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Effect of Flock Age, Egg Weight and Calcium Content of Egg Shell on Fertility and Hatchability of Vanaraja Breeder Chicken Egg

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ABSTRACT

The study was conducted at Hatchery unit of West Bengal University of Animal and Fishery Sciences, Mohanpur. campus under Poultry Seed Project, 2009. Total 18 numbers of hatching and 886 numbers of unhatched eggs of Vanaraja were observed. The study revealed a significant difference (P<0.05) in fertility (%), hatchabilty (%) of total egg set in different flock of age ranges. However, there is no significant difference in hatchabity (%) on fertile eggs set on between 27-40 weeks and 41-72 weeks but significant difference exists between 27-40 weeks and 73-92 weeks and also between 41-72 weeks and 73-92 weeks of age of flock. The result showed a significant difference (p<0.05) in fertility, hatchabilty of FES (Fertile Egg Set) between 38 to 41.3 g and >55g weighed eggs and also between 41.6 to 54.8 g and >55g weight eggs. The results also demonstrated a significant difference (p<0.05) in hatchability of TES (Total Egg Set) in different ranges egg weight.

Key words: *Vanaraja, Hatchabilty, Fertility, FES, TES*

INTRODUCTION

At present, India is the third largest egg producer in the world (after China and USA). As per 19th Livestock census, the total poultry population in India is 729.2 million, which is 12.39% higher than the previous census. The growth of poultry industry should be viewed not only in terms of the commercial success it has achieved, but also as one of the core support system for small and marginal farmers. After realizing the importance of backyard farming, Project Directorate on Poultry (ICAR), Hyderabad has been developed a suitable germplasm i.e Vanaraja for backyard or range framing system. Flock age has an influence on the fertility of eggs[3], and there is a general tendency of fertility to decline with age[12]. Tomhave[24], reported greater variation in fertile egg percentage in early production cycle than later. Egg weight is an important trait in domestic poultry production. In early production cycle, hen starts to lay small sized eggs as day goes by egg size will go medium and then large size.

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Eggs with thick shell and firm interiors lead to increased egg weight. Hatchability for small eggs is lower compared that of medium and large eggs[6]. Best hatchabilty (97%) was reported medium sized eggs (50g) of Anak broiler eggs[1]. A fertile egg contains all nutrients and qualities that required for a successful hatching into a fully developed chick. Eggs become fertile about 14 days after the cock has been introduced to the hens. The physical characterstics of the egg play a vital role in the successful hatching of eggs. Calcium in the hen's diet also affects on hatchabilty of eggs. Too much calcium results in thick-shelled eggs, which will prevent chicks from hatching leads in dead in shell.

Aim of present study was to determine the effect of flock age, egg weight and calcium content of egg shell on fertility and hatchability of Vanaraja breeder chicken eggs reared under deep litter system.

MATERIAL AND METHODS

The present study was designed with an aim to explore fertility, hatchability of eggs conducted on fertile eggs of Vanaraja chicken reared in deep litter system. The study was conducted at Hatchery unit of West Bengal University of Animal and Fishery Sciences, Mohanpur. campus under Poultry Seed Project, 2009. Total 18 numbers of hatching and 886 numbers of unhatched eggs of Vanaraja were observed. The chickens were reared in deep litter system with well ventilated and lighted houses. Five batches of flocks were considered for the study: 1. 86 to 92 weeks, 2. 56 to 76 weeks, 3. 52 to 72 weeks, 4. 36 to 56 weeks, 5. 27 to 47 weeks. Cock and hen were of same age group. Fertile eggs were collected after 2 weeks of first laying at 22 to 24 weeks of age. All eggs were weighed individually and recorded daily to the nearest gram and averaged for each replicate by means of digital weighing balance during the whole study and grouped into 3 categories: category 1-38 to41.3 g, category 2-41.6 to 54.8g, category 3-more than 55g.

Fertility (%) and Hatchability (%)

Fertility (%) and Hatchability (%) on total egg set and fertile egg set were recorded from hatchery register of the poultry farm.

$$\textbf{Fertility (\%)} = \frac{\text{No. of fertile eggs}}{\text{Total number of eggs set}} \times 100$$

$$\textbf{Hatchabilty (\%)} = \frac{\text{No. of chicks hatched}}{\text{Total number of eggs set}} \times 100$$

$$\textbf{Hatchabilty of fertile eggs (\%)} = \frac{\text{No. of chicks hatched}}{\text{Total number of fertile eggs}} \times 100$$

Calcium of fully hatched egg shell, pipped or cracked shell (live embryo unable to hatch out) and dead in shell egg samples were estimated as per A.O.A.C[5]. Percentage of Ca is determines as

$$\frac{\text{ml of N/10 KMnO4} \times 0.00204 \times \text{total vol. of mineral extract}}{\text{Vol. of aliquot taken for test} \times \text{Dry wt. of sample (g)}} \times 100$$

Statistical Analysis

Fertility (%) and hatchability (%) were calculated as per (Ref). Data were subjected to statistical analysis[23], using Statistical Package for Social Sciences (SPSS 21.0, Chicago, IL, USA).

RESULTS AND DISCUSSION

a. Effect of flock age on fertility, hatchability of total egg set and fertile egg set

The effects of flock age on fertility (%), hatchability (%) of total egg set and fertile egg set are tabulated in the table 1. Study revealed that there is a significant difference ($p<0.05$) in fertility(%), hatchability(%) of total egg set in different flocks of age ranges i.e. 27-40 weeks, 41-72 weeks, 73-92 weeks; however there is no significant difference in hatchability(%) on fertile eggs set between 27-40 weeks and 41-72 weeks but significant difference exists between 27-40 weeks and 73-92 weeks and also between 41-72 weeks and 73-92 weeks of age of flock. It is observed that at 27 to 40 weeks of age there is maximum fertility, hatchability on TES and FES with a mean of 90.13±0.65, 82.27±0.70 and 89.13±0.59 respectively. It is gradually decreasing at 41 to 72 wks and 73 to 92 wks of age. The findings of the present study are in accordance with the findings of Fasenko *et. al.*[10], Elibol *et. al*.[9], Ruiz and Lunam[20], Vieria *et. al.*[25], Alsobayel and Albadry[4], Ipek and Sozcu[13] and Iqbal *et. al*.[14]. They conducted their study on broiler breeder flocks and concluded that there was a significant effects of flock age on fertility, hatchability on total egg set and fertile egg set and also demonstrated that older broiler breeder has reduced fertility and hatchability. However Zakaria *et. al.*[26] found that there were no difference in hatchability of fertile eggs with flock age; Gualhanone *et. al.*[11] revealed that hatchability was not affected by flock age in broiler.

b. Effect of egg weight on fertility, hatchability of total egg set and fertile egg set

The effects of egg weight on fertility (%), hatchability (%) on total egg set and fertile egg set are tabulated in the table 1. The result showed that there is a significant difference ($p<0.05$) in fertility, hatchability of FES between 38 to 41.3 g and >55 g weighed eggs and also between 41.6 to 54.8g and >55 g weighed eggs; however no significant difference found in between 38 to 41.3g and 41.6 to 54.8 g weighed eggs. The results also demonstrated a significant difference ($p<0.05$) in hatchability of TES in different ranges egg weight. Fertility is highest at 38 to 41.3g weighed eggs with a mean of 90.04±0.40, whether hatchability of TES and FES are maximum at 41.6 to 54.8 g weighed eggs with a mean of 81.68±0.73 and 89.16±0.57 respectively. The observations of the present study are in consonance with the results of Abiola *et. al.*[1], Ng'ambi *et. al*.[17], Rashid *et. al*.[19], Kgwatalala *et. al*.[16]. They experimented on broiler breeder flocks and revealed that hatchability is higher in medium sized eggs than large and small sized. However there are some observations on contrary of these findings, Alabi *et. al*.[2] observed no difference in fertility with egg weight in indigenous Venda chickens; Ishaq *et. al*.[15] found higher hatchability on large egg weight; Elamin *et. al*.[8] revealed hatchability of fertile eggs was not significantly affected by egg weight. In the present study medium to large eggs have more hatchability which may be due to more nutrients present in the egg to support the growth of the embryo than lighter eggs and small eggs have less space for growth of embryo.

Table-1 Effect of flock age and egg weight on fertility, hatchability of total egg set and fertile egg set.

Traits	Egg Weight (g)			Flock Age (weeks)		
	38-41.3 g	41.6-54.8 g	> 55 g	27-40 wks	41-72 wks	73-92 wks
Fertility	90.04^{a}±0.40	89.88^{a}±0.63	82.27^{b}±0.33	90.13^{a}±0.65	86.38^{b}±0.20	81.30^{c}±0.56
Hatchability (TES)	79.84^{a}±0.46	81.68^{b}±0.73	69.79^{c}±0.38	82.27^{a}±0.76	75.26^{b}±0.23	67.73^{c}±0.66
Hatchability (FES)	87.62^{a}±0.36	89.16^{a}±0.57	84.37^{b}±0.30	89.13^{a}±0.59	86.68^{a}±0.18	83.08^{b}±0.51

Values bearing different subscripts (a, b and c) in the column differ significantly.

a. Effect of egg shell calcium content on hatchability

The effect of egg shell calcium content on hatchability is tabulated in the table 2. The study revealed a significant effect ($p<0.01$) of shell calcium content on hatchability. It is observed that fully hatched embryo has egg shell calcium percentage in between 27.39 to 35.90%, maximum embryo which pipped the shell membrane but not able to hatch out having a shell calcium percentage in between 35.96 to 37.96% and maximum embryos which are dead in shell having a shell calcium percentage more than 37.96% with a mean percentage of 52, 67.71 and 37.93 respectively. The results of the present study i.e. relationship of calcium content and embryonic mortality is in tune with the findings of Shatokhina[22], Novo *et al*.[18]; they found that eggs with extremely thick or thin shells resulted in increased embryonic mortality. The effect of calcium on hatchability is also in agreement with the research of Novo *et al*.[18] who found a significant effect of calcium on hatchability. It also been stated that excess calcium in egg shell causes thick and bumpy shell which inhibit the exchange of gases, causes drowning of the embryo in the egg fluid and also impairs the pipping of embryo at time of hatching.

Table 2. Effect of egg shell calcium content on hatchability of Vanaraja

Calcium content of egg shell (%)	Fully hatched embryos (%)	Pipped, unable to hatch out embryos (%)	Dead in shell embryo (%)
27.39-35.90 %	52	28	20
35.96-37.96 %	5.88	67.71	29.41
>37.96 %	37.93	24.14	37.93

P<0.01: highly significant

CONCLUSION

Flock age, egg weight and calcium content in egg shell influence the fertility and hatchability of chicken eggs. So the management of Vanaraja chicken should be dealt with the above parameters.

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