The Effects of High-Air Velocity on Broiler Performance[1]

J. D. Simmons,*[,2] B. D. Lott,† and D. M. Miles*

*USDA, Agricultural Research Service, South Central Poultry Research Laboratory, Mississippi State, Mississippi 39762; †Poultry Science Department, Mississippi State University, Mississippi State, Mississippi 39762

ABSTRACT Two trials using a total of 1,484 Ross male broilers were conducted to study the effect of air velocities of 180 and 120 m/min versus still air (<15 m/min) on BW gain (BWG) and feed:gain from 3 to 7 wk of age. Broilers were raised in a common environment to 3 wk of age. The experimental facility was a closed sided house containing eight wind tunnel floor pens and six floor pens. There were two wind tunnels (four pens/tunnel) used to test air velocities of 180 or 120 m/min. At 3 wk of age, 53 birds were placed in pens on litter in each of two wind tunnels (four pens/tunnel) or on litter in floor pens (six pens) in an environmentally controlled facility. All floor pens contained 3.75 square meters of floor space, one tube feeder, and one trough waterer. The temperature regimen was a diurnal cycle of 25-30-25 C with 23 C dewpoint. Air velocities of 180 and 120 m/min had no significant effect on BWG or feed:gain during the first week (3 to 4 wk) in the tunnels as compared with the still air. However, significant improvements were noted in BWG and feed:gains for increased air velocities from 4 to 5 and 5 to 6 wk of age. During the last week (6 to 7), an air velocity of 180 m/min significantly improved BWG and feed:gain, as compared with the 120 m/min or the still air.

(*Key words*: broiler, air velocity, gain, feed:gain)

2003 Poultry Science 82:232–234

INTRODUCTION

The use of tunnel ventilation may have originated from research done 30 yr ago when Drury (1966) noted increased weight gains as air velocity was increased over 7-wk-old birds. In addition, similar results for birds 3- to 6-wk of age were obtained (Drury, 1966). Tunnel-ventilated poultry houses are typically operated with an air velocity of 120 m/min. There is a trend of increasing air velocity in tunnel-ventilated houses. Drury (1966) indicated improved BW with air velocities of 165 m/min but found no improvement in feed utilization. Lacy and Czarick (1992) noted improved BW gain (BWG) of broilers in tunnel- versus cross-ventilated houses. Likewise, Lott et al. (1998) demonstrated improvements in BWG and feed utilization with increased air velocity. Drury and Siegel (1966) observed that after a thermal stress, body temperatures did not stay elevated for as long at high air velocities when compared with lower velocities. More recently, Mitchell (1985) showed that, at 30 C, sensible heat loss of broilers was increased by increasing wind speed. Also, Timmons and Hillman (1993) observed that higher wind speeds increased sensible heat loss and reduced latent heat loss in broilers. Research by Simmons et al. (1996) demonstrated that air velocity did not affect total heat loss, but increasing the air velocity caused a shift from latent to sensible heat loss for temperatures between 29.5 and 35 C. Lott et al. (1998) demonstrated improvements in broiler performance with an air velocity of 125 m/min as compared with an air velocity of less than 15 m/min (still air). The objective of this research was to determine the effect of high air velocity on growth and feed conversion of broilers at normal tunnel-ventilation temperatures.

MATERIALS AND METHODS

Two trials were conducted with 742 male broiler chickens per trial. The chicks were obtained from a commercial hatchery and reared in an environmentally controlled house with normal brooding practices until they were 3 wk old. Corn-soybean-meal diets formulated to meet or exceed National Research Council (1994) requirements were provided to all chickens. The starter diet that was provided until 3 wk contained 3,150 kcal of ME/kg of diet with 1.15 and 0.88% Lys and sulfur AA, respectively. A finisher diet that was provided from 3 to 7 wk of age in both trials contained 3,200 kcal of ME/kg of diet with

Received for publication January 17, 2002.
Accepted for publication September 19, 2002.

[1]Trade names in this article are used solely to provide specific information. Use of trade names does not constitute a guarantee or warranty by USDA and does not signify that the product is approved to the exclusion of other comparable products.

[2]To whom correspondence should be addressed: jdsimmons@msa-msstate.ars.usda.gov.

Abbreviation Key: BWG = BW gain.

TABLE 1. The effect of air velocity of 120 m/min and 180 m/min on weekly BW gain (g) of male broilers in cyclic temperatures of 25-30-25 C

Weight period	Air velocity			
	Weight			
	<15	120	180	SEM
	(g)			
3 to 4 wk	526[a]	545[a]	552[a]	8
4 to 5 wk	579[a]	653[b]	666[b]	9
5 to 6 wk	489[a]	620[b]	650[b]	22
6 to 7 wk	366[a]	504[b]	592[c]	18

[a–c]Values within a row without a common letter are significantly different ($P < 0.05$).

1.03 and 0.83% Lys and sulfur AA, respectively. The starter feed was in crumble form, and the finisher diet was pelleted. When the chickens were 3 wk old, they were separated into 14 groups, and average BW of the groups were equated to 703 g in Trial 1 and 696 g in Trial 2. Six groups were placed in environmentally controlled floor pens, and four groups were placed in pens within the tunnel. Fifty-three chickens were placed in each 1.5 × 2.5 m pen in the floor and tunnel pens (700 cm^2/bird). Temperature, light intensity, bird density, and distance to a feeder and waterer were equal in both the tunnel and floor pen. Trough waterers were used. The tunnel and floor pens were inside the same poultry house (11 × 19 m) with environmental control for temperature and humidity. The air velocity was maintained at a constant 180 m/min within one tunnel and a constant 120 m/min in the other tunnel for the 3-to-7-wk period. Temperature within the house was a diurnal cycle of 25-30-25 C over 24 h. The dewpoint was maintained at a constant 23 C. The incidental air velocity over the birds reared on the floor was recorded at less than 15 m/min.

Ambient temperature and air velocity were measured and recorded every 30 min in the tunnel. BW and feed consumption data were collected weekly. Mortality was recorded daily.

A completely randomized design was used. The data were analyzed using the General Linear Models procedure for ANOVA (SAS Institute, 1994). Significant differences among treatment means were identified using Duncan's new multiple-range test (Duncan, 1955) at the 5% level of probability.

RESULTS AND DISCUSSION

BWG data are presented in Table 1. Air velocity did not affect BWG between 3 to 4 wk. However, at 4 to 5 wk an air velocity of 120 m/min significantly improved BWG in broilers as compared with broilers receiving still air and continued to increase the difference throughout the experimental period. It was not until the final period of 6 to 7 wk that a significant difference was observed in BWG between 120 and 180 m/min.

Feed:gain data are presented in Table 2. No significant differences were noted in feed:gain for the 3-to-4-wk period. Again, increased air velocities improved feed:gain at all other weigh periods similar to BWG. At the 6-to-7-wk weigh period, 180 m/min significantly improved feed:gain over 120 m/min air velocity.

The significant differences noted at the last week of the experiment were attributed to the body mass in relation to the surface area of the broiler body. Hence, body mass increased relative to the surface area, making heat dissipation more difficult. As stated by other researchers (Mitchell, 1985; Timmons and Hillman, 1993; Simmons et al, 1996), increased air velocity increased sensible heat dissipation and decreased latent heat dissipation. It would appear more energy-efficient to dissipate sensible heat rather than latent heat, since panting is not involved in sensible heat dissipation. Latent heat dissipation apparently would require additional energy inputs (e.g., more feed consumption) for panting.

TABLE 2. The effect of air velocity of 120 m/min and 180 m/min on weekly feed:gain of male broilers in cyclic temperatures of 25-30-25 C

Weight period	Air velocity (m/min)			
	Weight			
	<15	120	180	SEM
	(g)			
3 to 4 wk	1.54[a]	1.54[a]	1.55[a]	0.02
4 to 5 wk	1.76[a]	1.69[b]	1.71[b]	0.02
5 to 6 wk	2.26[a]	2.01[b]	1.99[b]	0.07
6 to 7 wk	2.96[a]	2.57[b]	2.13[c]	0.06

[a–c]Values within a row without a common letter are significantly different ($P < 0.05$).

REFERENCES

Drury, L. N. 1966. Air velocity and broiler growth in diurnally cycled hot environment. Trans. ASAE 9:329–332.

Drury, L. N., and H. S. Siegel. 1966. Air velocity and heat tolerance of young chickens. Trans. ASAE 9:583–585.

Duncan, D. B. 1955. Multiple range and multiple F tests. Biometrics 11:1–42.

Lacy, M. P., and M. Czarick. 1992. Tunnel-ventilated broiler houses: Broiler performance and operating cost. J. Appl. Poult. Res. 1:104–109.

Lott, B. D., J. D. Simmons, and J. D. May. 1998. Air velocity and high temperature effects on broiler performance. Poult. Sci. 77:391–393.

Mitchell, M. A. 1985. Effects of air velocity and convective and radiant heat transfer from domestic fowls at environmental temperatures of 20 and 30 C. Br. Poult. Sci. 26:413–423.

National Research Council. 1994. Nutrient Requirements of Poultry. 9th rev. ed. National Academy Press, Washington, DC.

Simmons, J. D., B. D. Lott, and J. D. May. 1996. Heat loss from broiler chickens subjected to various wind speeds and ambient temperatures.

SAS Institute. 1994. SAS Users Guide. SAS Institute Inc., Cary, NC.

Timmons, M. B., and P. E. Hillman. 1993. Partitional heat losses in heat stressed poultry as affected by wind speed. 4th International Livestock Environment Symposium, London. ASAE, St. Joseph, MI.