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POST HATCH PERFORMANCE OF MEAT TYPE JAPANESE QUAIL INFLUENCED BY TIME OF OFFERING FEED AND AMBIENT ENVIRONMENT

J. Hussain, S. Mehmood, I. Ullah, A. Mahmud, A. Ghayas, M. Usman, A. Rehman and S. Ahmad

Department of Poultry Production, University of Veterinary and Animal Sciences-Lahore-Pakistan
Corresponding Author E-mail: jibran.hussain@uvas.edu.pk

ABSTRACT

Present study evaluated the effect of time of offering feed and ambient environment on growth, morphometric and carcass traits in Japanese quail chicks.Nine hundred chicks hatched from prior incubated eggs were distributed in 5 feeding and environmental regimes (FR) having 9 replicates of 20 birds each under completely randomized design. In FR0, conventional hatching was practiced; chicks hatched from prior incubated eggs remained in hatcher till the end of incubation (17 days) without any provision of feed and water. In FR1, provision of feed and water was ensured to newly hatched chicks just after hatching and were shifted to rearing house after 17 days of incubation, while in FR3, FR5&FR7, newly hatched chicks were brooded within the same hatcher for an extra 3, 5 and 7 days along with provision of feed and water. Different FR strategies significantly influenced overall body weight, body weight gain, and times of gain.FR strategies also affected body, drumstick, keel, and shank length, wing spread, drumstick and shank circumference as well as thigh, liver and heart weight. On overall basis, FR3 and FR5 proved to be the best in terms of overall growth performance and morphometric traits respectively.

Key words: Japanese quail, feeding and environmental regimes, Growth, Morphometric, Carcass traits.

INTRODUCTION

Poultry production is playing a significant role in nourishing the global masses with food in terms of meat and eggs. During the last decade, beside other poultry enterprises, quail farming has assumed special character as an alternative source of high quality animal proteins (Faitarone *et al*., 2005) in terms of its highly nutritious eggs (Panda and Singh, 1990) and meat (Genchev *et al*., 2008). Post-hatch growth of poultry chicks vividly depends upon genetic potential and given environment obviously from first day of life. Similar to other poultry, quail chicks also need a well maintainedand appropriate environment at early ages which is considered very crucial to show its full growth potential. In a general workflow of hatchery, chicks are removed from hatcher only when most of chicks have hatched within the period of hatch-window which is almost 36 to 48 hours (Careghi *et al*., 2005). Many factors affect delay in hatching, the most important being the parent flock age, handling of eggs, time of egg preservation and internal incubation conditions (Decuypere *et al*., 2001). Little space in the hatcher for newly hatched chicks, opening of hatcher over many time and late collection of chicks can lead to dehydrated and low quality chicks (Bamelis *et al*., 2005). Chicks selected for high growth rates depend on exogenous, extra-yolk-sac feeding very soon after hatching because nutrient supply via yolk sac is not sufficient to sustain the extreme growth of chick after hatching and absence of feed in the gut in very early post-hatching period impairs development, hence, late collection and placement at farm from the hatchers probably after twelve hours may result in the loss of body weight (BW) of 2.6% and 2.3% for males and females respectively (Gonzales *et al*., 2003). According to an estimate, 70% of chicks had to wait about 20 to 35 hours in hatcher before pulling (Tong *et al.,* 2015). Recent experiments were likely to show negative results of late hatching chicks in terms of early growth that is considered the most important phase of broiler's life (Bergoug *et al.,* 2015; Tong *et al.,* 2015). To reduce above stated risks, a concept named "Patio system" was proposed to improve the growth performance of chicks. In this system, pre-incubated eggs (hatching phase) and after hatching chicks (brooding phase) are placed combined in hatchery (Van de Ven *et al*., 2009). It was reported that, this system improves BW and quality of chicks and also reduces chick mortality in meat type birds (Van de Ven *et al*., 2009). After getting such idea, it was planned to incorporate interventions in Japanese quail hatching and brooding phase through combining them in the hatcher for variable lengths.

MATERIALS AND METHODS

Present study evaluated the effect of time of offering feed and ambient environment on growth, morphometric and carcass traits in Japanese quail chicks. Nine hundred chicks hatched from prior incubated eggs were distributed in 5 feeding and environmental regimes (FR) having 9 replicates of 20 birds each under Completely Randomized Design (CRD). In FR0, conventional hatching was practiced; chicks hatched from prior incubated eggs remained in hatcher till the end of incubation (17 days) without any provision of feed and water. In FR1, provision of feed and water was ensured to the chicks just after hatching and were shifted to rearing house after 17 days of incubation, while in FR3, FR5 & FR7, newly hatched chicks were brooded within the same hatcher for an extra 3, 5 and 7 days along with provision of feed and water.

Earlier the eggs were set in the setter machine (at 37.6^0C temperature and 65% relative humidity, broader end up and automatic turning at 45^0 angle after every hour) for 14 days and then shifted to hatcher (36.6^0C temperature and 75% relative humidity, placed in natural position) where these were divided and placed equally (270 eggs/tray) in 5 separate egg trays (0, 1, 3, 5 and 7). Tray 0 was considered as control group where no water and feed was offered during last three days in hatcher, in tray 1 water and feed was offered during last three days in hatcher, in tray 3, 5, and 7 feed and water was provided for an additional 3, 5 and 7 days, while keeping the chicks in same hatcher. Till 17 days, the temperature remained 36.6^0C and relative humidity 75%. From 18^{th} day onwards, temperature was reduced by 0.30^0C per day, while, relative humidity remained 70%. Chicks hatched in each tray were further split into 9 replicates with 20 birds in each.After the completion of brooding in different feeding and environmental regimes, birds were managed in well ventilated octagonal (33×12×9 cubic ft.) house, equipped with French made multi deck cages designed especially for quails. All the birds were fed broiler quail ration (starter crumbs) according to NRC (1994) standards having 24% CP and 3200 Kcal/Kg ME. Fresh and clean drinking water (24 hours) was provided through nipple drinking system.

Data regarding growth performance were collected in terms offeed intake, Body weight (g), Body weight gain (g), Times of gain, Feed conversion ratio and Mortality% from each experimental group. Morphometric measurements were recorded in terms of Body Length (cm), Wing spread (cm), Shank length (cm), Shank circumference (cm), Drumstick length (cm), Drumstick circumference (cm), Keel length (cm) and Breast width (cm). At the age of 28 days, four birds (2 males & 2 females) from each experimental group were slaughtered to study the carcass traits including Live weight (g), Dressed weight (g), Carcass yield (%), Giblet weight (g), Breast Meat Yield (%) and Thigh Yield (%).

Statistical Analysis: Data were analysed through one-way ANOVA technique (Steel *et al*., 1997) using SAS software (Version 9.1, SAS Institute Inc., Cary, NC). Differences among treatment means were separated by the Tukey's HSD test assuming following mathematical model:

$$Y_{ij} = \mu + \tau_i + \varepsilon_{ij}$$

Where,

Y_{ij}= Observation of dependent variable recorded on i^{th} treatment

μ = Population Mean

τ_i = Effect of i^{th} treatment (i =1, 2, 3, 4, 5)

ε_{ij} = Residual error due to j^{th} observation of i^{th} treatment NID ~ 0, σ^2

RESULTS

Growth performance and carcass traits: Overall growth performance of Japanese quail subjected to different feeding and environmental regimes (FR) is shown in table 1. Statistical analysis revealed non-significant differences (P>0.05) for cumulative feed intake among different FR strategies. However, body weight, overall weight gain and times of gain were significantly higher (P≤0.05) in the birds kept under FR3. As far as FCR and mortality% are concerned, non-significant differences (P>0.05) were observed in various FR strategies.

For carcass traits, relative thigh weight % significantly (P≤0.05) differed among the groups of Japanese quail reared under different FR strategies while non-significant differences (P>0.05) were observed regarding dressing and breast meat yield% in sexed Japanese quails (Table 2). Statistical analysis of internal organs (%) including liver, heart and gizzard showed significant differences (P≤0.05) among different experimental groups (Table 3).

Morphometric Measurements: As expected, body measurements including body length, drumstick length, its circumference, keel length, shank length and shank circumference as well as wing spread were observed significantly different (P≤0.05) among the experimental groups of Japanese quail reared under different FR strategies. FR5 showed highest values of all these parameters. Breast width also showed significantly higher (P≤0.05) value in birds kept under FR0.

Table 1. Growth performance of Japanese quail (4weeks) subjected to different feeding and environmental regimes (n=900).

Treatment	Feed Intake (g)	Body weight (g)	Weight Gain (g)	Times of Gain	FCR	Mortality (%)
FR0	388.85±8.52	159.33±0.70^{b}	149.99±0.67^{b}	17.04±0.07^{b}	2.60±0.12	13.58±0.53
FR1	405.23±9.00	163.11±1.29^{b}	153.71±1.29^{b}	17.35±0.13^{b}	2.63±0.07	13.12±0.33
FR3	421.24±6.23	172.88±3.02^{a}	163.43±3.02^{a}	18.30±0.31^{a}	2.59±0.08	13.08±0.30
FR5	411.60±6.60	168.78±3.17^{a}	159.48±3.17^{a}	18.14±0.34^{a}	2.59±0.07	12.78±0.40
FR7	400.88±10.98	168.22±2.36^{a}	158.22±2.37^{a}	17.90±0.25^{a}	2.52±0.08	12.44±0.38

$^{a-b}$ Different alphabets on means within column show significant difference ($P \leq 0.05$); FCR: Feed Conversion Ratio

Table 2. Carcass traits of Japanese quail subjected to different feeding and environmental regimes (n=100).

Treatment	Carcass yield (%)			Breast yield (%)			Thigh yield (%)		
	Male	Female	Mean	Male	Female	Mean	Male	Female	Mean
FR0	55.08±1.23	54.68±0.99	54.88±1.11	35.57±0.92	35.20±0.78	35.39±0.85	19.78±0.45^{a}	19.67±0.50	19.73±0.48
FR1	55.17±1.02	56.15±1.02	55.66±1.02	34.65±0.63	35.97±0.62	35.31±0.82	20.55±0.79^{a}	20.40±0.39	20.48±0.59
FR3	53.60±0.59	56.70±1.20	55.15±0.90	35.79±0.90	36.45±1.43	36.12±1.17	19.27±0.57^{ab}	20.39±0.87	19.83±0.72
FR5	54.00±1.38	56.37±1.11	55.19±1.25	34.33±0.72	36.14±0.75	35.24±0.74	19.14±0.40^{ab}	19.03±0.77	19.09±0.59
FR7	52.24±1.18	56.20±2.18	54.22±1.68	33.45±0.74	35.71±1.08	34.58±0.91	18.13±0.54^{b}	18.60±0.91	18.37±0.73

$^{a-b}$ Different alphabets on means within column show significant difference ($P \leq 0.05$)

Table 3. Relative giblet weight of Japanese quail subjected to different feeding and environmental regimes (n=100).

Treatment	Heart (%)			Gizzard (%)			Liver (%)		
	Male	Female	Mean	Male	Female	Mean	Male	Female	Mean
FR0	0.95±0.08^{a}	0.90±0.06^{ab}	0.93±0.07^{a}	4.15±0.18^{a}	3.87±0.16	4.01±0.17^{a}	3.10±0.20^{ab}	2.60±0.08^{b}	2.85±0.14^{ab}
FR1	1.00±0.07^{a}	0.93±0.06^{a}	0.97±0.07^{a}	3.85±0.17^{ab}	4.03±0.13	3.94±0.15^{ab}	2.88±0.15^{b}	2.62±0.13^{b}	2.75±0.14^{b}
FR3	0.77±0.03^{b}	0.80±0.03^{ab}	0.79±0.03^{b}	3.92±0.19^{ab}	3.63±0.14	3.78±0.17^{ab}	2.70±0.08^{bc}	2.55±0.11^{b}	2.63±0.10^{bc}
FR5	0.80±0.05^{b}	0.75±0.06^{b}	0.78±0.06^{b}	3.40±0.21^{b}	3.90±0.25	3.65±0.23^{b}	3.42±0.20^{a}	3.17±0.16^{a}	3.30±0.18^{a}
FR7	0.77±0.03^{b}	0.82±0.05^{ab}	0.80±0.04^{b}	3.52±0.20^{b}	3.85±0.37	3.69±0.29^{b}	2.40±0.13^{c}	2.98±0.15^{ab}	2.69±0.14^{c}

$^{a-c}$ Different alphabets on means within column show significant difference ($P \leq 0.05$)

Table 4. Morphometric traits (cm) of Japanese quail subjected to different feeding and environmental regimes (n=100).

Treatment	BL	DL	DC	SL	SC	KL	BW	WS
FR0	28.70±0.30^{b}	6.04±0.01^{a}	4.79±0.04^{c}	3.95±0.02^{ab}	1.40±0.01^{b}	4.00±0.02^{ab}	3.37±0.02^{a}	20.00±0.21^{b}
FR1	29.04±0.25^{b}	5.97±0.01^{bc}	4.88±0.03^{b}	3.92±0.02^{b}	1.40±0.01^{b}	3.93±0.02^{b}	3.28±0.03^{b}	20.04±0.47^{ab}
FR3	28.90±0.30^{b}	6.01±0.02^{ab}	4.90±0.03^{b}	3.97±0.02^{ab}	1.38±0.01^{b}	3.95±0.02^{ab}	3.28±0.03^{b}	20.10±0.45^{ab}
FR5	29.83±0.19^{a}	6.05±0.01^{a}	5.05±0.03^{a}	4.02±0.02^{a}	1.45±0.01^{a}	4.02±0.02^{a}	3.33±0.02^{ab}	21.03±0.20^{a}
FR7	28.81±0.29^{b}	5.93±0.03^{c}	4.90±0.04^{b}	3.92±0.02^{b}	1.39±0.01^{b}	3.97±0.02^{ab}	3.28±0.02^{b}	20.70±0.23^{ab}

$^{a-c}$ Different alphabets on means within column show significant difference ($P \leq 0.05$); BL: Body Length, DL: Drumstick Length, DC: Drumstick Circumference, SL: Shank Length, SC: Shank Circumference, KL: Keel Length, BW: Breast Width, WS: Wing Spread

DISCUSSION

Growth performance: In the present study, non-significant differences for cumulative feed intake among different FR strategies showed the least effect of these treatments on the bird's intake possibly due to dietary habits of Japanese quail. However, significantly higher body weight observed in birds kept under FR3 might be attributed to better environmental conditions especially the control over temperature and relative humidity in the hatcher and reduced shifting and transportation stress. Earlier studies on broilerare in accordance to our results.Van de Van *et al*. (2009) also observed significantly higher body weight in broilers kept under patio system. The same trend persisted in overall body weight gain and times of gain. Lower weight gain in the birds of control (FR0) group is in accordance with the results of Gonzales *et al.* (2003) and Careghi *et al*. (2005) who reported adverse effect of fasting due to delayed access to feed while shifting from hatcher to farm. It may also be possible that early hatchers got fasted more than late hatchers in control group before shifting to the farm. This might had led to weight loss due to positive correlation between chick weight loss and holding time (Careghi*et al*., 2005). Delayed feed and water access might had induced more dehydration and lower tri-iodothyronine levels in early hatchers of control FR treatment (Careghi *et al*., 2005) ultimately impaired cell hyperplasia particularly during the first week after hatching which is critical growth stage (Gonzales *et al.,* 2003). As far as FCR is concerned, non-significant differences (P>0.05) were observed in various FR strategies which might be attributed to same trend of feed intake and body weight among treatment groups ultimately minimizing variation in FCR. Non-significant mortality% (P>0.05) among different FR strategies in the current trial could be attributed to the same genetic background and selection for adaptability to the local climatic conditions in Japanese quail. Gonzales *et al*. (2003) also found non-significant mortality% in broiler chicks kept off-fed for 36 hrs before placement at farm. However, findings of Van de Van *et al*. (2009) are in contradiction to the findings of present study revealing positive effect of early feed and water provision on mortality %.

Carcass traits: Non-significant differences (P>0.05) were observed among different FR strategies regarding carcass and breast yield relative to live body weight in both sexes of Japanese quails. Powell *et al.* (2016) also observed non-significant difference among broilers given immediate and late access to the feed after hatch. However, in current study, thigh meat yield (% of live body weight), liver, heart and gizzard (% of live weight) were significantly influenced by different treatments. Thigh meat% and heart% were found to be significantly higher in male Japanese quails treated by FR1 than others showing an aesthetic effect of post-hatch early feeding.This might be due to increased expression of myogenic regulatory factors (*MYOD1*) in birds with post-hatch immediate access to feed which possibly had enhanced the satellite cells differentiation and led to muscle hypertrophy via myonuclear accretion and protein synthesis as observed by Powell *et al.* (2016) in a recent experiment. Velleman *et al.* (2010, 2014) also agreed on the fact that expression of these myogenic regulatory factorsis affected by feed deprivation or partial feed restriction in chicks. However, liver% was found significantly higher in birds kept under FR5 as compared to others and gizzard% was significantly higher in male Japanese quail under FR0. It was not possible to establish any clear cut trend regarding different slaughter characteristics in response to different patio treatments; hence, further studies are suggested.

Morphometric traits: Regarding different Morphometric measurements FR5 proved to be the best with significantly higher body length, drumstick length, keel length, shank length, drumstick circumference, shank circumference and wing spread. The higher drumstick length, keel length, shank length, drumstick circumference, shank circumference and wing spread may be a product of amplified body length. In todays' broiler breeding programs, selection on the basis of initial body length is an important criteria and this tool may be useful in improving other body parts too. However, significantly higher breast width was observed in birds kept under FR0. It might be due to increased muscle growth as discussed above which ultimately had improved the breast dimension. The reason behind improved breast width in FR0 needs further thorough investigations.

Conclusion: The feeding and environmental regimes (FR) influenced growth performance, slaughter characteristics and body conformation in Japanese quail. Keeping birds for an extended three to five days in hatcher along with provision of feed and water proved to be better regarding overall growth performance and morphometric traits. However, variation among different FR strategies also existed and needs further studies for its optimization.

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