ISSN 1682-8356
ansinet.org/ijps

INTERNATIONAL JOURNAL OF

POULTRY SCIENCE

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

International Journal of Poultry Science 14 (8): 463-465, 2015
ISSN 1682-8356

Relationship Between Environmental Temperature and Performance Indices of Commercial Broiler Farms in Korea

Kyu Ree Park, Ah Reum Son, Doo Seok Nam and Changsu Kong
Department of Animal Science and Technology, College of Animal Bioscience and Technology, Konkuk University, Seoul 143-701, Republic of Korea

Abstract: This study was conducted to validate the relationship between environmental temperature during feeding period and performance indices in commercial poultry farms in Korea. A total of 406 performance data were used to analyze and the data were provided from the commercial farms which belong to the integrated broiler company in Korea. The data were collected from August 2013 to November 2014. The environmental temperature used in this study was an average temperature of Chungcheong-do in Korea where the commercial farms located. The average environmental temperature negatively correlated ($p<0.05$) with all performance indices except the ADG, medicine cost and total income. There were positive correlations ($p<0.05$) in medicine cost and total income per gain (won/kg/d) with the average environmental temperature. In conclusion, the higher environmental temperature reduced the ADFI, feed cost and total cost but increased total income in the commercial broiler farms in Korea.

Key words: Air temperature, correlation, performance index, poultry

INTRODUCTION

Many factors including nutrition, genetics and environment affect productivity of commercial broiler farms (Sasaki *et al*., 2014). It has been known that poultry is sensitive to environmental temperature and this affect growth performance (Xiao *et al*., 2010). When chickens are under high or low ambient temperature, feed intake decreases, growth are delayed and energy consumption for regulating the body temperature increases. These conditions resulted in decreased performance and productivity for broilers (Donkoh, 1989; Akyuz, 2009; Baracho *et al*., 2011).

It has been reported that effects of environmental temperature on growth performance and productivity for chickens. Most of previous studies were conducted under controlled conditions such as specific temperature (Deaton *et al*., 1968; Donkoh, 1989; Dai *et al*., 2009). However, there may be differences in environmental temperature between the commercial farms and experimental conditions. Therefore, this study was conducted to validate the relationship between environmental temperature during feeding period and performance indices in commercial broiler farms in Korea.

MATERIALS AND METHODS

Data set: A total of 406 performance data used in this study were from the commercial farms belonged to the integrated broiler company in Korea. The data were collected from August 2013 to November 2014. The performance indices included average market weight, feeding period, average daily feed intake (ADFI), average daily gain (ADG), feed conversion ratio (FCR), feed cost, animal cost, medicine cost, fuel cost, total cost and total income. Values for the cost and income were expressed as Korean currency (won) of both per gain and per head.

Temperature data: The temperature data were collected from the Korea Meteorological Administration. The values for the average temperature were measured in Chungcheong-do in Korea because the commercial poultry farms spread out in Chungcheong-do.

Statistical analysis: Data were analyzed using PROC CORR of SAS (SAS Inst. Inc., Cary, NC, USA). The average environmental temperature during the feeding period was used as an independent variable and each performance index was used as a dependent variable. An outlier (difference from median > 2.5 × interquartile range) was removed from the Data set for the final statistical analysis. The experimental unit was a feeding period and the statistical significance was set at p-value < 0.05.

RESULTS

The average environmental temperature during the feeding period and variation of performance indices were presented in Table 1. The environmental temperature during the feeding period ranged from -2.06 to 25.6°C.

Corresponding Author: Changsu Kong, Department of Animal Science and Technology, College of Animal Bioscience and Technology, Konkuk University, 120 Neungdong-ro, Gwangjin-gu, Seoul 143-701, Republic of Korea

Table 1: Average environmental temperature during feeding period and variation of performance indices for commercial broiler farms in Korea

Item[1]	n	Mean	SD	CV	Min	Max
Environmental temperature (°C)	405	12.9	9.24	71.8	-2.06	25.6
Average market weight (kg)	405	1.62	0.15	9.28	1.25	2.05
Average feeding period (d)	405	31.8	1.56	4.90	27.0	35.0
Average daily feed intake (kg)	405	0.08	0.01	7.04	0.07	0.10
Average daily gain (kg)	405	0.05	0.00	7.90	0.04	0.06
Feed conversion ratio	405	1.62	0.09	5.39	1.36	2.05
Feed cost per gain (won/kg)	405	27.5	1.85	6.75	21.4	36.7
Feed cost per head (won/head)	405	44.4	3.55	8.00	34.6	56.4
Animal cost per gain (won/kg)	405	10.5	3.13	29.9	4.89	21.1
Animal cost per head (won/head)	405	16.8	4.63	27.6	8.35	28.3
Medicine cost per gain (won/kg)	405	0.91	0.09	9.55	0.70	1.22
Medicine cost per head (won/head)	405	1.47	0.08	5.18	1.25	1.72
Fuel cost per gain (won/kg)	405	1.67	1.20	72.1	0.31	4.36
Fuel cost per head (won/head)	405	2.70	1.93	71.4	0.54	6.68
Total cost per gain (won/kg)	405	41.0	4.95	12.1	29.4	58.5
Total cost per head (won/head)	405	61.2	6.51	10.7	46.0	81.8
Total income per gain (won/kg)	405	8.16	1.99	24.3	-2.17	14.2
Total income per head (won/head)	405	13.3	3.67	27.6	-3.33	23.4

SD: Standard deviation; CV: Coefficient of variation; Min: Minimum; Max: Maximum

[1]Values were daily basis except average environmental temperature, market weight and feeding period

The average environmental temperature negatively correlated ($p<0.05$) with all performance indices except the ADG, medicine cost and total income (Table 2). The daily fuel cost per gain (won/kg/d; r = -0.956) and fuel cost per head (won/head/d; r = -0.973) highly correlated ($p<0.001$) with the average environmental temperature. There were positive correlations ($p<0.05$) in medicine cost and total income per gain (won/kg/d) with the average environmental temperature.

Table 2: Correlation coefficients (r) between the environmental temperature and performance indices

Item[1]	r	p-value
Average market weight	-0.147	0.003
Average feeding period	-0.239	<0.001
Average daily feed intake	-0.144	0.004
Average daily gain	-0.029	0.556
Feed conversion ratio	-0.151	0.002
Feed cost per gain	-0.328	<0.001
Feed cost per head	-0.447	<0.001
Animal cost per gain	-0.274	<0.001
Animal cost per head	-0.343	<0.001
Medicine cost per gain	0.224	<0.001
Medicine cost per head	0.130	0.009
Fuel cost per gain	-0.956	<0.001
Fuel cost per head	-0.973	<0.001
Total cost per gain	-0.512	<0.001
Total cost per head	-0.487	<0.001
Total income per gain	0.168	0.001
Total income per head	0.086	0.085

[1]Values used for statistical analysis were daily basis except average market weight and feeding period

DISCUSSION

Most of commercial broiler farms providing data were windowed houses. It was reported that growth performance of chickens reared in the windowed house were more influenced by air temperature compared with those reared in the windowless house (Kadim *et al*., 2008). Therefore, there may be correlations in most of performance indices of broilers with the environmental temperature.

The result determined in this study showed that the air temperature was negatively correlated with the ADFI which agreed with literatures (Donkoh, 1989; Geraert *et al*., 1996; Akyuz, 2009; Dai *et al*., 2009). When animals ingest feeds, the heat which comes from nutrients digestion and absorption processes is generated in the animal body. Because the removal of body heat is difficult under the high ambient temperature, the animals try to reduce generating body heat.

In this study, the ADFI decreased with increasing the average environmental temperature during feeding period, but the ADG did not correlate with the air temperature. This may be a reason for decreasing the FCR as the average environmental temperature increased. It was reported that the ADFI, ADG and feed efficiency decreased with increasing the air temperature (Donkoh, 1989). A study reported that broilers reared in summer season had lower the weight gain and feed efficiency as well as greater mortality compared with those in other seasons (Sasaki *et al*., 2014).

The negative correlations in the total cost per gain (won/kg/d) and total cost per head (won/head/d) with the average environmental temperature were observed in this study. Although the ADFI decreased as the average air temperature increased, the total cost per gain (won/kg/d) reduced. The reason for this may be that there was a highly negative correlation between the fuel cost per gain (won/kg/d) and the average environmental temperature. Moreover, a large part of the total cost of rearing the broilers is the feed cost. It seems that the decreased the total cost may be attributed to the decreased feed intake of broilers as well as fuel cost per gain (won/kg/d).

Conclusion: In conclusion, most of performance indices of broilers were negatively correlated with the average environmental temperature. The higher environmental temperature reduced the ADFI, feed cost and total cost but increased total income in the commercial broiler farms in Korea.

REFERENCES

Akyuz, A., 2009. Effects of some climates parameters of environmentally uncontrollable broiler houses on broiler performance. J. Anim. Vet. Adv., 8: 2608-2612.

Baracho, M.S., I.A. Nääs, G.R. Nascimento, J.A. Cassiano and K.R. Oliveira, 2011. Surface temperature distribution in broiler houses. Brazilian J. Poult. Sci., 13: 177-182.

Dai, S.F., L.K. Wang, A.Y. Wen, L.X. Wang and G.M. Jin, 2009. Dietary glutamine supplementation improves growth performance, meat quality and colour stability of broilers under heat stress. Br. Poult. Sci., 50: 333-340.

Deaton, J.W., F.N. Reece and T.H. Vardaman, 1968. The effect of temperature and density on broiler performance. Poult. Sci., 47: 293-300.

Donkoh, A., 1989. Ambient temperature: a factor affecting performance and physiological response of broiler chickens. Int. J. Biometeorol., 33: 259-265.

Geraert, B.Y., J.C.F. Padilha and S. Guillaumin, 1996. Metabolic and endocrine changes induced by chronic heat exposure in broiler chickens: growth performance, body composition and energy retention. Br. J. Nutr., 75: 195-204.

Kadim, I.T., B.H.A. Al-Qamshui, O. Mahgoub, W. Al-Marzooqi and E.H. Johnson, 2008. Effect of seasonal temperatures and ascorbic acid supplementation on performance of broiler chickens maintained in closed and open-sided houses. Int. J. Poult. Sci., 7: 655-660.

Sasaki, Y., R. Uemura, S. Sekiguchi, T. Takahashi, Y. Fujii and M. Sueyoshi, 2014. An analysis of factors affecting production performance in broiler flocks on Japanese commercial farms. Br. Poult. Sci., 55: 737-744.

Xiao, M., P. Huang, P. Lin and S. Yan, 2010. Broiler growth performance analysis: from correlation analysis, multiple linear regression, to neural network. In: Bioinformatics and Biomedical Engineering (iCBBE), 2010 4th International Conference on. IEEE, pp: 1-4.