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**SEMEN QUALITY OF CAGED RED JUNGLE, SERAMA AND VILLAGE
FOWLS AND EFFECTS OF DIETARY ENERGY AND PROTEIN ON
SEMEN QUALITY OF CAGED RED JUNGLE FOWL**

By



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**Thesis Submitted to the School of Graduate Studies, Universiti Putra
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Science**

September 2013



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***For my husband, Lukman Saidin and our adorable son, Uwais AlQarni.
I am truly blessed.***

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

**SEMEN QUALITY OF CAGED RED JUNGLE, SERAMA AND VILLAGE
FOWLS AND EFFECTS OF DIETARY ENERGY AND PROTEIN ON
SEMEN QUALITY OF CAGED RED JUNGLE FOWL**

By

FAZHANA BINTI ISMAIL

September 2013

Chair : Associate Professor Azhar Kassim, PhD

Faculty : Agriculture

The primary objective of this research were to compare semen quality in three local chicken breeds; Red Jungle Fowl (RJF), Serama (SC) and village chicken (VC) and semen production and fertility of caged Red Jungle Fowl (RJF) related to the dietary energy and protein level. Semen quality was compared on 8 cockerels of each breeds aged 28 weeks to achieve the first objective. In second experiment, a total of 45 RJF cockerels aged 24 weeks fed on five different dietary energy and protein level accordingly to determine its effects on their semen quality and fertility. The collection of semen was carried out using the manual abdominal massage once a week from each individual cockerel. Spermatozoa were screened for the volume, concentration, color, size and the percentage of live, motility, total abnormal

and morphological defects spermatozoa. When at least 80% of the hen started consistently laying eggs, the artificial insemination was done in each hen. Fertility was determined by two methods; Semen Quality Factor (SQF) calculation and percentage of fertile eggs. Total feed intake and weight gain percentage were also recorded. Statistical analyses of the data were done using one way analysis of variance (ANOVA) in the statistical programme SPSS version 17.0.

The results of the study indicate that different breeds of chicken significantly produced different spermatozoa characteristics. All three breeds produced more than 90% of live spermatozoa which indicated a good quality of fresh semen. SC produced lowest semen volume (0.14ml) and concentration (1.78×10^9 sperms/ml) with least motile spermatozoa percentage (49%) and highest abnormal spermatozoa (34.5%) were observed. VC and RJF were not significantly different in semen volume but RJF was significantly produced higher semen concentration (4.51×10^9 sperms/ml) with high motile spermatozoa (53.8%). In addition, RJF significantly produced lower abnormal spermatozoa (26.7%) compared to VC (28.1%).

Since RJF semen characteristics was the most superior compared to SR and VC, only RJF cockerels were selected to be used in dietary effects on semen quality experiment assuming that the affects would be more obviously

determined. Five diet treatments were determined; Group A, control (3000kcal/kg ME and 16% CP), Group B (3320kcal/kg ME and 16% CP), Group C (2621kcal/kg ME and 16% CP, Group D (2980kcal/kg ME and 20% CP) and Group E (3000kcal/kg ME and 10% CP). It was found that providing higher dietary energy significantly reduced semen volume (0.27ml) and concentration (4.08×10^9 sperms/ml) in RJF but improved the percentage of general sperm motility (68.4%) and live spermatozoa (97.15%). Lower dietary energy did not detriment to the semen volume (0.33ml) but significantly reduced the semen concentration (4.00×10^9 sperms/ml), sperm general motility (47.3%), live spermatozoa (92.11%) and total abnormalities (24.34%). Higher dietary protein significantly reduced semen volume (0.26ml), concentration (4.22×10^9 sperms/ml), and live spermatozoa (85.31%). It was also caused significantly increased total abnormalities (26.93%). Lower dietary protein at 10% significantly reduced semen volume (0.25ml), concentration (3.78×10^9 sperms/ml), general motility (51.3%) ,live spermatozoa(58.16%) and total abnormalities(25.71%). SQF and fertile eggs percentage were significantly affected in all diet treatments. SQF in Group B, C, D and E were 8.03, 9.99, 8.02 and 7.02, respectively which were significantly lower than control group, 10.86. Fertile eggs percentage was 79.1%, 83.4%, 72.8% and 59.8% in Group B, C, D and E , respectively which was also lower than control group, 85.8%.

From this study, RJF produced the greatest quality of semen compared to SC and VC. Providing too high or too low dietary energy or protein levels may detriment to semen quality and fertility in caged RJF. Therefore, recommended dietary energy at 3000 kcal ME/kg and 16% crude protein should be followed so that the optimum productivity will be maintained. SQF could be one of the methods to predict fertility in breeder males during parentstock selection.



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

**KUALITI AIR MANI AYAM HUTAN, SERAMA DAN AYAM KAMPUNG
DALAM SANGKAR SERTA KESAN KANDUNGAN TENAGA DAN PROTIN
DALAM DIET TERHADAP KUALITI AIR MANI AYAM HUTAN DALAM
SANGKAR.**

Oleh

FAZHANA BINTI ISMAIL

September 2013



Pengerusi : Profesor Madya Azhar Kasim, PhD

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Objektif utama kajian ini dijalankan adalah untuk membandingkan kualiti air mani pada tiga jenis baka ayam tempatan; ayam hutan, serama dan ayam kampung dan kaitan penghasilan air mani dan kesuburan ayam hutan dalam sangkar dengan kandungan tenaga dan protin dalam diet. Kualiti air mani dibandingkan dalam 8 ekor ayam jantan matang bagi setiap baka ayam berusia 28 minggu untuk mencapai objektif kajian yang pertama. Dalam eksperimen kedua, sejumlah 45 ekor ayam hutan jantan berusia 24 minggu diberi makan dengan lima tahap kandungan tenaga dan protin yang berbeza





untuk menentukan kesannya terhadap kualiti air mani dan kesuburan. Pengumpulan air mani dijalankan secara urutan abdomen manual sekali setiap minggu daripada setiap ayam jantan tersebut. Sperma dikaji berdasarkan isipadu, kepekatan, warna, saiz dan peratusan sperma hidup, pergerakan, sperma cacat, serta jenis kecacatan sperma. Setelah sekurang-kurangnya 80% ayam betina bertelur secara konsisten, pernianian beradas dilakukan dalam setiap ayam betina. Tahap kesuburan ditentukan menggunakan dua kaedah; pengiraan Faktor Kualiti Air Mani (SQF) dan peratusan telur bernas. Jumlah pengambilan makanan dan pertambahan berat badan turut direkod. Data analisa menggunakan kepelbagaian analisa satu hala (ANOVA) dalam program statistic SPSS versi 17.0.



Dapatan kajian menunjukkan baka ayam yang berbeza menghasilkan karektor sperma yang berbeza. Ketiga-tiga baka ayam tempatan menghasilkan lebih 90% sperma hidup menunjukkan air mani segar yang berkualiti. Serama menghasilkan isipadu (0.14ml) dan kepekatan(1.78×10^9 sperma/ml) air mani terendah dengan peratusan sperma bergerak terendah (49%) dan spermatozoa cacat tertinggi (34.5%). Ayam kampung dan ayam hutan tidak berbeza secara signifikan dari segi isipadu air mani tetapi ayam hutan menghasilkan kepekatan air mani lebih tinggi (4.51×10^9 sperma/ml) dengan peratusan sperma bergerak yang juga tinggi (53.8%). Selain itu,





ayam hutan secara signifikan menghasilkan sperma cacat lebih rendah (26.7%) berbanding ayam kampung (28.1%).

Memandangkan ciri-ciri air mani ayam hutan lebih baik berbanding serama dan ayam kampung, hanya ayam hutan dipilih untuk digunakan dalam eksperimen kesan diet terhadap kualiti air mani dengan anggapan kesannya akan dapat ditentukan dengan lebih jelas. Lima jenis diet telah dikaji, Kumpulan A, kawalan (3000kcal/kg tenaga and 16% protin kasar), Kumpulan B (3320kcal/kg tenaga and 16% protin kasar), Kumpulan C (2621kcal/kg tenaga and 16% protin kasar, Kumpulan D (2980kcal/kg tenaga and 20% protin kasar) and Kumpulan E (3000kcal/kg tenaga and 10% protin kasar). Kajian ini mendapati bahawa diet tinggi kandungan tenaga secara signifikan mengurangkan isipadu (0.27ml) dan kepekatan (4.08×10^9 sperma/ml) air mani ayam hutan tetapi meningkatkan peratusan pergerakan sperma secara amnya(68.4%) dan sperma hidup (97.15%). Kandungan tenaga yang lebih rendah tidak mengganggu isipadu air mani (0.33ml) tetapi secara signifikan mengurangkan kepekatan (4.00×10^9 sperma/ml), pergerakan sperma secara am(47.3%), sperma hidup(92.11%) dan sperma cacat (24.34%). Kandungan protin lebih tinggi secara signifikan menyebabkan penurunan isipadu air mani (0.26ml), kepekatan (4.22×10^9 sperma/ml) dan sperma hidup (85.31%). Ia juga menyebabkan peningkatan peratusan sperma cacat (26.93%). Diet berprotin rendah sehingga 10% secara signifikan mengurangkan isipadu air





mani (0.25ml), kepekatan (3.78×10^9 sperma/ml), pergerakan sperma (51.3%), sperma hidup (58.16%) dan jumlah sperma cacat (25.71%). SQF dan peratusan telur bernas secara signifikan dipengaruhi dalam kesemua diet. SQF dalam Kumpulan B, C, D dan E adalah 8.03, 9.99, 8.02 dan 7.02 masing-masing menunjukkan secara signifikan lebih rendah daripada kumpulan kawalan(10.86). Peratusan telur bernas adalah 79.1%, 83.4%, 72.8% dan 59.8% dalam Kumpulan B, C, D dan E juga menunjukkan lebih rendah dibandingkan dengan kumpulan kawalan, 85.8%.

Berdasarkan kajian ini, ayam hutn menghasilkan air mani yang lebih berkualiti berbanding Serama dan ayam kampung. Pemberian kandungan tenaga atau protin yang terlalu tinggi atau terlalu rendah merosakkan kualiti air mani dan kesuburan pada ayam hutan dalam sangkar. Oleh itu, saranan kandungan tenaga sebanyak 3000 kcal ME/kg dan 16% protin kasar perlulah diamalkan supaya produktiviti yang optimum dapat dikekalkan. SQF boleh digunakan sebagai kaedah menjangka kesuburan ayam penjantan pada masa hadapan sewaktu pemilihan ayam baka.





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I certify that a Thesis Examination Committee has met on 5 September 2013 to conduct the final examination of Fazhana binti Ismail on her thesis entitled "Semen Quality of Caged Red Jungle, Serama, and Village Fowls and Effects of Dietary Energy and Protein on Semen Quality of Caged Red Jungle Fowl" in accordance with the Universities and University Colleges Act 1971 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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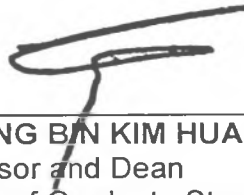


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DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.



FAZHANA BINTI ISMAIL

Date: 5 September 2013



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LIST OF ABBREVIATIONS

Abbreviation

AI	-	artificial insemination
BW	-	body weight
CP	-	crude protein
FI	-	feed intake
FSH	-	Follicle Secreting Hormone
GnRH	-	Gonadotropin Releasing Hormone
LH	-	Luteinizing Hormon
ME	-	metaboilsable energy
RJF	-	Red Jungle Fowl
SC	-	Serama chicken
SQF	-	semen quality factor
SQI	-	semen quality index
T	-	Testosterone
VC	-	village chicken





CHAPTER 1

INTRODUCTION

1.0 Background of the Study

Reproduction is the most important requisite in animal breeding. Hisgenetic factor carried by the broiler breeder males may affect their progeny ability to fertilize eggs (Fiser and Chambers, 1981). An ultimate profitability in any breeder flock is indicated by the total number of success fertile eggs that purposely for hatching. Normally, broiler producer favor to rear chicken with fast growth and an excellent appetite so that it will meet the target of meat yield production. However, there have been paramount in the development of the modern broiler intense selection for growth, yield, and carcass characteristics (Harms, 1984; Reddy, 1994).

Flock management is the main factor for reproductive efficiency in any broiler breeder production. Fertility in male broiler breeder is a complex trait that involving several physiological processes starting at the point of reproductive organ development from birth to puberty, spermatogenesis, ejaculation and mating behavior. All these processes should be well coordinated as to produce high quality of semen.





Common criteria for evaluating semen quality are including spermatozoa motility, volume, concentration and morphology (Bearden & Fuquay, 1997). Reinecke *et al.*, (1995) stated that sperm morphology is among the essential characteristic for successful fertilization in most domestic animals.

The quality, amount and type of food may exert complex effects on the reproductive system (Hahn et al., 2005). Almost 65-70% of total production cost is due to feed expenses and in fact, energy and protein are the most costly item in poultry diets. As the result of economic and performance concerns, there has been continuous interest in manipulating dietary energy and protein level in poultry nutrition.



Numerous studies have been well documented on the importance of providing sufficient dietary energy and protein during the growing phase of the poultry. As the result, the adequate-nourished flocks will perform superbly by the end of their growth cycle or during reproduction/ breeder phase in case of breeder flock.

Many researchers suggest higher dietary energy and protein level during the growing phase in the chicken life cycle because it gives many advantages to the flock when they reach their sexual maturity. Later, it is recommended to reduce the level of both nutrients when they reach the puberty because by that time, energy and protein are only for body maintenance. Therefore, most





of previous studies focused on manipulating dietary energy and protein levels only during the grower phase. However, information on the manipulation of dietary energy and protein levels in diets during reproduction phase itself or in other word, after sexually maturity in breeder males on their semen production and fertility is still inadequate.

Therefore, it was desirable to determine the effects of dietary energy and protein level during the reproduction phase in caged breeder males on their reproductive performance. Initially, three breeds of local chicken; Red Jungle Fowl (RJF), Serama (SC) and village chicken (VC) will be evaluated for their semen quality since there is no other documented report regarding to their semen profile. The most superior semen producer will be determined in this experiment and will be selected for the dietary energy and protein effects on their semen production and fertility in the second experiment.

1.1 Objectives

1. To evaluate and compare semen parameters in three breeds of local chicken; Red Jungle Fowl, Serama and village chicken fed on commercial breeder diets;
2. To determine the effects of dietary energy and protein level on semen production and fertility in the most superior semen producer of the local chicken breed.





1.2 Hypothesis

It is expected to see variation in semen characteristics among three breeds of local chicken. According to the body size, it is expected Serama (SC) will produce the smallest number of semen volume and concentration since testis size often used to estimate sperm production (Moller, 1988). Red Jungle Fowl (RJF) and village chicken (VC) are expected to not obviously differ in term of semen quality since RJF is the ancestor of the domesticated chicken. However, sperm production estimates can be highly variable (Briskie and Montgomerie, 2007). It is expected high dietary energy and protein may cause improvement in semen quality and fertility in caged breeder males. On the other hand, low dietary energy and protein diet is detrimental to the semen quality and fertility. Fertility depends on the semen quality and can be predicted by SQF value or fertilized eggs percentage.

