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PHYSIOLOGICAL AND BEHAVIOURAL RESPONSES TO DIFFERENT REARING SYSTEM IN BROILER CHICKENS

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PHYSIOLOGICAL AND BEHAVIOURAL RESPONSES TO DIFFERENT REARING SYSTEM IN BROILER CHICKENS

BY

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A project report submitted to Faculty of Agriculture, Universiti Putra Malaysia, in fulfilment of the requirement of SHW 4999 (Final Year Project) for the award of the degree of Bachelor of Agriculture (Animal Science)

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CERTIFICATION

This project report entitled **Physiological And Behavioural Responses To Different Rearing System In Broiler Chickens** is prepared by **Nurul Syafiqa Binti Norsam** and submitted to the Faculty of Agriculture in fulfilment of the requirement of SHW 4999 (Final Year Project) for the award of the degree of Bachelor of Agriculture (Animal Science).

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LIST OF ABBREVIATIONS

CORT	Corticosterone
APP	Acute Phase Protein
OVT	Ovotransferrin
CPN	Ceruloplasmin
TI	Tonic immobility
CRS	Cage rearing system
FRS	Floor rearing system
%	Percentage
C	Celcius
cm	Centimeter
m	Meter
s	second

ABSTRACT

Floor system is commonly practiced in the Malaysian broiler industry. In a hot and humid tropical environment, broilers tend to drink more and thus water intake increases. Higher water consumption may result in wet feces and lead to litter problem. Consequently irritation to mucous membrane, stress, increase susceptibility to diseases, contact dermatitis and leg weakness in broilers. The objective of this study was to determine the welfare of broiler chickens raised on litter floor pens and battery cages under the hot and humid tropical environment. Physiological, imunological and behavioural measurements were used to assess the welfare of broilers. A total of 200 one-day-old Cobb 500 male broiler chicks were equally assigned to either battery cages with wire floors or floor pens with wood shavings as litter material. There were 10 replicates of 10 birds for each rearing system. The cages and pens were in a naturally-ventilated house and the stocking density allowed for both rearing systems was 0.1 m^2/bird. Birds were fed with commercial diet and vaccinated against Newcastle disease on day 7 and 21 via intraocular route. Broilers raised on floor pens had significantly higher corticosterone (CORT), ovotransferrin (OVT) and ceruloplasmin (CPN) than their cage rearing system (CRS) counterparts on day 42. Antibody titre against ND vaccinations on day 42 was not significantly affected by rearing system. Both CRS and FRS broilers showed similar durations of tonic immobility (TI) on day 42. However, the number of inductions to elicit TI was significantly higher in CRS birds when compared to those of FRS. Mean percentages of CRS chicks resting on day 13 was significantly higher than FRS. On day 13, the FRS birds showed significantly more walking activity than the CRS group. Other behaviors were not significantly affected by rearing system on day 13. On day 27, the

CRS birds spent more time feeding and drinking than their FRS counterparts. Walking and resting activities were significantly reduced in CRS birds when compared to FRS on day 27. On day 41, only resting activity was significantly affected by rearing system. The FRS birds rested more than those of CRS. Based on physiological stress and fear reactions, this study suggested that cages, while may restrict the expression of a more diverse behavioural repertoire in broilers, were better than floor pens with respect to welfare.

ABSTRAK

Sistem lantai merupakan sistem yang biasa diamalkan di dalam industri ternakan ayam di Malaysia. Dalam persekitaran tropika panas dan lembap, ayam daging cenderung untuk minum lebih banyak air sekali gus meningkatkan pengambilan air. Pengambilan air yang lebih tinggi boleh mengakibatkan najis yang basah dan membawa kepada masalah sarap . Akibatnya kerengsaan kepada membran mukus, tekanan, meningkatkan kerentanan kepada penyakit, contact dermatitis dan kelemahan kaki dalam ayam daging. Kajian ini bertujuan untuk menentukan kebajikan ayam daging yang diternak di sarap lantai reban dan sangkar bateri di bawah persekitaran tropika yang panas dan lembap. Fisiologi, imunological dan pengukuran tingkah laku telah digunakan untuk menilai kebajikan ayam daging. Sejumlah 200 satu hari-Cobb 500 ayam jantan anak ayam diletakkan secara rawak sama ada sangkar bateri dengan jaring lantai atau lantai reban dengan kayu atau sebagai bahan sarap. Terdapat 10 replicates 10 burung bagi setiap sistem ternakan. Sangkar dan reban yang berada di rumah pengudaraan secara semula jadi dan kepadatan stok yang dibenarkan untuk kedua-dua sistem ternakan adalah 0.1 m2/burung. Burung diberi makan dengan diet yang komersial dan pelalian terhadap penyakit Newcastle pada hari 7 dan 21 melalui laluan intraocular. Ayam daging di lantai reban mempunyai jauh lebih tinggi CORT, OVT dan CPN daripada rakan-rakan CRS mereka pada hari 42. Titre antibodi terhadap ND vaksin pada hari 42 ini tidak ketara dipengaruhi oleh sistem ternakan. Ayam daging CRS dan FRS menunjukkan jangkamasa sama TI pada hari 42. Walau bagaimanapun, bilangan induksi menghimpunkan TI adalah jauh lebih tinggi dalam CRS burung jika dibandingkan dengan orang-orang yang FRS. Min peratusan anak ayam CRS berehat pada hari 13 adalah lebih tinggi dari FRS. Pada hari 13, burung

FRS menunjukkan aktiviti berjalan kaki lebih daripada Kumpulan CRS. Tingkah laku yang lain tidak terjejas dengan ketara oleh sistem ternakan pada hari 13. Pada hari 27, burung CRS menghabiskan lebih banyak masa makan dan minum daripada ayam di FRS Berjalan dan berehat aktiviti telah ketaranya dalam CRS burung jika dibandingkan dengan FRS pada hari 27. Pada hari 41, hanya berehat aktiviti ini secara ketara dipengaruhi oleh penternakan sistem. Burung FRS berehat lebih daripada CRS. Berdasarkan reaksi ketakutan dan tekanan fisiologi, kajian ini mencadangkan bahawa sangkar, sementara mungkin mengehadkan tingkah laku yang pelbagai dalam ayam daging, adalah lebih baik daripada lantai reban dari segi kebajikan.

CHAPTER 1

INTRODUCTION

Rearing system is a crucial factor affecting the performance and welfare of poultry (Wang *et al.,* 2015). One of the most common rearing system for broiler chickens in Malaysia is on floor pens with litter. However, the cost and availability of suitable litter materials for broiler production is a problem many areas. Litter scarcity and expense continue to increase, and substantial research is being directed towards finding alternatives to conventional litter grow-out of broilers. Cage system, which allow manure to pass through from birds, negate the need for litter and offer an obvious alternatives to conventional litter grow-out of boilers. Numerous workers have compared performance of broilers grown on litter with those raised in cages. Cage-reared broilers showed better growth performance when compared to those grown on litter when raised to heavy weights (Hypes *et al.,* 1994). However, the welfare of broiler chickens in cages could be affected by movement restriction, poor bone strength leg disorders due to lack of exercise, and prevention of key behavioural patterns such as dustbathing and ground scratching (Shields and Greger, 2013). Broilers housed in cages were more susceptible to leg disorders (Haye and Simon, 1978; Rizk et al., 1980). There is a paucity of information on the effects of rearing system on physiological stress and fear reactions in broiler chickens. Work in laying hens showed negligible differences between cage and pen rearing systems in putative physiological measures such as adrenal, thyroid and pituitary weights, adrenal cholesterol, plasma glucose, cosrticosterone, or choloesteol, or differential leucocyte counts (Wolford and Ringer 1962; Bareham, 1972; Eskeland, 1976; Craig and Craig,

1985). The only documented work on physiological stress reaction to pen and cage rearing systems in broiler chickens was by Fouad *et al.* (2008). The authors found that caged birds had higher heterophil to lymphocyte ratios than those grown on floor pens. On a cautionary note, however, caged birds had smaller floor space when compared to those raised on floor pens (500 cm^2 versus 600 cm^2 per bird). Using novel object test, Fouad *et al*. (2008) reported that caged broilers were more fearful than their counterparts on floor pens.

Earlier work comparing broilers raised on litter and in cages were conducted under temperate conditions. In a hot tropical environment, chickens tend to drink more to remove the heat in the body (Boushy and Marle, 1978). Thus, they eliminate more water though the droppings and this will result in wet litter problem. Wet litter may increase obnoxious odour coming from ammonia and bacterial action in the droppings. Wet litter may compromise the welfare of chickens through irritation to mucous membrane, distress susceptibility to respiratory diseases, contact dermatitis and leg weakness (Ingrid *et al.*, 2014). Broiler chickens raised in cage rearing system may also provide a greater hygienic condition compared to litter rearing system (Willis *et al.*, 2002). A major advantage of cage rearing system is the separation of birds from their excreta and thus decreasing the disease and parasitic infection (Appleby *et al.*, 2004).

A central issue in animal welfare research is in how the welfare state of animals can be assessed objectively and scientifically. In the present study, the welfare of broilers raised on floor pens and in cages will be determined by physiological, behavioural and immunological measurements (Hughes and Curtis,

1997; Mench and Mason, 1997; Terlouw *et al.*, 1997). Circulating levels of corticosterone, which reflect the hypothalamic-pituitary-adrenal axis activity is considered the most frequently monitored physiological response to stress in poultry (Zulkifli and Siegel, 1995). Acute-phase proteins (APP) are a class of protein which in response to inflammation either the plasma concentrations increase (positive acute-phase protein) or decrease (negative acute-phase protein). The changes in acute-phase protein concentration are due to changes in their production of hepatocytes. The positive APP includes ceruloplasmin (CPN) and ovotransferrin (OVT). Ceruloplasmin is a copper-containing ferroxidase which protects tissues from iron-mediated free radical injury through oxidation of the toxic ferrous iron to nontoxic ferric form (Patel *et al.*, 2002). Ovotransferrin is an iron binding protein and provide antimicrobial properties by sequestering iron and also to modulate heterophil and macrophage function in chickens (Murata *et. al.*, 2004). Recent work showed that serum levels of APP were modified in chickens subjected to adverse non-inflammatory stimuli such as high temperature (Najafi *et al.*, 2015; Olubodun *et al.*, 2015), overcrowding (Shakeri *et al.*, 2014; Najafi *et al.*, 2015), and feed withdrawal (Najafi *et al.*, 2016). Murata *et al.*, (2014) suggested that APP may play a profound role in the restoration of homeostasis in animals with respect to non-inflammatory, psychophysical stressors. Animals encountering difficult conditions often show some degree of immunosuppression. Stress influences both cell mediated and antibody dependent immune functions (Kidd, 2004).

Behavior is the internally coordinated and externally visible response of whole living organism towards the internal or external stimuli. Behaviour is considered one of the most easily observed measures of welfare. Animals respond to environmental

difficulties by altering their behaviour . Abnormal behavior is behaviour that differs in pattern, frequency or context from which is shown by most members of the species in conditions that allow a full range of behavior (Fraser and Broom, 1997). Fear is an undesirable state of suffering and a powerful stressor which can seriously harm an animal's welfare (Jones, 2002). Tonic immobility, a temporary state of motor inhibition, loss of the righting response and reduced responsiveness to the external stimulation has been widely used to determine underlying fearfulness in poultry (Zulkifli *et al.,* 2009; Al-Aqil and Zulkifli *et al.,* 2009; Al-Aqil *et al.,* 2013).

The objective of this study was to determine the welfare of broiler chickens raised on litter floor pens and battery cages under the hot and humid tropical environment. Physiological, imunological and behavioural measurements were used to assess the welfare of broilers.

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