COMPLEMENTARY INFLUENCE OF CHICK SIZE AND PROTEIN LEVEL ON THE POST-HATCH GROWTH PERFORMANCE OF JAPANESE QUAIL (*COTURNIX COTURNIX JAPONICA*) CHICKS

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ABSTRACT
The differences in chick weights at hatch causes inequalities in their growth and could be compensated by the diets given. The experiment was aimed at determining the complementary effect of chick sizes (CS) and protein levels (PL) on the post-hatch growth performance of quails. 810-day old unsexed Japanese quail chicks were used for a six week growth study. At hatch, the quail chicks were grouped according to the various egg sizes of small (<9.00g), medium (9.00-9.99g) and large (10.00-13.00g). The initial weights (INWT) of the chicks were 5.80, 6.16 and 7.59g, respectively. They were raised in wooden cages with feed and water provided *ad lib*. Chicks from a particular egg size constituted a treatment and each placed on three dietary PL of 24, 26 and 28%. The birds were randomly assigned into 9 treatment combinations with an average of 90 chicks per treatment combination involving 3 replicates of 30 quails each. The experiment was a completely randomized design in a 3x3 factorial arrangement. The best interaction effects of CS x PL on the final live weights (FWT) were recorded in the large and small chicks fed 28% PL. The same trend was observed for the feed intake (FI) and the average daily weight gain (ADWG). The growth indices were significantly ($P < 0.05$) affected by the CS and PL, this implies that, the differences in the initial weight of the small chicks in relation to their counterpart were compensated by very high PL.
Keywords: Japanese quails, chick size and protein level.

INTRODUCTION
The emphasis on other poultry birds has gained tremendous attention over the years meanwhile there could be nutritional values and economic returns from quail production since quails grow very fast and resistant to diseases in relation to other domestic birds (Oluyemi and Roberts, 2000). Quails require less space for keeping them and the required space for raising 8 -10 adult quails can only be used to raise a matured chicken (Haruna *et al.*, 1997). The level of cholesterol in the eggs is low and the meat is equally high in protein thereby making the products suitable for individuals prone to high blood pressure (Olubamiwa *et al.*, 1999). It has remained unresolved, the extent in which chick size influences the subsequent growth performance of growing Japanese quail chicks. There is a linear regression of egg size on the post hatch body weights of guinea fowl keets up to 4 weeks of age, thereafter, the egg size cannot be reliably used for determining the subsequent body weight (Ayorinde *et al.*, 1994). In contrast, Wyatt *et al.* (1985) had earlier reported that, the influence of large eggs on the body weight diminishes while the feed consumed by the birds determines the subsequent body weight of the animal.
Nutrition is the most important factor required to maintain chicks hatched from different egg sizes. Generally, information on protein requirements of quails in Nigeria is limited. Protein values found suitable for raising quails in temperate countries may not be appropriate for quails in the tropical environments. In quail production, for the growth performance to be improved, certain base line information/data are needed. The experiment was aimed at determining the complementary effect of chick sizes and protein levels on the post-hatch growth performance of quail chicks.

MATERIALS AND METHODS

The experiment was conducted in the poultry unit, Teaching and Research Farm of Ahmadu Bello University, Samaru, Zaria and the hatchery unit, College of Agriculture, Mando, Kaduna respectively. The National Veterinary Research Institute (NVRI) Vom, Plateau state, Nigeria supplied the fertile quail eggs that were used for this study. A total of 1,000 quail eggs graded into small (<9.00g), medium (9.00-9.99g) and large (10.00-13.00g) sizes using a digital electronic scale were set in the incubator for 15 days and subsequently transferred to the hatcher. The quail chicks were hatched on the 18th day from which 810-day old unsexed healthy Japanese quail chicks were selected for a six week trial. At hatch, the quail chicks were grouped according to the various egg sizes of small (<9.00g), medium (9.00-9.99g), large (10.00-13.00g) and the average weights were 8.49, 9.54 and 10.77g, respectively. The initial weights of the chicks were 5.80, 6.16 and 7.59g, respectively. They were raised in wooden cages with feed and water provided *ad lib*. Chicks from a particular egg size constituted a treatment and each placed on three dietary protein level of 24, 26 and 28% making nine treatment combinations. The birds were randomly assigned into 9 treatment combinations with an average of 90 chicks per treatment combination involving 3 replicates of 30 chicks each. The experiment was a completely randomized design in a 3x3 factorial arrangement.

Experimental Diet

Table 1: Composition of dietary protein levels for Japanese quail chicks (Day 1-6 weeks)

	Dietary Protein Levels, %		
Ingredient	24	26	28
Maize	47.88	42.23	36.59
Soya beans full-fat	23.68	27.45	35.21
Groundnut cake	11.84	13.72	15.60
Wheat offal	9.50	9.50	9.50
Fishmeal	3.50	3.50	3.50
Bone meal	2.25	2.25	2.25
Limestone	0.50	0.50	0.50
Salt	0.25	0.25	0.25
Vitamin-mineral premix	0.30	0.30	0.30
Methionine	0.20	0.20	0.20
Lysine	0.10	0.10	0.10
Total	100	100	100
Calculated analysis			
Feed cost/Kg ₦	132.16	134.42	136.68
Crude protein %	24.00	26.00	28.00
ME (Kcal/Kg)	2,871.02	2,837.40	2,803.82
Crude fibre (%)	3.92	4.03	4.13
Ether extract (%)	8.01	8.64	9.26
Ash	4.01	4.29	4.57
Calcium	1.21	1.22	1.23
Phosphorus (%)	0.91	0.93	0.95
Lysine (%)	1.49	1.64	1.79
Methionine (%)	0.57	0.59	0.61

Statistical Analysis

The generated data from the experiment was analyzed using the General Linear Model Procedure of SAS (2014). The Duncan's New Multiple Range Test was used to separate the means in the treatment groups where significant differences were observed.

RESULTS

Table 2 presents the effects of chick size and protein level on the growth performance of Japanese quails. The initial live weights for the small, medium and large sized chicks were 5.80 g, 6.16 g and 7.59 g,

respectively. The size of the chicks and protein levels significantly ($P < 0.01$) affected the final live weight (FWT) of the birds. The pattern revealed that the FWT of the quail chicks were enhanced by an increase in chick size together with increasing protein levels in the diet. The same trend was also observed for the average daily weight gain (ADWG), feed intake (FI) and cost per kilogram weight gain (CKGWTG) of the birds. The feed conversion ratio (FCR) was better in the quails on lower crude protein of 24%. The effects of the protein levels and chick sizes were not significant ($P > 0.05$) on the percent mortality.

The FWT was significantly ($P < 0.01$) affected by the interaction effect of chick size and dietary protein levels. The pattern revealed that the growth of chicks with small initial size were compensated for by very high protein level while chicks with initial bigger size could tolerate lower protein levels without adverse effect on the final live weights as they maintained relative comparative advantage of their initial and bigger sizes. The same trend ($P < 0.05$) was recorded for the ADWG and FI respectively. The percent mortality did not reveal any significant ($P > 0.05$) effect by the interaction of chick size and dietary protein level.

Table 2: Effect of chick sizes and dietary protein levels on the growth performance indices of Japanese quails (1-6weeks)

CS	Inwt	Fwt	Adwg	Fi	Fcr	Ckgwtg	Mort
Small	5.80	139.5^{c}	3.19^{b}	12.49^{c}	3.96^{b}	532.57^{b}	1.39
Medium	6.16	142.1^{b}	3.26^{a}	13.01^{b}	3.98^{b}	535.00^{b}	1.80
Large	7.59	146.5^{a}	3.34^{a}	13.83^{a}	4.24^{a}	570.90^{a}	0.00
SEM	-	1.17	0.04	0.20	0.08	10.40	0.94
P values	-	0.0018	0.0296	0.0006	0.0306	0.0306	0.3800
PL, %							
24	5.80	138.54^{b}	3.14^{b}	11.77^{c}	3.78^{b}	499.96^{c}	0.65
26	6.16	139.57^{b}	3.22^{b}	13.10^{b}	4.12^{a}	553.41^{b}	1.53
28	7.59	150.14^{a}	3.42^{a}	14.45^{a}	4.28^{a}	585.10^{a}	1.01
SEM	-	1.17	0.04	0.20	0.08	10.40	0.94
P values	-	0.0001	0.0001	0.0001	0.0009	0.0001	0.8013
Interaction CS*PL							
Sx24	5.80	132.11^{e}	3.01^{d}	10.52^{e}	3.54	468.25	0.00
Sx26	5.80	136.29^{d}	3.12^{cd}	12.44^{c}	4.14	556.86	2.22
Sx28	5.80	150.20^{b}	3.43^{ab}	14.50^{a}	4.24	579.88	1.96
Mx24	6.16	139.42^{cd}	3.24^{c}	13.10^{bc}	4.01	529.52	0.00
Mx26	6.16	143.45^{c}	3.27^{c}	14.01^{ab}	4.28	575.02	2.38
Mx28	6.16	143.71^{c}	3.28^{bc}	14.38^{a}	4.45	608.17	3.03
Lx24	7.59	139.80^{cd}	3.15^{cd}	11.70^{d}	3.80	502.12	0.00
Lx26	7.59	143.01^{c}	3.32^{b}	12.86^{c}	3.93	528.34	0.00
Lx28	7.59	156.77^{a}	3.55^{a}	14.45^{a}	4.15	567.25	0.00
SEM	-	2.02	0.06	0.34	0.13	18.02	1.62
P values	-	0.0020	0.0191	0.0161	0.5003	0.5117	0.6320

CS=Chick size;PL=Protein level;S=Small;M=Medium;L=Large;SE=Standard error;a,b,c,d,eMeans with different superscript in the same column are significantly ($P< 0.05$) different;NS=Non Significant($P> 0.05$);Inwt=Initial weight(g/bird);Fwt=Final weight(g/bird);Adwg=Average daily weight gain(g/bird/day);Fi=Feed intake(g/bird/day);Fcr=Feed conversion ratio;Ckgwtg = Cost per Kg weight gain;Mort=Mortality.

DISCUSSION

The superiority in the FWT of the large chicks over its medium and small sized counterparts may be attributed to differences in the initial sizes of the chicks. The large quails at hatch grew faster due to their comparative weight advantage which was sustained through the six week study period. This corroborates with the reports of Ayorinde *et al.* (1994) that keets after 12 weeks of age increased in weight in relation to

the various grades of eggs (large, medium and small) from which the chicks were hatched. The increase in the FWT of the quail chicks fed higher level of 28% CP over those fed 26% and 24% crude protein level could be supported by the works of Bawa *et al.*, 2011.

The interaction effects of different sizes of chick and protein levels on the FI, FWT and ADWG of Japanese quails were enhanced and could be due to the increasing level of dietary protein. This may have influenced the initial weight differential of the chicks. However, the low initial weight was compensated for in the medium and small sized chicks on high protein diet (28% CP). The lower feed intake, final live weights and average daily weight gains observed in the medium and small sized chicks on low protein diet compared with the large sized chicks suggest that the nutrient requirement of the small and medium sized chicks in Japanese quails cannot be met by 24 and 26% CP, hence the need for the chicks to be fed higher protein level (28%). Quail chicks hatched from small and medium eggs should be fed 28% PL to enhance their growth whereas those from the large eggs can be sustained on 24-26% PL as a result of their comparative weight advantage at hatch.

CONCLUSION AND RECOMMENDATION

It can be concluded that dietary protein level of 24% is adequate for the large chicks without compromising their growth while 28% crude protein diet should be fed to the small and medium sized chicks in order to enhance their growth. The interaction effect of chick size and protein level on the growth performance were complementary, mostly favoring the large sized chicks on high dietary protein level of 28% while the low initial weights of the medium and small sized chicks were enhanced with high dietary protein level (28%).

Acknowledgement

We thank the Management of Landmark University OmuAran, Ahmadu Bello University, Zaria and College of Agriculture, Mando, Kaduna for providing sponsorship to this conference and the facilities used for this study respectively.

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