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IMPACT OF STOCKING DENSITY ON BROILER INTERNAL ENVIRONMENT HOUSED IN CONTROLLED AND NON CONTROLLED ENVIRONMENTS

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SUMMARY

The current experiment was conducted to investigate the influence of increased stocking density (as a management practice) in environmentally controlled (closed) and non controlled (open) broiler houses, on their internal parameters (body temperature, Tb., Hemoglobin concentration Hb.g/dl, heterophil / lymphocyte ratio H/L, somatic indices of liver , spleen and bursa fabricus , B.f) as well as their histological alterations and final productivity included live body weight (LBW /g) and mortality (M%). The results showed, negative correlation between Ta. C° and Tb. C° in control group of closed house .Increased NH_3, CO_2 concentrations and mortality % with age .In open house positive correlations were noticed between indoor Ta C and B.f index , between CO_2 and each of Hb. concentration , H/L ratio and mortality %. Indoor NH3 and CO_2 were positively correlated with Hb .concentration in birds of open house. In closed and open environments, there were significant differences (decrease) in LBW between stocked and their control groups at 42 days old. Stocking significantly increased Tb .C Vs control groups in both environments but did not significantly affect hemoglobin concentrations. The H/L ratio in closed house showed non significant increase Vs control ,while in open house a little decrease was recorded in stocked Vs control. Conclusively, proper management could enhance stocked birds in current work to modulate their internal homeostasis to cope the resulted harsh microclimate with final

reasonable productivity regarding the used Cobb-500 breed. Tb. and H/L ratio were indicative of internal nonspecific stress response despite the individual variety in their values . The recorded histological alteration of stocked broiler organs ranged from mild to severe , the liver and lung responses were indicative of acute stress but spleen of broilers in closed severely affected and bursa response was varied. The current results threw light on the importance of histological investigation as a measure of increased stocking density impact on internal organs even with low mortality rate. Age related histological changes not easily to be distinguished from stress induced ones for bursa fabricus .

INTRODUCTION

The effect of increased stocking density (available floor area cm²/ bird) on broiler might include loss of their final body weight , increased mortality ,morbidity ,internal environmental alteration as blood hemograms (hemoglobin concentration, altered WBCs percents) as well as behavioral disorders .Many authors investigated the effect of increasing birds density on floor area (confinement place) on mortality, food conversion rates, breast blisters at evisceration with low grade carcasses which increased significantly. Decreased breast muscle thickness ,vitality as well as decreased live body weight linearly with increased stocking number from 7-10-16-23 birds/m². In addition to increased the incidence of foot bad inflammation , dermatitis ,interfered with birds stability and welfare. Increased the litter moisture content, let litter more wet and fragile , increased house temperature, heat stress and microbial activity with ammonia production and emission which severely affected birds health and productivity. Decreased food utilization and growth rate , increased seasonal (winter and summer) incidence of Sudden Death Syndrome mortality in baby chicks when reared from 1-63 or 24-43 days old as well as decreased final BW gain and food intake in summer, when stocking reached up to 20 birds/ m² as reported by (Proudfoot, et al;1979 .Quinones et al ; 1984 ; Delev, and Dzhankor,1986 ; Blokhius, and Vander Haar,1990; Bruce at al;1990 and Grashorn and Kutritz, 1991 ; Bilgili, and Hess, 1995; Martenchar, et al; 1997 ; Imaeda ,2000 ; Reiter and Bessei, 2000 ; Pettit-Riley and Estevez, 2001 ; Segura et al; 2002 and El-Deek and AL-Harthi ,2004).On the other hand (Mizubuti et al; 1994) mentioned, stocking at low rates 10,12,14 did not affect significantly

the increase in BW. The blood profile and white blood cells badly affected with increased density where reduced lymphocytes and monocytes but increased heterophil especially at 7 weeks old (Stevenson and Taylor ,1988 ,and Cravener et al ;1992),despite within birds the H/L ratio characterized by individual variety and diversity regarding birds ability to synthesize and release the lymphocytes, a fact must be considered even under strict controlled environmental conditions (Talebi et al; 1995). Therefore the current experiment was conducted to throw light on the impact of stocking density in summer season and different houses on broiler's internal environment included hemoglobin concentration , heterophil / lymphocyte ratio as well as the somatic indices of hem-organs (liver and spleen) and bursa fabricus gland , their histological alteration and the final body weight and mortality % as measures of performance.

MATERIALS AND METHODS

1) Experimental units

The experimental unit was constructed followed the recommended environmental requirements after (Sainsbury, 2000 and Moura et al; 2001).The floor area was 5x3m (15m²)x3 m height with conventional controlled ventilation system and 2 exhaustion fans (30 x30 cm dimension and 2300m³/ hour capacity) for controlled house but with fans and natural ventilation for open house.

2) Management and stress procedures

Total 380 one day old chicks , mixed sex (Cobb-500) were obtained from the recent poultry company in Dammam ,Eastern region ,KSA. They were divided into two groups one housed in controlled environment 200 birds (closed house), the second was in naturally ventilated house ,180 birds (open house). Each group was kept on litter floor with 3-5 cm thickness .Indoor ambient temperature started at 34 C then declined gradually 1 C each 2 days according to (Sainsbury , 2000) ..Indoor relative humidity was kept with range 60-70 % (Aengwanish and Simaraks ,2004) . Food and water were allowed *ad libitum* . Light was available 23 hour/day (Smith and Bartlit,2001).Traditional prophylactic program was applied through rearing period. The birds were housed and managed properly as could as possible till 21 days old then each group subdivided into two groups one subjected to increased number of birds/ m² as 17 birds in closed house and 15 birds in open one while the rest were kept as control for each unit as 12 and 10 birds/ m² respectively. The

stocked birds were marked with plastic leg tags.

3) Measures

1-Indoor Ta.C , RH % and A.V m/sec were checked daily using thermo-hygrometer and anemometer (Lott et al;1998) to keep proper environment for all birds till 21 days old .The indoor ammonia (NH3) and carbon dioxide (CO_2) concentrations were estimated in part per million (ppm) by using Multigas detector , Kitagaw pump and detecting tubes (Theresa and Wathes,1989).

2-Body temperature (Tb.C) were recorded from both control and stocked group, for 10 randomly selected birds using digital mercury thermometer then they were weighed for recording LBW weekly .Mortality was recorded daily for weekly percents.

3-Blood samples with anticoagulant were collected from brachial vein of the randomly selected 10 birds for determining hemoglobin concentration using spectrophotometer at 540 nm wave length and multiplying the reading by 36.77 factor to get Hb.g/dl (Pilaski ,1972 and Huff et al; 1996).

4-Blood smears were made directly and stained with Geimsa for WBcs count and estimation of heterophil/ lymphocyte ratio as non specific stress response (Rajmane ,1996 and Zakia and Gross ,1996).

5-The selected birds were scarified to get internal organs mainly liver, spleen and bursa fabricus for weighing and recording their somatic indices as a ratio to the BW (Plavnik and Yahav ,1998). The tissue specimens of these organs and the lung were kept in 10 % buffered formalin solution , washed in running tap water ,dehydrated in serial dilution of alcohol ,cleaned in xylene and embedded in paraffin beas-5 U section were obtained and stained by hematoxylin and eosin for histological investigation (Luna , 1968) and the lesions had been evaluated (Wheater et al; 1989).

4-Statistical analysis

The obtained data were subjected to descriptive analysis ,correlations (r-value) and T test . Using personal computer and Spss .V10 . * = low significant $p \leq 0.1$. ** = Significant $p \leq 0.05$. *** = highly significant $p \leq 0.01$.

RESULTS AND DISCUSSION

Results shown in table 1 a,b, indicated significant negative correlations between indoor Ta.C and both of Tb. and H/L ratio (P=0.03 and 0.07) as well as with LBW and mortality % (P=0.01, 0.19)) in control birds of closed house. Liver index was positively correlated with Ta. (P=0.01), CO_2 with mortality % (P=0.06). In open house positive correlations were between indoor Ta and B.f index. (P= 0.1), CO_2 and each of Hb. concentration, H/L ratio and mortality (P= 0.01, 0.1, 0.1 respectively).The negative correlation between closed house Ta. and Tb .might be attributed to dry condition in this summer (RH was ranged 44-50 %) which allowed more heat dissipation of body heat produced (via evaporation) ,in addition to controlled ventilation .The liver index and Ta. correlation was recorded when bird subjected to artificial or induced stress with ACTH or elevated indoor Ta. by (Thaxton & Puvadolpirod, 2000). The correlation between Ta . and B.F index might be due to increased its weight with age (3-5 weeks) then stabilized at 5-6 wks(approximate ,experimental period) which occasionally matched with increased indoor Ta. with age , this result coincided with that reported by (Whittow ,2000). Many workers confirmed the significant effects of indoor Ta.C on LBW and mortality % as (Veldkamp ,et al; 2000 and Deeb & Cahaner ,2001). Indoor NH_3 and CO_2 had positive correlation with Hb concentration in birds of open house (P<0.01) , this result could be due to increased values of these variables with age not to their direct inter-relation specially the indoor gases values were non stressful limits , Redwine et al; 2002 recorded increased NH_3 with age.

Data recorded in (table 2 a,b), clarified the effect of stocking on bird internal parameters and final LBW. In closed and open environments , there were significant differences (decrease) in LBW between stocked (17, 15 birds/ m^2) and the control groups(12, 10 birds /m^2) respectively at 42 days old (P<0.01). These results coincided with (Weaver et al; 1982, Qunones et al;1984 , Bruce et al, 1990 ; Reiter and Bessei ,2000) but disagreed with (Mizubti et al;1994 and Bilgli and Hess, 1995). Birds Tb .showed significant increase Vs control groups in both environments, (P=0.01 and 0.05), this might be due to stocking and confined places created a new microclimate

around the bird with increased heat radiated, beside decreased air flow in between, that imposed upon birds body, in addition to the impact of summer Ta.C at this situation the bird might not be able to get ride of excess heat produced and failed thermoregulatory mechanism ,therefore increased their Tb.C , this explanation previously reported by (Feddes et al; 2002).The current stocking density did not significantly affect hemoglobin concentrations in comparison to control groups ,beside their values were within normal levels of Cobb-500 according to (Smith et al;1995).The H/L ratio of bird in closed house showed non significant increase Vs control birds ,while in open house a little decrease was recorded in stocked Vs control .The increased heterophil number under stocking stress was reported by (Stevenson and Taylor, 1988).The wide variety in individual values of H/L ratio in birds and their ability to synthesize and release the lymphocyte even under severe strict environmental conditions was confirmed by (Talebi et al;1995) as well as this ratio was considered as valid indicators of chronic stress as stocking despite their were no significant differences in H/L ratio at 12.16 .20 birds / m^2 (Martenchar, et al;1997). The interrelationship between different housing and increased white blood cells responsible for non specific immune response as heterophil was reported by (Shini ,2003) where houses slightly affected differential leukocyte count and H/L ratio. The histological findings of spleen in the control broilers in closed characterized by diffused focal aggregation of lymphocytes in white pulp and necrotic changes in red pulp but in open house diffused focal aggregation in white pulp and thicken blood vessels walls (micrographs 9&13). Mild changes in liver of broilers in closed house within normal hepatic architecture regarding age and environmental controlled house, manifested as mild fatty degeneration ,dilated sinusoids with kuffer cells in between ,while in open house severe dilated central vein and sinusoids (micrographs 10 & 14). Bursa fabricus in closed house characterized by intra-follicular inflammatory cells infiltration and fibrosis while in open one desquamated epithelial lining mucosa with diffused inflammatory cells underlying lamina (micrographs11&15). Lung in closed house revealed inflammatory cells infiltration and hyperemia but in open one only inflammatory cells infiltration (micrographs 12 & 16). The disorders in lipid

Metabolism (may with altered finisher diet ingredients) may result in accumulation of lipid as droplet in the hepatic cells and during staining slides these droplets appeared as vacuoles as illustrated by (Wheaters et al . 1989).The recognition of focal aggregated

lymphocytes in birds not so remarked normally as in mammals but under stress it can be recognized in birds as recorded by (Randall & Reece,1996). Bursa undergoes normal growth regression pattern from 2-6weeks old (maturity) so atrophied with remarked lymphocytes depletion and necrosis or may be viral infection or vaccination contribution according to (Pettit et al, 1983; Pope ,1991 and Hair-Bejo et al; 2004).The inflammatory cell infiltration and hyperemia were an acute stress response which might be physiological or environmental microbial interference with birds homeostasis after (Wheaters et al ,1989).The stocked broilers indicated , spleen (micrograph 1) of broiler in closed revealed necrotic changes in white pulp and hyperemic red pulp while in open (micrograph 5) focal aggregation of lymphocytes in white pulp .Liver (micrograph 2) in close house remarked by dilated central vein and bile duct hyperplasia with focal aggregation of white blood cells while in open one (micrograph 6) , severe dilated sinusoids with inflammatory cells and kuffer cells infiltration .Bursa fabricus (micrograph 3) in closed house characterized by central follicular necrotic changes and fibrosis between follicles with inflammatory cell infiltration ,while in open house micrograph7, desquamated epithelia lining mucosa with diffused inflammatory cells in underlying lamina propria .Lung (micrograph 4) in closed house indicated hyperplasia in peri-bronchioles with infiltration of inflammatory cells and edema while in open one (micrograph 8) , severe dilated blood vessels and inflammatory cells infiltration .The recorded histological alteration of stocked broiler organs ranged from mild to severe , the liver and lung responses were indicative of acute stress but spleen of broilers in closed severely affected, bursa response varied, might be due to its normal growth regression with age or involvement of increased Ta and Tb as mentioned in tables 1,2 with consequent impact on bursa ,lung, spleen and liver. The stocking induced alteration of bird internal environment with physiological and histological manifestations which were mostly reversible .Many authors recorded the effect of elevated Ta ,Tb and indoor gases with age or increased stocking on architectural and functional alteration of internal organs as (Julian , 1989 , Pope , 1991; Nakamura et al; 1999 ;Yang et al 2002;Aengwanish and Simaraks,2004 and Zakia and Zahraa,2005). Conclusively, the decreased floor area allowed / bird in both houses decreased final BW Vs control ,increased Tb. and H/L ratio (more in closed one) and did not affect Hb. concentration. Indoor gases increased with

stocking (more in closed) in summer season . Tb. and H/L ratio were indicative of internal nonspecific stress response despite the individual variety in their values.

Proper management could enhance stocked birds in current work to modulate their internal homeostasis to cope the resulted harsh microclimate with final reasonable productivity regarding the used Cobb-500 breed .The current results threw light on the importance of histological investigation as a measure of increased stocking density impact on internal organs even with low mortality rate. Age related histological changes not easily to be distinguished from stress induced ones for bursa fabricus .

Table (1 a): Effect of indoor climatic conditions on bird's internal environmental parameters in control group of closed house.

Indoor air Parameters	Birds internal parameters						Productive Performance	
	Tb. C°	Hb (g/dl)	H/L Ratio	LI	SI	BfI	BW/ g	M.%
Ta. °C	-.841** .03	-.714 .11	-.771* .07	.886*** .01	-.471 .34	.657 .15	-.943*** .01	-.617 .19
RH%	.319 .53	-.143 .78	.029 .95	-.257 .62	.000 1.00	-.086 .87	.429 .39	.617 .19
NH_3 ppm	.647 .165	.638 17	.638 .17	-.696 .12	.418 .41	-.435 .38	.696 .12	.376 .46
CO_2 ppm	.525 .28	.000 1.00	.000 1.00	-.414 .41	-.320 .53	.000 1.00	.414 .41	.783* .06

Table (1-b) :Effect of indoor climatic conditions on bird's internal environmental parameters in control group of open system

Indoor air parameters	Birds internal parameters						Productive performance	
	Tb. C°	Hb (g/dl)	H/L ratio	LI	SI	BfI	BW/ g	M.%
Ta.C	-.429 .39	-.371 .46	-.657 .15	.371 .46	-.464 .35	.725* .10	-.714 .11	.247 .63
RH %	.257 .62	-.143 .78	.314 .54	-.486 .32	.464 .35	-.203 .70	.657 .15	.062 .90
NH3ppm	.464 .35	.928*** .01	.522 .25	-.464 .35	.397 .43	-.191 .71	.464 .35	.454 .36
CO2 ppm	.638 .17	.928*** .01	.725* .10	-.696 .12	.250 .63	-.426 .39	.638 .17	.720* .10

Values in columns are correlation value (r)

* = low significant $p \leq 0.1$. ** = Significant $p \leq 0.05$. *** = highly significant $p \leq 0.01$.

LI, SI and BfI are the liver , spleen and bursa fabricus somatic indices (the percent of organ weight to body weight) .

Table (2a): Effect of stocking density on bird's internal environmental parameters at 42 days .old in closed ecosystems .

Bird's measures	parameters at 42 ys .old in closed ecosystems .		
	Control	Stocking stress	T-test
BW/g	2062.4 222.43	1701.2 213.75	2.949*** .01
Tb. C°	41.7 . 234	41.2 0.295	3.261*** .01
Hb g / dl	9.53 .540	10.21 1.681	.613 .54
H/L ratio	1.65 .588	2.11 1.412	.492 .62
LI	2.00 .424	1.800 .212	.775 .43
SI	.100 .028	.065 .007	1.549 .12
B.f I	.065 .007	.045 .007	1.549 .12

Values in columns are Means ± SD.
T test values = Comparison between control groups and stocked group.
BW/g :Body weight in gram . Ta. C : ambient temperature in centigrade.
Hb . g/dl: Hemoglobin concentration in gram/deciliter of blood.
H/L ratio :The ratio of heterophil to lymphocytes cells in 100 while blood cell .
LI, SI and BfI are the liver , spleen and bursa fabricus somatic indices (the percent of organ weight to body weight) .

Table (2 b): Effect of stocking density on bird's internal environmental parameters at 42 days old in open ecosystems

Bird 's measures	Control.	Stocking stress	T-test
BW/g	1719.8 91.77	1371.4 154.51	3.369*** .01
Tb. C°	42.5 .501	42.0 .458	1.896** .05
Hb.g/dl	9.23 .733	9.01 .477	.911 .36
H/L ratio	2.99 1.787	2.34 1.525	.835 .40
LI	2.000 .424	1.895 .205	.000 1.00
SI	.075 .007	.055 .007	1.549 .12
B.fI	.065 .007	.040 .042	.408 .68

Values in columns are Means ± SD.
T = Comparison between control groups and stocking density stressed group.
BW/g :Body weight in gram . Ta. C : ambient temperature in centigrade.
Hb . g/dl: Hemoglobin concentration in gram/deciliter of blood.
H/L ratio : The ratio of heterophil to lymphocytes cells in 100 while blood cell .
LI, SI and BfI are the liver , spleen and bursa fabricus somatic indices
(the percent of organ weight to body weight).

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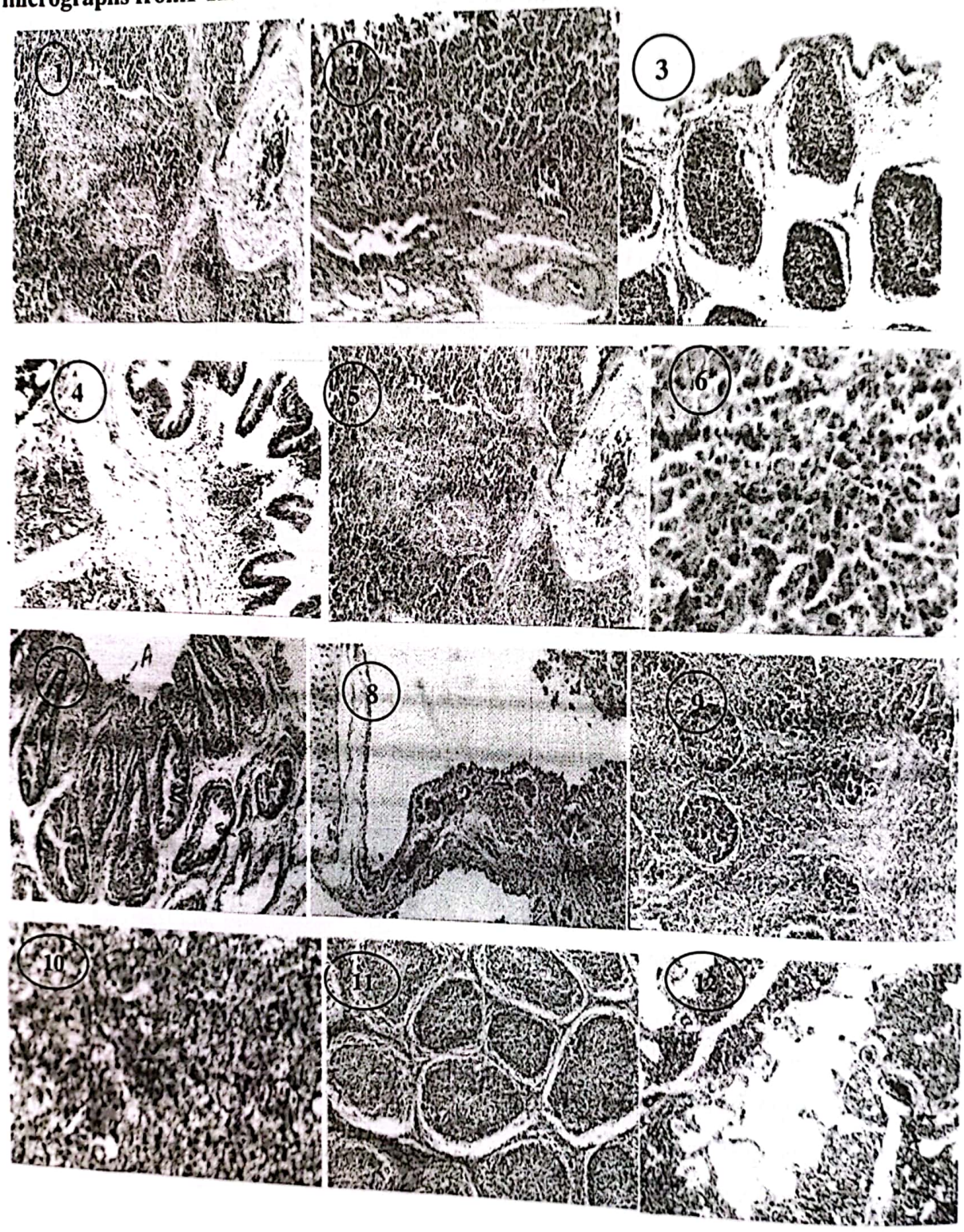
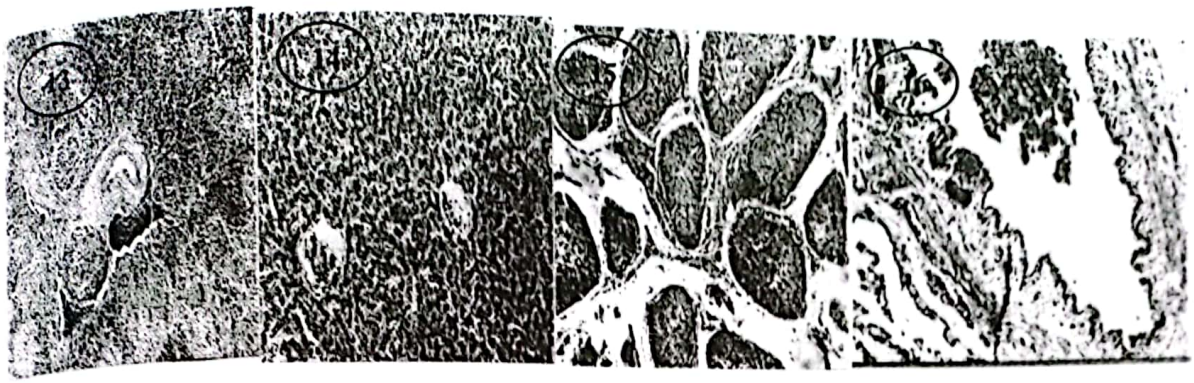
Histopathological alterations in the internal organs of stocked birds as listed in Legend 1 micrographs from1-12.





Micrograph 1: Spleen of stocked Cobb-500 broiler at 42 days old in closed house showing necrotic changes in white pulp and hyperemia in red pulp associated with focal circumscribed aggregated lymphocytes (H&E x 40).

Micrograph 2 : Liver of stocked Cobb-500 broiler at 42 days old in closed house showing dilated central vein and bile duct hyperplasia associated with focal circumscribed inflammatory cell aggregation (H&E x 40).

Micrograph 3: Bursa fabricus of stocked Cobb-500 broiler at 32 days old in closed house remarked by intra follicular necrosis associated with diffuse inflammatory cells infiltration and fibrosis in the stroma of connective tissue of lamina propria as well as ulceration of the mucosal epithelia (H&E x 40).

Micrograph 4: Lung of stocked Cobb-500 broiler at 42 days old in closed house showing hyperplasia of epithelia lining bronchioles associated with infiltration of inflammatory cells and edema (H&E x 40).

Micrograph 5:Spleen of stocked Cobb-500 broiler at 32 days old in open house showing focal circumscribed white blood cells aggregation in white pulp (H&E x 40).

Micrograph 6-Liver of stocked Cobb-500 broiler at 42 days old in open house showing severe dilated sinusoids and inflammatory cells infiltration with Kuffer cells (H&E x 160).

Micrograph 7: Bursa fabricus of stocked Cobb-500 broiler at 42 days in open revealed desquamated epithelia lining mucosa associated with diffused inflammatory cell in underlying lamina propria in addition to central depletion of follicular lymphocytes (H&E x 40).

Micrograph 8:Lung of stocked Cobb-500 broiler at 32 days old in open house revealed infiltration of peri bronchial tissue with massive number of mononuclear white blood cells with severe dilated blood vessels (H&E x 40).

Micrograph 9: Spleen of control broiler in closed at 42 days old revealed diffused focal circumscribed aggregation of lymphocytes in white pulp and necrotic changes in red pulp (H&E x 40).

Micrograph 10: Liver of control broiler at 42 days old in closed house showing normal architecture with mild fatty changes ,dilated sinusoids with Kuffer cell (H&E x 40).

Micrograph 11:Bursa of control broiler in closed house revealed mild follicular lymphocytes depletion with intra follicular fibrosis (H&E x 40).

Micrograph 12: Lung of control broiler in closed house at 42 days old showing inflammatory cells infiltration and hyperemia (H&E x40).

Micrograph 13:Spleen of control in open house at 42 days old showing diffuse focal circumscribed lymphocytes aggregation and thickened blood vessels walls (H&E x 40).

Micrograph 14: Liver of control broiler at 42 days old in open house remarked by dilated sinusoids and central vein with inflammatory cells infiltration (H&E x 40).

Micrograph 15 : Bursa fabricus of control broiler in open house remarked by central lymphocytes depletion and necrosis (H&E x 40).

Micrograph 16: Lung of control broiler in open house inflammatory cell infiltration (H&E x 40).

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التأثير الضار لزيادة كثافة التسكين على البيئة الداخلية للطيور اللاحمة المسكنة بالبيئة المنضبطة وغير المنضبطة

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أجريت التجربة الحالية لتفحص تأثير زيادة كثافة التسكين ببيئة الطيور اللاحمة (المنضبطة- المغلق) وغير المنضبطة- المفتوح) على معايير بيئة الطائر الداخلية والممثلة في درجة حرارتة و تركيز خضاب الدم ونسبة خلايا الدم البيضاء غير متجانسة الصبغ إلى الليمفاوية و المؤشرات الجسدية للكبد والطحال و غدة فابريشيا والتغيرات النسيجية المرضية للكبد والطحال والغدة والرئة ، كذلك الإنتاجية النهائية كالوزن الحي ومعدل النفوق. **أوضحت النتائج** : العلاقة السلبية بين درجة حرارة الهواء الداخلي وحرارة الطائر بالمجموعة الضابطة بالمسكن المغلق مع زيادة تركيز غازي النشادر وثاني أكسيد الكربون ومعدل النفوق مع تقدم العمر . بالمسكن المفتوح لوحظت العلاقات الإيجابية بين حرارة المسكن ومؤشر غدة فابريشيا وكذلك بين غاز ثاني أكسيد الكربون بكل من تركيز خضاب الدم ونسبة خلايا الدم البيضاء غير المتجانسة الصبغ إلي الليمفاوية ومعدل النفوق . إرتبطت تركيزات الغازات بالهواء الداخلي للمسكن المفتوح إيجابيا بتركيز خضاب الدم . لوحظ وجود فروق معنوية بين أوزان الطيور الحية عمر 42 يوم والطيور الضابطة بكل من المسكن المغلق والمفتوح حيث إنخفض الوزن الحي النهائي بكل منهما عند عمر 42 يوم. زادت درجة حرارة الطيور نتيجة لزيادة كثافة التسكين بكلتا البيئتين مقارنة بالمجموعات الضابطة لهما ولكن لم تؤثر معنويا على تركيز خضاب الدم. أوضحت نسب خلايا الدم البيضاء غير متجانسة الصبغ والليمفية زيادة غير معنوية بطيور المسكن المغلق وقلتها الطفيفة بطيور المسكن المفتوح.

خلصت النتائج إلى إن الرعاية البيئية المنضبطة للمسكنين ساعدت الطيور على مواجهة الظروف المناخية الدقيقة الضارة والناشئة عن زيادة التكثيف والحصول على وزن حي نهائي مقبول وفقا لطبيعة السلالة المستخدمة (كوب500) . تعتبر درجة حرارة الطائر ونسبة خلايا الدم البيضاء غير متجانسة الصبغ إلى الليمفاوية من الدلائل الهامة لردود أفعال الطائر غير التخصصية ضد الإجهاد التسكيني بالرغم من الإختلافات الفردية في قيمها . تراوحت التغيرات النسيجية لأعضاء الطيور اللاحمة المكثفة عدديا بين الطفيفة والشديدة حيث كانت ردود الكبد والرئة مماثلة للإجهاد الحاد ولكن الطحال بطيور المسكن المغلق تأثر بشدة وإختلفت غدة فابريشيا في رد الفعل. أكدت النتائج أهمية التغيرات النسيجية المرضية للأعضاء الداخلية والمرافقة للتكثيف العددي حتى مع قلة النفوق. لم تكن التغيرات النسيجية المرتبطة بالعمر بغدة فابريشيا من السهل تمييزها عن الناتجة عن الإجهاد التسكيني.