



**UNIVERSITI PUTRA MALAYSIA**

**EFFECTS OF FEEDING LOW PROTEIN AND LOW ENERGY DIET WITH  
PROTEASE SUPPLEMENTATION ON THE PERFORMANCE OF  
BROILER CHICKENS UNDER TWO STOCKING DENSITIES**

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# EFFECTS OF FEEDING LOW PROTEIN AND LOW ENERGY DIET WITH PROTEASE SUPPLEMENTATION ON THE PERFORMANCE OF BROILER CHICKENS UNDER TWO STOCKING DENSITIES

## ABSTRACT

A study was conducted to determine the effect of supplementing exogenous protease to broiler chickens fed low protein and low energy diets on growth performance, incidence of pododermatitis and antibody production against Newcastle disease vaccination under two stocking densities. A total of 1650 birds were randomly assigned to 60 floor pens with wood shavings as litter material in a closed house into normal (10 birds/m<sup>2</sup>) and high stocking densities (15 birds/m<sup>2</sup>). Commencing from day 1-21, birds from each density were given two types of starter diets, normal protein-normal energy (NPNE) and low protein-low energy (LPLE). From day 21-42, birds from each starter diet were given the following three types finisher diets: (i) normal protein-normal energy for both starter and finisher (NPNE-NPNE), (ii) normal protein-normal energy starter and low protein-normal energy finisher (NPNE-LPNE), (iii) normal protein-normal energy starter and low protein-normal energy plus protease finisher (NPNE-LPNEP), (iv) low protein-low energy starter and normal protein-normal energy finisher (LPLE-NPNE), (v) low protein-low energy starter and low protein-normal energy finisher (LPLE-LPNE), and (vi) low protein-low energy starter and low protein-normal energy plus protease finisher (LPLE-LPNEP). Body weight and feed intake, were recorded weekly. Feed conversion ratios were calculated. Daily mortality were recorded. On day 42, 75 birds per diet per density were scored for incidence of pododermatitis. On a similar day, blood samples were collected from 20 birds per diet per density for Newcastle disease antibody titer which was determined by ELISA. There was no significant diet x density interaction for all the parameters. Birds fed LPLE starter diet had significantly lower body weight on day 21 and feed intake during day 1-21 than NPNE. Body weight on day 42, total feed intake (day 1-42) and final FCR (day 1-42) were not significantly affected by diet. Diet had no significant effect on FCR (day1-21) and incidence of pododermatitis (day 42). Birds fed LPLE diets during the starter period had significantly lower Newcastle disease antibody titer than NPNE. High stocking density resulted in significantly lower body weight on day 42, poorer final FCR (day 1-42), higher incidence of pododermatitis, and lower Newcastle disease antibody titer than those stocked at lower density. Neither diet nor stocking density had significant effect on mortality rate. In conclusion, a lower protein and energy diets can be used without any adverse effects on growth performance of broilers chickens. However, LPLE diets may reduce ND antibody production. High stocking density was detrimental to growth performance, incidence of pododermatitis and ND antibody production.

Keywords: Low protein diets, Low energy diets, Protease, Stocking densities, Growth performance, Incidence of pododermatitis, Antibody production

KESAN PEMBERIAN MAKANAN YANG MENGANDUNGI RENDAH PROTIN DAN RENDAH  
TENAGA DITAMBAH DENGAN SUPLEMENTASI PROTEASE UNTUK PRESTASI  
PERTUMBUHAN AYAM PEDAGING APABILA DIBELA DALAM KEPADATAN YANG  
BERBEZA

ABSTRAK

Satu kajian telah dijalankan untuk mengenalpasti kesan suplementasi protease kepada ayam pedaging yang diberi makan dengan makanan yang rendah kandungan protin dan rendah kandungan tenaga untuk prestasi pertumbuhan, kejadian pododermatitis, dan penghasilan daya ketahanan badan terhadap vaksin sampar apabila dibela dalam keadaan kepadatan biasa dan kepadatan tinggi. Sebanyak 1650 anak ayam diagihkan secara rawak kepada 60 lantai pen dengan dilapisi habuk kayu di dalam sistem rumah tertutup dan dibahagikan kepada kepadatan biasa (10 birds/m<sup>2</sup>) dan kepadatan tinggi (15 birds/m<sup>2</sup>). Mulai dari hari 1-21, anak ayam diberi makan dengan dua jenis diet permulaan iaitu protin biasa-tenaga biasa (NPNE) dan protin rendah-tenaga rendah (LPLE). Mulai dari hari ke 21-42, ayam telah diberi makan dengan tiga jenis diet finisher, (i) protin biasa-tenaga biasa pada makanan permulaan dan makanan finisher (NPNE-NPNE), (ii) protin biasa-tenaga biasa makanan permulaan dan protin rendah-tenaga biasa makanan finisher (NPNE-LPNE), (iii) protin biasa-tenaga biasa makanan permulaan dan protin rendah-tenaga biasa ditambah protease makanan finisher (NPNE-LPNEP), (iv) protin rendah-tenaga rendah makanan permulaan dan protin biasa-tenaga biasa makanan finisher (LPLE-NPNE), (v) protin rendah-tenaga rendah makanan permulaan dan protin rendah-tenaga biasa makanan finisher (LPLE-LPNE), dan (vi) protin rendah-tenaga rendah makanan permulaan dan protin rendah-tenaga biasa ditambah protease makanan finisher (LPLE-LPNEP). Data berat ayam setiap minggu, pengambilan makanan setiap minggu, dan kadar kematian direkodkan. FCR mingguan dikira. Pada hari ke-42, 75 ayam untuk setiap kumpulan diet-kepadatan diskor untuk kejadian pododermatitis. Pada hari yang sama juga, sampel darah diambil daripada 20 ekor ayam untuk setiap kumpulan diet-kepadatan untuk penghasilan daya ketahanan badan terhadap vaksin sampar dan dianalisa dengan menggunakan ELISA. Secara keseluruhannya, tiada interaksi antara diet x kepadatan untuk eksperimen ini. Ayam yang diberi makan makanan permulaan LPLE mempunyai berat yang terendah pada hari ke-21 dan pengambilan makanan pada hari ke 1-21 berbanding NPNE. FCR juga tidak terkesan dengan diet. Berat ayam pada hari ke-42, jumlah pengambilan makanan pada hari 1-42, dan FCR akhir (hari 1-42) tidak terkesan dengan jenis diet. Diet juga tidak memberi kesan kepada kejadian pododermatitis. Ayam yang diberi makanan permulaan LPLE mempunyai penghasilan daya ketahanan badan yang rendah terhadap vaksin sampar berbanding NPNE. Kepadatan tinggi memberi kesan kepada berat ayam pada hari ke-42, FCR keseluruhan yang tidak bagus, kekerapan berlaku kejadian pododermatitis dan rendah penghasilan daya ketahanan badan terhadap vaksin sampar. Kepadatan dan diet tidak memberi apa-apa kesan terhadap kematian ayam. Konklusinya, makanan yang rendah protin dan rendah tenaga boleh diberikan kepada ayam mengikut kesesuaian umur tanpa memberi kesan kepada prestasi pertumbuhan ayam pedaging. Walaubagaimanapun, diet tersebut boleh merendahkan daya ketahanan badan. Kepadatan tinggi memberi kesan buruk kepada prestasi pertumbuhan, kejadian pododermatitis dan penghasilan daya tahan badan.

Kata kunci: diet rendah protin; diet rendah tenaga; protease; kepadatan; prestasi pertumbuhan; kejadian pododermatitis; penghasilan daya ketahanan badan

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## DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institutions.

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# CHAPTER 1

## INTRODUCTION

### Background of Study

The broiler chicken industry in Malaysia has attained the status of self-sufficiency since the 1970s. It contributes 70% of the total meat requirements in Malaysia. However, Malaysia is highly dependent on imported feed ingredients and their global prices are expected to continue soaring. This would result in higher production costs and consequently higher retail price of chickens. The price of corn, a major feed ingredient in poultry diets, has risen by about 118.9% while the price of soybean meal, the second major feed ingredient, has risen by 100% from 2006 to July 2008 (Federation of Livestock Farmers' Association of Malaysia, 2008).

It has been reported that exogenous enzymes supplementation can increase the digestibility of nutrients in broiler chickens (Adeola and Cowieson, 2011). Hence, there is a possibility that with enzyme supplementation, dietary crude protein and energy can be reduced without any adverse effect on performance. Exogenous protease has been shown to improve both protein and energy digestibilities in chickens. (Law *et al.*, 2014). Diets with lower nutrient contents are more cost effective and have less environmental pollution problems (Torres-Rodriguez *et al.*, 2005). It has been shown that enzyme supplementation was more beneficial when dietary nutrient level or availability is less than the requirement.

Over the past decades, genetic selection for high productivity has resulted in higher susceptibility to physiological stress in broilers (O'Dea *et al.*, 2006). Management practices and rearing conditions have significant effects on animal welfare (Estevez, 2007). There is a great concern about stocking density because of its effects on welfare and health of broiler chickens

(Thaxton *et al.*, 2006). Crowding has been shown to elicit physiological stress responses and adversely affect growth rate, feed efficiency, survivability, and carcass quality (Estevez, 2007). Although crowding is widely known to be detrimental to productivity, economic studies suggested that such practices may increase the net profit of meat production. It is well documented that stressful environment may influence nutrient requirements in poultry (Butcher, 2002).

### **Research Problem**

Feed comprised more than 70% of cost of broiler chicken production. Lowering dietary energy and protein may reduce feed cost substantially. However, such changes in feed formulation could be detrimental to growth performance. Enzyme supplementation which can improve nutrient digestibility may allow the feeding of lower energy-protein diets. Overcrowding can be stressful to chickens but it is not known whether their nutritional requirements will be modified.

### **Hypothesis**

Lower protein and lower energy diets with enzyme supplementation could be provided to broiler chickens during certain rearing periods without adverse consequences on growth performance. Chickens stocked at a higher density may have different dietary energy and protein requirements.

### **General Objective**

Thus, this study was conducted to evaluate the effect of feeding low-protein and low-energy diets with protease supplementation on growth performance, incidence of pododermatitis, and antibody production in broiler chickens stocked at different densities.

### **Specific Objective**

- i) To determine the effect of supplementing exogenous protease to broiler chickens fed low-protein and low-energy diet on growth performance, incidence of pododermatitis, and antibody production against Newcastle disease vaccination.
- ii) To determine the effect of stocking density on dietary protein and energy requirements in broiler chickens.

### **Significance of study**

The findings will help in the formulation of lower cost diets for commercial broiler chickens stocked at different densities.

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