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GROWTH PERFORMANCE OF BROILERS UNDER TWO REARING SYSTEMS IN THREE DIFFERENT HOUSING ZONES IN AN ENVIRONMENTALLY CONTROLLED HOUSE DURING WINTER

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ABSTRACT

An experiment was conducted with the intent to compare the growth performance of broilers housed under two different rearing systems (cage and floor) placed in three housing zones (near vent, middle and near variable speed fans). For this purpose, a total of 240 day old commercial broilers (Hubbard Classic) were reared on floor and cages divided into three above mentioned housing zones. Each treatment was replicated four times containing 10 birds apiece. Weekly data on feed intake, body weight gain, FCR and production efficiency factor (PEF) were recorded and analyzed using Analysis of Variance (ANOVA) technique in Completely Randomized Design (CRD) under factorial arrangements and means were compared through Duncan's Multiple Range Test (DMR). Results revealed that significantly ($P<0.05$) better body weight (2098.25±73.88 g) feed intake (3901.13±134.01 g), PEF (263.34±9.71) and FCR (1.90±0.00) on floor than those reared on the cages. The body weight (2266.81±53.4g) feed intake (4218.50±94.98 g), PEF (284.76±7.16) FCR (1.90±0.00) were found to be best near vents followed by middle and fan area. It may be concluded that birds reared on floor placed near the vent area exhibited better growth performance as compared to those reared in cages in other housing zones.

Key words: broiler, rearing system, growth performance, housing zones.

INTRODUCTION

Environment control housing has made the maximum expression of genetic potential possible in broilers (Kao *et al*. 2011) as harsh environmental conditions have a negative impact on the health and performance of poultry (Dawkins *et al*. 2004; Estevez, 2007). In winter season minimum ventilation is opted to ensure necessary air flow required to provide fresh air containing optimum concentration of oxygen, maintaing good air quality and improving animal welfare (Czarick *et al*. 2012). Air renewal is necessary to keep the ambient temperature at appropriate level in the house during brooding by removal of excessive humidity from the environment in order to keep the litter dry and reduce the obnoxious gases concentration (Cordeiro *et al*. 2010)

There is a unique relationship between temperature and humidity but these parameters of ventilation vary in the house with some fluctuations (Cezarick, 2012) affecting body weight, feed intake and FCR of the broilers in different housing zones. It has been reported that when birds are exposed to low ambient temperature maximum body weight could be achieved between 28 to 35 day (Simmons *et al*. 2003; Dozier *et al*. 2005) however, high temperature has also been reported to have adverse effect on broiler growth performance e.g. body weight gain and FCR (Ahmad *et al*. 2006).

High humidity exerts damaging effect on performance, wellbeing, growth rate and feed consumption of broilers (Daghir, 1995) causing heavy productive losses (Francesch *et al*. 2004) and adversely affecting the respiratory epithelium of the broilers (Kristensen *et al*. 2000) resulting into desquamation of respiratory epithelium. It is documented that 70% humidity is a good indicator for minimum ventilation (Czarick *et al*. 2012) leading to maximum broilers growth. However, low humidity causes dusty conditions, making the birds susceptible for respiratory diseases (Cezarick *et al*. 2012).

Broiler rearing system is a crucial factor affecting bird's comfort, health and production efficiency (Faoud *et al.* 2008). In the recent years, lot of research is being conducted on the alternate rearing systems instead of floor (Zimmerman *et al*. 2006). However, Swain *et al*. (2002) reported that rearing system (floor v/s cage) had no significant effect on feed intake, body weight gain and FCR of the broilers but contrary it has also been documented that rearing system significantly affected body weight, feed intake and FCR of the broilers (Santos *et al*. 2012).

The preceding discussions, present evidence that temperature and humidity may vary in different areas of the house which may ultimately affect the growth performance of broilers. However, the subject has not yet

been fully explored under different rearing systems such as cage vs. floor under environmentally controlled housing system. Keeping this in view the present study was undertaken to evaluate the growth performance of broiler maintained under two rearing systems with three housing zones.

MATERIALS AND METHODS

The present study was conducted at Poultry Research and Training Center (PRTC) Department of Poultry Production, University of Veterinary and Animal Sciences Ravi campus, Pattoki. The experiment was a 2×3 factorial in completely randomized design (CRD) with each treatment replicated four times. For this study a total of 240 day old commercial broilers were divided in 2 rearing system (120 birds in each) (cage v/s floor). In each rearing system, there were three housing zones (near vent, middle, near variable speed fans) consisting of 4 replicates containing 10 birds apiece. These areas were decided on the basis of difference in temperature and humidity under minimum ventilation conditions during sever winter. Water and commercial feed were offered *ad-libitum* to the birds throughout the experimental period. Birds were vaccinated (IBH120, ND and IBD) against the prevailing diseases of the area.

Data collection: The data were collected for feed intake and body weight on weekly basis to calculate FCR, body weight gain and production efficiency factor (PEF).

Statistical analysis: The data thus obtained were analyzed by Analysis of variance (ANOVA) technique in Completely Randomized Design (CRD) with factorial arrangements (Steel *et al*. 1997) and means were compared through Duncan's Multiple Range test (DMR) (Duncan, 1955) using SAS 9.1 software.

RESULTS AND DISCUSSION

Feed intake (gm): Different rearing systems significantly (P<0.05) affected the cumulative as well as weekly (Table 2; Fig 1.1) feed intake in broilers. Broilers reared on floor consumed significantly (P<0.05) more feed (3901.13±134.01g) as compared to cage (3731.63±81.03 g) because birds reared on the floor have ample space which facilitated the birds for normal physiological and metabolic responses, ultimately resulted into more feed intake as compared to cage system where stocking density of the birds was high. Similarly Rodrigez *et al*. (2005) and Swain *et al*. (2002) also reported that broilers reared in cage consumed less feed as compared to those of floor.

The house zones also significantly (P<0.05) affected the cumulative (Table 2) as well as weekly (Fig. 1.2) feed intake of the broiler. The birds placed in the vent area consumed significantly (P<0.05) maximum feed (4218.50±94.98 g) followed by middle (3855.31±23.56 g) and then fan (3375.31±14.21 g) areas of the house. Increased feed intake might be due to the optimum temperature and availability of fresh air in the ventilator area as compared to the elevated temperature and accumulation of obnoxious gases in the other two areas of the house which resulted into less feed intake. Similarly Liberati *et al*. (2009) also reported that lowering down the temperature in the house increases the feed consumption in broilers.

Body weight and body weight gain (gm): Rearing systems significantly (P<0.05) affected the overall means (Table 2) as well as weekly trend (Fig. 2.1) of body weight and body weight gain of the broilers. Broiler reared on floor showed significantly (P<0.05) higher body weight (2098.25±73.88 g) and body weight gain (2056.32±74.05 g) as compared to those of cage (1968.13±49.00 g) and (1927.41±48.83 g) respectively. This may be due to bird's comfort on deep litter system which plays an important role in relieving cage stress. Hence enhancing the physiological and metabolic functions which resulted into higher body weight as compared to those of cages. Similarly Anderson *et al*. (1994) and Tolon *et al*. (1997) also found that birds reared in the cage showed less body weight as compared to those of floor.

Birds grown in the vent area showed significant (P<0.05) difference in overall means (Table 2) as well as in weekly trend (Fig. 2.2) of body weight and body weight gain. The highest body weight (2266.81±53.41g) and body weight gain (2225.69±53.46 g) was observed in vent area followed by those of middle and fan area of house. This could be due to availability of fresh air along with optimum temperature and humidity near vent area which resulted into efficient growth than those of middle and fan area. Similar results were found by Blakely *et al*. (2007) and Cezarick *et al*. (2012) who reported that any variation in the environment surrounding the birds resulted into stunted growth and major productive losses.

Feed conversion ratio (FCR): There was a significant effect of rearing systems (P<0.05) on overall means (Table 2) as well as weekly FCR in broilers (Fig. 3.1). Broilers reared on the floor showed significantly (P<0.05) better FCR (1.90±0.00) as compared to those reared in cage (1.94±0.01) because levels of the oxygen varies between the tiers of the cages, causing difficult breathing, leading unhealthy conditions in the cages by disturbing metabolic systems which ultimately results poor feed utilization. These findings are in line with those of Graham *et al*. (1998) who also reported variation in oxygen availability between tiers of the cage which causes to depress the performance of the broilers. Santos *et al*. (2012) reported that feed conversion ratio of

broilers reared on the floor was significantly (P<0.05) better when compared with those of cages.

Birds grown in the vent area showed significant (P<0.05) difference in overall means (Table 2) as well as in weekly trend (Fig. 3.2) of FCR of the broilers. Birds reared near the vent area had significantly (P<0.05) better FCR (1.90±0.00) followed by middle (1.92±0.01) and fan area (1.94±0.01) of the house. In vent area the conditions (temperature, humidity, and fresh air) were conducive for the birds to exploit their genetic potential by increasing feed intake and body weight resulting into better FCR as compared to the other two housing zones. Similar findings were observed by Katersky *et al*. (2007) who also reported that FCR was adversely affected when temperature exceeds towards the critical temperature limit as it was observed in the fan area of the house.

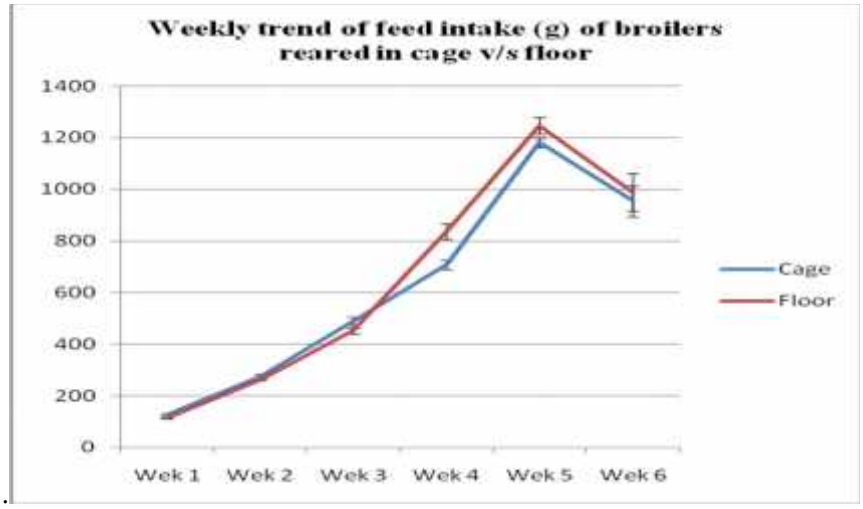

Fig. 1.1. Weekly trend of feed intake of the broilers reared in cage v/s floor.

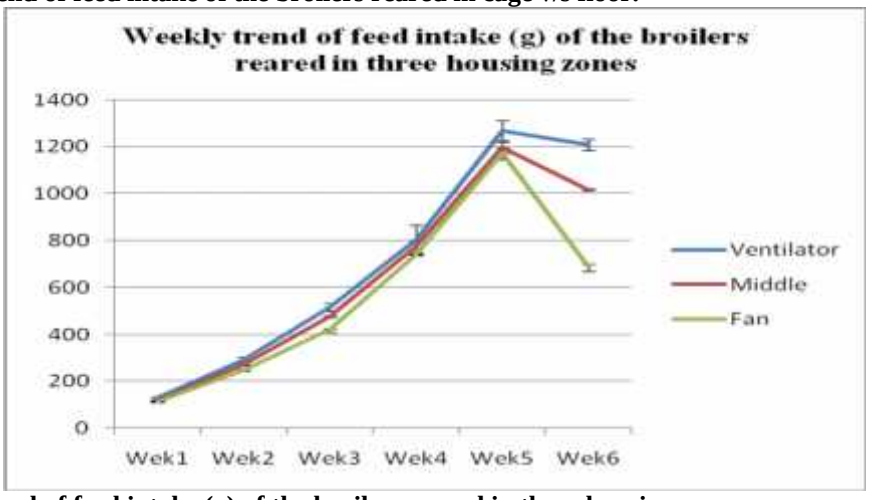

Fig. 1.2. Weekly trend of feed intake (g) of the broilers reared in three housing zones.

Production efficiency factor (PEF): Rearing system significantly (P<0.05) affected the overall means (Table 2) PEF of the broilers. PEF of the broilers reared on the floor was significantly (P<0.05) higher (263.34±9.71) as compared to those in cages (242.08±6.93). Higher efficiency factor in the birds reared on floor might be due to uniform altitude, community conditions of living, easy approach to feed and some unknown growth factors while feed wastage, stress factor and high stocking density which lead to poor feed efficiency in the cages. Similar findings were observed by Santos *et al*. (2012) who also reported that birds reared on floor showed better production efficiency as compared to those of reared in the cages. Santos (2012) also reported better production efficiency for the birds reared on the floor.

Bird grown in the vent area showed significant (P<0.05) difference in overall means (Table 2) of PEF of broilers. Birds grown in vent area had significantly (P<0.05) higher PEF (284.76±7.16) followed by middle (255.07±3.02) and fan (218.30±2.68) area of the house. Fresh air coming from the vents lowers the temperature and creates comfortable environment in this area leading to improved live weight, reduced mortality, improved health and

vigor of the birds. Similar findings were also reported by Feddes *et al*. (2002) who verified improved growth under better ventilation conditions. Lott *et al*. (1998) also reported that body weight of the broiler was positively affected by the air velocity as it was in the vent area of the house.

Fig. 2.1. Weekly trend of body weight (g) of broilers reared in cage v/s floor

Fig. 2.2. Weekly trend of body weight (g) of broilers reared in three housing zones

Fig. 3.1.Weekly FCR of the broilers reared in cage v/s floor

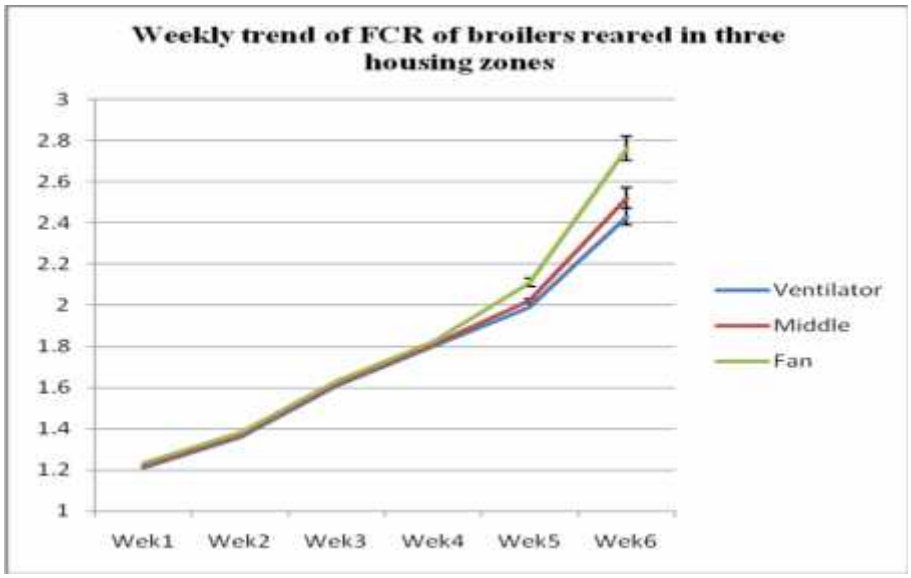

Fig. 3.2. Weekly trend of FCR of broilers reared in three housing zone

Table 1: Temperature and Humidity in three housing zones (Means±SE)

Housing zone	Temperature (˚F)	Relative Humidity (%)
Vent area	71.65±1.01	71.85±0.94
Middle area	76.52±0.69	64.69±0.50
Variable speed fan area	78.76±0.28	62.06±0.82

Table 2: Growth performance of broilers in two rearing system within three housing zones

Performance Variables	Feed intake (g)	Body weight (g)	Body weight gain (g)	FCR	PEF
Rearing systems					
Cage	3731.63±81.03^{b}	1968.13±49.00^{b}	1927.41±48.83^{b}	1.94±0.01^{a}	242.08±6.93^{b}
Floor	3901.13±134.01^{a}	2098.25±73.88^{a}	2056.32±74.05^{a}	1.90±0.00^{b}	263.34±9.71^{a}
Housing zones					
Vent	4218.50±94.98^{a}	2266.81±53.41^{a}	2225.69±53.46^{a}	1.90±0.00^{a}	284.76±7.16^{a}
Middle	3855.31±23.56^{b}	2053.13±16.47^{b}	2011.31±16.45^{b}	1.92±0.01^{b}	255.07±3.02^{b}
Fan	3375.31±14.21^{c}	1779.63±13.31^{c}	1738.59±13.00^{c}	1.94±0.01^{c}	218.30±2.68^{c}
Rearing system× Housing zones					
Cage× Vent	3977.50±49.89^{b}	2129.88±25.09^{b}	2088.65±25.36^{b}	1.90±0.00^{d}	266.29±3.04^{b}
Cage× Middle	3849.50±22.21^{c}	2024.00±11.34^{c}	1982.80±11.56^{c}	1.94±0.00^{b}	248.22±1.40^{c}
Cage× Fan	3367.88±18.90^{d}	1750.50±10.44^{e}	1710.78±10.78^{e}	1.97±0.00^{a}	211.71±1.43^{e}
Floor× Vent	4459.50±29.80^{a}	2403.75±13.44^{a}	2362.73±13.18^{a}	1.89±0.00^{e}	303.23±1.52^{a}
Floor× Middle	3861.13±45.54^{c}	2082.25±23.92^{b}	2039.83±24.22^{b}	1.89±0.00^{e}	261.92±3.03^{b}
Floor× Fan	3382.75±23.40^{d}	1808.75±12.31^{d}	1766.40±12.52^{d}	1.92±0.00^{c}	224.88±1.63^{d}

*Different alphabets on means within a column show significant difference at P<0.05

Conclusion: Based on the findings, an inference could, thus, be drawn from the present study that broilers reared on floor near vent area exhibited better growth performance with optimum feed intake leading to best FCR as compared to those of cages placed in the middle and fan area.

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