EFFECTS OF DIETARY INCLUSION OF MICROALGAE *Arthrospira platensis* ON THE GROWTH PERFORMANCE AND CARCASS QUALITY IN JAPANESE QUAILS (*Coturnix japonica* TEMMINCK & SCHLEGEL)

DANNY CHEONG SWEE WENG

FP 2014 45
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By

DANNY CHEONG SWEE WENG

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirements for the Degree of Master of Science

October 2014
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In recent years, quail meat has been gaining much popularity among consumers in Malaysia and quail rearing is expected to increase to meet the high demand for local and international market. Although a series of researches had been carried out to determine the optimum level of Arthrospira platensis inclusion for fast growing commercial broiler and layer chicken diet but not in Japanese quail diet. Hence, two experiments were conducted to study the effects of feeding microalgae Arthrospira platensis on the growth performance and carcass quality of Japanese quails. In the first experiment, three hundred 14 days old quails were randomly subjected to 5 treatments consisted of basal diet-control (C), diet with 1% Arthrospira platensis inclusion, diet with 2% Arthrospira platensis inclusion, diet with 4% Arthrospira platensis inclusion and diet with 8% Arthrospira platensis inclusion. Each treatment was replicated three times, consisting of 20 birds. The feeding experiment period lasted for 21 days. Basal diet was based on corn and soybean meal. In the first experiment, dietary of Arthrospira platensis inclusion significantly improved weekly body weight gain (BWG) and feed conversion ratio (FCR) in quails. Also, Mortality rate (MR), carcass yield, meat colour values and meat tenderness were significantly improved by Arthrospira platensis diet. These results concluded that Arthrospira platensis was suitable as a supplement in quails’ feed for improving growth performance and carcass quality. In this experiment, 4% Arthrospira platensis inclusion was identified to be the most suitable level considering most parameters showed positive observation. In the second experiment, three hundred 14 days old quails were randomly allocated into 5 dietary treatment groups, consisting basal diet-control group, groups with 4% Arthrospira platensis diet at different starting age of 15 days old, 22 days old and 28 days old and group fed with commercial diet. Each treatment was replicated three times, consisting 20 birds. The feeding experiment lasted for 21 days. Body weight gains (BWG), feed conversion ratio (FCR) and mortality rate (MR) were significantly improved from the time of Arthrospira platensis inclusion into diet. Also, carcass yield, meat colour test and meat tenderness were also significantly improved when introduced Arthrospira platensis diet at earlier growing stage. The results demonstrated that at starting age from day 15 to as later as day 22 were found to be the best time of Arthrospira platensis inclusion into quail diet to achieve positive growth performance and improve carcass quality.
KESAN MIKROALGA *Arthrospira platensis* KE ATAS PRESTASI KADAR TUMBESARAN DAN KUALITI DAGING PADA BURUNG PUYUH (*Coturnix japonica* TEMMINCK & SCHLEGEL)

Oleh

DANNY CHEONG SWEE WENG

Oktober 2014

Pengerusi: Profesor Madya Azhar Kasim, DVM, MS, PhD
Fakulti: Pertanian

berlainan dan lebih ketara apabila diet 4% \( A. \textit{platensis} \) diberi pada usia 15 hari. Hasil karkas and bahagian daging, nilai warna daging dan kelembutan daging juga jauh berbeza antara kumpulan yang diujikaji. Eksperimen ini menunjukkan bahawa burung puyuh yang diberi diet 4% \( A. \textit{platensis} \) seawal usia 15 hari atau selewat-lewatnya 22 hari memberikan kesan positif kepada kadar tumbesaran disamping meningkatkan kualiti daging.
ACKNOWLEDGEMENTS

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I certified that a Thesis Examination Committee has met on 28 October 2014 to conduct the final examination of Danny Cheong Swee Weng on his thesis entitled “Effect of Dietary Inclusion of Microalgae *Arthrospira platensis* on the Growth Performance and Carcass Quality in Japanese Quails (*Coturnix japonica* Temminck & Schlegel)” in accordance with the Universities and University Colleges Act 971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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<tr>
<td>%</td>
<td>Percentage</td>
</tr>
<tr>
<td>β</td>
<td>Beta</td>
</tr>
<tr>
<td>AA</td>
<td>Arachidonic acid</td>
</tr>
<tr>
<td>ADF</td>
<td>Acid Detergent Fiber</td>
</tr>
<tr>
<td>ALA</td>
<td>Alpha-linolenic acid</td>
</tr>
<tr>
<td>AOAC</td>
<td>Association of Official Analytical Chemists</td>
</tr>
<tr>
<td>Atm</td>
<td>Atmosphere</td>
</tr>
<tr>
<td>BWG</td>
<td>Body Weight Gain</td>
</tr>
<tr>
<td>°C</td>
<td>Degree Celsius</td>
</tr>
<tr>
<td>Cal</td>
<td>Calorie</td>
</tr>
<tr>
<td>cm</td>
<td>Centimeter</td>
</tr>
<tr>
<td>cm²</td>
<td>Centimeter square</td>
</tr>
<tr>
<td>cm³</td>
<td>Centimeter cube</td>
</tr>
<tr>
<td>CP</td>
<td>Crude Protein</td>
</tr>
<tr>
<td>DHA</td>
<td>Docosahexaenoic acid</td>
</tr>
<tr>
<td>DM</td>
<td>Dry Matter</td>
</tr>
<tr>
<td>EPA</td>
<td>Eicosapentaenoic acid</td>
</tr>
<tr>
<td>EC</td>
<td>European Commission</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>°F</td>
<td>Fahrenheit</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agriculture Organization of United Nation</td>
</tr>
<tr>
<td>FC</td>
<td>Feed Consumption</td>
</tr>
<tr>
<td>FCR</td>
<td>Feed Conversion Ratio</td>
</tr>
<tr>
<td>g</td>
<td>Gram</td>
</tr>
<tr>
<td>g/L</td>
<td>Gram per liter</td>
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<tr>
<td>GE</td>
<td>Gross Energy</td>
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<tr>
<td>GLA</td>
<td>Gamma-linolenic acid</td>
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<tr>
<td>GLM</td>
<td>General Linear Model</td>
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<tr>
<td>H₂SO₄</td>
<td>Sulphuric Acid</td>
</tr>
<tr>
<td>Kcal</td>
<td>Kilo Calories</td>
</tr>
<tr>
<td>Kcal/g</td>
<td>Kilo Calories per gram</td>
</tr>
<tr>
<td>Kg</td>
<td>Kilogram</td>
</tr>
<tr>
<td>L</td>
<td>Liter</td>
</tr>
<tr>
<td>LA</td>
<td>Linoleic acid</td>
</tr>
<tr>
<td>ME</td>
<td>Metabolizable Energy</td>
</tr>
<tr>
<td>mg</td>
<td>Milligram</td>
</tr>
<tr>
<td>mg/g</td>
<td>Milligram per gram</td>
</tr>
<tr>
<td>MR</td>
<td>Mortality Rate</td>
</tr>
<tr>
<td>ml</td>
<td>Milliliter</td>
</tr>
<tr>
<td>mm</td>
<td>Millimeter</td>
</tr>
<tr>
<td>MSE</td>
<td>Mean Square Error</td>
</tr>
<tr>
<td>Na₂CO₃</td>
<td>Sodium Carbonate</td>
</tr>
<tr>
<td>NDF</td>
<td>Neutral Detergent Fiber</td>
</tr>
<tr>
<td>NRC</td>
<td>National Research Council</td>
</tr>
<tr>
<td>PSE</td>
<td>Pale, soft, exudative</td>
</tr>
<tr>
<td>ppm</td>
<td>Part Per Million</td>
</tr>
<tr>
<td>RM</td>
<td>Ringgit Malaysia</td>
</tr>
<tr>
<td>SDA</td>
<td>Stearidonic acid</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>--------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>SE</td>
<td>Standard Error</td>
</tr>
<tr>
<td>Sec</td>
<td>Second</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>WHC</td>
<td>Water Holding Capacity</td>
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CHAPTER 1

INTRODUCTION

The Malaysian poultry industry had undergone remarkable changes and also growth over the last five decades attaining self sufficiency in meat and eggs since the early 80’s (Ferket et al., 2005). Poultry meat and eggs are the two most popular and still being the cheapest source of animal proteins. Most of the poultry meats are from chickens. However, other poultry species such as ducks, geese and quails are gaining in popularity. The local poultry industry can be considered a value added industry since the source which produce the commercial-type birds are imported and raised by feeding with feeds comprising mainly of imported ingredients.

Commercially formulated feeds paved the way to mass production of poultry. Efficiency in production is further enhanced through management and nutritional means. Due to the increasing demand of raw material to meet commercial poultry production, it is of interest to know the other available raw material sources can be used in Malaysia. The industry should not depend totally on imported feed ingredients since there are potential local sources of ingredients that can partially replace the conventionally corn-soybean meal-based diets. To be a good ingredient, it should be able to provide sufficient protein or energy. It will be an added advantage if the ingredient can contribute towards improving the quality of the end products despite increasing the efficiency of feed conversion into meat (Sharifi et al., 2011).

Recently there is an interest of using microalgae to save world problem from global warming, climate change, soil depletion, crop failure and using microalgae biomass for food, feed and fuel (Macfarlane, 2009; Gurierrez, 2009). In the past, multiple studies done by researchers to investigate the incorporation of microalgae in diet for poultry production. However, such studies on Spirulina in literature are minimally available. The preference of raw material for poultry feed productions varies with respect to major sources like corn, soybean and fishmeal. Hence, an attempt is made to study whether Spirulina can be as one of raw materials supplying adequate nutrient in poultry diet.

Incorporations of microalgae into the feed formulation for a wide variety of animals ranging from aquacultures, pets and farm animals, have been studied to a certain extent (Spolaore et al., 2006). The use of microalgae as a supplementation has been recommended to benefit poultry involving growth, survival, feed utilization and carcass quality. In fact, 30% of the current world algal production is sold for animal feed applications (Becker, 2004). But before commercialization, microalgae strain has to meet various criteria. It has to be easily cultured and nontoxic. It also needs to be of the correct size and in physical forms to be easily ingested despite having high nutritional qualities and a digestible cell wall to make nutrients available (Brown et al., 1999; Renaud et al., 2002; Priyadarshani, 2012).
Studies have suggested a role for microalgae in broiler for good growth and feed efficacy (Ross and Dominy, 1990), and eventually resulting in satisfactory improvement in growing chicken (Becker and Venkataraman, 1982; Brune, 1982). Similar results were obtained when microalgae were fed to laying hens (Nazarenko et al., 1975; Sauveur et al., 1979). A Japanese patent (Sakakibara et al., 1994) describes the use of *Spirulina* to reduce the death rate in quail. More recently has attributed to significantly higher growth rate and lower non-specific mortality rate in turkey fed with *Spirulina*, further support earlier findings in broilers and white leghorn type chickens (Qureshi et al., 1994).

To date, extensive research had carried out to determine the optimum level of *A. platensis* (henceforth referred as Spirulina) inclusion for mainly fast growing commercial broiler and layer chicken. However, not many information in the literature especially on performance parameters, carcass yields and meat characteristic of Japanese quail fed corn soybean meal diet with Spirulina inclusion. Also, the previous studies were conducted to investigate the effect of Spirulina on limited numbers of parameters such as feed efficiency, mortality and egg production in quail. Hence it is worthwhile to gather information and conduct analysis from the quails in experiment to evaluate the suitability of Spirulina in Japanese quails to assess the effect of nutritional levels of microalgae on several parameters in quails as well as to identify the best inclusion time of Spirulina into diet to achieve marketable weight of quail.

Thus, the objectives of the present study were:

1. To compare and determine the effects of different level of Spirulina inclusion in feed on growth performance and carcass yield of Japanese quails and,

2. To identify the effects of different starting age of Spirulina inclusion in feed on growth performance and carcass yield of Japanese quails.
REFERENCES


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