall economy of the country (Oh, 1984).

Poultry production in the region can be broadly categorised into backyard or small scale subsistence production, semi-intensive production and intensive or confinement rearing. Generally, free range rearing is commonly practised on subsistence and small broiler grow-out operations whereas the raising of pullets, layers and breeders is basically kept to confinement rearing (Leong, 1982).

Backyard or small scale subsistence production, often referred to as the extensive or free range system, is mainly confined to rural household. Small chicken coops and small sheds are built to provide night shelters in the compound of the household. Production basically caters for family consumption. Scavenging on scraps, grass clippings, picking of spilled padi around the vicinity of the household farm is the feeding pattern.

Sometimes small supplementation of compounded poultry mash is made from available ingredients. Generally, productivity is low.

Semi-intensive systems of production are a combination of the intensive system of brooding and range rearing during the growing period. Brooding boxes, each housing 100 chicks, are used. Poultry droppings serve as a fertilizer for soil. Home mixed feeds and commercial feeds are provided. A typical flock size of table or meat bird is small, between 1,000 to 2,000 birds. This kind of production system is popular and commonly practised and the majority of the country's supply of table or meat birds are produced in this way.

Intensive production, commonly referred to as the confinement system, is widely practised and adopted. Rearing of pullets is normally in colony pens and layers are kept in one or two tier battery systems. Modern husbandry practices and good management are often observed in most breeding farm operations. Management of broilers or breeding stock are either on deep litter floors or raised floors of wooden slats or reinforced wiremesh or grid. Raised floor systems are generally more popular among broiler farmers. Flock size can vary from 10,000 to 50,000 birds or more for broiler or breeding farms and layer flock sizes vary from 3,000 to 20,000 layers.

There are very few large integrated poultry operations in the country. The number is slowly increasing since the profit margin is higher when broilers are produced in an integrated system. Under this system, rearing of broilers is contracted out to farmers who are provided with chicks and feeds. On reaching market weight the broilers are returned to the operators for slaughter and marketing.

Poultry farmers generally are progressive and responsive to new technological innovations. It is for these reasons that technology transfer process is relatively sucessful, thus resulting in the rapid expansion of poultry production in the country.

There are a number of factors affecting broiler production in the tropics. These are climate, disease, marketing, feed and feeding, and management.

Climate

The effect of climate on poultry production is of great concern to poultry keepers in the tropics. The average annual temperature in the tropics is about 26.5°C to 30°C but it may vary from 10°C to 43°C at different seasons. In addition, there can be wide temperature fluctuations between day and night. Relative humidity could be low or high depending on the rainfall. Climate can influence poultry production by its indirect effects on the food supply, disease vectors, and water availability; or it can have a direct effect on the animal itself (Vohra, 1982).

Like other developing countries in the tropics, Malaysia too is facing problems that impede the rapid development of poultry industry. Intensification of production has resulted in increase disease occurrence, marketing, and mangement constraints as well as shortages of feeds. These constraints unless overcome, will restrict the growth of the poultry industry (Oh, 1987).

Disease

Intensive poultry production in the tropics under stressful climatic conditions is manifested by a high prevalence of functional disorders, morbidity and sometimes mortality.

A major health challenge to the poultry industry is to reduce the occurrence of chronic respiratory disease (CRD) complex in the flock. CRD complex occurs most commonly among the poorly managed farms where environmental conditions are neglected. The Newcastle Disease in poultry continues to cause great financial losses to the poultry industry despite improvement in live and inactivated vaccines. Although intensive vaccination is practised, periodic outbreaks of the disease continue to appear in many areas. This could be due to other factors which influence the response of the birds to vaccination.

Marketing

The present marketing structure and practices involving middlemen and other intermediaries, especially in broilers, do not ensure proper returns to the producers and fair prices to consumers. The trading strategy and ability of a few wholesalers to control and dictate broiler prices sometimes cause unreasonable fluctuations. At times, broiler and egg farmers have to bear the consequences of over production due to excessive chick supply from local hatcheries and influx of hatching eggs and live-birds smuggled from neighbouring countries.

Efforts made by farmers to overcome the present problem in broiler marketing system have been unsuccessful because of lack of organization and co-operation among themselves, their dependence on credit from

middlemen and also their inability to fullfil contract or volume commitments individually. Broiler farmers affected by large price fluctuations are asking for drastic changes such as an integrated appoarch to broiler production and broiler processing with farmers having a share in the processing business. Thus, together with further processing and co-operative marketing could help, to a certain extent, to stabilize the market. Under normal circumstances, the farmer's profit margin for eggs is better than broilers.

Feed and Feeding

The challenge facing the poultry industry is the continuous search for ways to minimize production costs. Since feed accounts for 62% and 73% of the total cost of producing broilers and eggs respectively, a logical approach would be to reduce the feed costs by increasing the utilization of locally grown feeds and agricultural by-products and the use of proper equipment to minimize physical wastage of feed.

Besides cost, another problem in animal feeds is quality. In the absence of legislation on quality control of animal feeds, the quality of the feed products would remain questionable. With the eventual implementation of the Animal Feed Act, product quality will be assured and maintained.

Management

Most of the information on poultry management are obtained from the developed countries. Imported technologies are modified to suit the local environment and have been successfully used. However, there are still many areas which could be studied and improved viz. housing and

equipments to suit the local conditions, health and disease control, feeding management and husbandry practices and large scale integrated farming systems.

Measurements of performance through careful analysis of farm records will provide producers with data to help them in comparing and determining their own competative position within industry. With the exception of the larger farms, data collection in the medium and small farms is haphazard. The collected data are often not analyzed or used as a management tool to increase profitability. The importance of well-kept records, data collection and analysis should be emphasised to producers.

Regulation of Voluntary Intake

Animals eat to satisfy their energy requirements, and the nutrient requirements of animals frequently depend upon their bioavailable energy (BE) intakes. According to Brody (1945) "the B vitamins, which function as general metabolic catalysts, are needed in direct proportion to the total energy metabolism, or in direct proportion to the total caloric food intake" while Kleiber (1945) concluded that: "a ration is deficient in any food constituent whose addition increases the total efficiency of energy utilization." These statements imply that BE should be the base line for establishing nutrient requirements.

Browne (1922) observed that in the fowls the appetite is controlled by the presence of food in crop. As the crop empties, it stimulates the birds to eat. However, later, Hill (1971a) stated that 'the crop of the broiler chicken appeared almost functionless.' The apparent contradiction can be explained by the availability of feed. The modern broiler chicken is offered