Effect of different levels of energy and lysine on the laying performance of TANUVAS Namakkal Gold Japanese quail

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ABSTRACT

The aim of the present research was to study the laying performance by feeding different levels of energy (2600, 2700 and 2800 Kcal/kg) and lysine (0.8, 0.9 and 1.0 %) in laying TANUVAS Namakkal gold quail with 18% crude protein in all the treatments. A total of 360 Japanese quails aged 7 weeks old were divided into nine equal groups of four replicates each consisting of 10 quails. The laying phase of twenty weeks was divided into five periods with 28 days duration. No significant effect on the age at sexual maturity and age at 50% egg production. Low energy level recorded significantly (P<0.05) earlier age for 90 per cent egg production. Low energy and lysine showed significantly (P<0.01) higher hen day and hen housed egg production, feed consumption (g/bird/day), feed efficiency/dozen eggs and feed efficiency/kg egg mass.

Key Words: Energy, lysine, egg production, feed consumption and feed efficiency

INTRODUCTION

Genetic selection for higher body weight and egg production in Japanese quail is practiced during the last few decades (Hussain *et al.*, 2013). A new egg type Japanese quail strain "TANUVAS Namakkal gold Japanese quail" was evolved by the Department of Poultry Science, Veterinary College and Research Institute, Namakkal under Tamil Nadu Veterinary and Animal Sciences University. The actual nutrient requirement for these quails has not been worked so far and the NRC (1994) recommendations have been followed throughout the production cycle. Consequently, there is a need of updating optimal nutritional requirements to maximize the production potentiality.

Energy protein ratio and the ratio of energy to other nutrients are important in the formulation of the diet. Supplementing the required limiting amino acids in diet will reduce dietary protein content. The information on the amino acid nutrition

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of Japanese quail, as a whole, is scanty (Shrivastav and Panda, 1999). The ideal protein concept implies feeding the best ratios between lysine and other amino acids, thus reducing the crude protein content of the diet. Lysine in lower or excess levels may bring metabolic damages, which affects the bird's performance (Kidd and Kerr, 1998). Hence, the present study has been carried out to evaluate the effect of different dietary metabolizable energy and lysine levels, in "TANUVAS Namakkal gold Japanese quail".

MATERIALS AND METHODS

The experiment was conducted in "TANUVAS Namakkal gold Japanese quail" from day old to twenty six weeks of age. The whole experimental period was divided into three phases *viz.* chick (0-2 weeks), grower (3-5 weeks) and layer (7-26 weeks). Seven hundred and twenty day old quail chicks were divided into nine treatments with four replicates of 20 chicks each. Nine experimental diets were formulated in 3x3 factorial arrangements with three levels of dietary energy (2700, 2800 and 2900 Kcal/kg) and three levels of lysine (1.2, 1.3 and 1.4 per cent) during chick phase (0-2 weeks) and 2700, 2800 and 2900 Kcal/kg energy with 1.1, 1.2 and 1.3 per cent during grower phase (3-5 weeks). After five weeks, only 10 females were retained in each replicate, so a total of 360 birds were maintained during the laying phase. Nine experimental diets were formulated in 3x3 factorial arrangements with three levels of dietary energy (2600, 2700 and 2800 Kcal/kg) and three levels of lysine (0.8, 0.9, and 1.0 per cent) from 7-26 weeks during layer phase.

The quail chicks used for the experiment were housed in cage system and maintained under standard managemental conditions. The laying phase (7-26 weeks) was divided into five periods with 28 days duration. During the laying period, the egg production was recorded replicate wise each day and total feed consumption was recorded once in every twenty-eight days. Mortality was recorded at occurrence. With the data collected, feed consumption (g) per bird per day, hen day egg production, hen housed egg production, feed efficiency per dozen eggs and feed efficiency per kg of egg mass and livability percentage were worked out. The data were analysed statistically as per the methods described by Snedecor and Cochran 1994).

RESULTS AND DISCUSSION

The age at sexual maturity, age at 50 and 90 per cent egg production, production performance like hen day egg production (HDEP) and hen housed egg production (HHEP) percentage, feed consumption and feed efficiency and energy x lysine interaction results are shown in Table 1.

The energy x lysine interaction and the influence of energy and lysine levels revealed no significant difference between the groups for age at sexual maturity and age at 50 per cent egg production. The age at 90 per cent egg production showed a significant ($P<0.05$) difference between the groups. Japanese quail fed with 2900 kcal/kg energy and 0.8% lysine (T_3) and 2900 kcal/kg energy and 0.9% lysine (T_6) recorded significantly delayed 90 per cent egg production (84.25 days), while all other groups reached 90

Table I: Egg production performance of "*TANUVAS Namakkal Gold Japanese Quail*" from 7 to 26 weeks of age under caged system of housing

Treat-ments	Parameters							
	Age at sexual maturity	Age at 50% egg production	Age at 90% egg production	Hen day egg production (%)	Hen housed egg production (%)	Feed consumption (g/bird/day)	Feed efficiency per dozen eggs	Feed efficiency per kg egg mass
General Linear Model (GLM) analysis of Energy X Lysine level interaction								
T_1	39.50±0.50	45.00±0.41	53.00^{a}±2.80	84.67^{A}±0.69	83.75^{A}±1.72	38.14^{a}±0.43	0.563^{A}±0.016	3.725^{A}±0.186
T_2	41.25±1.03	44.75±0.85	53.75^{a}±2.17	73.31^{B}±1.43	72.64^{B}±0.62	35.92^{bc}±0.38	0.641^{AB}±0.023	4.275^{AB}±0.184
T_3	43.00±1.73	58.75±4.92	84.25^{b}±9.21	60.15^{D}±2.17	58.00^{D}±1.15	33.45^{ef}±0.29	0.804^{BC}±0.050	5.458^{BC}±0.333
T_4	41.50±0.50	48.00±3.03	59.75^{a}±5.23	70.91^{BC}±3.22	70.62^{B}±2.98	36.84^{ab}±0.18	0.700^{ABC}±0.048	4.716^{ABC}±0.295
T_5	41.00±1.47	56.25±5.04	74.75^{ab}±7.48	59.45^{D}±0.69	58.18^{D}±1.48	34.71^{cde}±0.43	0.865^{C}±0.040	5.915^{C}±0.247
T_6	44.00±2.12	59.75±5.12	84.25^{b}±8.55	55.69^{D}±0.87	54.93^{D}±0.93	32.11^{f}±0.26	0.843^{C}±0.033	5.705^{C}±0.159
T_7	43.25±1.25	56.00±4.34	74.25^{ab}±5.53	63.34^{CD}±1.20	61.88^{CD}±1.40	36.03^{bc}±0.16	0.858^{C}±0.032	5.755^{C}±0.269
T_8	43.50±1.19	56.25±3.71	74.25^{ab}±8.73	69.27^{BC}±3.44	69.09^{BC}±3.33	35.29^{bcd}±0.51	0.708^{ABC}±0.057	4.689^{ABC}±0.414
T_9	42.75±1.18	51.75±2.78	67.50^{ab}±5.95	63.81^{CD}±2.48	61.95^{CD}±2.56	33.81^{de}±0.56	0.739^{BC}±0.049	4.904^{ABC}±0.356
General Linear Model (GLM) analysis of Energy levels								
2700	41.42±0.63	49.67±2.13	62.33^{a}±3.62	72.97^{A}±2.87	72.08^{A}±2.93	37.00^{A}±0.30	0.706^{a}±0.041	4.732^{a}±0.283
2800	41.92±0.73	52.42±2.51	67.58^{ab}±4.60	67.34^{B}±2.09	66.64^{B}±2.16	35.30^{B}±0.27	0.738^{ab}±0.036	4.960^{ab}±0.261
2900	43.25±0.91	56.75±2.54	78.67^{b}±4.82	59.88^{C}±1.44	58.29^{C}±1.24	33.13^{C}±0.30	0.795^{b}±0.027	5.356^{b}±0.185
General Linear Model (GLM) analysis of Lysine levels								
0.8	41.25±0.76	49.50±2.48	63.67±5.30	72.71^{A}±3.13	71.47^{A}±3.25	35.84^{A}±0.61	0.669^{A}±0.035	4.486^{A}±0.253
0.9	42.17±0.89	54.67±2.78	72.92±4.84	62.02^{B}±2.21	61.24^{B}±2.29	34.56^{B}±0.60	0.802^{B}±0.031	5.445^{B}±0.202
1.0	43.17±0.64	54.67±2.01	72.00±3.72	65.47^{B}±1.56	64.30^{B}±1.68	35.04^{B}±0.36	0.768^{B}±0.031	5.116^{B}±0.230

n = 4, Means within a column with different superscript small letters differ significantly ($P < 0.05$)
Means within a column with different superscript capital letters differ significantly ($P < 0.01$)

per cent egg production at an early age. The influence of energy levels showed that the low (2600 kcal/kg) energy level recorded significantly ($P<0.05$) earlier age at 90 per cent egg production (62.33 days) when compared to high (2800 kcal/kg) energy level (78.67 days). The medium (2700 kcal/kg) energy group was statistically comparable with other groups. The influence of lysine levels showed no significant difference for 90 per cent egg production. Aggoor *et al.* (2006) reported delayed age at 40 per cent egg production due to high energy which is in accordance with this study, while Olusoji (2011) and Bulus *et al.* (2013) found no significance in the age at sexual maturity.

Hen day and hen housed egg production (%)

The energy x lysine interaction data revealed significant ($P<0.01$) difference between the groups for hen day and hen housed egg production. The overall hen day and hen housed egg production (84.67 and 83.75%) was significantly higher in T_1 (2600 kcal/kg and 0.8%) when compared to all other groups. The influence of energy and lysine levels showed significantly ($P<0.01$) higher hen day and hen housed egg production (72.97 and 72.08%) in low energy (2600 kcal/kg) levels and 72.71 and 71.47% hen day and hen housed egg production in low lysine (0.8%) levels when compared to other levels of supplementation. Aggoor *et al.* (2006) reported high egg production in low energy (2700 kcal/kg) group while Azghadi *et al.* (2014) recorded high egg production in high energy (3050 kcal/kg) group which is not in concurrence to this trial. Lima *et al.* (2016) observed higher egg production in high lysine group which is in contrast to the results of the present study. Egg production increases as the protein level increases, but as the level increases too high or exceeds the need of the bird, it is wasted as it increases the burden for the birds and reduces the performance of the birds. The results of this trial recommend low energy and low lysine (2600 kcal/kg and 0.8%) for egg production in the layer phase.

Feed consumption and feed efficiency

The energy x lysine interaction revealed significant difference between the treatment groups for feed consumption (g/bird/day), feed efficiency/dozen eggs and feed efficiency/kg of egg mass from 7 to 26 weeks of age.

Feed consumption (38.14 and 36.84 g) was significantly ($P<0.05$) high in T_1 (2600 kcal/kg and 0.8%) and T_4 (2600 kcal/kg and 0.9%). Statistically ($P<0.01$) and numerically best feed efficiency/dozen eggs and feed efficiency/kg egg mass (0.563 and 3.725) was recorded in T_1 (2600 kcal/kg and 0.8%) when compared to all other groups. The influence of energy and lysine levels showed significant ($P<0.01$) increase in feed consumption in the low energy and lysine (2600 kcal/kg and 0.8%) groups. Energy groups recorded 37.00, 35.30 and 33.13 g and lysine levels recorded 35.84, 34.56 and 35.04 g, for low, medium and high levels respectively. Feed consumption was significantly higher in low energy (2700, 2600 kcal/kg) groups as recorded by Aggoor *et al.* (2006), Kadam *et al.*, (2006) and Abdel-Azeem (2011) whose findings are in agreement with the present observations. On the contrary, Azghadi *et al.* (2014) recorded increase in feed consumption in high and medium (2900 and 3050 kcal/kg) energy. Sung-Taek *et al.* (2012), Ribeiro *et al.* (2013) and Nery *et al.*, (2015) observed no significant difference in feed consumption due to lysine levels.

Low and medium (2600 and 2700 kcal/kg) energy levels showed a good feed efficiency/dozen eggs (0.706 and 0.738) and feed efficiency/kg egg mass (4.732 and 4.960) when compared to high (2800 kcal/kg) energy (0.795 and 5.356) level. The medium energy (2700 kcal/kg) level was intermediate and statistically comparable to other groups. The influence of lysine levels showed significant ($P<0.01$) difference in lysine groups for feed efficiency/dozen eggs and feed efficiency/kg egg mass. Better feed efficiency/dozen eggs and feed efficiency/kg of egg mass (0.669 and 4.486) was observed in low (0.8%) lysine levels, whereas poor feed efficiency/dozen eggs (0.768 and 0.802) and feed efficiency/kg egg mass (5.445 and 5.116) was recorded in medium and high (0.9 and 1.0%) lysine levels. Low energy (2700 and 2610 kcal/kg) showed better feed efficiency in the studies conducted by Aggoor *et al.* (2006) and Yusuf *et al.* (2016), while Azghadi *et al.* (2014) has reported better feed efficiency in high energy (3050 kcal/kg) group, which is not in agreement with the present study. Better feed efficiency was reported in low lysine (1.100%) levels by Garcia *et al.* (2005) which is in agreement to this study, while linear improvement in feed efficiency was observed by Lima *et al.* (2016) with different levels of *D*-lysine, which is not in accordance to the results of the study.

It is inferred that, the low energy and low lysine (2600 kcal/kg and 0.8%) is recommended for optimum feed consumption (g/bird/day) and feed efficiency/dozen eggs and feed efficiency/kg of egg mass in the layer phase of "*TANUVAS Namakkal gold Japanese quail*".

CONCLUSION

The final recommendation based on the production performance is 2700 kcal/kg energy and 1.2 per cent lysine during chick phase; 2700 kcal/kg energy and 1.1 per cent lysine during grower phase and 2600 kcal/kg and 0.8 per cent lysine during layer phase.

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REFERENCES

Abdel-Azeem, F. (2011). Influence of qualitative feed restriction on reproductive performance of Japanese quail hens. *Egyptian Poultry Science,* **31**: 883-897.

Aggoor, F. A., Attia, Y. A., Ismaili, F. S. A., Qota, E. M. A. and Shakmaki, E.A. (2006). Effect of level and source of dietary energy and/or enzyme additions on productive performance and egg quality of Japanese quail hens.

XII European Poultry Conference, Verona, Italy 10-14 September, 1-7

Azghadi, M.A., Kermanshahi, H. and Goli, A. (2014). The Effect of dietary energy and protein levels on growth performance and antibody responses of offspring of laying Japanese quails. *Iranian Journal of Applied Animal Science,* **4**(1): 185-190.

Bulus, E.D., Aguda, A.Y., Ezekiel, J., Dodo, S.T. and Ibe, E.A. (2013). Growth performance of Japanese quails (*Coturnix coturnix japonica*) fed two types of commercial broiler diet. *Advances in Agriculture Science and Engineering Research,* **3**(10): 1227 – 1234.

Garcia, E. A., Mendes, A. A., Pizzolante, C. C., Saldanha, E. S. P. B., Moreira, J., Mori, C and Pavan, A. C. 2005. Protein, Methionine+Cystine and Lysine Levels for Japanese quails during the production phase. *Brazilian Journal of Poultry Science,* **7**(1): 11–18.

Hussain, J., Akram, M., Sahota, A. W., Javed, K and Ahmad, H. A. (2013). Selection for higher three week body weight in Japanese quail: 1. Effect on growth performance. *J. Animerican Plant Science,* **23**: 1496-1500.

Kadam, M.M., Mandal, A.B., Elangovan, A.V and Kaur, S. (2006). Response of laying Japanese quail to dietary calcium levels at two levels of energy. *The Journal of Poultry Science*, **43**: 351-356

Kidd, M.T. and Kerr, B.J. (1998). Dietary arginine and lysine ratios and electrolyte balance. *Poultry Science*, **77**: 864-869.

Lima, H.J.D., Barreto, S. L.T., Donzele, J. L., Souza, G. S., Almeida, R. L., Tinoco, I. F. F. and Albino, L. F. T. (2016). Digestible lysine requirement for growing Japanese quails. *Journal of Applied Poultry Research,* **25**(4): 483-491.

Nery, V.L.H., Novoa, D. M.T and Duran, A.O. (2015). The effect of protein level on egg-laying Japanese quails. ORINOQUIA - Universidad de los Llanos - Villavicencio, *Meta. Colombia*, 17(1): 30-37.

NRC, National Research Council. (1994). Nutrient Requirements of Poultry. 9th Rev. Edition. National Academy Press, Washington, DC. U.S.A.

Olusoji, A.S. (2011). Effect of age and egg size of Japanese quail hens on hatchability and post hatch performance of quail chicks fed different dietary protein levels. Thesis submitted to the School of Postgraduate Studies, Ahmadu Bello University, Zaria for the degree of Masters of Science (Animal science).

Ribeiro, C.L.N., Barreto, S.L.T., Reis, R S., Muniz, J.C.L., Donzele, J.L., Gomes, P.C., Junior, J.G.V, and Albino, L.F.T. (2013). Digestible lysine levels in diets for laying Japanese quails. *Revista Brasileria Zootecnia*, **42**(7) : 489-495.

Shrivastav, A.K. and Panda, B. (1999). A review of quail nutrition research in India. *World's Poultry Science Journal*, **55**: 73-81.

Snedecor, G.W and Cochran, W.G. (1994). *Statistical Methods*. 9th Edn, Iowa state University press, Ames, USA. Iowa – 50010.

Sung-Taek, O., Kim, J., Park, S., Yun, J., Zheng, L., Anand, B., and Kang, C. (2012). The effects of dietary protein level on laying performance and egg quality in Japanese quail. *Korean Journal of Poultry Science,* 39(3): 207-213.

Yusuf, M.S., Nabtiti, A.S.E and Cui, H. (2016). Effects of NENP vs LELP Diets on some laying and reproductive performance parameters of Japanese quail's hens. *Journal of Advanced agricultural Technologies,* **3**(2): 132-135.