
**UNIVERSITI PUTRA MALAYSIA**

# *EFFECTS OF Borreria latifolia (Aubl.) K.SCHUM. AND Rosmarinus officinalis L. AS FEED ADDITIVES ON PERFORMANCE AND MEAT QUALITY OF FINISHING VILLAGE CHICKENN*

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**By**

**ALI ABDUL AMEER**

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

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**DEDICATIONS**

To My Beloved Mother And Father

And

To My Family With Love And Respect



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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

**EFFECTS OF *Borreria latifolia* (Aubl.) K.SCHUM. AND *Rosmarinus officinalis* L.AS FEED ADDITIVES ON PERFORMANCE AND MEAT QUALITY OF FINISHING VILLAGE CHICKEN**

By

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**October 2016**

**Chairman : Associate Professor Azhar Kasim, PhD**
**Faculty : Agriculture**

The poultry industry would extremely appreciate natural antioxidants that could replace synthetic ones and satisfy consumer demands for food products without residues from substances that can possibly hurt human health. Besides health decay, lipid oxidation is also a major cause of meat quality deterioration, affecting color, flavor, texture, and nutritional value.

The objective of this study was to investigate the impact of dietary supplementation of *Borreria latifolia* and *Rosmarinus officinalis* as natural antioxidant on performance and meat quality of finishing village chicken. Two experiments were conducted, the first experiment was to confirm the antioxidant activity of BL through a comparison with *Rosmarinus officinalis* (RO) as a reference in addition to evaluate their effect on performance and meat quality. Three treatments were employed: T1 (control basal diet without supplementation), T2 (basal diet with 1% of BL), T3 (basal diet with 1% of RO). There was a significant difference ($p < 0.05$) between dietary treatments in cooking loss value. Cooking loss value was higher in T1 compared to the T2 and T3. Significantly ($p < 0.05$), pH value was affected by dietary treatments with T2 and T3 having higher pH value compared to T1. Additionally, significant effect of dietary treatments was recorded during sensory evaluation test whereas T2, T3 had a higher score in overall acceptability compared to control with T2 higher ($p < 0.05$) than T3. Moreover, significant effect ($p < 0.05$) of dietary treatment on lipid oxidation value was observed. T2 and T3 had a lower malondialdehyde (MDA) concentrations compared to T1. Additionally, there was significant ($p < 0.05$) difference between males and female detected in final body weight, weight gain, feed intake, carcass weight, breast and thigh weight, wing weight, neck and loin weight. Moreover, the sex effect was significant ($p < 0.05$) on MUFA, PUFA, PUFA:SFA ratio, n6:n3 ratio, pH value, yellowness (b*) and lipid oxidation. In addition, significant ($p < 0.05$) increase in tenderness, pH, and lipid oxidation through post mortem aging period (1, 3, 5 d) were recorded, while cooking loss (CL) and redness (a*) were decreased. Significant interactions between herb and



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sex on pH parameter, and herb by sex, herb by post-mortem period, sex by post-mortem period, and herb by sex by post-mortem period interactions in regards with lipid oxidation were observed.

The second experiment was to evaluate the effect of three different levels of BL on meat quality and growth performance. Four treatments applied were: T1 (control basal diet without supplementation), T2 (basal diet with 1.5% of BL), T3 (basal diet with 2% of BL), and T4 (basal diet with 2.5% of BL). There was a significant ($p < 0.05$) effect of the dietary treatments on redness (a*) value. T4 showed higher value than T1, T2, and T3. Furthermore, T4 produced higher ($p < 0.05$) scores than T1, T2, and T3 in both overall acceptability and texture through sensory evaluation test. With regard to lipid oxidation test, T4 showed the lowest malondialdehyde concentration whereas T1 had the highest concentration of MDA. Meanwhile, T2 and T3 had a higher concentration of MDA compared to T4. Furthermore, there was significant ($p < 0.05$) difference between males and females in MUFA, PUFA, PUFA:SFA ratio, n6:n3 ratio, yellowness (b*) and lipid oxidation. In addition, significant ($p < 0.05$) effect of sex on final body weight, weight gain, feed intake, carcass weight, breast and thigh weight, wings weight, neck and loin weight, and liver weight was recorded. The obtained result of the current studies showed significant ($p < 0.05$) decreases in redness (a*) and cooking loss (CL) during post mortem aging period while pH value, tenderness, and lipid oxidation were elevated. Additionally, there were significant interactions between herb and sex, herb and aging period, sex and aging period, and the herb by sex by aging period interaction on lipid oxidation as well as a significant interaction between herb and sex on pH was noticed in the study.

Generally, the present study revealed that dietary supplementation of 2.5% BL improved oxidative stability which could have extended meat shelf life and may enhance meat acceptability including a partial improvement in meat color. While, the enhancement of growth performance was not revealed.

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Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

# KESAN PEMAKANAN *BORRERIA LATIFOLIA* KE ATAS PRESTASI PERTUMBUHAN, CIRI-CIRI BANGKAI DAN KUALITI DAGING DALAM AYAM KAMPUNG

Oleh

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Potensi keupayaan anti oksidan bagi *Borreria latifolia* dikaji dalam kajian ini. Dua eksperimen telah dijalankan untuk mengkaji kesan daripada suplemen pemakanan *Borreria latifolia* (BL) pada prestasi pertumbuhan, ciri-ciri bangkai, dan kualiti daging ayam kampung. Dua eksperimen telah dijalankan, percubaan pertama adalah untuk mengesahkan aktiviti antioksidan BL melalui perbandingan dengan Officinalis Rosmarinus (RO) sebagai rujukan di samping menilai kesannya pada prestasi dan kualiti daging. Tiga rawatan adalah digunakan: T1 (mengawal diet basal tanpa suplemen), T2 (diet basal dengan 1 % daripada BL), T3 (diet basal dengan 1 % daripada RO). Terdapat perbezaan yang signifikan ($p < 0.05$) antara rawatan pemakanan dalam nilai penurunan memasak. Penurunan nilai memasak adalah lebih tinggi pada T1 berbanding dengan T2 dan T3. Secara ketaranya ($p < 0.05$), nilai pH terjejas oleh rawatan diet dengan T2 dan T3 yang mempunyai nilai pH yang lebih tinggi berbanding dengan T1. Selain itu, kesan yang ketara bagi rawatan pemakanan dicatatkan semasa ujian penilaian deria manakala T2, T3 mempunyai skor yang lebih tinggi dalam penerimaan keseluruhan berbanding untuk mengawal dengan T2 lebih tinggi ($p < 0.05$) berbanding T3. Selain itu, kesan yang signifikan ($p < 0.05$) rawatan pemakanan nilai pengoksidaan lipid diperhatikan. T2 dan T3 mempunyai kepekatan MDA yang lebih rendah berbanding dengan T1. Selain itu, terdapat perbezaan signifikan ($p < 0.05$) antara jantan dan betina dikesan dalam berat akhir badan, berat badan, pengambilan makanan, berat bangkai, payudara dan berat paha, berat sayap, leher dan berat pinggang. Selain itu, kesan seks itu yang signifikan ($p < 0.05$) pada MUFA, PUFA, PUFA: Nisbah SFA, n6: Nisbah n3, nilai pH, kekuningan (b *) dan lipid pengoksidaan. Di samping itu, peningkatan ketara ($p < 0.05$) dalam kelembutan, pH, dan lipid pengoksidaan melalui bedah siasat penuaan period (1, 3, 5 d) telah direkodkan penuaan, semasa penurunan memasak (CL) dan kemerahan (* a) telah menurun. Interaksi yang signifikan antara herba dan seks di parameter pH, dan di antara herba dan seks, herba dan penuaan tempoh, seks dan penuaan tempoh, dan herba mengikut jantina oleh penuaan interaksi tempoh dalam hal dengan pengoksidaan lipid diperhatikan. Percubaan kedua adalah untuk mengkaji kesan tiga



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tahap yang berbeza BL kepada kualiti daging dan prestasi pertumbuhan. Empat rawatan digunakan iaitu: T1 (mengawal diet basal tanpa suplemen), T2 (diet basal dengan 1.5 % daripada BL), T3 (diet basal dengan 2 % daripada BL) dan T4 (diet basal dengan 2.5 % daripada BL). Terdapat perbezaan yang bererti ($p < 0.05$) kesan rawatan pemakanan pada kemerahan (a *) nilai. T4 menunjukkan nilai lebih tinggi daripada T1, T2 dan T3. Tambahan pula, T4 dihasilkan ($p < 0.05$) pada skor yang lebih tinggi daripada T1, T2, T3 dan dalam kedua-dua penerimaan keseluruhan dan tekstur melalui ujian penilaian deria.

Berhubung dengan ujian lipid pengoksidaan, T4 menunjukkan kepekatan MDA yang paling rendah manakala T1 mempunyai kepekatan tertinggi MDA. Sementara itu, T2 dan T3 mempunyai kepekatan yang lebih tinggi MDA berbanding T4. Tambahan pula, ada perbezaan signifikan ($p < 0.05$) antara jantan dan betina dalam MUFA, PUFA, PUFA: Nisbah SFA, n6: Nisbah n3, kekuningan (* b) dan lipid pengoksidaan. Di samping itu, ketara kesan ($p < 0.05$) seks pada berat akhir badan, berat badan, pengambilan makanan, berat bangkai, payudara dan berat paha, berat sayap, leher dan berat badan pinggang, dan berat hati direkodkan. keputusan yang diperolehi daripada kajian semasa menunjukkan signifikan ($p < 0.05$) mengurangkan kemerahan (* a) dan kehilangan memasak (CL) semasa bedah siasat tempoh penuaan manakala nilai pH, kelembutan, dan pengoksidaan lipid dinaikkan. Selain itu, terdapat interaksi yang signifikan antara herba dan seks, herba dan penuaan tempoh, seks dan penuaan tempoh, dan herba mengikut jantina oleh penuaan tempoh interaksi pada pengoksidaan lipid serta interaksi yang signifikan antara herba dan hubungan seks pada pH telah disedari dalam kajian ini. Secara umumnya, kajian ini mendedahkan bahawa suplemen pemakanan sebanyak 2.5% BL bertambah baik kestabilan oksidatif yang boleh dilanjutkan hidup daging rak dan boleh meningkatkan daging penerimaan termasuk peningkatan separa dalam warna daging. Sementara itu, peningkatan prestasi pertumbuhan tidak didedahkan.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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## LIST OF ABBREVIATIONS

| | |
|---|---|
| a* | Redness |
| b* | Yellowness |
| BL | *Borreria latifolia* |
| $^{o}C$ | Celsius degrees |
| CL | Cooking loss |
| CP | Crude protein |
| cm2 | Square centimeter |
| d | Day |
| ddH2O | Deionized distilled water |
| DL | Drip loss |
| DM | Dry matter |
| EE | Ether extract |
| FA | Fatty acid |
| FCR | Feed conversion ratio |
| g | Gram |
| GC | Gas chromatogaphy |
| HCL | Hydrochloric acid |
| h | Hour |
| $H_2SO_4$ | Sulfuric acid |
| kg | kilogram |
| KOH | Potassium hydroxide |
| L | Liter |
| L* | Lightness |
| MDA | Malondialdehyde |
| mg | Milligram |
| min | Minute |
| ml | Milliliter |
| MUFA | Monounsaturated fatty acids |
| OM | Organic matter |
| PBS | Phosphate buffered saline |
| PSE | Pale Soft Executive |
| PUSFAs | Polyunsaturated fatty acids |
| PUFA:SFA ratio | Total PUFA to Total SFA ratio |
| RCBD | Randomized completely block design |
| RO | *Rosmarinus officinalis* |
| SE | Standard error |



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| | |
|---|---|
| Se | Second |
| SFA | Saturated fatty acids |
| TBA | Thiobarbituric acid |
| TBARS | Thiobarbituric acid reactive substances |
| TCA | Trichloroacetic acid |
| USFA | Unsaturated fatty acid |
| USFS:SFA ratio | Total USFA to Total SFA ratio |
| µl | Micro liter |
| µM | Micromole |
| VSF | Volodkovitch Shear Force |
| v/v | Volume per volume |
| WHC | Water holding capacity |

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# CHAPTER 1

# GENERAL INTRODUCTION

Traditionally, herbs have been used for centuries in many civilizations to treat certain medical conditions due to the efficiency and availability of these herbs (Schulz *et al*., 2001). Primitive man had been impressed by the diversity of plants that could be obtained, which provided food, clothing and medicine. The attention given on the use of medicinal herbs was the result of years of struggle against sicknesses which drove man to seek medication in tree barks, seeds and different parts of plants. Herbs have been the source of treatment and prophylaxis (Kelly, 2009). In addition, substances from herbs offer great promise to the pharmaceutical industry for the production of medication to treat coronary illness, hypertension, torment, asthma, and various other medical conditions.

In poultry production, the utilization of intricate intensive poultry production systems creates the revelation and prevalence of using various herbs as feed additives. The principle goal of adding herbs is to boost animal performance and production quality. Herbs and their extracts are included in chicken feed to improve the utilization of feed nutrients and lead to better feed efficiency and higher production. Several herbs and spices contain synthetic substances, like polyphenols, quinines, and polypeptides. Some of them show remedial qualities, such as antioxidant activities (Li, 1993).

Poultry meat is particularly prone to oxidative deterioration due to high concentration of polyunsaturated fatty acids (PUFA; Igene and Pearson, 1979). There are many studies showing an improvement in the oxidative stability of tissue after feeding poultry with antioxidant compounds added into the diet (BotsoglouT *et al*., 2002; Lee *et al*., 2004; Govaris *et al*., 2005), There is a trend to search for compounds that may allow a shift from synthetic to natural antioxidants (Sheehy *et al*., 1995; Yanishlieva, 2001; Botsoglou *et al*., 2002). This trend is justified because a carcinogenic potential from the use of synthetic antioxidants has been suspected (Madavi & Salunkhe, 1995).

Plant phenols show *in vitro* antioxidant activity, acting to restrain lipid peroxidation as chain-breaking peroxyl radical scavengers (Proestos *et al*., 2006; Miguel, 2010). Along these lines, they can assume a defensive part aimed at unsaturated lipids in food against oxidative damage (Couladis *et al*., 2003). Oxidative deterioration is the major non-microbial element that causes value crumbling in foods (Descalzo *et al*., 2005). Throughout the handling, processing and storage of fresh meat, lipid oxidation is associated with discoloration, drip losses, off-flavor and off-odor development in addition to the ability to form toxic compounds (Gray *et al*., 1996).

A few *in vivo* studies have been directed to test natural substances capable of enhancing the stability of lipid in meat. It has been shown that dietary supplementation with natural antioxidants, for example, rosemary (*Rosmarinus officinalis*), sage (*Salvia officinalis*) and oregano (*Origanum vulgare*) derivatives may improve antioxidant defenses and meat shelf life (Lopez-Bote *et al*., 1998, Florou-Paneri *et al*., 2006). Among many kinds of herbs, *Borreria latifolia* is an annual herb and a member of the Rubiaceae family, which develops as a prevailing weed on waste ranges and/or agricultural farms. It originated from tropical



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America and was ordinarily dispersed in India, Southeast Asia, and Malaysia. *Borreria alata, Borreria scaberrima bold, Spermacoce latifolia Aubl,* are synonyms for *Borreria latifolia.*

In the present study, addition of *Borreria latifolia* and *Rosmarinus officinalis* as feed additives was to improve meat quality and evaluating the performance at finishing stage of village chicken. However, there is a dearth of information and published scientific data on the effects of *Borreria latifolia* as feed supplementation for growth performance and meat quality in chicken diets. Therefore, the present study was carried out to determine the effect of adding *Borreria latifolia* to the finisher diets on growth performances, carcass characteristics and meat quality. Hence, this study is aimed at achieving these objectives:

1. To determine the capability of *Borreria latifolia* as a natural antioxidant.
2. To examine the impact of feeding *Borreria latifolia* on the performance of village chicken.
3. To evaluate the effect of feeding *Borreria latifolia* on chicken meat parameters.

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