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Effects of cage and barn rearing system on early laying performance of pullet

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Abstract

The present experiment was conducted with 144 Shaver 579 egg laying pullets to compare their performances reared on barn and in cages for a period of 16 weeks from 25 to 40 weeks of age. Feed consumption, feed conversion (FC) and egg weight were significantly higher when reared on barn than in cages. However, hen day egg production (HDEP), egg mass, body weight, livability, albumen index, Haugh unit (HU), yolk index, shape index and egg shell thickness did not differ (P>0.05) between pullets under two different rearing systems. Soiled eggs (p<0.01) and shell breaking strength (P<0.05) were higher for the pullets reared on barn than in cages. In contrast, yolk color score (YCS) was higher (P<0.05) in eggs collected from the cage-reared pullets when compared with the eggs of pullets reared on barn. It is concluded that egg laying pullets can be reared either on barn or in cages successfully in Bangladesh condition without any adverse effect on egg production.

Key words: Laying pullets, Egg production performance, Egg quality, Barn, Cage

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Introduction

Raising egg laying commercial strains in Bangladesh is gaining popularity in the last two decade. Commercial layers are reared both on barn and in cages. The use of cages for housing laying pullets has gained widespread favor in recent years. Most commercial producers have a very definite preference for either cage or barn system. However, they are very much convinced by others to their choice rather than experimental supports. Barn and cage rearing systems have their own merits and demerits. Several investigators (Abrahamsson et al. 1996; Tauson et al. 1999; Dukic-Stojcic et al. 2009; Ahammed and Ohh, 2013) have reported that cage-reared pullets lay more eggs than those reared on barn. In contrast, higher egg production under barn rearing system compared to cage rearing system has been reported in the findings of Al-Rawi and Abou-Ashour (1983). However, it has been reported that rearing systems (barn vs cage) did not affect egg production (Jin and Craig, 1988; Anderson and Adams, 1994; Muthusamy and Viswanathan, 1998).In Bangladesh, most of the farmers prefer cage rearing system for keeping their laying pullets while others prefer barn system, but still they do not know which system is better in regards to egg production and egg quality. Considerable research has been carried out to evaluate the relative merits of cage and litter system for management of laying pullets. However, the evidence is not consistent indicating the superiority of either cage or litter system. So, it is necessary to compare these two systems of rearing of laying pullets at the present time in Bangladesh. Therefore, the present study was undertaken to examine the effects of barn and cage rearing systems on egg production performance of laying pullets under Bangladesh condition and to determine the influence of these two systems on egg quality.

Materials and Methods

A total of 144 Shaver 579 ready-to-lay pullets of 17 weeks of age were transferred to layer house

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and experimental data were collected when laying pullets reached to peak production, from 25 weeks for this experiment. The duration of experiment was 16 weeks (from 25 to 40 weeks). Pullets were housed in concrete type open sided house and reared on either barn or in cages. Dry sand was used as litter in barn which was spread at 10 cm depth on floor. In barn rearing system, a total of 72 pullets were randomly allocated to three separated pens of equal size (6.69m^2/pen). Floor space for each pullet in this system was 2787 cm^2. One community type wooden nest box having five small nests was provided in each pen. The measurement of each small nest was 36 cm long, 30 cm wide and 32 cm high. The cages were 3-tier individual cage made by galvanizing iron rod. Each cage was 1.83 m long, 0.29 m wide and 1.89 m high. Living space for each pullet in this system was 704 cm^2.

A commercial layer ration was formulated as per standard nutrient requirements of the Shaver 579. A total amount of 115 g feed was allotted to each pullet two times a day. A 16 hr continuous lighting program was followed including natural day length and artificial light with the help of a 60 watt electric bulb in each pen. Data on egg production, feed consumption, body weight, egg weight, egg quality like shape index, shell breaking strength, shell thickness, albumen index, HU, yolk index and YCS were recorded. Width and length (cm) of each egg were measured using a manual calipers and shape index was calculated as percent ratio between egg width and egg length. Shell thickness meter was used to determine the shell thickness of egg and shell breaking strength (kg/cm^2) of un-craked egg was measured using the equation suggested by Arad and Marder (1982). Albumen height (mm) was measured using stage micrometer. HU was estimated following the equation proposed by Haugh (Stadelman, 1995). Yolk color was evaluated by comparison of yolk colour with Roche yolk colour fan (DSM, 2005-HMB, 51548, Basel, Switzerland). All recorded and calculated data were subjected to t-test with SPSS statistical programme.

Results and Discussion

The results of egg laying performance are presented in Table 1. The data given an impression that the difference in HDEP between rearing systems was statistically non significant at all ages. The result is in agreement with the findings of Jin and Craig (1988), Anderson and Adams (1994) and Ahammed and Ohh (2013). They found no significant difference in hen day egg production between barn and cages. This result contradicts the findings of Abrahamsson et al (1996), Tauson et al (1999) and Dukic-Stojcic et al (2009). They found significantly higher egg production in cages than on barn.

Table 1. Performance characteristics of egg laying pullets on barn and in cages

Parameter	Barn	Cage	t value and
	Mean ± SE	Mean ± SE	sig. level
HDEP (%)	88.34±3.36	91.57±1.24	1.06^{NS}
Body weight (g)	1476±13.22	1622±5.72	0.80^{NS}
FC (g/bird/day)	113±0.75	106±0.87	8.88^{**}
Egg weight (g)	53.83±0.71	52.37±0.15	3.07^{**}
Egg mass output (kg)	45.49±3.51	47.19±1.06	0.67^{NS}
Feed conversion	3.23±0.54	2.63±0.05	2.67^{*}
Livability (%)	97.92±2.17	100.0±0.00	1.00^{NS}

*HDEP, hen day egg production; FC, feed consumption; NS, Non-significant, **, p<0.001, *, p<0.05, SE, standard error*

The data on egg weight and egg mass output are shown in Table 1. The egg weight on barn was significantly (P<0.01) higher than in cages. Several observations (Sing et al 2009; Lewko and Gornowicz, 2011) also agreed with this finding that reported heavier floor eggs than cage eggs. The average egg weight has been evidently associated with the frequency of egg production as far as the amount of feed consumed per bird. A contradictory result was reported by Bangcong and Cagmat (1990) and Ahammed et al (2014), who found significantly higher egg weight in cages than those kept on barn in the early productive life. Egg mass output was higher in cages than on barn, but the result did not differ significantly. This result is in agreement with the

findings of Jin and Craig (1988), who reported that floor and cage rearing systems have no influence on egg mass outputthe. The result of the current study similar the findings of Yakabu et al (2007) and Ahammed et al (2014) who found higher egg mass in cages than on floors. However, a contradictory result was observed by the findings of Vits et al. (2005), who reported greater egg mass in floor pens than in cages.

Table 2. External egg quality characteristics on barn and in cages

Parameter	Barn	Cage	t value and
	Mean±SE	Mean±SE	sign. level
Soiled egg (%)	4.08±0.85	1.26±0.33	5.16**
Blood spot (%)	0.33±0.17	0.54±0.07	1.48NS
Shape index (%)	77.87±0.08	78.33±0.54	0.03NS
Breaking strength (kg/cm^2)	3.19 ± 0.52	2.97±1.02	2.74*
Shell thickness (mm)	0.38±0.01	0.37±0.01	0.24 NS

*NS, non-significant, **, p<0.001, *, p<0.05, SE, standard error*

Table 3. Internal egg quality characteristics on barn and in cages

Parameter	Barn	Cage	t value and
	Mean ± SE	Mean ± SE	sign. level
Albumen index	0.81 ± 0.01	0.98±0.35	1.637NS
Haugh unit	90.11±1.04	92.97±1.13	0.551NS
Yolk colour score	5.85±0.25	6.75±0.25	0.589*
Yolk index	0.413±0.01	0.407±0.01	0.314NS

*NS, non-significant, **, p<0.001, *, p<0.05, SE, standard error*

The data give an impression that the difference in body weight between rearing systems was not significant (P>0.05). The result coincided with the findings of Bangcong and Cagmat (1990) and Ahammed and Ohh (2013). They reported that housing system had no significant difference on body weight between barn and cages. Present result showed that body weight of cage birds was higher at all ages than those in barn. The result also supported the findings of Balachandran et al (1979), who found higher body weight in cages than on floor.

The result of feed consumption is presented in Table 1. It was revealed that feed consumption of egg laying pullets was significantly (P<0.01) higher on barn than in cages. It was observed that caged birds consumed more feed in all ages than floor birds. Similar result was also reported by Ahammed and Ohh (2013) and Ahammed et al (2014), who reported that birds reared on barn system spent more time for frequent locomotion and tended to consume more feed compared to cage rearing system. Studies have shown that higher stocking densities in cages have been associated with less movement of hens and minimum loss of heat increment, resulting in lower feed consumption (Emmans and Charles, 1977). However, the result was dissimilar to the findings of Singh et al (2009) and Tactacan et al (2009), who found no difference in feed consumption between barn and cage rearing systems in the early stage of egg production. Present result indicated that (Table 1) FC was significantly better in cages than on barn. It is believed that poor FC exhibited by the barn birds probably due to more feed consumption. This is in accordance with the findings of Mostert et al (1995), who reported significantly better FC in cage than those in barn. However, a contradictory result was reported by the findings of Muthusamy and Viswanathan (1998), Ahammed and Ohh (2013) and Ahammed et al (2014) who found non-significant difference in FCR between barn and cages during 1st phase of egge production. A higher feed intake on floor was compensated by higher egg weight and thus FC for egg mass on floor became equalized with that of pullets in cages.

No significant (p>0.05) difference on livability was observed between barn and cages. However, livability was better in cage birds compared to floor (Table 1). During the experimental period, 3 birds died due to cannibalism on barn. The result clearly indicated that rearing system affected the livability/mortality of laying pullets, suggesting that the mortality could be affected by many

different management methods of any housing systems. But it was really difficult to mention that floor system was inferior over cage system in terms of mortality in this study. Similar result was obtained by Tauson et al (1999); Ahammed and Ohh (2013) and Ahammed et al (2014), who reported slightly better liveability in cage birds in early laying period when compared with floor birds. Some other researchers (Al-Rawi and Al-Nour, 1983 and Jin and Craig, 1988) also found non- significant difference in mortality between two systems. However, the result was dissimilar to the findings of Al-Rawi and Abou-Ashour (1983), who found significantly higher mortality in cages than on floor.

Table 2 represents the data of external egg quality parameters in both systems. External egg quality such as shape index, shell thickness and blood spot of shell were not observed any significant differences ($P>0.05$) between rearing systems but shell breaking strength was significantly higher in floor eggs (3.19 kg/cm^2) than that of cage eggs (2.97 kg/cm^2). Some other recent studies (Lewko and Gornowicz, 2011 and Ahammed and Ohh, 2013) also agreed with present results and found no significant differences on shape index between two systems but Ahammed and Ohh (2013) reported significantly higher shell thickness in floor eggs than in cages. Rearing system was also significantly ($P<0.01$) affected the cleanliness of eggs. Higher incidence of soiled eggs was recorded from floor eggs (4.08%) compared to cage eggs (1.26%). The result was coincided with the findings of Ahammed and Ohh (2013), who reported that soiled egg was higher on barn than in cages. The result is also partially supported by Belyavin (1988), who reported that the incidence of dirty and soiled eggs were higher on floor than in cages.

The results of internal egg quality parameters are presented in Table 3. Albumen index and HU in cage eggs was slightly higher on barn, but this was not differed significantly between two management systems. Height of albumen has been considered the main factor of albumen index and HU. Lower albumen height caused the lower albumen index of an egg. Singh et al (2009) and Ahammed et al (2014) found lower albumen height in eggs from floor than cage system, which was also the case in present research. Lower albumen height of eggs may be due to their exposure to ammonia (from litter) which affects albumen quality (Roberts, 2004). Sauveur (1991) and Mohan et al. (1991) also found no significant difference in albumen index between barn and cages. Higher HU value of cage eggs would be attributed to higher albumen height and lower egg weight. The result of the present study is also supported by Venugopal et al. (1982) and Mohan et al. (1991). They reported no significant difference in HU between barn and cages. However, the previous findings of Sharma (1974) and Pavlovski et al. (1994) observed that HU was significantly higher in cages than on barn eggs.

Present study showed that the YCS was significantly higher ($P<0.05$) for eggs from cage than in floor (Table 3). The result of the current study agreed with the findings of Pavlovski et al. (1994) and Ahammed and Ohh (2013), who found significantly higher YCS in cages than on barn. However, Pistekova et al. (2006) found greater yolk color in floor than in cage, but provided no potential reason for the difference. Some previous investigators (Sauveur, 1991 and Mohan et al., 1991) also reported that there was no significant difference in yolk colour between floor pens and cages. Singh et al. (2009) observed differences in the yolk color at different ages among strains in the floor pen. The variation of yolk index between barn and cages was not significantly different. Almost same values of yolk index between floor (0.413) and cage (0.407) eggs were found in the present study (Table 3). The result obtained coincided with the findings of Pavlovski et al. (1994) and Ahammed and Ohh (2013), who reported no significant difference in yolk index between barn and cages. However,

Mohan et al. (1991) found significantly higher yolk index on barn than in cages.

Conclusion

It is therefore concluded that the laying performance of hybrid layers was not remarkably affected by the rearing systems. Some performance parameters such as egg weight, feed consumption and FC were affected by the systems and these were expected, while other differences could not be considered a significant factor for egg users. On the other hand, some egg quality parameters such as shell strength, yolk colour and cleanliness of egg were significantly affected by the systems which are directly related to the egg transfer and consumer preferences. This study also suggested that management of barn should be improved to minimize the soiled egg production and mortality. More research is required to establish a logical explanation of performance variation between two rearing systems.

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