IMPACT OF SOME MICRO-CLIMATIC ELIMENTS ON BROILER PERFORMANCE

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ABSTRACT

Some microclimatic variables were examined in a poultry house at Dakahlia province. It was clear from the results that the accumulation of carbon dioxide and ammonia inside the poultry house were from the 1st to 7th week of examination(1240/1120 - 3740/3400 p.p.m) and (35/17-75/65 p.p.m) in case of carbon dioxide and ammonia respectively, although the accumulation was higher in summer than in autumn months.

The highest microorganism carrying particles were observed at the 4th week where the R.H% was 82 and temperature of 30°C & 26°C.

There was a marked relationship between Eimeria oocyst count and temperature with pH of the litter, where it reached the highest count at temperature of 29°C and pH of 7.6 (1200) in summer season and (1600) in autumn one.

The coliform count allover the period of examination in autumn weeks was lesser than that in summer weeks.

There was a correlation between the body gain of the birds and temperature with humidity as a microclimatic variable.

INTRODUCTION

The microclimatic variables play an important role in the poultry industry. Any deviation in these variables from the ground state will cause serious deterioration of the atmosphere of the building. The most important microclimatic variables affecting poultry are relative humidity, ambient temperature as well as carbon dioxide and ammonia. The air pollutants usually increased with age of the chick, **Le Bars (1968) and Satish et al. (2002)**. Also, the number of microbes

carrying particles are usually increased in poultry houses. **Hojovec & Fiser (1968) and Wathes et al. (1997)**.

The number of viable microbes are significantly affected by micro climatic factors, the number of microbe carrying particles are greatly increased with increasing temperature. **Bessarabov et al. (1971), Petekov (1975), Platz (1979), Zahran (1980) and Michael et al. (2001)**. Meanwhile, **Saif (1974)** found an inverse correlation between relative humidity and concentration of air-borne particles.

The broiler performance is also affected by microclimatic variables. The ambient temperature below 21°C increases the body weight gain. **Deaton et al. (1984), Carr et al. (1976) and David (1984)**. The relative humidity above 80% greatly affects the body gain. **David (1984)**. Inside the poultry house the ammonia as air pollutant should not increased more than 70 p.p.m otherwise weight gain and feed conversion will be affected, **Reece & Lott (1980), Rcece et al. (1981), David (1984) and Demmers et al. (1995)**.

The average carbon dioxide level inside the poultry house is usually ranged between 2000-3000 p.p.m, **Harwood & Reeee (1975), Reece & Lott (1980) and Amr (2001)**.

The microbial count in the poultry litter is affected by phsico-chemical character of the litter itself. The development of chemical decomposition of organic substance and the establishment of biological equilibrium within the micro-population decrease the microbial count, **Ivos et al. (1966), Hassanien (1971), Arafa et al. (1979), Zakia (1984), Whyte (1993) and Whyte et al. (1993)**.

Long & Millared (1977) noticed that higher number of E.oocyt is observed at 4-5 weeks old. High temperature, ammonia production and bacterial decomposition are factors assist in destruction of oocysts within 2 weeks, **David (1984)**.

MATERIAL & METHODS

A broiler poultry house at Sherbein City, Dakahlia governorate was investigated. The house was climatic provided with electric fans hanged in the roofs. 5,000 Hubberd breed broilers were reared in the house, the bird density was about 13/m^2. The microclimatic variables of the house were observed for a period of 7 weeks over two successive seasons **(Summer & Autumn 2002)**.

A- Air examination :

(1) Physical examination:

1- Ambient temperature. 2- Relative humidity.

5 Thermohygrometers were placed inside the house in different places. The average daily reading was obtained. Results recorded in table (1).

(2) Chemical examination: **(Nadvor 1976).**

1- Determination of carbon dioxide

2- Determination of ammonia

(3) Microbial examination: **(Cruickshank et. al. 1975).**

Two plates of 10 cm diameter of nutrient agar, blood agar, Mac.Conkey agar were used. The plates are placed open for 30 seconds in different places inside the poultry house at a distance of 50-60 cm above the floor level. Then the plates were incubated at 37°C for 24 hrs, then counted, the average count of each two plates was estimated as the sedimentation rate of microbe-carrying particles in 30 sec./10 cm diameter plates.

B- Litter examination :

(1) Temperature:

Temperature of the litter in the house was recorded by inserting ordinary thermometer (0-100C) in the litter for a few minutes till reaching constant reading.

(2) Chemical examination :

1- Determination of pH

10 gms of well mixed litter sample were soaked in 100 ml. dist. water. The PH was measured by pH-meter.

2- Determination of moisture content **(Tuker 1967).**

10 gms of thoroughly mixed litter were placed in a known weight porceline cruicible, the crucible was then kept in hot air oven at 105°C for 5 hrs, then cooled and weighted. The process was repeated several times till two constants successive weights were obtained. Difference in weights represents the moisture content.

3- Determination of ammonia **(Conway 1957).**

(3) Microbial examination :

Samples of the litter were collected under aseptic condition. A handful samples were collected randomly in sterile polyethylene bags from different places of the house.

1- Total Bacterial Count (T.B.C)

1gm of litter was mixed with 9cc sterile saline solution. The mixture was triturated in sterile mortar. 10 fold dilutions were made from the mixture up to 10^{15}.

One ml from each dilution was transferred to each 4 separate sterile plates. Ten ml of standard plate count agar (45°C) were aseptically poured into each dish. After mixing, the plates were solidified and incubated at 22°C for 3 days & 37°C for 48 hrs.

2- Total coliform count :

The presumptive coliform test was performed after chalmer s 1962. Inoculating Mac.Conkeys bile salt lactose broth tubes with 1 ml of previously prepared serial dilution. Inoculated tubes were incubated at 37°C for 48hrs. Positive tubes were subjected to confirmatory test.

3 loopfuls from positive presumptive tubes were transferred into brillient green bile salt lactose broth tubes.

The MPN of coliform /gm was determined according to DeMan s table 1975. Results are recorded in table 2.

3- Total Eimeria oocyst count

(Using McMaster technique according to **Coles 1967**).

2 gms of the litter were crushed and thoroughly mixed with 28 ml of water. 1ml of a clear mixture was placed in a test tube, mixed with 1 ml of sheather's solution. Draw sufficient amount to fill McMaster counting chamber. The slide was placed on the microscope to count the eggs or oocysts. The counted number was multiplied by 300 to give the number of oocysts/gm of litter.

C- Body weight of birds :

20 random chicken were weighted weekly during the rearing period (7 weeks) the average body weight was obtained and recorded in table 3.

RESULTS AND DISCUSSION

In this work, relative humidity, temperature, carbon dioxide and ammonia as microclimatic elements were considered.

Results in table (1) showed gradual increase in relative humidity percent to reach the maximum at the 5th week, although at the 4th week, the two records are similar (82%), in the 5th week the autumn record was higher than summer one (84 and 88%) respectively.

Regarding the temperature, there was a difference of 3°C from the 1st to 7th week in summer

records, while it was 7°C in autumn record. Also, there was a stability in summer recorded temperatures from the 5th week of observation.

Concerning the values of carbon dioxide and ammonia, there was a gradual increase in concentration from the first week to reach the maximum at the 7th week in both summer and autumn (1240 / 1120-3740 / 3400 & 35 / 17-75 / 65 p.p.m.).

From the obtained data in table (1) it is clear that summer season exhibited the highest microclimatic variables which need more attention in poultry management to mitigate the stress effect of these variables.

The number of microorganisms carrying particles as shown from the table showed gradual increase from the first week to reach the peak in the 4th week in both seasons (1100-3000 in summer season and 400-1800 in autumn one) on nutrient agar. This may be attributed to increasing of the birds activity which assist in dust pulvarization or may be as a result of favourite condition of relative humidity and temperature (82 / 82% & 30 /26°C) which encourage the survival and propagation of environmental microorganisms.

The fore mentioned data are merely the same recorded by **Petekov & Tsutsumans (1975), Zahran (1980), Bessarabov (1984), Wathes et al. (1997) and Michael et al. (2001).**

The physicochemical characters of the litter as temperature, hydrogen ion concentration, moisture content and ammonia are important factors for existence and maintenance of disease agents, **Zakia (1984).** If not the above mentioned factors are adjusted and controlled, they constitute adverse state on the bird performance.

Results in table (2) showed a gradual increase in the litter's temperature in summer time from 28-34°C, meanwhile there was a decrease in values in autumn records from 30°C in the first week to reach 22°C at the 7th week. Also, there was an increase in the values of pH, moisture content and ammonia from the 1st week (6.8 /6.6- 8.8 / 8.5, 15 / 15- 52 /45, 0.0080 /0.012-0.080/0.065), respectively.

From the obtained data, it is clear that summer records of physico-chemical analysis of the litter showed higher values than that recorded in autumn examination so, rearing of birds in the summer season need further attention and accommodations rather than other seasons.

Concerning the microbial count in the litter, the highest total count per gram of litter at 37°C and 22°C was recorded at the 7th week, although the count recorded in autumn weeks ($80x10^{11}$) was lower at 37°C than that counted in summer weeks ($200x10^{11}$).

Regarding the coliform count per gm litter, also, there was a gradual increase in both periods of examination from the 1st till 7th week, although the autumn period examination exhibited a

lower count ($20x10^5$ to $70x10^7$) than summer period ($90x10^6$ to $80x10^8$). These findings go hand in hand with that mentioned by **Zakia (1984), Memerine (1984) and Satish et al. (2002)**.

It is interest to notice the existence of Eimeria oocysts in the litter, it reached the peak at the 3rd week in summer reading, when the physico-chemical factors were 29°C, pH 7.6, moisture 25% and ammonia 0.034p.p.m. The same records were merely the same in autumn examination at the 4th week.

Generally, the decrease in oocysts count in the litter may be attributed to turning over of the litter, or increase the ammonia concentration or may be as a result of biological competition, **David (1984)**.

Interpretation of the data recorded in table (3) concerning the effect of different microclimatic factors on body gain, it is clear that the maximum body gain was obtained at the 7th week (1400-1500gm) for summer and autumn records respectively, although in autumn observation, there is a variation in weekly gain from that of summer by at least 150gm.

From the obtained data, it is clear that the microclimatic variables had a great effect on the body gain of the bird specially temperature, ammonia and carbon dioxide, which may impair growth of the bird, **David (1984), Memerin (1985), Donkoch (1989), Kutlu & Michael (1993) and Demmers et al. (1995)**.

The authers recommended the adjustment of these variables either by controlling the temperature and relative humidity of the building or by decreasing the stocking density of the flock.

Table 1. Incidence of air microbes in relation to microclimatic variables.

Intervals In week		Microclimatic Variables				No. of microorganisms Carrying particles		
		RH %	Temp. °c	CO^2 p.p.m	Ammonia p.p.m	N. agar	Blood agar	McConkey. Agar
1	*	75	31	1240	35	1100	1200	750
	**	70	28	1120	17	400	600	300
2	*	75	31	2400	48	1300	1400	850
	**	75	28	2200	30	600	700	450
3	*	77	30	3000	48	1450	1500	900
	**	80	26	2500	30	1200	1250	900
4	*	82	30	3200	60	3000	3050	2500
	**	82	26	2500	42	1800	2000	1300
5	*	84	28	3480	65	1200	1300	1000
	**	88	26	3000	50	1800	2000	1300
6	*	76	28	3700	66	1200	1250	750
	**	80	24	3200	60	1000	1100	750
7	*	77	28	3740	75	1200	1220	530
	**	80	21	3400	65	900	1000	580

* summer records
**autumn records

Table 2. Physico-chemical character and microbial load in poultry litter

Period of exam./ Week		Physico-chemical character				Microbial count			Eimeria oocyst
		Temp. °c	PH	Moisture %	Amm / gm	T.B.C. 37°C	T .B.C. 22° C	MPN	
1	*	28	6.8	15	0.008	$80X10^{7}$	$90X10^{8}$	$90x10^{6}$	00
	**	30	6.6	15	0.012	$62X10^{8}$	$40x10^{8}$	$20x10^{5}$	00
2	*	29	7.0	20	0.012	$86X10^{7}$	$210x10^{8}$	$25x10^{7}$	00
	**	30	7.1	15	0.016	$210X10^{8}$	$105x10^{7}$	$20x10^{5}$	00
3	*	29	7.6	25	0.034	$130X10^{8}$	$150x10^{9}$	$25x10^{7}$	1200
	**	29	7.2	20	0.034	$75X10^{9}$	$200x10^{9}$	$80x10^{5}$	00
4	*	30	8.0	35	0.045	$40X10^{9}$	$110x10^{10}$	$80x10^{7}$	600
	**	29	7.0	28	0.038	$50X10^{10}$	$80x10^{16}$	$60x10^{6}$	1600
5	*	32	8.0	42	0.048	$100X10^{10}$	$200x10^{10}$	$80x10^{7}$	300
	**	28	7.9	36	0.038	$180X10^{10}$	$220x10^{10}$	$20x10^{6}$	800
6	*	34	8.3	48	0.065	$200x10^{10}$	$210x10^{16}$	$80x10^{8}$	00
	**	27	8.0	42	0.050	$200x10^{10}$	$50x10^{11}$	$20x10^{6}$	500
7	*	34	8.8	52	0.080	$200x10^{11}$	$110x10^{11}$	$80x10^{8}$	00
	**	22	8.5	45	0.065	$80x10^{11}$	$220x10^{11}$	$70x10^{7}$	00

* Summer records.
** Autumn records

Table 3. Body gain of chicken in relation to microclimatic variables.

Age of bird /week	Microclimatic Variables				Average body weight in gm.
	Temp. °C	R.H%	Amm. p.p.m	CO_2 p.p.m	
1 *	31	75	35	1240	85
**	28	70	17	1120	100
2 *	31	75	48	2400	200
**	28	75	30	2200	250
3 *	30	77	48	3000	300
**	26	80	30	2500	340
4 *	30	82	60	3200	600
**	26	82	42	2500	700
5 *	28	84	65	3480	850
**	26	88	50	3000	1000
6 *	28	76	66	3700	1200
**	24	80	60	3200	1300
7 *	28	77	75	3740	1400
**	21	80	65	3400	1500

* Summer records.
** Autumn records.

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الملخص العربى

تأثير بعض العوامل المناخية المتغيرة على آداء بدارى التسمين

المشتركون فى البحث

المتولى عبدالعاطى طه سويلم محمد لطفى على الغنام عادل حلمى نجيب الجوهرى

لقد تم من خلال هذه الدراسة فحص إحدى مزارع بدارى التسمين بمحافظة الدقهلية حيث تم قياس العوامل المناخية المتغيرة لمدة سبعة أسابيع فى موسمين متتابعين هما الصيف والخريف عام ٢٠٠٢م. حيث تم فحص الهواء والفرشة فى المزرعة من الناحية الفيزيائية والكيميائية كذلك تواجد الميكروبات بهما. كما تم دراسة الزيادة فى وزن بدارى التسمين خلال فترة الدراسة.

وقد أسفرت النتائج عن الآتى :

١- تراكم غاز ثانى أكسيد الكربون وغاز النشادر فى مساكن الدواجن فى الفترة مابين الإسبوع الأول والإسبوع السابع حيث كان غاز ثانى أكسيد الكربون فى الإسبوع الأول ١٢٤٠ / ١١٢٠ جزء فى المليون فى الإسبوع الأول وزاد إلى ٣٧٤٠/ ٣٤٠٠ جزء فى المليون فى الإسبوع السابع، كذلك كان غاز النشادر ١٧/٣٥ جزء فى المليون فى الإسبوع الأول وزاد إلى ٦٥/٧٥ جزء فى المليون فى الإسبوع السابع فى فصل الصيف والخريف على التوالى، كذلك كان معدل التراكم عالياً فى شهور الصيف عن شهور الخريف.

٢- أظهرت النتائج أن أعلى معدل الجزيئات الحاملة للميكروبات كان فى الإسبوع الرابع حيث كانت الرطوبة النسبية ٨٢٪ ودرجة الحرارة بين ٢٦- ٣٠°م.

٣- يوجد علاقة بين عدد بويضات طفيل الإيميريا ودرجة الحرارة والأس الهيدروچينى (pH) لفراشة الدواجن حيث أن أعلى معدل قد سجل عند درجة حرارة ٢٩°م؛ والأس الهيدروچينى ٦ر٧ وكان العدد ١٢٠٠ فى فصل الصيف و ١٦٠٠ في فصل الخريف.

٤- كذلك سجلت النتائج أن عدد ميكروبات coliform كانت أقل خلال أسابيع الخريف عنها فى أسابيع الصيف.

٥- كذلك كانت هناك علاقة بين الزيادة فى وزن بدارى التسمين والحرارة مع الرطوبة كعوامل مناخية متغيرة.

حيث تم دراسة أثر هذه المتغيرات المناخية على آداء بدارى التسمين، وننصح بضبط وتعديل هذه العوامل المناخية المتغيرة أو تقليل كثافة الطيور فى المزرعة.