



**UNIVERSITI PUTRA MALAYSIA**

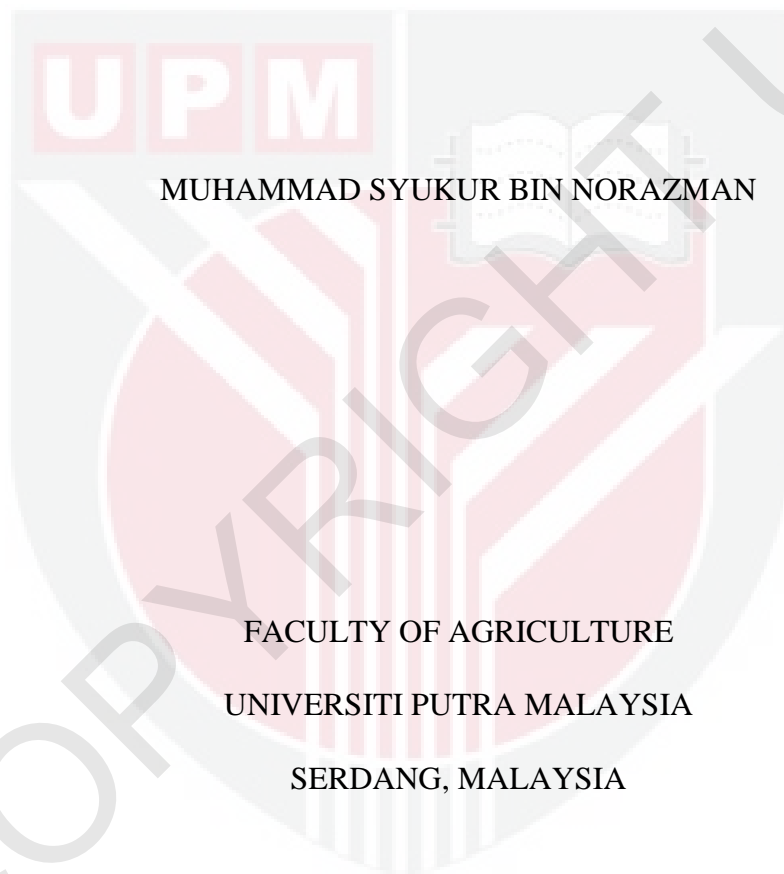
**DIFFERENTIATION OF MEAT QUALITY, LIPID OXIDATION AND FATTY ACID PROFILE BETWEEN *COBB 500 BREED* AND *SASSO BREED***

**MUHAMMAD SYUKUR NORAZMAN**

**FP 2016 92**

DIFFERENTIATION OF MEAT QUALITY, LIPID OXIDATION AND FATTY

ACID PROFILE BETWEEN *COBB 500 BREED* AND *SASSO BREED*



MUHAMMAD SYUKUR BIN NORAZMAN

FACULTY OF AGRICULTURE

UNIVERSITI PUTRA MALAYSIA

SERDANG, MALAYSIA

2015/2016

DIFFERENTIATION OF MEAT QUALITY, LIPID OXIDATION AND FATTY

ACID PROFILE BETWEEN *COBB 500 BREED* AND *SASSO BREED*

MUHAMMAD SYUKUR BIN NORAZMAN

This 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)

FACULTY OF AGRICULTURE

UNIVERSITI PUTRA MALAYSIA

SERDANG, MALAYSIA

2015/2016

## CERTIFICATION FORM

This project entitled differentiation of meat quality, lipid oxidation and fatty acid profile between *Cobb 500* breed and *Sasso* breed by Muhammad Syukur Bin Norazman 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)

Student's name

Muhammad Syukur Bin Norazman

169223

Student's signature:

Certified by:

Dr.Henny Akit

Project Supervisor

Department of Animal Science

Faculty of Agriculture

Universiti Putra Malaysia

Serdang, Selangor.

Date:

## ACKNOWLEDGEMENT

Firstly, i would like to thanks and extend my gratitude to my project supervisor, Dr Henny Akit which sacrifices her time for the guidance, supervision and comments to me throughout this project.

Followed by the coordinator Professor Dr.Dahlan Ismail for the advice and support for the final year project. I would like to thank all the staff and friends in the Department of Animal Science.I would like to thank to the postdoctor, Dr. Mehdi Ebrahimi, Nurhazirah binti Shazali for their guidance, assistance and patience.

Futhermore, I would like to thank my mantee under same supervisor, Kaushelia. Also, my coursemate especially Mohd Afiq bin Azmi, Mohd Hanif bin Mohd Nor, and Mohd Noranin Naim bin Sahroni for lending me a hand during my project. Last but not least, I would like to dedicate an appreciation to my beloved parents, Mr.Norazman bin Ismail and Mrs.Samidah binti Md Talib and my siblings for their support, caring and encouragement along my university's life.

## CONTENT

|                                       | Page |
|---------------------------------------|------|
| <b>CERTIFICATION FORM</b>             | ii   |
| <b>ACKNOWLEDGEMENT</b>                | iii  |
| <b>LIST OF TABLES</b>                 | vi   |
| <b>LIST OF PLATES</b>                 | vii  |
| <b>ABBREVIATION</b>                   | viii |
| <b>ABSTRACT</b>                       | ix   |
| <b>ABSTRAK</b>                        | x    |
| <b>CHAPTER 1 INTRODUCTION</b>         | 1    |
| 1.0 Objectives                        |      |
| 1.1 General Objectives                | 2    |
| 1.2 Specific Objectives               | 2    |
| 1.3 Reseach Hypothesis                | 3    |
| 1.4 Signifinance of study             | 3    |
| <b>CHAPTER 2 LITERATURE REVIEW</b>    |      |
| 2.1 Slow-growing chicken              | 6    |
| 2.2 Meat Quality                      |      |
| 2.2.1 Ultimate pH muscle              | 7    |
| 2.2.2 Colour                          | 9    |
| 2.2.3 Drip loss                       | 9    |
| 2.2.4 Cooking loss                    | 10   |
| 2.3 Lipid Oxidation                   | 11   |
| 2.4 Fatty acid                        | 12   |
| <b>CHAPTER 3 MATERIALS AND METHOD</b> |      |
| 3.1 Location of study                 | 14   |
| 3.2 Experimental design               | 14   |
| 3.3 Preperation of samples            | 14   |
| 3.4 Methodology                       |      |
| 3.4.1 Drip loss                       | 15   |
| 3.4.2 Colour analysis                 | 15   |
| 3.4.3 Cooking loss                    | 16   |
| 3.4.4 pH                              | 16   |

|  |    |
|--|----|
| 3.4.5 Lipid oxidation                            | 17 |
| 3.4.6 Fatty acid                                 | 18 |
| 3.7 Data analysis                                | 19 |
| <b>CHAPTER 4 RESULTS AND DISCUSSION</b>          |    |
| 4.1 Meat Quality                                 | 20 |
| 4.2 Lipid Oxidation                              | 23 |
| 4.3 Fatty acid profile                           | 25 |
| 4.3.1 Effects of muscle and breed on ratio n6:n3 | 27 |
| <b>CHAPTER 5 CONCLUSION</b>                      | 28 |
| <b>REFERENCES</b>                                | 29 |
| <b>APPENDICES</b>                                | 32 |



## LIST OF TABLES

Tables Page

|         |   |    |
|---------|---|----|
| Table 1 | Meat quality between <i>Cobb 500</i> and <i>Sasso</i> breed   | 20 |
| Table 2 | Fatty acid composition (% of total identified fatty acids) of the breast and thigh muscle of <i>Cobb 500</i> and <i>Sasso</i> breed | 25 |





## LIST OF PLATES

List Page

|            |   |    |
|------------|---|----|
| Appendix 1 | Picture of arrival <i>Sasso</i> breed chicken               | 33 |
| Appendix 2 | Picture body size of <i>Sasso</i> breed chicken             | 33 |
| Appendix 3 | <i>Cobb 500</i> were raise in litter floor space management | 34 |



## ABBREVIATION

|       |                                   |
|-------|-----------------------------------|
| ANOVA | Analysis of variance              |
| ug    | microgram                         |
| g     | gram                              |
| ml    | millilitre                        |
| °C    | Degree of celcius                 |
| M     | Mole                              |
| nm    | Nanometre                         |
| min   | Minutes                           |
| FAO   | Food and Agriculture Organisation |

## Abstract

The aim of the experiment was to study the differences in meat quality, lipid oxidation and fatty acids between *Cobb 500* breed and *Sasso* breed chicken. The experiment involve total of 30 roosters (n = 15 of *Sasso* breed and n = 15 of *Cobb 500* breed ). They were separated by breed in litter floor space management and all birds were fed with commercial diet. *Cobb 500* breed was slaughtered at the age of 42 days, while *Sasso* breed was slaughtered at the age of 56 days. Meat sample was stored at 4°C for 24 hours after slaughtered. Meat quality assessment ( ultimate pH , drip loss, cooking loss, colour) and lipid oxidation were conducted on the breast ( *pectoralis* muscle ) while fatty acid profile were conducted on both breast and thigh muscles ( *femorocruralis* muscle ). *Cobb 500* breed had higher (  $P < 0.05$  ) lightness value (  $L^*$  ) and higher (  $P > 0.05$  ) cooking loss compared to *Sasso* breed. Malanonaldehyde (MDA) value at day 7 was lower (  $P > 0.05$  ) in *Cobb 500* breed compare *Sasso* breed. *Sasso* breed muscles contained more saturated fatty acids than *Cobb 500* breed muscles. *Sasso* breed showed a higher percentage of polyunsaturated fatty acids (  $P < 0.05$  ) and a lower percentage of monounsaturated fatty acids (  $P < 0.05$  ) than *Cobb 500* breed chicken muscles. In conclusion, pH ,  $L^*$  values and cooking loss was higher for *Cobb 500* breed compared to *Sasso* breed. *Cobb 500* breed MDA value was lower than *Sasso* breed. *Sasso* chicken meat contained higher omega-3 polyunsaturated fatty acids (PUFA) than *Cobb 500* breed. Hence, *Sasso* breed had better nutritional values in terms of fatty acid profile. However, *Sasso* breed meat had shorter shelf life compared with *Cobb 500*.

## Abstrak

Tujuan eksperimen ini adalah untuk mengkaji perbezaan dalam kualiti daging, pengoksidaan lipid dan asid lemak antara *Cobb 500* baka dan baka ayam *Sasso*. Eksperimen ini telah melibatkan sejumlah 30 ayam jantan ( $n = 15$  baka *Sasso* dan  $n = 15$  *Cobb 500* baka). Mereka dipisahkan oleh baka di lantai sampah pengurusan ruang dan semua unggas diberi makan dengan diet komersial. *Cobb 500* baka telah disembelih pada usia 42 hari, manakala baka *Sasso* telah disembelih pada usia 56 hari. Sampel daging disimpan pada  $4\text{ }^{\circ}\text{C}$  selama 24 jam selepas disembelih. Penilaian kualiti daging (pH muktamad, kehilangan titisan, kehilangan memasak, warna) dan pengoksidaan lipid dijalankan ke atas dada (*otot pectoralis*) manakala profil asid lemak yang dijalankan ke atas kedua-dua buah dada dan paha otot (*otot femorocruralis*). *Cobb 500* baka mempunyai lebih tinggi ( $P < 0.05$ ) kecerahan ( $L^*$ ) dan ( $P$  lebih tinggi  $> 0.05$ ) kehilangan memasak berbanding baka *Sasso*. Nilai Malonaldehyde (MDA) pada hari ke-7 adalah lebih rendah ( $P > 0.05$ ) dalam baka *Cobb 500* berbanding baka *Sasso*. Otot pada baka *Sasso* yang terkandung asid lemak yang lebih tepu berbanding otot pada baka *Cobb 500*. Baka *Sasso* menunjukkan peratusan yang lebih tinggi asid lemak poli tak tepu ( $P < 0.05$ ) dan peratusan yang lebih rendah asid lemak mono tak tepu ( $P < 0.05$ ) berbanding otot pada baka *Cobb 500*. Kesimpulannya, pH, nilai  $L^*$  dan kehilangan memasak lebih tinggi dalam baka *Cobb 500* berbanding baka *Sasso*. Nilai MDA pada baka *Cobb 500* adalah lebih rendah daripada baka *Sasso*. Daging ayam *Sasso* terkandung lebih tinggi omega-3 asid lemak poli tak tepu (PUFA) daripada baka ayam *Cobb 500*. Oleh itu, baka *Sasso* mempunyai nilai pemakanan yang lebih baik dari segi profil asid lemak. Walau bagaimanapun,

daging baka *Sasso* mempunyai jangka hayat lebih pendek berbanding dengan *Cobb* 500.



## CHAPTER 1

### Introduction

Intensive broiler production, as an integral part of industrial poultry production, began its development in Malaysia in around 1960s and it allowed the quantitative satisfaction markets with relatively cheap chicken meat throughout the year. The relatively poor quality of chicken meat from intensive broiler production (watery meat, insufficiently taste and aroma, a large percentage of fat under skin and in the abdominal cavity, weak and brittle bones, etc..) and development of consumer awareness about animal welfare and food safety, have led to the emergence of the perception that broilers meat is not healthy and natural.

Consequently, the number of the slow growing chicken has been increasing for the past 20 years to satisfy the customer demands for more intense flavor and firmness of their meat. Over the past few years, the concept of food has undergone a radical transformation, as its safety and impact on human health has become more and more important. Poultry farming systems have been influenced by consumers' priorities, as more attention is being paid to birds raised without using antibiotics or synthetic chemicals. Following the growing demand of consumers who are more sensitive to the ethical and cultural aspects of foods from animal origin, there is an increasing interest toward animal-friendly farming systems, which can improve animal welfare as well as

guarantee high qualitative standards concerning food safety, nutritional values. Today, a greater proportion of consumers in Malaysia are interested in broiler specialty products derived from slow-growing chicken meat.

In our country, only few authors has investigated rearing of slow-growing chicken and meat quality in free range system. Although numerous studies on breeding selection, methods of raising, dietary and growth performance and body composition of different chicken breeds have been widely conducted, little is know about fatty acids composition of slow-growing chicken breeds (for example *Sasso*). Regarding this, the aim of the present work was to evaluate differences in meat quality, fatty acid profile and lipid of fast-growing chicken (*Cobb 500*) and slow-growing chicken (*Sasso* breed).

## **1.1 Objectives**

### **1.1.1 General Objective**

To differentiate between meat quality, fatty acid profile and lipid oxidation of *Cobb 500* and *Sasso* breed.

### **1.1.2 Specific Objective**

- a) To differentiate the pH, drip loss, cooking loss and color between *Cobb 500* and *Sasso* breed.
- b) To investigate the effect of breed and type of muscle on the n-6: n-3 ratio between *Cobb 500* and *Sasso* breed.
- c) To differentiate malondialdehyde level between *Cobb 500* and *Sasso* breed.

### **1.1.3 Research Hypothesis**

*Sasso* breed have better n-6:n-3 polyunsaturated fatty acid ratio compare to *Cobb 500*.

### **1.1.4 Significance of study.**

Based on the information on the meat quality, fatty acid profile and lipid oxidation level, consumers were able to choose meat based on the nutritional value of chicken meat in term of meat quality, fatty acid profile.



## Reference

- Aberle, E. D., J. C. Forrest, D. E. Gerrard, and E. W. Mills. (2001). Principles of Meat Science. 4th ed. Kendall/Hunt Publ. Co., Dubuque, IA.
- Adeyemi, K. & Olorunsanya, O., (2012b). Comparative analysis of phenolic composition and antioxidant effect of seed coat extracts of four cowpea (*Vigna unguiculata*) varieties on broiler meat. *Iran J. Appl. Anim. Sci.* 2, 343-349.
- Baeza, E., C. Dessay, N. Wacrenier, G. Marche, and A. Listrat. (2002). Effect of selection for improved body weight and composition on muscle and meat characteristics in Muscovy duck. *Br. Poult. Sci.* 43:560–568.
- Barbut, S. (1997b). Occurrence of pale soft exudative meat in mature turkey hens. *Br. Poult. Sci.* 38:74–77
- Bendall, J. R. (1973). Post mortem changes in muscle. Page 243 in *Structure and Function of Muscle*. G. H. Bourne, ed. Acad. Press, New York, NY.
- Berri, C., N. Wacrenier, N. Millet, and E. Le Bihan-Duval. (2001). Effect of selection for improved body composition on muscle and meat characteristics of broilers from experimental and commercial lines. *Poult. Sci.* 80:833–838.
- Bogosavljević-Bošković, S., Pavlovski, Z., Petrović, M.D., Dosković, V., Rakonjac, S., (2010). Broiler meat quality: proteins and lipids of muscle tissue. *Afr. J. Biotechnol.* 9:9177-9182.
- Castellini, C., C. Mugnai, and A. Dal Bosco. (2002a). Effect of organic production system on broiler carcass and meat quality. *Ital. J. Food Sci.* 14:401–412.
- Castellini, C., C. Mugnai, and A. Dal Bosco. (2002b). Meat quality of three chicken genotypes reared according to the organic system. *Meat Sci.* 60:219–225.
- Coetzee, G. & Hoffman, L., (2001). Effect of dietary vitamin E on the performance of broilers and quality of broiler meat during refrigerated and frozen storage. *S. Afr. J. Anim. Sci.* 31, 158-173.
- Fanatico, A.C., Cavitt, L.C., Pillai, P.B., Emmert, J.L., Owens, C.M., (2005). Evaluation of slower-growing broiler genotypes grown with and without outdoor access: meat quality. *Poultry Sci.* 84:1785-1790.
- Fanatico, A.C., Pillai, P.B., Cavitt, C., Emmert, J.L., Meullenet, J.F., Owens, C.M., (2006). Evaluation of slow-growing broiler genotypes grown with and without outdoor access: sensory attributes. *Poultry Sci.* 85:337-343.
- Fanatico, A.C., Pillal, P.B., Emmert, J.L., Owens, C.M., (2007). Meat quality of slow and fast-growing chicken genotypes fed low-nutrient or standard diets and raised indoors or with outdoor access. *Poultry Sci.* 86:2245-2255.

- Fletcher, D. L., M. Qiao, and D. P. Smith. (2000). The relationship of raw broiler breast meat color and pH to cooked meat color and pH. *Poult. Sci.* 79:784-788.
- Garcia RG, Freitas LW de, Schwingel AW, Farias RM, Caldara FR, Gabriel AMA, Graciano JDI, Komiyama CM, Almeida Paz ICL (2010). Incidence and physical properties of PSE chicken meat in a commercial processing plant. *Brazilian Journal of Poultry Science*, 12(4), pp233-237
- Hasan Eleroğlu, Arda Yıldırım, Nursel D. Işıklı, Ahmet Şekeroğlu, Mustafa Duman. (2013). Comparison of meat quality and fatty acid profile in slow growing chicken genotypes fed diets supplemented with *Origanum vulgare* or *Melissa officinalis* leaves under the organic system
- Herman, L., Uyttendaele, M., Heyndrickx, M., (2002). Bacterial safety of organically produced agricultural products. Working group of the scientific committee of the FAVV (SC Com 2001/35), Merelbeke, Belgium.
- Honikel, K.O. (1998). Reference methods for the assessment of physical characteristics of meat. *Meat Sci.* 49: 447-457.
- Hovi, M., Sundrum, A., Thamsborg, S.M., (2003). Animal health and welfare in organic livestock production in Europe: Current state and future challenges. *Livest. Prod. Sci.* 80:41-53
- Hoz, L., 2004. D'Arrigo M, Cambero, I. & Ordonez, J.A., (2004). Development of an n-3 fatty acid and  $\alpha$ -tocopherol enriched dry fermented sausage. *Meat Sci.* 67, 485-495.
- Jensen et al (1998). *Journal of Food Investigation and Research*. A , 207 : 363-368 .
- Karwen Yassen Kareem, Teck Chwen Loh, Hooi Ling Foo, Samsudin Anjas Asmara, Henny Akit, Nazim Rasul Abdullah (2015) . Carcass meat and bone quality of broiler chicken fed with postbiotic and prebiotic combinations. *International Journal of Postbiotic and Prebiotics* Vol 10, No 1, pp.22-30, 2015
- Kralik, G., S. Ivanković, and Z. Škrtić. (2005). Fatty acids composition of poultry meat produced in indoor and outdoor rearing systems. *Agriculture* 11:3842.
- Lynch, S.M., and B. Frei. 1993. Mechanism of copper- and iron-dependent oxidative modification of human low density lipoprotein. *J. Lipid Research*, 34: 1745-1753.
- Lonergan, S. M., N. Deeb, C. A. Fedlet, and S. J. Lamont. (2003). Breast meat quality and composition in unique chicken populations. *Poult. Sci.* 82:1990–1994.
- Mallia, J. G., S. Barbut, J. P. Vaillancourt, S. W. Martin, and S. A. McEwen, (1998). A dark, firm, dry-like condition in breast meat of chickens condemned for ascites, valgus-varus deformity, and emaciation. *Poultry Sci.* 77(Suppl. 1):61. (Abstr.)

- Mercier, Y., Gatellier, p., Viau, m., remignon, H. and m.renerre, (1998). Effect of dietary fat and vitamin E on colour stability and on lipid and protein oxidation in turkey meat during storage. *Meat Sci.*,48: 301–318.
- Monin, G., and P. Sellier. (1985). Pork of low technological quality with a normal rate of muscle pH fall in the immediate post-mortem period: The case of Hampshire breed. *Meat Sci.* 13:49–63
- Offer, G., Knight, P., Jeacocke, R., Almond, R., Cousins, T., Elsey, J., et al. (1989). The structural basis of the water-holding, appearance and toughness of meat and meat-products. *Food Microstructure*, 8, 151–170.
- Owens, C. M., E. M. Hirschler, S. R. McKee, R. Martinez-Daw-son, and A. R. Sams. (2000). The characterization and incidence of pale, soft, exudative turkey meat in a commercial plant. *Poult. Sci.* 79:553–558.
- Pryor (1991). W.A. Pryor. The antioxidant nutrients and disease prevention—what do we know and what do we need to find out? *Am. J. Clin. Nutr.*, 53 (1) (1991), pp. 391–393
- Quentin, M., I. Bouvarel, C. Berri, E. le Bihan-Duval, E. Baeza, Y. Jego, and M. Picard. (2003). Growth, carcass composition and meat quality response to dietary concentrations in fast, medium and slow-growing commercial broilers. *Anim. Res.* 52:65–77.
- Rey, A.I., Kerry, J.P., Lynch, P.B., Lopez-Bote, C.J., Buckley, D.J. & Morrissey, P.A., (2001). Effect of dietary oils and  $\alpha$ -tocopheryl acetate supplementation on lipid (TBARS) and cholesterol oxidation in cooked pork. *J. Anim. Sci.* 79, 1201–1208.
- Santos, A. L., N. K. Sakomura, E. R. Freitas, C. M. L. S. Fortes, E. N. V. M. Carrilho, and J. B. K. Fernandes. (2005b). Growth, performance, carcass yield and meat quality of three broiler chickens strains. *Rev. Bras. Zootec.* 34:1589–1598.
- Sirri, F., Castellini, C., Bianchi, M., Petracci, M., Meluzzi, A., Franchini, A. (2011). Effect of fast-, medium- and slow-growing strains on meat quality of chickens reared under the organic farming method. *Animal* 5:312-319.
- Wattanachant, S., S. Benjakul, and D. A. Ledward. (2004). Composition, color, and texture of Thai indigenous and broiler chicken muscles. *Poult. Sci.* 83:123–128.
- Woelfel, R. L., C. M. Owens, E. M. Hirschler, and A. R. Sams, (1998). The incidence and characterization of pale, soft and exudative chicken meat in a commercial plant. *Poultry Sci.* 77(Suppl. 1):62. (Abstr.).
- Woelfel, R. L., C. M. Owens, E. M. Hirschler, R. Martinez-Daw-son, and A. R. Sams. (2002). The characterization and incidence of pale, soft, and exudative broiler meat in a commercial processing plant. *Poult. Sci.* 81:579–584.
- Wood, J., Richardson, R., Nute, G., Fisher, A., Campo, M., Kasapidou, E., Sheard, P. & Enser, M., 2004. Effects of fatty acids on meat quality: a review. *Meat Sci.* 66, 21-32.