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Assessment of pre and post-incubation parameters in Uttara breeder hens

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ABSTRACT

A study was conducted to determine the effects of pre-incubation egg parameters on post-incubation parameters in Uttara breeder hens. A total of 2,890 hatching eggs were classified according to three egg weight groups *viz.* small (44-52 g); medium (53-57 g) and large (58-68 g). Results indicated that large-sized eggs produced chicks with higher hatch-weight than medium and small-sized eggs. However, no differences were observed for fertility and hatchability rates but significant differences were found for chick quality and chick weight. It was therefore concluded from the results of the present study that sorting of eggs by weight prior to incubation might be advantageous in producing uniform size hatchlings to meet specific market demands with focus on breeding for obtaining maximum number of saleable chicks.

Key words: Hatching eggs, Pre and post-incubation traits, Uttara fowl.

INTRODUCTION

A native chicken population from Uttarakhand, named as "Uttara fowl" is a distinctive bird with rich black plumage and feathered shank which has recently been identified (Kumar *et al.,* 2014). It has medium egg production, medium growth rate, medium body size, medium-sized egg weight as well as moderate sexual maturity. It is found in high hills of Pithoragarh, Almora and Nainital districts and kept by mostly tribes in the interior parts of the of Uttarakhand and adjoining Nepal and Tibet border. This germplasm has a number of desirable characters such as hardiness, adaptability to the wide agro-climatic variability, disease tolerance, and rich flavor of meat and eggs. Despite a drastic increase in the import of high yielding strains from across the world, the local birds still retain preference in its native environment mainly due to its special capabilities i.e., being good foragers, mothering ability and low cost. The birds require no extra care and housing which make them suitable for landless labourers and marginal farmers. The Uttara fowls have appreciable degree of resistance to diseases compared with other exotic breeds of fowl in its natural habitat in free range.

The avian egg is a biological system projected to warrant the safety of the embryo and its successful hatching into a fully developed chick (Reijrink *et al.,* 2009). Effect of egg weight on hatchability and chick quality are very important parameters for commercial hatcheries. Until recently, day-old chick quality had received little attention, as there has been no universally established method for its measurement. Day-old chick quality at take-off seems to be an all or none question (marketable or non-marketable chicks). The parameters used for quality selection are neither well defined nor standardized (Tona *et al.,* 2004). Presently, there is no information available on pre-incubation egg parameters for measuring day-old chick quality in Uttara breeder hens. Keeping the above facts in view, the present study was undertaken to determine the effects of pre-incubation egg parameters on post incubation traits.

MATERIALS AND METHODS

A total number of 2,890 hatching eggs of different sizes produced by Uttara breeder hens belonging to 14 hatches were taken for the present investigation. The least square analysis of the data revealed that there is no effect of hatch on egg weight. All the hens used for egg collection were maintained under similar environmental and management conditions. The experimental eggs were classified into small (44 – 52 g); medium (53 – 57 g) and large (58 – 68 g) groups for the experiment. Shape index, egg density and volume of eggs were determined before being stored for 4-5 days. To measure the volume of the egg, a measuring cylinder of 500 ml capacity with a known quantity of water was filled. After noting the lower meniscus of the water, the measuring cylinder was slanted and the egg carefully slided into the measuring cylinder and final reading of the water was noted, the difference in value gave the volume of egg in cm^3. The egg density was determined by dividing egg weight (g) with egg volume (cm^3). The stored eggs were trayed and placed in the incubator and after 18 days, the eggs were transferred from the incubator to hatcher after candling for determining fertility. The chicks were carefully removed from the pedigree boxes and their weights were determined by using an electronic balance with a sensitivity of 0.01 g on 22nd day. Chick quality was determined by visual examination based on activeness of

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chicks, dryness, lively looks of eyes, good posture of legs and appearance of umbilical region as reported by Tona *et al.* (2003) and Sahin *et al.* (2009).

Statistical analysis: The least square analysis of the data revealed that there is no effect of hatch on egg weight. The data were then analysed statistically by running ANOVAs using SPSS 16.0 software and Chi-square test for independence using 'R' software. Significant mean differences between the treatments were determined at a 5% probability level ($p<0.05$) using Duncan's Multiple Range Test (DMRT) as modified by Kramer (1957).

RESULTS AND DISCUSSION

The mean values for pre-incubation egg parameters are presented in Table 1. The mean egg weights for small, medium and large egg weight groups were 50.35, 55.05 and 61.36 g respectively with pooled egg weight of 55.54 g. The mean egg density for small, medium and large egg weight groups were observed as 1.050, 1.045 and 1.057 g/cm^3 with pooled egg density as 1.051 g/cm^3. The corresponding shape index values were found as 76.88, 76.91 and 76.90 respectively with pooled value as 76.90. The means of egg volume for small, medium and large egg weight groups were 47.98, 52.68 and 58.03 cm^3 respectively with pooled value as 52.85 cm^3.

Lower egg weights were observed by Thakur *et al.* (2006) in Kadaknath, Iqbal *et al.* (2009) in Kashmir Favorella, Singh *et al.* (2009) in Aseel, Kadaknath, desi and Assel × Deshi cross, Faruque *et al.* (2010) in non-descript deshi (ND) and hilly (H), Lemlem and Tesfay (2010) in indigenous chicken of Ethiopia, Olwande *et al.* (2010) in indigenous chicken, Magnesha (2012) in indigenous chicken and Mohammed *et al.* (2012) in Sudanese indigenous fowl. However, Padhi *et al.*, (1998) observed higher egg weight in White Leghorn. These variations in egg weight might be due to difference in breed and environmental conditions.

The results indicated that mean egg weight, egg density and volume among the three groups were significantly different ($p<Â0.05$) and increasing egg weight had positive effects on egg density and volume. Egg weight, however, did not have any effect on shape index. The results are in line with the findings of Sahin *et al*. (2009) and Alabi *et al.* (2012) as they observed significant effect of egg weight on egg density and volume but did not find any significant effect on shape index.

The mean values for post-incubation egg parameters are presented in Table 2. The fertility rates for small, medium and large egg weight groups were 88.82, 89.74 and 89.79 per cent respectively. The mean hatchability values on fertile egg set basis (FES) for small, medium and large egg weight groups were observed as 78.57, 76.44 and 77.73 per cent with the corresponding hatchability values on total egg set basis (TES) as 70.05, 68.60 and 69.79 per cent respectively.

The results indicated that egg weight had no significant effect ($p>0.05$) on the fertility rates and hatchability. This is similar to the observations made for fertility rates by Petek *et al.* (2005) in quails, Sahin *et al.* (2009) in breeder hens, Kamanli *et al.* (2010) in ATAK-S Brown layers and Alabi *et al.* (2012) in indigenous Venda Chickens. Padhi *et al.* (2000), while working on Nicobari, Barred Desi, White Leghorn (WLH), Nicobari × WLH and WLH × Nicobari crosses found lower fertility rates. Similarly, lower fertility rates were observed by Singh *et al.* (2000), Bhardwaj *et al.* (2006) and Mohan *et al.* (2008) in indigenous chicken (Aseel and Kadaknath).

The results showed that egg weight had no apparent effect on hatchability. Similar views were expressed by Sahin *et al*. (2009). However, Mbajiorgu (2011) found significant improvement in hatchability with increase in hatching egg weight.

Hatchability being a typical fitness trait with a very low heritability cannot be improved by mere genetic selection and hence optimization of hatching egg weight for different poultry breeds and improvement in hatchery management practises would therefore be the most promising route for enhancing hatchability values.

The differences in discarded chick percentage as observed in the present study for three egg weight groups were found statistically significant which were determined as 8.64, 3.78 and 6.03 % for small, medium and large egg weight groups respectively. The highest value was observed

Table1: Means of pre-incubation egg parameters in Uttara breeder hens

Characteristics	Groups						Pooled	
	Small (44-52 g)		Medium (53-57 g)		Large (58-68 g)		44-68 g	
	n = 975		n = 965		n = 950		n = 2890	
	X	SEM	X	SEM	X	SEM	X	SEM
Egg weight (g)	50.35^d	0.06	55.05^c	0.04	61.36^a	0.08	55.54^b	0.09
Egg density (g cm^{-3})	1.050^c	0.01	1.045^d	0.02	1.057^a	0.02	1.051^b	0.02
Egg volume (cm^3)	47.98^c	0.06	52.68^b	0.04	58.03^a	0.08	52.85^b	0.08
Shape index (%)	76.88	0.01	76.91	0.01	76.90	0.01	76.90	0.01

Means within rows with different superscript differ significantly ($P < 0.05$)
SEM: Standard error of mean

Table 2: Means of post-incubation parameters in Uttara breeder hens

Characteristics		Groups			Chi-sq. test of independence
		Small (44-52 g)	Medium (53-57 g)	Large (58-68 g)	
		n = 975	n = 965	n = 950	
Fertility rate	No. eggs	866	866	853	0.612 (NS)
	(%)	88.82	89.74	89.79	
Infertile egg	No. eggs	109	99	97	
	(%)	11.18	10.26	10.21	
Hatchability (FES)	No. of fertile eggs	866	866	853	0.034 (NS)
	(%)	78.57	76.44	77.73	
Hatchability(TES)	No. of total eggs	975	965	950	
	(%)	70.05	68.60	69.79	
Discarded chicks	No. ofchicks	59	25	40	13.75*
	(%)	8.64	3.78	6.03	
Chick quality	No. ofchicks	624	637	623	
	(%)	91.36	96.22	93.97	
Chick weight (g)		30.26^{c}	34.94^{b}	39.94^{a}	-

FES: Fertile egg set; TES: total egg set; Means within rows with different superscript differ significantly ($P < 0.05$)
* $P < 0.05$

in the smallest weight group followed by largest and medium weight groups indicating that medium sized eggs are most suitable for hatching and obtaining acceptable size chicks. However, in a similar study carried out by Sahin *et al.* (2009), no significant differences were found in the rate of discarded chicks among three egg weight groups.

The average values of chick quality of the small, medium and large egg weight groups were found as 91.36, 96.22 and 93.97 per cent respectively, indicating that medium sized eggs produce best quality chicks as compared to small and large sized eggs. However, Sahin *et al*. (2009) did not find any relationship between egg weight and chick quality.

Decuypere and Michels (1992) and Borzemska *et al*., (1998) observed that good hatchability does not necessary positively correlate with high percentage of chicks of good quality, and that maximal hatchability is not the best indicator for the highest post-hatch viability and growth.

Chick quality being a commercial trait is necessary to be maintained by hatcherymen in order to attract customers and to stay afloat in the highly competitive hatchery business.

The means of chick weight for small, medium and large egg weight groups were 30.26, 34.94 and 39.94 g respectively. The results indicated that chick weight among the groups were significantly different ($p<0.05$). It is anticipated that light egg produce small chicks and heavy egg produce large sized chicks as the larger eggs have more egg mass. The results are similar to the findings of other researchers *viz.* Asusquo and Okon (1993), Smith (2000) and Sahin *et al.* (2009). Chick weight being highly dependent on egg weight can be easily improved to remain competitive in the hatchery business as larger chicks are preferred by commercial farmers.

CONCLUSION

It can be concluded from the results of this study that in order to maximize total number of saleable chicks per hen, medium sized eggs would be suitable for obtaining highest number of quality chicks with acceptable size which will eventually maximize profit of hatcherymen. The present study is suggestive of the fact that Uttara breeder hens have all the attributes of bird of choice for rural as well as industrial sector.

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