Vet.Med.J.,Giza. Vol.53, No.4. (2005) : 931-939.

THE EFFECT OF SEASONAL VARIATIONS ON BROILER INTERNAL ENVIRONMENT

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Received: 14.7.2005.
Accepted: 18.7.2005.

SUMMARY

A field study was carried out on two broiler farms (controlled environment ,conventional ventilation) in Eastern Region of KSA to investigate the effect of indoor ambient climatic conditions { ambient temperature ,Ta°C and Relative humidity, RH %) and gaseous pollutants { ammonia (NH_3) & carbon dioxide (CO_2) ppm } during winter and summer on birds internal environment (body temperature ,Tb & hemoglobin concentration (Hb) and heterophil / lymphocyte ratio H/L ratio).

The results revealed highly significant differences between seasons for Ta (P=0.001) and less significance for RH % (P=0.063). NH_3 gas level showed no significant difference within seasons, while CO_2 in winter was significantly higher than in summer (P =0.001).

Ta in winter did not correlate with Tb, but negatively correlated with Hb (P=0.001) while positively correlated in summer with Tb and negatively correlated with H/L ratio (P=0.001 for both).

Indoor RH % in winter was correlated positively with Tb (P0.034) and negatively with both H/L ratio (P= 0.026) and Hb (P=0.001) but in summer it was negatively correlated with Tb and Hb (P=0.001).

Ammonia gas in winter was not significantly correlated with bird measures, while in summer positively correlated with Hb and H/L ratio (P=0.001).

CO_2 gas in winter was negatively correlated with Hb (P=0.001) and H/L (P=0.003) but in summer was positively correlated with Tb (P=0.004) .

Key words : ambient temperature ,Ta°C & relative humidity. RH% & gaseous pollutants .ammonia and carbon dioxide (NH_3 and CO_2) & body temperature, Tb°C & hemoglobin concentration, Hb, g/dl & heterophil /lymphocyte ratio, H/L ratio.

INTRODUCTION

The continual production of intensive livestock production systems has been associated with increased stocking density and herd size. The concentration of aerial pollutants in livestock building normally increases as stocking density rises (Takai et al, 1998). Seasonal variations accompanied with environmental changes (which affect the living organisms responses physiologically) especially heat to maintain their homeostasis, may acclimate, this acclimation include other physical factors such as relative humidity , light and radiation (Brewer, 1988) . Ammonia and carbon dioxide gases may arise and accumulate within stock houses as a result of inadequate ventilation, that associate with more relative humidity (Tom Tabler, 2003). The effect of ambient temperature(Ta°C) on broiler body temperature (Tb°C) was previously studied at different ages , period exposure and breeds and concluded that broilers are so sensitive to thermal changes and used Tb as an important physiological indicator (Cooper and Washburn, 1998; Koh and Macleod, 1999; Deeb and Cahaner, 1999; Setter et al., 1999 and Aengewanich and Simaraks , 2004).

The effects of environmental factors either climatic or pollutants on some blood parameters (H/L ratio) were investigated by Macfarlane and Curtis. 1989; Zulkifli et al., 2003 and Borges et al., 2003.

The present study was planned to evaluate the degree of controlling broiler environment through different seasons on the indoor ambient temperature, relative humidity ,ammonia and carbon dioxide and the effects of these elements on bird internal environment including body temperature, hemoglobin concentration and heterophil / lymphocyte ratio.

MATERIALS AND METHODS

A total 12 field visits (weekly visit) were applied on 2 broiler houses (controlled environment, conventional ventilation) through winter and summer seasons in Adammam , Eastern region in KSA.

The first rearing period started on 1-11-1423h (15-1-2002),total number 14280 bird, stocked at 20 bird/m^2 (winter). The second rearing period started on 25-3-1423h (6-6-2003), total number 11500 bird, stocked at 16 birds /m^2 (summer). The visits started from one day till market age (1-35 ds). The birds were fed and water ad libtum, light applied 23 h/d and had traditional prophylactic program.

Measurements

1- Indoor ambient environmental factors:-

Climatic conditions, Ta°C and RH%, were directly recorded in field by digital thermo hygrometer (Bruzual et al., 2000), the gaseous pollutants were estimated by using Kitagawa pump and detecting tubes for NH_3 range 0, 2-20 ppm and for CO_2 range 1000-2600 ppm (Theresa and Wathes, 1989). The measures were taken from six different representing sites over the building for each visit.

2- Bird internal environmental measures:-

Rectal temperature (Tb°C) were recorded individually by medical thermometer for 10 birds randomly selected each visit (Cooper and Wachburn, 1989). Blood samples were collected in heparinized tubes from wing vein (Huff et al., 1996) to determine Hb. concentration using spectrophotometer at 540 nm then multiplied by factor 36.27 to get Hb / g/dl (Pilaski, 1972).Blood smears were made and stained with Gemsa for WBCs differentiations to obtain H/L ratio in 100 cell (Gross and Siegel, 1983).

3-Statistical analysis: For weekly collected data and all rearing period were done using SPss (descriptive analysis for indoor Ta, C, RH% and gases ppm & correlations between mentioned factors and bird measures and their effects on same measures within seasons) Holander and Douglas , (1973).

RESULTS AND DISCUSSION

The results of field study in winter and summer were grouped accordingly into, **1)** The mean differences of indoor ambient climatic conditions and gaseous pollutants between seasons., **2)** The effect of seasons on bird internal measures. **3)**

Table (1): Mean differences of indoor ambient temperature , relative humidity and gaseous pollutants in controlled environment between seasons.

Days	Climatic conditions		Gaseous pollutants	
	Ta°C	RH%	NH_3ppm	CO_2ppm
1	5.109*** 0.001	1.601* 0.109	0.000 1.000	5.385*** 0.001
7	3.107*** 0.002	2.223** 0.025	5.985*** 0.001	5.385*** 0.001
14	4.836*** 0.001	2.101** 0.036	5.385*** 0.001	5.385*** 0.001
21	5.002*** 0.001	3.215*** 0.001	5.385*** 0.001	NS
28	5.017*** 0.001	NS	NS	NS
35	4.889*** 0.001	NS	NS	NS

Values in columns are of T .test (Mann-Whitney).
* $P \leq 0.05$,** $P \leq 0.01$,*** $P \leq 0.001$.
NS= non significant.

The effect of indoor ambient conditions and 4) gaseous pollutants on bird internal measures.

The mean differences of indoor Ta°C between winter and summer was highly significant from 1-35 days (P=0.0001 and 0.002) but for RH% was highly significant only at 21 d (P=0.001),less significant at 7 and 14 ds (p=0.025 and 0.036 respectively). These results can be attributed to the nature of eastern region in summer where outdoor ambient temperature mostly high, the stocking density (20 bird/m^2) with more heat production that transferred by air through the building, despite the indoor Ta .was not so high Vs outdoor(ranged from 26-47°C) but the values are still high around the birds especially after 4 wks and the expected impact on bird performance as mentioned (Yalcin, et al., 1997). There were no mean differences in NH_3 concentration between seasons, while CO_2 mean values were higher in winter than summer with significant mean difference (P=0.001), this findings was expected as a consequence of poultry men care of preserving indoor warm by minimizing ventilation rate , save fuel cost, without considering accumulation of gases and moisture that increases with growing up, this explanation, although all values in seasons were non stressful to human and birds, these data were in contact with the results of (Weaver and Meijerhof , 1991) who indicated that ammonia gas during the first 2 wks of growing period often very low (undetectable) and added (Estevized and Angles , 2002) that the effect of ammonia on bird health started at concentration of 10 ppm within building.

(Table 2): Effect of seasons on indoor climatic conditions and gaseous pollutants in controlled broiler environment.

Climate & gases	Winter Mean ± SD	Summer Mean ± SD	T.value Sig.
Ta.C	28.680± 0.218	32.626± 0.113	16.140*** 0.001
RH%	58.986± 0.778	60.720± 0.516	1.856* 0.065
NH_3ppm	6.880± 0.862	6.000± 0.930	0.631± 0.800
CO_2ppm	1300.0± 46.449	600.0± 43.496	10.994±*** 0.001

Values in columns are mean +- SD and T.values and the significance,

* $P \leq 0.05$, ** = $P \leq 0.01$, *** $P \leq 0.001$. NS= non significant.

(Table 3): The effect of seasonal climatic conditions on broiler internal environment in controlled environment.

Climate / bird	Summer		Winter	
	RH%	Ta°C	RH%	Ta°C
Tb°C	-0.420*** 0.001	0.465*** 0.001	0.246* 0.034	NS
Hb g/dl	-0.674*** 0.001	NS	-0.443*** 0.001	NS
H/L ratio	-0.529* 0.026	-0.547*** 0.001	NS	NS

* $P \leq 0.05$, ** $P \leq 0.01$, *** $P \leq 0.001$. NS =non significant.

Values in columns are T.test values and Significance.

2) The effect of seasonal indoor climatic conditions and gases on broiler internal environment.

In winter, indoor Ta affected Hb concentration (negatively correlated, P=0.001) while in summer significantly affected Tb positively correlated, P=0.001) and H/L ratio negatively correlated, P=0.001), the non significant, effect of Ta on Tb in winter was not expected according to the findings of (Donkoh, 1989) and (Cooper and Washburn, 1998) who found linear correlation between Ta and Tb. Meanwhile, the correlation with H/L was expected as it varies with changes in temperature and other accidental environmental stress may happen under field conditions as regarded by (Kassab et al., 1992).

4) The effect of gaseous pollutants on bird internal environment in winter and summer.

Ammonia levels were not high in both seasons and did not show significant correlations with internal bird measures, while in summer was significantly correlated with both Hb and H/L ratio (P=0.001). The positive correlation of ammonia in summer with Hb indicates the impact of gas on blood even with non stressful levels, this might be attributed to the increase of Hb with age to cope the oxygen demand for metabolic activity and dissipation of heat produced and of ambient temperature, in addition to the increase of ammonia with age. (indirect correlation of both parameters with age), the gradual increase of ammonia with age was reported by (Xin , et al., 2004).

CO_2 levels were non stressful but higher in winter than summer. It was positively correlated with Hb (P=0.001. and negatively correlated with H/L (P=0.003), while in summer positively correlated with Tb (P=0.004) .The obtained data were expected regarding CO_2 and Hb especially in winter. The effect of CO_2 in summer may attribute to the effect of Ta and the consequent effect on both Tb.

It can be concluded that , broiler controlled environment in eastern region of KSA was characterized by significant increase of Ta°C in summer Vs winter and less increase of RH % . Safe levels of gaseous pollutants mainly ammonia and carbon dioxide although seasonal variation was noticed, higher CO_2 level in winter. Indoor Ta in winter affected only Hb concentration, while in summer affected Tb and H/L ratio. Indoor RH % in winter affected Tb, Hb, and H/L ratio while in summer affected Tb and Hb only. The effects of gases in both seasons on bird internal environment were age-related not to the gases themselves because of their safe levels. The significant effects were to the indoor ambient temperature in both seasons, especially summer.

Table (4): The effect of seasonal indoor gaseous concentration on broiler internal environment under controlled environment.

Gases / Bird	Winter		Summer	
	NH_3	CO_2	NH_3	CO_2
Tb°C	NS	NS	NS	0.325** 0.004
Hb.g/dl	NS	0.571*** 0.001	0.392*** 0.001	NS
HIL ratio	NS	-.399*** 0.003	0.779*** 0.001	NS

Values in columns are T. test values and significance as in other tables.
NS = non significant.

ACKNOWLEDGMENT

The authers gratefully thanking the City of King Fahd Abel-Aziz for Sciences and technology in Ryadh, KSA, for their valid support and funding this work which included in a proposal submitted by postgraduat Zahraa. H. Alghamdi for Ph. D. (Animal ecology).

The authors appreciate the kind help of Dr. Ebtesam. Elseheimy and Dr. Badriah. Al Sowiegh, the physiologists in Zoology Department, Girls College of Science, Adammam, KSA.

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