RESEARCH ARTICLE

Reproductive Performance of Japanese Quail Hens (*Coturnixcoturnix japonica*) Fed with Feed Restriction Regimes during Growth Period

RT Hertamawati[1], Suyadi[2*], E Soedjarwo[2], O Sjofjan[2]

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Abstract

Reproductive performance of quail hens (*Coturnixcoturnix japonica*) at sexual maturity was evaluated following two feeding restriction programs (100%, 90% and 80% of *ad libitum*) and energy metabolism (EM) of ration: 2900 Kcal/kg and 2800 Kcal/kg) between 2 weeks and 5 weeks of age with five replicates of 10 chicks per replicate. Body weight and feed conversion were measured weekly during feed restriction. After experimental feeding treatment, age at first egg, BW, egg weight, development of reproductive organ on sexual maturity were evaluated of one hen's quail per treatment. The results of the experiment indicated that the restricted feeding until 80% of *ad libitum* was consequently ($p < 0.01$) delayed sexual maturity and influence the development of the reproductive organ. However, it did not show significant influence on the body weight of the first-laid egg and initial egg production. Restricted feeding at 90% of *ad libitum* and EM ration 2900 Kcal/kg showed the best results for quail feed management during growth.

Keywords: Egg production, Energy metabolism, Reproductive organ, Sexual maturity.

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Introduction

Japanese quail is a breed for eggs and meat production. There are few studies published on egg production (Vali, 2008). However, reports on quail reproductive and growth are limited. It is well known that both protein and energy in poultry ration are considered the most expensive items in the cost of a complete feed, where energy alone contributes to about 70% of the total cost of poultry ration (Skinner *et al*., 1992).

Furthermore, both dietary energy and protein represent approximately 85% of the total feed cost (Gunawardana *et al*., 2008). Hence, it is to be expected that many programs will be made to reduce their use in the rations without lowering performance. Many of these restriction programs involve quantitative feed and energy feeding regimes.

Only a little or limited information was reported to deal with the use of qualitative restricted feeding as a nutritional approach to reducing the cost of feeds or problems associated with egg production in Japanese quail hens. Some studies have determined the effects of qualitative and quantitative feed restriction on growth performance of broiler chicken (Jang *et al*., 2009), reproductive performance (Anderson, 2010), ovary morphology and laying traits of turkey (Renema *et al*., 1999).

The advantages of restricted feeding over full feeding during the rearing period are usually considered to be greater the longer the laying flock is kept. Although feed restriction delayed the onset of egg production by approximately two days as compared to control (full fed) in quail production but early feed restriction significantly ($p < 0.05$) affected first egg weight and the number of eggs produced from 6 to 13 weeks of age in Japanese quail (Hassan *et al*., 2003).

Therefore, the experiment was aimed to study the effect of feed restriction on reproductive performance and egg production of Japanese quail, which would be very beneficial to poultry farmers in rural areas of Indonesian province and elsewhere.

[1]Postgraduate Faculty of Animal Science, Brawijaya University, Malang, Indonesia

[1]Polytechnic State of Jember, Department of Animal Husbandry, Indonesia

[2]Faculty of Animal Science, Brawijaya University, Malang, Indonesia

Corresponding Author: Suyadi, Faculty of Animal Science, Brawijaya University, Malang, Indonesia, e-mail: suyadi@ub.ac.id

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Materials and Methods

The experiment was conducted on State Polytechnic of Jember, East Java, Indonesia from April to June 2017. The sample was collected from300 of Japanese quail hens at 2 weeks of age. Birds were housed with natural ventilation of 5×3 m^2 with laying cages of ($40 \times 20 \times 15$ cm^2) at a density of 10 quail per cage. Quail hens were equally allotted to 2 dietary regimes, basic on EM R1= 2900 Kcal/kg; R2 = 2800 Kcal/kg and quantitative restricted feeding; P0 = 100% of *ad libitum*; P1 = 90% of *ad libitum* and P2 = 80% of (N = 300). Each group (n = 50) had five replicates containing 10 birds each.

All birds were reared under similar managerial and hygienic conditions. A starter diet containing 24% crude protein was fed from day-old to two weeks of age. Drinking

water was provided via automatic nipple drinkers. Following 2 weeks on *ad libitum* feeding, all birds were fed according to treatment diets from 14 to 42 days of age and maintained until the first laid egg is seen. The composition of the experimental diet was given in Table 1.

Body weight and total feed intake data were determined on 14, 28, 35 and 42 days of age. Birds were maintained on assigned feeding regimens until first oviposition. Quails were individually weighed and mortality was recorded as occurred. Body weight, age at the first egg, first-egg weight, and development of reproductive organs were measured at sexual maturity. Initial egg production was recorded daily and egg weights (EW) were measured.

All of the data were studied by analysis of variance, including the effects of restricted feeding and EM content of the feed. When the *F*-test was significant, the least squares mean being compared. Initial egg production was recorded for two weeks period.

Results and Discussion

Reproductive Performance and Onset Sexual Maturity

The effect of restricted feeding and EM of a ration on reproductive performance consisting of the average age of sexual maturity, the body weight of sexual maturity and first egg weight of quail hens are presented in Table 2. Restricted feeding on different EM ration indicated existence to delay of age at sexual maturity (p <0.01). The delay was due to dietary restriction inhibiting growth rates including reproductive organs (Bunan, 1990). Sexual maturity of quail was postponed up to 8.8 days at a feeding rate of 80% with ME 2900 Kcal/kg, and 9.6 days at EM 2800 Kcal/kg. Age of sexual maturity at *ad libitum* feeding and restricted 90 % of *ad libitum* did not show a significant difference (p >0.05). The significant difference occurred in treatment P2 (80% of *ad libitum*). Wilson *et al.* (1983) suggested that the reduction of ration as much as 20% of the recommended amount of ration could slow down the reproductive organs.

Body weight at sexual maturity was not influenced by restricted feeding (p >0.05). The weight of quail bodies with feeding *ad libitum* had the highest body weight of 187.67 g and the lowest at the feeding rate of 80% of 167.00 g. According to Hassan *et al.* (2003), the optimum weight at the adult age was150 g, while the age of sexually adult was about 42 days. Delays in sexual maturity of adult genital quail with limited feed were due to the lack of optimal body weight. Brody *et al.* (1984) suggested that sexual maturity takes a certain weight and age to finalize on each strain of poultry. To achieve the weight of

Table 1: Composition and calculated analysis of experimental diets offered to quail hensfrom 1 to 42 days of age

Variables	*R1*		*R2*	
Maize (%)	0.40		0.30	
Rice Bran (%)	0.07		0.18	
Concentrate Feed (%) (Comfeed Ltd.)	0.53		0.52	
	Calculated	Analysis*	Calculated	Analysis*
Protein (%)	24.01	23.6	24.01	23.9
Fat (%)	4.95	3.3	5.66	3.9
Crude Fibre (%)	5.28	2.8	5.77	3.1
Ca (%)	1.37	-	1.34	-
P (%)	0.76	-	0.90	-
Metabolize Energy (kcal/kg)	2916.56	2930**	2822.40	2830**

*Proximate analysis; **Estimation of Gross Energy

Table 2: The average of age, body weight, first egg on sexual maturity with restricted feeding

ME ration (kcal/kg)	*Restricted Feeding (% Ad-libitum)*	*Age of Sexual maturity (day)*	*Body Weight at SM (g)*	*Weight of first egg (g)*
2900	100	44.00a	181.67	8.29[a]
	90	46.67a	174.33	8.79[a]
	80	53.00b	167.00	9.54[b]
2800	100	42.67a	187.67	7.99[a]
	90	50.67b	180.67	9.22[b]
	80	55.33c	171.00	9.08[b]
	SEM	1.79	2.93	0.24
	p value	0.000	0.103	0.003

[a,b,c]: means within same column with different superscripts (p <0.05)are significantly different

optimal sex required high protein consumption. Other factors affecting genitalia are the lighting and cage system.

Restricted feeding was able to increase the weight of the first egg laid ($p < 0.01$). The first group of quail eggs provided with limited feeding was significantly ($p < 0.05$) higher than the quail group with feeding *ad libitum*. The highest mean egg weight was produced by quail group with 90% *ad libitum* with 2800 Kcal/kg of ration, followed by quail group which got 80% and lowest egg weight was produced by quail group with feeding *ad libitum*. Although the increase in egg weight was possible, the increase was estimated due to the influence of individual variations. Immature body weight decreased the weight of eggs, mainly due to increased body weight during sex maturity (Summers and Lesson, 1983).

Development of Reproductive Organs

The effect of restricted feeding and EM of a ration on the development of the reproductive organ of quail are presented in Table 3. Restricted feeding on different EM ration showed an increase of weight of the ovary ($p < 0.01$). The highest weight of ovary was on restricted 90% *ad libitum*. The length and weight of oviduct generally increased with increasing feed restriction. The decreasing of reproductive organs development was due to the slow growth of the reproductive organ (Hurwitz and Plavnik, 1989).

Egg Production, Egg Weight, and Egg Mass

The effect of restricted feeding and EM of a ration on initial egg production are presented in Table 4. Egg production, expressed as laying percentage was insignificantly affected by diet restriction until 90% of *ad libitum* feeding, both in ME of ration. Restricted feeding until 80% decreased egg production ($p < 0.05$). The average of initial egg production ranged from 32.97 to 38.81% and in this research, a diet containing 2900 Kcal EM/kg was satisfactory for Japanese quail hens for obtaining better egg production. These results were different than reported by Azeem and Azeem (2011). They found that ME required for Japanese quail during the laying period was 2800 kcal ME/kg. The higher egg weight was shown by 80% *ad libitum* feeding, but the converse trend, where quail fed 80% *ad libitum* feeding and 2800 to 2900 Kcal ME recorded similar values. This was in agreement with the reports of Summer *et al.* (1991) that restricted feeding birds had higher feed intake and egg weight than *ad libitum* feeding.

The results of the study indicated that 80% feed restriction significantly ($p < 0.05$) improved feed conversion. The increase of egg weight due to 80% *ad libitum* feeding was attributed to the age of quail which affected to a greater extent by the development of reproductive organs of quail.

Table 3: The average of the development of reproductive organs on sexual maturity with restricted feeding

ME ration (kcal/kg)	*Restricted Feeding (% Ad-libitum)*	*Ovary weight (g)*	*Oviduct weight (g)*	*Oviduct Length (cm)*
2900	100	5.44[a]	5.65 a	24.12[a]
	90	6.33[b]	6.88 b	28.60[b]
	80	6.13[b]	6.67b	31.64[c]
2800	100	5.39[a]	6.60	27.48[a]
	90	7.21[b]	6.68	28.62[b]
	80	5.78[a]	6.50	30.86[c]
	SEM	0.29	0.19	1.20
	p value	<0.001	0.003	<0.001

[a,b,c]: means within same column with different superscripts ($p < 0.05$) are significantly different

Table 4: The Average of Initial Egg Production with Restricted Feeding

EM ration (kcal/kg)	*Restricted Feeding (% Ad-libitum)*	*Feed intake (g/hens)*	*Egg weight (g)*	*Hen Day Production (%)*	*Feed conversion*
2900	Ad libitum	342.56a	9.28a	38.81a	6.1[a]
	90% Ad libitum	315.47b	9.74a	36.10a	5.89[a]
	80% Ad libitum	282.42c	10.11b	32.97b	4.99[b]
2800	Ad libitum	337.62a	9.88a	37.30a	5.77[a]
	90% Ad libitum	319.95b	10.50b	34.48a	6.20[b]
	80% Ad libitum	282.31c	10.31b	33.16b	5.22[a]
	SEM	10.9	0.138	0.957	0.140
	p value	<0.001	0.041	<0.001	0.002

[a,b,c]: means within same column with different superscripts ($p < 0.05$) are significantly different

Conclusion

Restricted feeding until 80% of *ad libitum* delayed age at sexual maturity, decreased the development of reproductive organs and egg production. However, it improved feed conversion value, and no effect was found on body weight during the onset of sexual maturity. Restricted feeding at 90% of *ad libitum* and EM ration 2900 Kcal/kg showed the best results for quail feed management during growth.

References

Anderson K. E. (2010). Effects of dietary regimes and brown egg pullet strain on growth and development. Intr. Journal of Poult. Sci., 9(3): 205-211.

Azeem A. and F. A. Azeem. (2011). Influence of qualitative feed restriction on reproductive performance of Japanese quail hens. Egypt. Poult. Sci. Vol 31 (IV) : 883-897.

Bunan A. T. (1990). Reproductive Performance as Influenced by Nutritional Management in Chickens Selected for Aspect of Growth and Body Composition. Proceeding of The Australia Poultry Science Symposium.

Brody T. B., P. B. Siegel and J. A. Cherry. (1984). Age, body weight and body composition requirements for the onset of sexual maturity of dwarf and normal chickens. Br. Poult. Sci. 25:245-252.

Gunawardana P., D. A. Roland and M. M. Bryant. (2008). Effect of energy and protein performance, egg components, egg solids, egg quality, and profits in molted Hy-line W-36 hens. J. Appl. Poult. Res., 17: 432-439.

Hassan S. M., M. E. Mady, A. L. Cartwright, H. M. Sabri, and M. S. Mobarak. (2003). Effect of early feed restriction on reproductive performance in japanese quail (Coturnixcoturnix japonica). Poult. Sci., 82: 1163-1169.

Hurwitz S. and I. Plavnik. (1989). Severe feed restriction in pullets during the early growing period: performance and relationships among age, body weight, and egg weight at the onset of production. Poultry Sci. 68(7): 914-924.

Jang I. S., S. Y. Kang, Y. H. Ko, Y. S. Moon and S. H. Sohn.(2009). Effect of qualitative and quantitative feed restriction on growth performance and immune function in broiler chicken. Asian Aust. J. of Animal Sci.,1(3): 226-237.

Renema, R. A., F. E. Robinson, J. A. Proudman, M. Newcomb and R. I. McKay. (1999). Effects of body weight and feed allocation during sexual maturation in broiler breeder hens. 2. Ovarian morphology and plasma hormone profiles. Poultry Sci. 78: 629-639.

Skinner J. T., A L Waldroup, P. W. Waldroup, O. P. Thomas, M. T. Farran and C.B. Tamplin. (1992). Effects of dietary nutrient density on performance and carcass quality of broilers 42 to 49 days of age. J. Appl. Poult. Res., 1:367-372.

Summers J. D., Spratt and J. L. Atkinson. (1991). Delaying sexual maturity of pullets by nutrient restriction at the onset of production. Can. J. Animal Sci. 71 : 1215-1221.

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

Vali N. (2008). The Japanese quail: A review. Intr. J. Poult. Sci., 925-931

Wilson H. R., D. R. Ingram and R. H. Harms. (1983). Restricted feeding of broiler breeders. PoultrySci. 62(7):1133-1141.

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