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SELECTION FOR HIGHER THREE WEEK BODY WEIGHT IN JAPANESE QUAIL: 1. EFFECT ON GROWTH PERFORMANCE

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ABSTRACT

The present experiment was planned to study the effect of selection for higher three week body weight on overall growth performance in Japanese quail for three generations. Initially a total of 11000 quail chicks were procured from the hatchery of ART Centre and randomly divided into 22 groups with equal number of chicks in each. At the age of 21 days birds were weighed individually and the birds (male and female) with the highest body weight were selected to be the parents of next generation. Out of these 22 groups, 20 groups were subjected to mass selection. In one group (group #21) selection was performed with full pedigree records. In group 22nd, birds were picked up randomly to be the parents of next generation without performing selection. The same procedure was repeated for all the three generations. The data on each flock in each generation were recorded regarding different parameters directly or indirectly linked with growth performance. The data were subjected to Analysis of Variance (ANOVA) in Completely Randomized Design (CRD) under factorial arrangements using GLM (General Linear Model) procedures with the help of SAS, 9.1. and the comparison of means using Duncan's Multiple Range (DMR) test depicted significant improvement in feed intake (g), body weight (g), body weight gain (g), FCR, Caloric and Protein intake / g body weight gain and decreased mortality in groups subjected to selection either mass or pedigree based while leg abnormality revealed non-significant differences in all the three groups.

Key words: - Japanese quail, selection, body weight, caloric and protein intake and mortality

INTRODUCTION

In a given set of environment, selective breeding is one of the most important techniques to improve the genetic potential of animals. Selective breeding is found to be a major tool behind the significant improvement in growth rate and carcass yield of indigenous breeds (Bhatti and Sahota, 1994; Bhatti *et al*., 1992). The improvement in production performance of Desi native breeds of chicken has been reported by Anjum *et al*., (2012) through selective breeding. In any genetic improvement program, body weight is one of the most important traits for a number of reasons including its relation with other meat production traits and its' relative ease of measurement (Caron *et al*., 1990). It is further stated that the most significant trait for evaluating different livestock species especially in meat production environment is growth. It can be enhanced by improving environmental aspects such as feed, housing, management etc. and by choosing the suitable mating system, sex ratio and parental age and by improving its genotypic value by selection and/or by cross breeding (Parks, 1971). Japanese quail (*Coturnix Coturnix Japonica*) is a type of popular commercial line which is known as "betair" in Pakistan. Quail farming has certain specific advantages. Quails can be used for meat production within a short period (4-5weeks) and matures at an early age of 6 weeks so that female birds are usually in full production by about 8 weeks (Jatoi *et al*, 2013). Japanese quail respond very quickly to the selection for higher body weight. Anthony *et al*., (1996) observed that selected lines of Japanese quail produced heavier carcasses and more meat. Khaldari *et al*., (2010) recorded a genetic improvement of 4-wk body weight as 9.6, 8.8, and 8.2 g in generation 2, 3, and 4 respectively, in Japanese quails. In a very recent study Akram *et al*., (2012) observed significant differences between two generations (G0 and G1) of Japanese quail being selected for higher four week body weight through mass selection procedures.

With the introduction of breeding stocks of Japanese quail in early 1970s, its farming flourished in urban and semi urban areas of Pakistan. A number of quail hatcheries were set in Karachi and Lahore, producing substantial number of day-old quail chicks for supply to the farmers. Quail farming, despite having enormous potential, is still one of the neglected components of the poultry sector in the country, reason being, very little research work is done on its breeding,

incubation, housing, nutritional requirements, feeding, management and disease control aspects. Continuous inbreeding, uncontrolled mating and poor knowledge of selective breeding are considered to be the main factors behind the deterioration in the production performance of quails being reared in Pakistan (Jatoi *et al*, 2013). The present experiment is also an effort in the same direction with the main objective to increase three week body weight of Japanese quail being raised in Pakistan.

MATERIALS AND METHODS

The present experiment was planned to study the effect of selection for higher three week body weight on overall growth performance in three generations of Japanese quail at Avian Research and Training (ART) Centre, University of Veterinary and Animal Sciences Lahore. In generation 0, a total of 11000 quail chicks were procured from the hatchery of ART Centre. The chicks were randomly divided into 22 groups with equal number of birds in each. At the age of 21 days birds were sexed and weighed individually and male and female with the highest body weight were selected to be the parents of next generation. Out of these 22 groups, 20 groups were subjected to mass selection. In one group (group #21) selection was performed with full pedigree records in order to compare bird's performance being selected through mass and pedigree selection procedures. In group 22, birds were weighed individually to keep all the records but picked randomly without performing any selection in order to minimize the effect of environment on overall progress/change in different traits over the generations. The same procedure was repeated for all the three generations.

Management and housing: All the experimental birds were maintained in cages especially designed for separate rearing and breeding of quail. The chicks were housed in multi deck cages placed in one of the well ventilated octagonal shape quail house (measuring 33×12×9 ft), under standard managemental conditions. Fresh and clean drinking water was provided all the times through automatic nipple drinkers. The birds were fed quail ration *ad-libitum* formulated according to NRC standards (1994), for quail broiler (CP 24% and ME 2900 K Cal/Kg).

Experimental Data: The data were collected regarding feed intake, body weight, weight gain, feed conversion ratio, calories and protein intake/gram body weight gain, overall mortality and the incidence of leg abnormalities in order to study the response to selection for three week body weight.

Statistical analysis: The data thus collected were subjected to analysis of variance (ANOVA) (Steel *et al*., 1997) with Completely Randomized Design (CRD) under factorial arrangements using GLM (General Linear Model) procedures with the help of Statistical Analysis System(SAS, 2002-3). The comparison of means were worked out using Duncan's Multiple Range (DMR) test (Duncan, 1955).

RESULTS AND DISCUSSION

Feed Intake: In the present experiment significant differences were observed in feed intake among different generations and selection groups. Birds in generation 2 had the highest feed intake (247.80g) and the lowest in generation 0 (227.56g) which might be due to increased body weight in progressive generations. Significantly higher feed intake was observed in pedigreed (243.05g) and mass selected (238.69g) groups than those of random bred (table 1). In overall comparison between different generations and selection methods pedigree based selected birds in generation three had the highest feed intake whereas the lowest in random bred birds in the same generation. This may be due to higher body weight, hence increased nutrient requirements. These results are quite in line with the findings of Khaldari *et al*. (2010) who reported higher feed intake in the lines selected for higher body weight as compared to non-selected birds, however feed intake / g body weight gain was lower than those of control line. Khaldari *et al*. (2010) further indicated that selected line had better feed efficiency than that of control line.

Body weight: In the present experiment significant differences were observed in weekly body weight among different generations and selection methods. Generation 2 showed maximum weekly body weights at the age of day one, and 21 respectively. This might be due to selection for higher body weight which showed positive response to selection. Similarly improved body weight in Japanese quail was also observed in birds selected for higher body weight in many other studies as well (Baylan *et al*., 2009; Syed Hussein *et al*., 1995; Tozluca, 1993; Nestor*et al*., 1982). Pedigreed selected birds showed maximum growth (114.16 g) for three week body weight (table, 1) and minimum in random-bred control group which indicated that pedigreed based selected birds had superior genetic potential as compared to mass selected or random bred birds. That was mainly the result of intensive selection which improves productive performance of birds. At different ages significant differences among strains and generations on body weight were also reported by Mohammed *et al*., (2006) and Varkoohi *et al*. (2010). Higher body weight in selected birds were also reported in other studies as well {(Khaldari *et al*., 2010, Siegel (1987), Anthony *et al*., (1986), Collins and Abplanalp, (1968) and Marks (1975)}.

Weight gain: Significantly higher body weight gain (108.90g) in generation 02 may be attributed to birds

selected for higher body weight having positive response to selection which lead to improved weight gain in progressive generations. Maximum weight gain in Pedigree based selected group in generation two and the minimum in random bred controls in same generation might be attributed to better feed utilization in pedigree based selected birds which resulted in improved body weight gain. Similarly in another study (Anthony *et al*., 1986) higher body weight gain was observed in selected birds as compared to random breds.

Feed conversion ratio: Significant differences were observed in feed conversion ratio among different generations and selection methods. Improved FCR (2.30) in generation 2 as compared to generation 0 (2.35) might be attributed to birds having higher body weight in adjustment to increased feed intake in progressive generations which resulted in improved FCR. Similarly in another study (Khaldari *et al*., 2010) better FCR in three selective generations of Japanese quail was also observed. Best FCR to a certain body weight could be partially due to lower maintenance costs and lower fat deposition of birds with higher growth rate (Pym, 1990). Selection for better FCR in broiler chickens resulted in direct selection for carcass leanness (Buyse *et al*., 1999).The best FCR (2.31) in pedigree based selected birds as compared to mass selected and random bred controls (table 1) could be due to intensive selection method which exploited the maximum potential of birds. Similarly Marks, (1980) reported feed conversions for two lines (P and T) selected for high 4-week body weight superior to that of a non-selected control line in 42 successive generations of selection. The results of the present study are also in agreement with those of Varkoohi *et al*., (1993).

Calories and Protein intake / g weight gain: In the present study significant differences were observed in calories and protein intake / g body weight gain among different generations and selection groups. The birds in generation 0 had highest calories (7.15) and protein (0.59) intake / g body weight gain. This might be attributed to higher feed intake in progressive generations which resulted proper utilization of nutrients. Similarly in another study (Varkoohi *et al*., 1993) higher nutrient intake was observed in birds selected for high body weight as compared to control line.

Mortality: Significant differences were observed in mortality % among different generations and groups. Birds in generation 02 had significantly lower (9.91) mortality %.This might be attributed to birds selected for higher body weight having improved livability in progressive generations. Pedigreed selected birds had the lowest (11.34) mortality % while highest (12.55) (table 2) in random bred control. It might be due to intensive selection correspondingly improved livability. This might also be attributed to superior genetic potential of birds selected for higher body weight. The results of the present study are in line with the findings of Bokhari and Singiorgi, (1977), Consitantini and Panella, (1982), Shoukat *et al*.,(1987-88) and Vieira and Moran, (1998) who reported that quails with higher body weight hatched from heavier eggs showed less mortality than small chicks hatched from smaller eggs.

Table 1. Comparison of overall growth performance in Japanese quail in three generations

	WEEK 0 (DAY 1) (g± S.E)	WEEK 03 (g± S.E)	Total F.I (g±S.E.)	Overall Gain (g±S.E)	FCR
Comparison between different Generations					
G0	6.68±0.06^{c}	104.76±1.30^{b}	227.56±2.00^{c}	98.07±1.28^{b}	2.35±0.0237^{ab}
G1	7.36±0.11^{b}	107.68±1.32^{b}	235.68±2.23^{b}	100.32±1.29^{b}	2.38±0.0223^{a}
G2	7.80±0.07^{a}	116.70±1.14^{a}	247.80±1.63^{a}	108.90±1.11^{a}	2.30±0.0203^{b}
Comparison between different Selection Methods					
Mass	7.40±0.09^{b}	111.52±1.31^{a}	238.69±2.08^{a}	104.12±1.28^{a}	2.32±0.0222^{b}
Pedigree	7.72±0.10^{a}	114.16±1.37^{a}	243.05±2.12^{a}	106.44±1.32^{a}	2.31±0.0217^{b}
Random-bred	6.72±0.06^{c}	103.45±1.11^{b}	229.30±1.86^{b}	96.721.11^{b}	2.40±0.0223^{a}
Overall interaction between different generations and selection groups					
G0xMass	6.77±0.13^{d}	104.61±2.27^{c}	226.43±3.39^{c}	97.83±2.24^{c}	2.35±0.0406^{abc}
G0xPedigree	6.59±0.11^{d}	103.43±2.36^{c}	229.90±3.63^{c}	96.84±2.33^{c}	2.41±0.0428^{ab}
G0xRandom-bred	6.67±0.11^{d}	106.23±2.14^{c}	226.35±3.44^{c}	99.55±2.12^{c}	2.30±0.0389^{bc}
G1xMass	7.38±0.19^{c}	108.10±2.18^{bc}	233.01±3.79^{c}	100.71±±2.14^{bc}	2.34±0.0370^{abc}
G1xPedigree	8.12±0.20^{ab}	112.64±2.33^{b}	242.22±4.07^{b}	104.51±2.29^{b}	2.34±0.0350^{abc}
G1xRandom-bred	6.59±0.11^{d}	102.32±2.18^{c}	231.81±3.65^{c}	95.72±2.15^{c}	2.45±0.0424^{a}
G2xMass	8.04±0.06^{b}	121.87±1.67^{a}	256.65±2.23^{a}	113.82±1.67^{a}	2.28±0.0379^{cd}
G2xPedigree	8.45±0.11^{a}	126.42±1.22^{a}	257.01±2.22^{a}	117.97±1.21^{a}	2.19±0.0281^{d}
G2xRandom-bred	6.89±0.09^{d}	101.80±1.36^{c}	229.75±2.48^{c}	94.90±1.36^{c}	2.43±0.0314^{a}

Table 2. Comparing different growth traits in different generations of Japanese quail

	Crude Protein intake/g gain in body weight (g± S.E)	Metabolizable Energy intake/g gain in body weight (K.Cal±S.E)	Mortality (%± S.E)	Leg Abnormality (%± S.E)
Comparison between different Generations				
G0	0.59±0.00709[a]	7.15±0.0857[a]	13.10±0.33[a]	0.10±0.0224
G1	0.57±0.00536[b]	6.90±0.0648[b]	12.48±0.31[a]	0.13±0.0277
G2	0.55±0.00487[c]	6.68±0.0589[c]	9.91±0.22[b]	0.17±0.0368
Comparison between different Selection Methods				
Mass	0.56±0.00586[b]	6.83±0.0708[b]	11.59±0.28[b]	0.16±0.0353
Pedigree	0.56±0.00598[b]	6.82±0.0723[b]	11.34±0.33[b]	0.08±0.0212
Random-bred	0.58±0.00593[a]	7.09±0.0717[a]	12.55±0.31[a]	0.15±0.0303
Overall interaction between different generations and selection groups				
G0 x Mass	0.58±0.01170[ab]	7.10±0.1413[ab]	12.97±0.52[ab]	0.11±0.0417
G0 x Pedigree	0.60±0.01252[a]	7.30±0.1513[a]	13.11±0.57[a]	0.08±0.0359
G0 x Random-bred	0.58±0.01266[ab]	7.06±0.1529[ab]	13.22±0.65[a]	0.10±0.0390
G1 x Mass	0.56±0.00890[bc]	6.79±0.1075[bc]	12.36±0.48[ab]	0.11±0.0417
G1 x Pedigree	0.56±0.0084[bc]	6.80±0.1016[bc]	12.10±0.62[ab]	0.08±0.0359
G1 x Random-bred	0.59±0.01017[ab]	7.13±0.1229[ab]	12.97±0.52[ab]	0.20±0.0619
G2 x Mass	0.54±0.00911[cd]	6.61±0.1101[cd]	9.45±0.32[c]	0.25±0.0877
G2 x Pedigree	0.52±0.00676[d]	6.35±0.0817[d]	8.83±0.37[c]	0.10±0.0390
G2 x Random-bred	0.58±0.00754[ab]	7.07±0.0911[ab]	11.46±0.40[b]	0.16±0.0540

Leg abnormality: Non-significant differences were observed in leg abnormality among different generations and selection groups (table 2). The results are in contrast to the earlier findings that genetic selection for rapid growth in broiler quail may cause skeletal abnormalities and gait disorders (Sanotra *et al*., 2001; Williams *et al*., 2000).

Conclusions: Based upon the findings of this study it can be concluded that Japanese quails respond very quickly to the selection for higher body weights, when being selected at the age of three weeks. This selection for higher three week body weight has shown significant differences among different techniques of selection; hence, proved pedigree based selection to be more efficient than mass selection.

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