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ORIGINAL ARTICLE

Age effects on egg quality traits in a 3-way cross egg type chicken developed for backyard poultry farming

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Abstract

Egg quality traits were measured at 32, 40, 52, 64 and 72 wks of age in a 3 way cross (PD1 x IWI x PD3) utilizing 20 to 30 eggs at different ages. Egg weight, colour index, albumen and yolk index, Haugh unit, shell thickness, shell % and albumen % differ significantly ($p \leq 0.05$) at different age of measurements. Egg weight increases linearly upto 52 wks of age and then it remain stable. Colour index significantly lower during beginning and at later ages the index was higher. Shell thickness was highest during 52 wks of age but at other ages it remains non significant. Yolk index significantly decreased at 72 wks of age compared to other ages of measurements. Albumen index decreases as the age of measurements increases. Haugh unit was significantly low at 72 wks of age compared to 64 and 40 wks of age. Yolk % increases as the age advances but it was statistically non-significant, whereas albumen % decreased significantly at 52, 64 and 72 wks of age compared to 32 wks of age. Shell % increases as the age advances. The results indicates that the age of the birds significantly affect different parameters of egg quality and as the age advances, at the end of cycle most of the quality parameters decreased in magnitude and the yolk content increases compared to the albumen content.

Key words: Age effect, backyard poultry, crossbred, 3-way cross, egg quality.

Introduction

Backyard poultry farming with improved variety mostly different crosses is gaining popularity in our country. In rural, tribal and remote locality of our country where industrial poultry is difficult to practice, the backyard poultry farming is practiced by farmers. Both heavy and light chicken breeds along with local non-descript birds are being used for backyard poultry farming. They have low egg production, slower growth rates and have broodiness with good mothering ability. Due to their better adoptability to the harsh environment the poor farmers preferred the local birds. However, there is always demand by the farmers for a bird having colour plumage like indigenous birds with better growth and production and requires very minimum or nil change in husbandry and housing practice that are being followed for the indigenous birds. Different crossbreds, synthetic hybrids and indigenous are being developed for backyard poultry farming and also evaluated for different traits (Padhi *et al*., 2003; Padhi *et al*., 2004; Khan 2008; Padhi *et al*., 2012a; Padhi and Chatterjee, 2013; Padhi *et al*., 2014). However, there is always needs to develop and evaluate more crosses for backyard poultry farming. Quality of eggs is an important attributes for any breeds or variety to be developed, besides the growth and production. The egg size and its component are influenced by a number of genetic and non genetic factors (Washburn, 1990). The growth and production of different lines/breeds used for backyard poultry development were available in literature (Padhi *et al*., 1999; Padhi *et al*., 2001; Padhi *et al*., 2012a, 2012b; Padhi and Chatterjee, 2012). Egg quality in different breeds/lines/crosses in both chicken and ducks are reported (Padhi *et al*., 1998; Chatterjee *et al*., 2007; Padhi *et al*., 2009). The yolk % is affected by breed or strain within a breed, age of hen and egg size (Campo, 1995; Suk and Park, 2001; Padhi *et al*., 2013). It is important to measures the egg quality at different ages whenever any new cross are being developed for the backyard poultry faming. Thus, the present study was undertaken to see the effect of hen age on egg quality in a 3-way egg type cross (PD1 x IWI x PD3) developed for backyard poultry farming.

Materials and Methods

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Eggs for the present study was collected from a 3-way crosses (PD1 x IWI x PD3) PD1 is being developed from a low performing Cornish population (Ayyagari, 2008) and used as male line for backyard poultry. IWI developed for higher egg production from a White Leghorn line. PD3 is being developed from Dhalem Red selected for higher egg mass. Eggs quality traits were measured at 32, 40, 5, 64 and 72 wks of age and at each age 20 eggs were collected at particular age except at 40 wks where 30 eggs were collected. Eggs for the present study were collected randomly late afternoon and were kept at room temperature overnight for evaluation in the next day. The eggs were numbered first and then weighed on an electronic balance to determine their weights in g. Thereafter, egg length (mm) and width (mm) were measured by digital Verniers Calipers for determining shape index. Then the eggs were broken on a clean flat glass surface. Measurements like yolk height (mm), albumen height (mm) were recorded using spherometer. Yolk width (mm) and albumen width (mm) were recorded using a Verniers Calipers. The yolk colour was measured with a Roche yolk colour fan scale (Roche scale). Shell thickness was randomly measured from the broad end, narrow end and the middle of the shell using a micrometer, and the average of the three measurements was taken as shell thickness in millimeter (mm). Weight of yolk was recorded and the shell weight was recorded after drying the egg for 48 hours. Albumen weight was determined by subtracting the yolk and shell weight from the gross egg weight. On the basis of the above measurements different egg quality traits were obtained using the following formulae. Shape index = egg width/egg length x 100; albumen index = albumen height/albumen width, yolk index = yolk height/yolk width; Haugh unit (HU) = 100log (H+7.57-1.7 $W^{0.37}$), where H= albumen height in mm, W=weight of egg in g, according to Haugh (1937); yolk % = yolk weight/egg weight x 100; albumen % = albumen weight/egg weight x 100 and shell % = shell weight/egg weight x 100. The data were analysed as per Snedecor and Cochran (1994) to see the significance between different genetic groups and also effect of age on different egg quality traits in each genetic group.

Results and Discussion

Egg weight showed significant ($p \leq 0.05$) difference between different age of recording and the egg weight increases as the age of measurement increases. However, the results revealed that egg weight at 40, 52, 64 and 72 wks of age did not differ significantly ($p \leq 0.05$) indicating that in early period there was gain in egg weight and towards later part the egg weight remain static (Table 1). Similar observation was reported by Suk and Park (2001), Padhi *et al*. (2013). The egg weight observed in the present study at 40 weeks of age was higher than the report of Padhi *et al*. (2013) in PD1. This may be due to effect of crossbreeding where three breeds are involved in the present study. Shape index did not showed any significant ($p \leq 0.05$) difference between different ages of measurements. Tumova and Gous (2012) reported no significant effect of age on shape index in broiler breeder and laying hen and Padhi *et al*. (2013) in PD1 which was used in the present study. Shape index value at different ages was lower than the report of Padhi *et al.* (2013). This may be due to use of other two lines in the development of 3 way cross.

Yolk index showed significant ($p \leq 0.05$) difference between different ages of measurement (Table 1). At 72 wks of age it decreased significantly compared to other age of measurement. However, yolk index was significantly ($p \leq 0.05$) higher at 40 and 52 weeks of age compared to other ages of measurement. Yolk index values were higher than the report of Chatterjee *et al*. (2007) and Padhi *et al*. (2013). No definite trend for yolk index was also reported by Padhi *et al*. (2013) in PD1. Albumen index differ significantly ($p \leq 0.05$) between different age of measurement and the lowest albumen index was observed at 72 wks of age indicating the poor quality of albumen at 72 wks of age (Table 1). Decrease albumen index as the age advances also reported by Padhi *et al.* (2013), however the index values observed in the present study was higher than the report indicating the better quality of eggs of this cross. Haugh unit differ significantly ($p \leq 0.05$) at different ages and the lowest Haugh unit was obtained at 72 wks of age. Decreases in Haugh unit towards later part of the laying cycle were reported by Tumova and Gous (2012) and Padhi *et al.* (2013) in broiler breeder and PD1, respectively.

Shell thickness differ significantly ($p \leq 0.05$) between different age of measurement (Table 1). The shell thickness was higher at 52 and 72 wks of age compared to other age of measurement indicating that the shell quality was better towards the end of the experiment. Similar observation was reported in PD1 by Padhi *et al*. (2013). This may be influenced in the cross as PD1 is used in the 3-way cross at 25 % level inheritance. Shell thickness observed in the present study at 40, 52 and 64 wks of age were comparable to the report of Padhi *et al*. (2013) in PD1.

The percent of yolk did not differ significantly ($p \leq 0.05$) between different age of measurement. But on numerical value as the age advances the yolk % increases in the eggs. The lower yolk % at early ages may be suitable for the consumer who needs less yolk %. Increase in yolk % compared to early ages was reported (Tumova and Gous, 2012; Padhi *et al*., 2013).

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Table 1: Egg quality parameters at different ages

Traits	32 week (20)	40 week (30)	52 weeks (20)	64 week (20)	72 Week (20)
Egg weight (g)	56.38±0.77[b]	59.08±0.94a[b]	61.89±0.92[a]	61.26±0.86[a]	61.05±0.51[a]
Shape index	74.57±1.68	74.88±0.57	75.73±0.64	73.89±0.71	74.66±0.57
Yolk index	0.4404±0.008[b]	0.4886±0.007[a]	0.4714±0.006[a]	0.4432±0.004[b]	0.4037±0.005[c]
Albumen index	0.1325±0.005[a]	0.1266±0.004[a]	0.1064±0.007[b]	0.1079±0.005[b]	0.0918±0.005[c]
Haugh unit	81.50±1.92[b]	89.93±1.03[a]	83.85±2.41[b]	86.30±1.42[a]	80.60±2.66[b]
Yolk %	27.00±0.35	28.52±0.46	29.21±0.26	29.29±1.35	29.53±0.51
Shell %	8.20±0.21[b]	8.15±0.15[b]	9.49±0.10[a]	9.03±0.35[a]	9.39±0.21[a]
Albumen %	64.80±0.31[a]	63.33±0.48[ab]	61.30±0.26[b]	61.68±1.67[b]	61.09±0.50[b]
Shell thickness (mm)	0.3425±0.005[b]	0.3421±0.005[b]	0.3684±0.003[a]	0.3463±0.005[b]	0.3548±0.005[b]
Yolk colour	4.26±0.18[c]	7.10±0.22[a]	6.05±0.21[b]	7.00±0.17[a]	7.40±0.28[a]

Values in parenthesis are number of eggs; Means having common superscript did not differ significantly (p≤0.05).

The percentage of albumen in the whole eggs showed significant (p≤0.05) difference between different ages of measurements (Table 1). The albumen % decreases as the age of measurement increases. Decrease in albumen % as age advances is in agreement with the report of Silversides and Scott (2001) and Padhi *et al*. (2013). However, the % of albumen was higher in the present findings than the report of Padhi *et al.* (2013). Shell % showed significant (p≤0.05) difference between different ages of measurement. As the age advances the shell % increases. This may be due to higher egg weight towards later part of laying cycle and higher shell thickness as observed towards later part. Higher shell % and shell thickness towards later part of the laying cycle is a desirable character of this cross which may helps to reduce breakage during handling. Yolk colour showed significant (p≤0.05) difference between different age of measurement and more intense colour was observed at 72 wks of age. More intense colour of yolk towards later part of laying was reported by Padhi *et al*. (2013) in PD1 a male parent line use for production of backyard poultry.

Conclusion

Development of crosses of egg type birds for backyard poultry using different exotic breeds to improve the egg production is an important area of research. In the present study a 3-way cross (PD1x IWI x PD3) was developed and the egg quality parameters at different ages were studied. The results revealed that most of the egg quality traits differ significantly (p≤0.05) at different ages of measurements in 3-way cross and the internal quality of eggs decreases towards the end of the experiments. However, the increases in shell thickness and shell % towards later part of the laying cycle is a desirable characters of this cross for decreasing handling loss of eggs.

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