



**UNIVERSITI PUTRA MALAYSIA**

***HAEMATOLOGICAL STRESS INDICATOR OF LAYER CHICKENS  
IN OPEN SIDED AND CLOSED HOUSE SYSTEMS***

**JULAILIYANI BINTI KADIR**

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CHICKENS IN OPEN SIDED AND CLOSED HOUSE SYSTEMS**

The logo of Universiti Putra Malaysia (UPM) is a shield-shaped emblem. It features a red and white color scheme. At the top left, the letters 'UPM' are written in white on a red background. In the center, there is a stylized white bird or wing shape. To the right of the bird, there is an open book. The shield is surrounded by a grey border.

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**HAEMATOLOGICAL STRESS INDICATOR OF LAYER CHICKENS IN OPEN  
SIDED AND CLOSED HOUSE SYSTEMS**

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**A project paper submitted to the  
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It is hereby certified that we have read this project paper entitled “Haematological Stress Indicator of Layer Chickens in Open Sided and Closed House Systems”, by JulailiyaniBintiKadirand in our opinion it is satisfactory in terms of scope, quality, and presentation as partial fulfillment of the requirement for the course VPD 4999-Final Year Project.

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## DEDICATION

I dedicate this paper to both my parents (KadirCheKasim and Fatimah Hamad), for their love and everlasting support that made me who I am today. To my siblings; my sister and brothers that inspire me to continue my study in tertiary education. To all my teachers and friends that help me all the way to here. Thank you very much.



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**LIST OF ABBREVIATIONS**

°C	Degree Celsius
AT	Ambient temperature
BCSPCA	British Columbia Society for the Prevention Of Cruelty To Animals
DVS	Department of Veterinary Service
HPA	Hipothalamus-Pituitary-Adrenal
H/L	Heterophil to lymphocyte
kg	kilogram
m/s	meter per second
RBC	Red blood cell
RH	Relative humidity
V	Velocity
WBC	White blood cell

**Abstract****Haematological Stress Indicator of Layer Chicken Raised In Open Sided and Closed House System****JulailiyaniBintiKadir****2015****Supervisor:****Dr. HazilawatiBintiHamzah,****Co-Supervisors:****Dr. SitiNurAisyahBintiIsman, Prof MohdAriff Bin Omar, Dr. HaslizaBinti Abu Hassim**

Layer hens in Malaysia are raised in different types of housing, such as open sided house and closed house system. Previous studies have shown layer hens raised in different housing systems experienced different levels of stress. Thus, this study was conducted to evaluate the heterophil to lymphocyte ratio (stress indicator) of layer hens raised in open sided and close house systems. A total of 120 Lohmann Brown birds were chosen randomly and equally (n=20) from two housing types comprised of three open sided houses and three closed houses. Blood samples were obtained once from the birds for the determination of the heterophil to lymphocyte (H/L) ratio. The environmental parameters include temperature, relative humidity and air velocity were taken in the

morning, afternoon and evening on the same day of blood sampling. The heat stress index was calculated by the sum of the temperature and the relative humidity. During sampling, two of six houses, both were open sided houses, were not contracted with disease outbreaks (viral infection). Results showed that H/L ratio of unhealthy birds in the open sided houses was significantly ( $p < 0.05$ ) higher (1.113) compared to the healthy birds (0.646) reared in the similar house type. Meanwhile, the H/L ratio of unhealthy birds in the open sided house was significantly ( $p < 0.05$ ) higher (1.113) as compared to the unhealthy birds in the closed house system (0.836). Although the heat stress index for both types of houses was not exceeded the limit, which is  $107^{\circ}\text{C}$ , the mean value of air velocity in the open sided houses was significantly ( $p < 0.05$ ) lower (0.4 m/s) compared to closed houses (1.8 m/s). Hence, it is suggested that low air velocity in the open sided houses contributed to the ineffective heat regulation by the birds via convection, which lead to stress and caused H/L elevated. Results in this study showed that H/L ratio is a good haematological stress indicator in layer hens, and unhealthy birds particularly the one that reared in an open sided house had higher H/L ratio indicating a greater stress response.

Keywords: heterophil to lymphocyte (H/L) ratio, Lohmann Brown, heat stress index

## **Abstrak**

### **Penunjuk Tekanan Secara Haematologi oleh Ayam penelur Yang Dijaga dalam Reban Terbuka dan Tertutup**

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Hassim**

Ayam penelur di Malaysia dijaga dalam pelbagai jenis rumah, seperti rumah reban terbuka dan rumah reban tertutup. Kajian-kajian sebelum ini ada menyatakan bahawa ayam penelur yang dijaga mengalami tahap tekanan berbeza mengikut jenis penjagaan. Oleh itu, kajian ini dijalankan untuk mengkaji nisbah heterofil kepada limfosit (penunjuk tekanan) dalam ayam penelur yang tidak sihat untuk rumah reban terbuka dan tertutup. Sejumlah 120 ayam penelur jenis Lohmann Brown telah dipilih secara rawak dan dalam jumlah yang sama ( $n=20$ ) dari dua jenis rumah terdiri daripada tiga rumah reban terbuka dan tiga rumah reban tertutup. Sampel-sampel darah diambil sekali sahaja daripada ayam untuk mendapatkan nisbah heterofil kepada limfosit (H/L). Parameter persekitaran termasuk suhu, kelembapan relatif, dan hala tuju udara telah di ambil pada waktu pagi, tengahari dan petang pada hari yang sama sampel darah di ambil. Indeks tekanan haba dikira dengan mendapatkan hasil penambahan

suhu dengan kelembapan relatif. Semasa pengambilan sampel, dua daripada rumah reban yang kedua-duanya rumah reban terbuka, tidak dijangkiti penyakit (jangkitan virus). Keputusan menunjukkan nisbah H/L pada ayam yang tidak sihat di dalam rumah reban terbuka dengan signifikannya ( $p < 0.05$ ) lebih tinggi (1.113) berbanding ayam yang sihat (0.646) yang dijaga di dalam sistem penjagaan yang sama. Sementara itu, nisbah H/L pada ayam yang tidak sihat di dalam rumah reban terbuka dengan signifikan ( $p < 0.05$ ) lebih tinggi (1.113) berbanding kepada ayam yang tidak sihat di dalam sistem rumah reban tertutup (0.836). Walaupun indeks tekanan haba untuk setiap jenis rumah tidak melebihi had, iaitu  $107^{\circ}\text{C}$ , nilai purata halaju udara di dalam rumah reban terbuka dengan signifikan ( $p < 0.05$ ) lebih rendah (0.4m/s) berbanding rumah reban tertutup (1.8m/s). Oleh itu, adalah dicadangkan bahawa halaju angin yang rendah di dalam rumah reban terbuka menyumbang kepada ketidakberkesanan pengawalan haba melalui perolakan, yang menjurus kepada tekanan dan menyebabkan peningkatan H/L. Keputusan dalam kajian ini menunjukkan bahawa nisbah H/L adalah penunjuk tekanan secara hematologi yang bagus di dalam ayam penelur, dan ayam yang tidak sihat terutamanya ayam yang dijaga di dalam rumah reban terbuka mempunyai nisbah H/L yang lebih tinggi menunjukkan respon tekanan yang lebih besar,

**Kata Kunci:** nisbah heterofil kepada limfosit (H/L), Lohmann Brown, indeks tekanan haba

## 1.0 Introduction

Poultry farming has been established for many years. It is expanding in relation to rapidly changing technology. Poultry numbers have increased by more than 50% in the last twenty years due to increasing consumer demand. It includes layer, broiler, duck, turkey and quail, which is categorized into poultry meat and egg production industry.

In layer poultry farming, birds are reared either in natural or controlled environment confinements; open sided or closed housing systems, respectively. Both housing systems practice cage and cage-free egg production systems. The types of cages used in the cage egg production system are conventional and enriched cages, while for the cage-free egg production system the birds are either reared in deep litter or free ranged system. Layer hens reared in the different housing systems are experienced different stages and magnitudes of stress, which influence performance of egg production.

The key differences between open sided and closed housing systems are temperature, relative humidity and air velocity. Increase or decrease level of these parameters are closely related to heat stress in birds. Apart from heat stress, health status also influences level of stress in the birds. Stressed birds have high plasma corticosterone; resulted from release of glucocorticoid after activation of the hypothalamus-pituitary-adrenal (HPA) system. The glucocorticoid will enhance influx of heterophils into blood circulation and suppress lymphocyte proliferation, which lead to increase in the H/L ratio.



Hence, the objectives of this study are 1) to determine and compare the stress levels in layer hens reared in two different housing systems by evaluating the H/L ratio, and 2) to evaluate the usefulness of H/L ratio as a haematological stress indicator.



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