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EFFECT OF DIFFERENT FEED RESTRICTION REGIMES ON GROWTH PERFORMANCE AND ECONOMIC EFFICIENCY OF JAPANESE QUAILS

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ABSTRACT

The present study was executed to examine the growth performance and economic efficiency of Japanese quail (*Coturnix coturnix japonica*) at Avian Research and Training (ART) Centre, UVAS, Lahore. For this purpose a total of 3200 quail chicks were allocated to four different feed restriction regimes comprising four close-bred stocks (Imported, Local-1, Local -2 and Local-3) at the age of 10 days. The experimental quails in group 1 were fed *ad-libitum* (20.30% CP, 1.3% Lysine) diet throughout the experimental period to serve as control while groups 2, 3 and 4 were provided with 1 hour feed- 3-hour off, 2-hour feed- 2hour off and 3-hour feed-1hour off feeding regimes, respectively. Weekly data on growth parameters were recorded. Maximum feed intake was observed in *ad-libitum* fed group whereas the highest body weight gain was observed in *ad-libitum* and 3 hour fed quails. The best FCR leading to maximum profit margin was observed in 3 hour-fed group. However, different close-bred stocks could not express any significant difference in growth parameters.

Key words: Feed restriction regimes, Growth performance, Economic efficiency, Japanese quails

INTRODUCTION

The shortage of animal protein intake among the ever increasing human population in developing and under developed countries is a matter of utmost apprehension today. Developing countries including Pakistan are greatly scarce in protein supply where per capita meat availability is 5.5kg and egg consumption is 55 eggs per annum, almost five times less than advanced countries, while, against per capita daily requirement of animal protein of about 27 gram only 17 gram is available (Pakistan Poultry Industry Statistics,2012-13).

One way of enhancing protein supply is to expand poultry production along with increasing production of other micro livestock such as Japanese quail (*Coturnix coturnix japonica*) having low maintenance cost, short generation intervals, early sexual maturity and better resistance to diseases. Quail attains 160-170g market weight at the age of four weeks (Akram *et al.,* 2012) and its meat is rich in high quality protein having high biological value with low caloric content (Olubamiwa *et al*., 1999).

Insufficiency and discrepancy of feed supply is a foremost bottle neck to proficient animal production in tropical farming system (Melaku and Peters, 2002). Nji *et al*. (1999) attributed the short fall in feed supply to paucity and high cost of conventional protein and energy feed stuffs and profit can be optimized by minimizing feed cost that accounts for 60-70 % of the total production cost (Wilson and Beyer,2000). Any effort to improve commercial poultry production and enhance its efficiency needs to emphasize on better utilization of existing resources (DZARC, 1997).

Different feeding schemes used in poultry industry are feeding time period, sequential feeding, choice feeding, restricted feeding and among all modifying growth pattern by quantitative feed restriction and stimulating compensatory growth is a successful approach in managing the scarcity of feed stuffs (Shariatmadari, 2012). The use of feed restriction program in broilers may elicit compensatory growth, improved feed efficiency and birds are not exposed to sub optimal level of nutrients but the efficiency of utilization of these nutrients may be changed. Researchers proposed that physical feed restriction at early age of birds for a short period may elicit compensatory growth, improved feed efficiency, reduced abdominal fat pad, and at market age restricted birds performed similar to full fed birds (Ibrahim*et al.,* 2002;Naji*et al*., 2003). Buragohain (2013) also observed equal body weight gain between *ad libitum* and 10% feed restricted groups of Japanese quails. In another report 75 % restriction of *ad-libitum* feeding exhibited an economic advantage over *ad libitum* feeding by enhancing feed utilization (Noveli, 2008, 2009).

Numerous studies have been conducted to investigate the effect of feed restriction on performance of broilers and turkeys, however, very few studies have

focused on the aspect of quantitative feed restriction in terms of time period and ideal age of restriction in quails. Keeping this in sight, research work needs to be undertaken in Japanese quails on the similar pattern as adopted in broiler industry to enhance their growth performance by manipulating feeding strategies that predictably will have a profound effect on profitability.

Considering these points in view, the present study was planned to assess the optimum time of restriction, compensatory growth period and effects of time restriction and different feed restriction regimes on nutrient digestibility and economics in terms of feed efficiency, profitability and growth performance in 4 close-bred stocks of Japanese quails (*Coturnix coturnix japonica*) maintained under local environmental conditions of Pakistan during hot season.

MATERIALS AND METHODS

The present study of 4 week duration was executed at Avian Research and Training (ART) Centre, University of Veterinary and Animal Sciences, Lahore-Pakistan. In this experiment, comparative performance of four close-bred stocks viz., Imported, Local-1, Local -2 and Local-3 allocated four different feed restriction regimes were studied. A total number of three thousand two hundred (3200) day old quail chicks, procured from ART Centre hatchery and, were fed *ad-libitum* for the first 10 days as adaptation period and then subjected to a 28 days experimental trial. The each treatment was replicated five times. The experimental quails in group 1 were fed *ad-libitum* throughout the experimental period and considered as control group. The group 2, 3 and 4 were provided with 1 hour feed-3-hour off, 2 hour feed-2-hour off and 3-hour feed-1hour off feeding regimes, respectively. The experimental birds were maintained under optimum husbandry practices of temperature, humidity and ventilation. All the experimental bids were provided the quail starter feed containing 20.30 percent crude protein with 1.3 percent lysine level as recommended by (NRC, 1994) throughout the experimental period. Data regarding feed intake, body weight and mortality was recorded for a period of 4 weeks. The body weight gain, feed conversion ratio, feed efficiency, and economics were calculated. The data thus obtained were analyzed according to Completely Randomized Design (CRD) under factorial arrangements using Analysis of Variance (ANOVA) technique (Steel *et al*., 1997). The means were compared by using Duncan's Multiple Range test (DMR) (Duncan, 1955) through SAS (Statistical Analysis System) 9.1 for windows.

Table 1. Ingredients and chemical composition of experimental quail diet.

Ingredients	Inclusion level (%)	Nutrients	Availability
Maize	54.56	Metabolize energy (k calories/kg)	2735
Sunflower Meal (25%)	16.44	Crude protein (%)	20.30
Soybean Meal (45.5%)	13.93	Fat (%)	3.38
Rapeseed Meal	3.00	Fibre (%)	6.72
Fish Meal (52%)	3.00	Calcium (%)	0.95
Poultry byproduct meal	3.00	Available Phosphorus(%)	0.40
Molasses	3.00	Chloride(%)	0.32
Limestone	1.11	Sodium(%)	0.19
Lysine sulphate	0.69	L.Acid(%)	1.29
MCP	0.46	Lysine(%)	1.30
Supplement	0.27	Methionine(%)	0.62
Salt	0.20	Methionine+Cystine(%)	0.97
Alimet	0.18	Arginine digestible(%)	1.30
BetaineHCl	0.07	Tryptophan digestible(%)	0.22
Threonine	0.05	Threonine digestible(%)	0.87
Phytase	0.005	D.Lysine(%)	1.14
D.Therionine	0.73	D.Methionine(%)	0.56
D.Tryptophan	0.20	D.Methionine +Cyst(%)	0.87
		D.Argnine(%)	1.18

RESULTS AND DISCUSSION

Feed intake (g): Significantly higher (P<0.05) feed intake was recorded in *ad-libitum* and 3-hour fed quails than those of 1-hour or 2-hour access to feed (Table 3). This could be attributed to sufficient time available for feeding that resulted in higher feed consumption as compared to restricted access. Similarly, significantly higher feed intake in full fed as compared to restricted fed birds was observed in broiler chickens (Ewa *et al.*, 2006; Mahmood *et al.*, 2007) and quail (Ocak and Erener, 2005). Feed restriction when applied on various close-bred stocks (CBS), significantly (P<0.05) higher feed intake was observed in *ad-libitum* feeding, while, the lowest was recorded in with 1 hour fed quails that may be due to the effect of treatments. However, non-significant effect of CBS on feed intake was observed.

Table 2. Feed intake (g), body weight gain (g), FCR, feed efficiency and mortality (%) in 4 close-bred stocks (CBS) of Japanese quails maintained under 4 feed restriction regimes for 4 weeks.

Parameters / Treatments		Feed Intake (g)	Body weight gain (g)	FCR	Feed Efficiency	Mortality %
Feed Restriction Regimes						
Ad-libitum		629.79 ±1.75^{a}	156.92±0.99^{a}	4.02±0.02^{a}	0.24±0.06^{d}	6.54± 0.08^{c}
1 hr-fed- 3hr off		543.57 ±1.08^{d}	142.42±0.37^{c}	3.81±0.01^{b}	0.26±0.07^{c}	7.95±0.06^{a}
2hr fed-2 hr-off		553.32±1.60^{c}	150.70±0.78^{b}	3.67±0.02^{c}	0.27±0.01^{b}	6.89±0.04^{b}
3hr fed-1hr-off		562.36±1.61^{b}	156.52± 0.62 ^{a}	3.59±0.02^{d}	0.28±0.01^{a}	6.52±0.03^{c}
Close-Bred Stocks						
Imported		572.88 ± 8.10	151.69±1.51	3.78±0.04	0.26±0.09	6.95±0.14
Local-1		573.54 ± 7.87	151.61±1.56	3.78±0.04	0.26±0.02	6.89±0.14
Local -2		570.91 ± 7.92	151.76±1.54	3.76±0.04	0.26±0.02	6.97± 0.15
Local-3		571.70 ± 7.77	151.50±1.51	3.77±0.04	0.26±0.02	7.09±0.13
Feed Restriction Regimes × Close-Bred Stocks						
	Imported	631.98 ±4.60^{a}	157.02±2.01^{a}	4.02±0.06^{a}	0.24±0.03^{e}	6.42±0.11^{e}
Ad-	Local-1	630.48 ±3.45 ^{a}	157.18±2.70 ^{a}	4.01±0.17^{a}	0.24±0.04 ^{e}	6.36±0.12^{e}
libitum	Local -2	628.24 ±3.44 ^{a}	156.85±2.47 ^{a}	4.01±0.14 ^{a}	0.24±0.04 ^{e}	6.57±0.19^{bcde}
	Local-3	628.45 ±3.28 ^{a}	156.64±1.19 ^{a}	4.00±0.09 ^{a}	0.24±0.01 ^{e}	6.81±0.13^{bcd}
	Imported	545.20 ±2.73^{efg}	142.78±0.36^{c}	4.57±0.09^{b}	0.26±0.01^{cd}	7.92±0.12 ^{a}
1 hr-fed-	Local-1	543.95±1.74^{gf}	142.14±1.10 ^{c}	4.49±0.08^{b}	0.26±0.01^{d}	7.84±0.13 ^{a}
3hr off	Local -2	541.36±2.68^{g}	142.53±0.96 ^{c}	4.53±0.05^{b}	0.26±0.01^{bcd}	7.99±0.11 ^{a}
	Local-3	543.77±1.69^{fg}	142.21±0.54 ^{c}	4.49±0.06^{b}	0.26±0.01^{d}	8.04± 0.10 ^{a}
	Imported	552.67±3.97^{cdef}	150.74±1.66^{b}	4.72±0.09^{cd}	0.27±0.02 ^{ab}	6.90±0.09 ^{b}
2hr fed-2	Local-1	555.41±3.52^{bcde}	150.66±0.76^{b}	4.70±0.06^{bcd}	0.27±0.02^{abc}	6.87±0.09^{bc}
hr-off	Local -2	551.47±3.58^{defg}	151.09±1.82^{b}	4.76±0.11^{d}	0.27±0.03 ^{a}	6.90±0.05 ^{b}
	Local-3	553.70±2.40^{cdef}	150.29±2.22^{b}	4.66±0.11^{bcd}	0.27±0.04^{abc}	6.92±0.06 ^{b}
	Imported	561.68±2.10^{bcd}	156.24± 2.02^{a}	4.89± 0.11^{d}	0.27±0.04 ^{a}	6.55± 0.07^{cde}
3hr fed-	Local-1	564.31±4.15^{b}	156.45± 1.04^{a}	4.89± 0.07 ^{d}	0.27±0.04 ^{a}	6.51± 0.07^{de}
1hr-off	Local -2	562.58±3.12^{bc}	156.56± 1.04^{a}	4.89± 0.06 ^{d}	0.27±0.02 ^{a}	6.40± 0.05^{e}
	Local-3	560.87±4.09^{bcd}	156.85± 1.04 ^{a}	4.91± 0.05 ^{d}	0.27±0.02 ^{a}	6.62± 0.07^{bcde}

Note: - Different alphabets on means show significant difference (P<0.05)

Body weight gain (g): Significantly (P<0.05) higher body weight gain was observed in *ad-libitum* and 3- hour fed quails followed by 2- hour and one- hour fed quails (Table 3). This could be due to optimum time for feeding which resulted in the highest body weight. Buragohain (2013) also observed equal body weight gain between *ad libitum* and 10% feed restricted groups of Japanese quails. Vadivukkarasi *et al.* (2007) also experienced better weight gain in groups of Japanese quails receiving maximum time of feeding. Feed restriction when applied on various CBS showed significantly (P<0.05) higher body weight in all four CBS fed *ad-libitum* and 3- hours fed, while, the lowest was observed in all four CBS of 1-hour fed quails that might be the effect of treatments. However, non-significant differences in body weight gain was observed among four close-bred stocks.

Feed conversion ratio: Feed conversion ratio was better in 3- hour fed quails followed by 2, 1 and *ad-libitum* fed quails (Table 3). Improved feed conversion ratio in 3-hour fed & one- hour off group of quails could be attributed to the availability of proper time (1-hour) for utilization of nutrients in the feed more efficiently by the

feed restricted birds leading to better FCR than in full-fed quails. Better FCR in feed restricted broiler chicken also have been reported by Lee and Leeson (2001) and Mehmood *et al.* (2012). Feed restriction can result in better feed conversion without reduction in carcass weight in Japanese quail (Ocak and Erener, 2005). Feed restriction when applied on various CBS showed significantly (P<0.05) best feed conversion ratio in all with 3- hour feeding in quails, while, the significantly (P<0.05) poor in *ad-libitum* fed quails that may be due to the effect of treatment.

Mortality: Significantly (P<0.05) higher mortality was observed in one hour fed followed by 2 and then 3- hour and *ad-libitum* fed quails (Table 3). This increase in mortality in one hour fed quails might be due to severity of feed restriction at 1st week of treatment during which small quails could not tolerate longer span of hunger but later on adult quails adjusted with the situation. Mortality rate was twice in feed restricted birds than those of *ad-libitum* fed birds (Gebhart-Henrich and Marks, 1995). Feed restriction when applied on various close-bred stocks showed significantly (P<0.05) highest mortality in 1-hour fed quails, the lowest mortality was observed in local-1 quails fed *ad-libitum.* However, non-significant effect of CBS on mortality was also observed in present study.

Economic Impact of feed restriction: The highest profit was recorded in 3-hour fed quails followed by 2-hour (22.82%), ad-libitum (18.53%) and 1 hour fed (18.14%) quails, respectively (Table 2). Among different treatment groups the highest feed cost of 23.83 Rs/quail was observed in ad-libitum fed followed by Rs 21.28, 20.94and 20.57 /quail in 3, 2 and one- hour fed quails, respectively. Maximum profit per quail in 3-hour feeding may be due to the best feed efficiency having optimum time for feed consumption and reasonable interval for digestion resulting in maximum gain turning into the highest profit as suggested by the earlier studies that 10% feed restriction is possible without any adverse effect on growth in Japanese quails (Buragohain, 2013). Ewa *et al*. (2006) also reported reduced feed cost/Kg weight gain, the highest profits and the least cost-benefit ratio from birds under feed restriction.

Table 2. Economics of quail raising under different feed restriction regimes.

Parameters	Feed Restriction Regimes			
	Ad-libitum	**1 hr-fed- 3hr off**	**2hr fed-2 hr-off**	**3hr fed-1hr-off**
Feed consumed (gm)	629.79	543.57	553.31	562.36
Cost of chick Rs.	8	8	8	8
Total feed cost (Rs)	23.83	20.57	20.94	21.28
Miscellaneous cost (Rs)	10	10	10	10
Total cost/quail (Rs)	41.83	38.57	38.94	39.28
Total live weight/quail (gm)	197.68	182.89	191.33	196.74
Sale price/ Kg live wt. (Rs)	250	250	250	250
Total sale price / quail (Rs)	49.42	45.72	47.83	49.18
Net Profit/ quail (Rs)	7.59	7.15	8.89	9.9
Profit (%)	18.14	18.53	22.82	25.20

Conclusions: It can be concluded that three hour fed and one- hour off quails exhibited maximum profit due to better body weight gain, optimum feed intake with better feed conversion ratio and reduced mortality. However, close bred stocks had similar growth and economic efficiency in Japanese quails. It is suggested that Japanese quails may be subjected to feed restriction of 1-hour after 2nd week followed by feed restriction of 2- hour after 3rd weeks of age.

REFERENCES

Akram, M., J. Hussain, A.W. Sahota, S. Ahmad, A.S. Jatoi, A. Ali, and M. Dawood (2012). Genetic gain in 4 week body weight through mass selection in 4 close-bred stocks of Japanese quail. Book of Abstract. 32nd Congress of Zoology, Lahore, Pakistan. 111p

Buragohain, R. (2013). Effects of feed restriction on compensatory growth period, nutrient digestibility and economics of Japanese quails (*Coturnix coturnix japonica*). Int. Multidisciplinary Res. J. 3(1):04-07.

Duncan, D.B. (1955). Multiple range and multiple F-tests. Biometrics. 11:1-42.

DZARC. (1997).DebreZeit Agricultural Research Center. Annual research report 1996/1997.DebreZeit, Ethiopia. 86p

Ewa, V. Udumma, Nwakpu, P. Emeka, and O. Michael (2006).Effect of feed restriction on growth performance and economy of production of broiler chicks.Animal Res. Int. 3(3): 513 – 515.

Gebhart-Henrich, S.G. and H.L. Marks (1995). Effects of feed restriction on growth and reproduction in random bred and selected lines of Japanese quail. Poultry Sci. 74: 402-406.

Ibrahim, I.K. and S.S. Al-Taleb(2002). The relationship between feed restriction at an early age and the occurrence of compensatory growth in light hybrid chickens. Mutah Lil Buhuth wad-Dirasat. 17(2):27-37.

Lee, K.H. and S. Leeson (2001). Performance of broilers fed limited quantities of feed or nutrients during seven to fourteen days of age. Poultry Sci. 80: 446-454.

Mahmood, S., S. Mehmood, F. Ahmad, A. Masood, and R. Kausar (2007). Effects of feed restriction during starter phase on subsequent growth performance, dressing percentage, relative organ weights and immune response of broilers. Pakistan Vet. J. 27(3): 137-141.

Mehmood, S., A.W. Sahota, M. Akram, A.S. Jatoi, and K. Javed (2012). Growth performance, breast yield and economics in sexed broiler chickens influenced by different phase feeding program. Abst. National Sci. Conf. on "Agriculture and food security issues in global environmental perspectives" The University of Poonch, Rawalakot, Azad Jammu and Kashmir. 281p

Melaku, S. and J. K. Peter (2002). Effects of supplementation of sole or mixtures of selected multipurpose trees (MPT) on feed intake, live weight and scrotum circumference changes in Menz sheep fed a basal diet of ef (Eragrosistef) straw. DeutsherTropentag. Book of Abstracts and Proceedings: 231 – 233 p

Naji, S.A., I.A. Al-Ani, J.K. Manati, and S.A. Mukhlis (2003). Effect of early feed restriction on growth, feed conversion and mortality in broiler chickens. Proc. 5th Con. Agric. Res., Feb. 22-24th, Mosul, University, Mosul, Iraq.

Nji, F.R., E.Niess, and E. Pfeffer (1999). Performance of Growing Broiler Chicks Fed Bambara Groundnuts (Vigna Subterranean). Deusher Trogentag, Book of Abstracts and Proceedings: 156 p

Novele, D.J., J.W. Ng'Ambi, D. Norris, and C.A. Mbajiorgu (2008). Effect of sex, level and period of feed restriction during the starter stage on productivity and carcass characteristics of Ross 308 broiler chickens in South Africa. Int. J.Poult. Sci. 7(6): 530-537.

Novele, D.J., J.W. Ng'Ambi, D. Norris, and C.A. Mbajiorgu (2009). Effect of different feed restriction regimes during the starter stage on productivity and carcass characteristics of male and female Ross 308 broiler chickens. Int. J. Poult. Sci. 8(1): 35-39.

NRC. 1994. National Research Council. Nutrient Requirement Table of poultry. 9th Ed. Washington, D.C. National Academy Press.

Ocak, N.and G. Erener (2005). The Effects of Restricted Feeding and Feed Form on Growth,Carcass Characteristics and Days to First Egg of Japanese Quail (*Coturnix coturnix japonica*).Asian-Aust. J. Anim. Sci. 18(10): 1479-1484.

Olubamiwa, O., E.S. Haruna, U. Musa, T.O. Akinade, L.H. Lombin, and O.G. Longe (1999). Effect of different energy levels of cocoa husk based diets on production performance of Japanese quails.Nig. J. Anim. Prod. 26: 88-92.

Pakistan Poultry Industry Statistics, 2012-13. http:// zaraimedia.com /2013/07/28/ Statisticals-of-Pakistan-Poultry-Industry-2012-13/ (Accessed on 27-03-2014).

SAS Institute. 2002-2004. SAS® Users Guide: Statistics. Version 9.01.SAS Institute Inc., Cary, N.C.

Shariatmadari, F. (2012). Plans of feeding broiler chickens. World's Poult. Sci. J. 68: 21-30.

Steel, R.G.D., J.H. Torrie, and D.A. Dickie (1997). Principles and procedures of Statistics-A biometric approach. 3rd Edit. McGraw-Hill Book publishing company, Toronto, Canada.

Vadivukkarasi, N., S. C. Edwin, and K. Viswanathan (2007). Effect of feed restriction in Japanese quail. 42(2): 205-207.

Wilson, K. J. and R.S. Beyer (2000). Poultry nutrition information for the small flock. Kansas State University Agricultural Experiment Station and Cooperative Extension Service. http://www.oznet.ksu.edu.