UNIVERSITI PUTRA MALAYSIA

LAYING PERFORMANCE AND EGG QUALITY OF QUAILS SUPPLEMENTED WITH $NaHCO_3$ DURING LATE LAYING PERIOD

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BY

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CERTIFICATION

This project entitled 'Laying Performance and Egg Quality of Quails Supplemented with $NaHCO_3$ During Late Laying Period' is prepared by Rosnadiana Binti Rosnadir and submitted to the Faculty of Agriculture in fulfillment of the requirement of SHW 4999 (Final Year Project) for the award of the Degree og Bachelor of Agriculture (Animal Science).

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LIST OF ABBREVIATION

°C	Celsius
Kg	Kilogram
g	Gram
L	Liter
cm	centimeter
mm	Millimeter
%	Percentage
FCR	Feed Conversion Ratio
$NaHCO_3$	Sodium bicarbonate

ABSTRACT

This study was conducted on a private farm at Kampung Valdor, Pulau Pinang to evaluate and determine the effects of increased level of dietary $NaHCO_3$ supplementation in water on egg production and egg quality parameters of quails during the late laying period. Japanese Quail (*Coturnix japonica*), 160 days of age, were blocked in galvanized-wire cages according to the cage locations and then assigned randomly to 3 treatment groups of hens; Treatment 0(T0) received 0% $NaHCO_3$ in their drinking water, Treatment 1(T1) received 0.4% $NaHCO_3$ in their drinking water, and Treatment 2(T2) received 0.8% $NaHCO_3$ in their drinking water; each treatment group consisting of 3 cages containing 10 hens. The feed fed is the commercial feed. Feed and water was given *ad libitum* to the hens in this experiment. The duration for this experiment was 75 days. Feed and water intake, mortality, egg production and egg weight were measured weekly. A sample of 3 eggs from each group were collected randomly every Monday for evaluation of egg quality parameters (egg weight, shape index, shell thickness, albumin index, yolk index). The results showed that the mortality rate and feed conversion ratio (FCR) were lower. The feed intake, egg production and egg weight were greater for the groups that were supplemented with $NaHCO_3$ in their drinking water compared with the controlled group. In conclusion, increasing $NaHCO_3$ level positively affected laying performance and altered the inner egg quality (albumin index, yolk index) but did not improve shell quality for late laying C. japonica. Based on Duncan Multiple Range Test for week 11mean yolk index for Group A was 20.43%, Group B was 16.53% and Group C was 17.02%. The mean of Group B and C are significantly different compared to Group A (controlled group).

Keywords: Sodium Bicarbonate, Egg Production, Egg Quality, Late Laying Period

ABSTRAK

Kajian ini menilai kesan pemberian $NaHCO_3$ yang disuplemenkan didalam air minuman puyuh terhadap prestasi pengeluaran telur dan kualiti telur keatas puyuh penelur tua. Kajian ini dijalankan selama 75 hari di Kampung Valdor, Pulau Pinang. Sebanyak 90 ekor burung puyuh berumur 160 hari digunakan di dalam kajian ini. Puyuh betina ditempatkan di dalam sangkar dawai besi dan dibahagikan kepada 3 kumpulan, dimana setiap satu kumpulan mempunyai 10 ekor, dan dibahagikan kepada 3 rawatan dan di ulangi susunan dan rawatan yang sama sebanyak 3 kali. Susunan adalah secara rawak. $NaHCO_3$ yang digunakan dberi melalui minuman puyuh penelur. Untuk kumpulan rawatan 0 (T0) akan mendapat 0% $NaHCO_3$, kumpulan rawatan 1 (T1) menerima 0.4% $NaHCO_3$, dan Kumpulan rawatan 2 (T2) menerima 0.8% $NaHCO_3$. Makanan yang digunakan ialah makanan komersial puyuh penelur. Makanan dan minuman telah diberi secara *ad libitum* iaitu tanpa had. Bagi pengambilan makanan dan air, kadar kematian, pengeluaran telur, berat telur direkodkan setiap minggu. Sampel diambil sebanyak 3 biji telur dan dikumpul secara rawak daripada setiap kumpulan untuk penilaian dan untuk direkodkan. Rekod tersebut dianalisis melalui parameter kualiti telur (berat telur, indeks bentuk, ketebalan cengkerang, indeks albumin, dan indeks kuning telur). Hasil kajian menunjukkan bahawa nisbah kadar kematian dan kadar penukaran makanan (FCR) adalah lebih rendah. Pengambilan makanan, pengeluaran telur dan berat telur adalah lebih besar kepada kumpulan yang telah ditambah dengan $NaHCO_3$ dalam air minuman mereka berbanding dengan kumpulan kawalan. Kesimpulannya, meningkatkan tahap $NaHCO_3$ mempengaruhi prestasi dan kualiti dalaman telur (indeks albumin, indeks kuning telur) secara positif tetapi tidak meningkatkan kualiti cengkerang untuk puyuh

penelur C. japonica. Berdasarkan Duncan Multiple Range Test untuk minggu 11, Indeks Kuning Telur (%) min Kumpulan A adalah 20.43 , Kumpulan B adalah 16.53 dan Kumpulan C adalah 17.02. Nilai min bagi Kumpulan B dan C adalah jauh berbeza berbanding dengan Kumpulan rawatan 0 (kumpulan kawalan).

Chapter 1

INTRODUCTION

From the technical and economic viewpoints, quail rearing is attractive due to their rapid growth and early onset of lay, high reproduction rates, and low feed intake (Murakami and Ariki, 1998; Albino & Barreto, 2003). Egg production rate decreased and egg weight increased as age advances (Al Bustany and Elwinger, 1987; Summers and Leeson, 1983). Egg quality and composition also changed in accordance with level of production and age of layers. As age advanced, proportion of yolk increased, whereas proportion of albumen and shell thickness decreased (Akbar et al., 1983: Fletcher et al., 1983). Despite no difference in feed conversion ratio (FCR), hen laying eggs with heavy shell weight have greater egg weight, shell weight and specific gravity than hens laying eggs with light shell weight (Abdullah et al., 1994). The frequency of defective eggs may increase to 11% during laying, collection and packaging phases of egg production (Yörük et al., 2004). Both shell thickness and shell stiffness decrease as age advances (Carnarius et al., 1996; De Ketelaere et al., 2002) because increased demand for calcium deposition to construct eggshell may be compromised (Roland, 1979; 1980). Reportedly about 10% of soft shell problem in quail eggs are found in total weekly production in a private quail farm owned by Mr. Lee at Kampung Valdor, Penang.

Calcium (Ca) and Phosphorus (P) are two major macro-minerals involved in bone formation (Frost and Roland Sr, 1991), while strength or weakness of eggshell is more directly related to carbonic anhydrase activity than Ca^{+2}-ATPase and calcium-

binding protein in shell gland (Balnave et al., 1992) and serum Ca concentration (Lennards et al., 1981). During shell formation, plasma lactate and pyruvate concentrations and pCO_2 increased sharply; minor changes occurred in HCO_3^- concentration, blood gases and osmolality; Na and Cl concentrations decrease in the uterine fluid (Arad et al., 1989). Meanwhile, HCO_3^- secreating cell localize towards luminal side, whereas HCl secreating cell localize towards serosal side (Mongin and Carter, 1977). Hens laying shell-less eggs were shown to be hypoxic and hypocapnia and have an increased plasma HCO_3^- concentration from renal sources, not from eggshell during shell formation (Rowlett and Simkiss, 1989). In a radioisotope study, Cipera (1980) showed that the highest ^{14}C activity in shell, albumen and yolk occurred 1, 2 and 4 days after injection of radiolabelled Ca. Carbonate caused the highest ^{14}Ca activity in amino shell, acids (glycine and leucine) in albumen and glucose and palmitate in yolk, respectively. Supplementations of salt and vitamin D, macro- and micro-minerals, alterations of acid-base balance by supplementing $NaHCO_3$ (Balnave and Muhreereza, 1997; Davidson and Wideman, 1992; Grizzle et al., 1992) are current ways for improving laying performance and egg quality. If alkaliosis occurred, lowered concentration of serum ionized Ca concentration negatively affects shell formation (Odom et al., 1986). Slower rate of passage and lower solubility of dietary Ca limit the formation of eggshell (Gordon and Roland, 1997).

Sodium bicarbonate is an electrolyte. Malaysia is a hot and humid country, thus livestock have a higher chance of suffering from heat stress. By adding $NaHCO_3$ in the drinking water, it can reduce the heat stress. Thus, there is no obvious harmful consequences' by conducting this experiment.

The effects of $NaHCO_3$ supplementation on acid based status and laying performance during peak production period have been investigated intensively in layers, data o is impact during late laying period are limited.

1.1 OBJECTIVES OF STUDY

The objective of this study was to investigate the effects of increased level of dietary $NaHCO_3$ supplementation in water on egg production and egg quality parameters of quails during the late laying period.

1.1.1 The specific objectives of this study are:

1. To evaluate the laying performance and egg quality of quails supplemented with $NaHCO_3$.
2. To determine if there is a significant difference between groups of quails supplemented with sodium bicarbonate and quails that aren't supplemented with sodium bicarbonate in the late laying period.

1.2 SIGNIFICANCE OF THE STUDY

The study will be able to determine if increased level of dietary $NaHCO_3$ supplementation in water can improve laying performance and egg quality in quail's late laying period.

1.3 RESEARCH HYPOTHESIS

Quails supplemented with $NaHCO_3$ had better egg quality and improved laying performance compared with quail that was not supplemented with $NaHCO_3$ in the late laying period.

REFERENCES

Abdullah, A.G., R.H. Harms, H.R. Wilson and O. El- Husseiny, 1994. Effects of removing trace minerals from the diet of hens laying with heavy or light shell weight. Poult. Sci., 73: 295-301.

Akbar, M.K., J.S. Gavora, G.W. Friars and R.S. Gowe, 1983. Composition of eggs by commercial size categories of genetic group, age and diet. Poult. Sci., 62: 925-933.

Al Bustany, Z. and K. Elwinger, 1987. Shell and interior quality and chemical composition of eggs from hens different strains and ages fed different dietary lysine levels. Acta. Agri. Scand., 37:175-187.

Albino LFT, Barreto SLT. Criação de codornas para produção de ovos e carne. Viçosa: Aprenda Fácil; 2003. 268p.

Arad, Z., U. Eylath, M. Ginsburg and H. Eyal-Giladi, 1989. Changes in uterine fluid composition and acid-base balance status during shell formation in the chicken. Am. J. Physiol., 257: R732-737.

Balnave, D. and S. K. Muheereza, 1997. Improving eggshell quality at high temperatures with dietary sodium bicarbonate. Poult. Sci., 76:588-593.

Balnave, D., N. U. El-Khatib and D. Zhang, 1992. Calcium and carbonate supply in the shell gland of hens laying eggs with strong and weak shells and during and after a rest from lay. Poult. Sci., 71: 2035-2040.

Carnarius, K.M., K.M. Conrad, M.G. Mast and J.H. Macneil, 1996. Relationship of eggshell ultrastructure and shell strength to the soundness of shell eggs. Poult. Sci., 76: 655-663.

Cipera, J.D., 1980. Source of carbon for the biosynthesis of eggshell carbonate in the hen. Comparison of six 14C labeled compounds as source of carbon in eggshells, albumen and yolk. Poult. Sci., 59: 1529-1537.

Davison, S. and R.F. Wideman, 1992. Excess sodium bicarbonate in the diet and its effect on Leghorn chickens. Br. Poult. Sci., 33: 859-870.

De Ketelaere, B., T. Govaerts, P. Couke, E. Dewil, J. Visscher, E. Decuypere and J. De Baerdemaeker, 2002. Measuring the Eggshell strength of 6 different genetic strains of laying hens: techniques and comparisons. Br. Poult. Sci., 43: 238-244.

Fletcher, D.L., WM. Britton, G.M. Pesti and S.1.Savage, 1983. The relationship of later flock age and egg weight on egg component yields and solid content. Pou~ Sci., 62: 1800-1805.

Frost, T.J. and D.A. Roland, Sr., 1991. The influence of various calcium and phosphorus levels on tibia strength and eggshell quality of pullets during peak production. Poult. Sci., 70: 963-969.

Grizzle, J., M. Iheanacho, A. Saxton and J. Broaden, 1992. Nutritional and environmental factors involved in eggshell quality of laying hens. Br. Poult. Sci., 33:781-794.

Lennards, R., D.A. Roland, Sr. and J.A. McGuire, 1981. The relationship of serum calcium to shell weight and other criteria in hens laying a low or high incidence of shell-less eggs. Poult. Sci., 60: 2501-2505.

Mongin, P. and N.W. Carter, 1977. Studies on the avian shell gland during egg formation: aqueous and electrolyte composition of the mucosa. Br. Poult. Sci., 18: 339-351.

Monira, K. N.; Salahuddin, M. and Miah, G. (2003). Effect of breed and holding period on egg quality characteristics of chickens. Int. J. of Poult. Sci. (2): 261–263.

Murakami, A.E., Ariki, J., 1998. Produção de codornas japonesas. Jaboticabal: FUNEP., 79p.

Murakami, A.E., Fernandes, J.I.M., Sakamoto, M.I., Souza, L.M.G., Furlan, A.C., 2007. Efeito da suplementação enzimática no desempenho e qualidade dos ovos de poedeiras comerciais. Acta Scientiarum. Animal Science, 29(2):165-172.

Murakami AE, Furlan AC. Pesquisas na nutrição e alimentação de codornas em postura no Brasil. In: 1º Simpósio Internacional de Coturnicultura; 2002; UFLA, Lavras, Minas Gerais. Brasil. p. 113-120.

Murakami, A.E., Sakamoto, M.I., Souza, L.M.G., Franco, J.R.G., Mituo, M.A.O, 2006. Determinação do melhor nível de sal comum para codornas japonesas em postura. Revista Brasileira de Zootecnia., 35(6):2333-2337.

Murakami, A.E., Souza, L.M.G., Sakamoto, M.I., Fernandes, J.I.M., 2008. Using processed feeds for laying quails (*Coturnix coturnix japonica*). Revista Brasileira de Ciência Avícola., 10(4):205-208.

Roland, D.A., 1979. Factor influencing shell quality of aging hens. Poult. Sci., 58: 774-777.

Roland, DA, 1980. The ability of young and old hens to change shell deposition with sudden neutral drastic changes in egg size. Poult. Sci., 59: 924-926.

Romanoff, A.L. and A.J. Romanoff, 1949. The avian egg. New York, John Wiley and sons Inc.

Rowlett, K. and K. Simkiss, 1989. Respiratory gases and acid-base balance in shell-less avian embryos. J.Exp. Biol., 143: 529-536.

Summers, J. D. and S. Leeson, 1983. Factors influencing early egg size. Poult. Sci., 62: 1155-1159.

Yörük M A, Gül M, Hayirli A and Karaoglu M 2004 Laying performance and egg quality of hens supplemented with sodium bicarbonate during the late laying period. International Journal of Poultry Science 3 (4): 272-278.