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Some Factors Affecting Blood Parameters of Broiler Chickens

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Abstract

The present study was aimed to investigate the effect of flock age, air pressure during incubation period and litter types on blood plasma constituents of broiler chicks. A total number of 600 one day old hatching chicks (ROSS 308) were taken randomly nearly a similar in live body weight were used in this study. Chicks were randomly divided into equal 12 groups in a 2×2×3 factorial arrangement experiment according to flock age (younger breeder flock 33 WKS and older breeder flock 43 WKS), air pressure (normal 100719 and high, 1011000 Pascal) and three litter types (wood shaving, plastic and sand). The results obtained showed that, broiler chicks produced from younger breeder flock recorded significantly ($p<0.001$) the higher levels of plasma total protein (TP), albumin (A) and globulin (G). However, broiler chicks produced from older breeder flock found to be significantly decreased levels of plasma triglycerides, total cholesterol, low density lipoprotein, aspartate aminotransferase (AST), alanine aminotransferase (ALT) creatinine, uric acid and malondialdehyde (MDA).Broiler chicks produced from eggs incubated at high air pressure (HAP) showed significant($p<0.001$) the higher levels of plasma TP, A , G and MDA. While, chicks produced from eggs incubated at low air pressure decreased significantly the levels of plasma triglycerides, total cholesterol, LDL, AST, ALT, creatinine, uric acid and significantly increased plasma levels of high density lipoprotein (HDL) and glutathione peroxidase (GPX). Blood plasma constituents significantly varied due to the effect of litter type, it was found that broiler chicks raised on sand litter type showed the higher levels of plasma TP, A and G. While, the lower levels of plasma triglycerides, total cholesterol, LDL, AST, ALT, creatinine, uric acid, MDA and higher levels of HDL and GPX were found in broiler chicks raised on plastic (PL) litter type. According to the interaction between the studied factors, it could be concluded that the interaction between 43 WKS × HAP ×PL seemed to be adequate to achieve the favorable results of blood parameters.

Key words: flock age, air pressure, litter type, blood parameters.

Introduction

In recent years, the poultry industry has grown dramatically and is one of the most important economic activities today**.** Body functions need to be in perfect equilibrium, known as homeostasis, to optimise the production capacity of poultry. Awareness of the levels of such blood parameters provides valuable data to assess the state of body balance, representing metabolic process requirements**(Rezende et al., 2017)**. Blood biochemical analysis is commonly used to aid disease detection and characterization. But, since certain metabolic disorders are difficult to diagnose only through clinical signs, it is an important method. It can also help monitor the health of poultry, diagnose and treat diseases and determine their health status**(Schmidt et al., 2007)**. The determination of blood components by laboratory tests is an important procedure to assist the diagnosis of various poultry diseases and disorders. On the other hand, there are several factors that can influence them, including, nutritional status, sex, age, season, trauma and general management. Thus, it is important to know these variations when assessing clinical blood parameters in birds**(Café et al., 2012)**. **Silva et al., (2007)** demonstrated that the assessment of total protein levels and their fractions provides the information necessary to interpret the frequency of dehydration, infections, immune diseases and inflammatory responses. Serum proteins are primarily synthesized in the liver and, among other functions, through the colloidal osmotic effect, preserve blood volume, buffer blood pH, transport hormones and drugs, participate in cell coagulation, catalyze chemical reactions (enzymes), control metabolism (hormones) and participate in the protection of the body against foreign agents**(Melillo 2013)**. **Peebles et al., (2004)** reported that the levels of LDL, which are lipoprotein-associated with the transport of cholesterol, compared to HDL levels, responsible for the reduction of serum cholesterol. Triglycerides are synthesized in the intestinal mucosa and in the liver from the digestion of dietary components and the absorption of fatty acids**(Alonso-Alvarez 2005)**. **Minafra et al., (2010)** argued that both reference levels for hematological and biochemical parameters for broilers are lacking data and it is important to draw blood profiles from birds in various experimental situations. Therefore, this study aimed to investigate the effect of flock age, air pressure, litter type and the interaction between them on blood biochemical parameters in commercial broiler chickens (ROSS 308).

Materials and methods:

The practical incubation work of the present study was carried out at the Association of Al-tanmia hatching and poultry production at El-Khanka, Qalyubia Governorate, Egypt for an incubation period of 21st days, starting from 12th July 2019. Chicks were brooding and reared at Poultry Research Farm, Department of Animal Production, Faculty of Agriculture, Benha University, Egypt, during the period from 1st August to 15th September 2019. The chemical analysis and microbiological studies were conducted at the laboratory of Food Analysis Center, Faculty of Veterinary Medicine belonging to Benha University. This study was aimed to evaluate the effect of air pressure during incubation period on hatchability traits and the effect of different litter types on productive and metabolic performance of hatched broilers chicks.

Incubation:

Broiler hatching eggs (Ross 308) were collected from a common commercial broiler breeder flock at 33 and 43 weeks of age, eggs were held for approximately 72 h under standard conditions before being set. A total number of 19200 egg were incubated by single-stage incubation program were taken randomly and equally divided into main two groups according to flock age (9600 egg per each flock). Eggs of each flock were then divided into two sub groups (each of 4800 egg) according to ventilation by air pressures. Eggs of the 1st sub group were incubated by ventilation of the normal air pressure (100719 Pascal) and considered as a control group, the 2nd sub group was incubated by ventilation with higher air pressure (101000 Pascal). Eggs were incubated by Pas Reform incubator (Model V6.0 SmartSet ™, SmartHatch ™); the incubator was set at 99.7°f dry bulb with relative humidity at 55%, while the hatcher was set at 97.8°f dry bulb with relative humidity at 50%.

Birds and their management:

A total number of 600 one day hatched chicks from the two flocks age and incubated by different levels of air pressure were randomly chosen. Chicks were similar in live body weight, weighed individually at hatch and wing banded. Chicks were randomly divided into equal 12 group in a 2×2×3 factorial arrangement experiment. Hatched chicks of each subgroup were then divided into three subgroups each of 50 birds according to litter types. Chicks of the 1st subgroup were kept on a litter type of wood shaving and considered as a control group, the 2nd and 3rd subgroups were brooding and raised on a litter type of plastic and sand, respectively. Chicks were kept under similar, standard hygienic and environmental conditions. Chicks were vaccinated against Newcastle and Gumboro diseases, Pullorum free and avian influenza according to vaccination program under the supervision of a licensed veterinarian. Wood shaving, sand, and plastic were used at 10cm depth and higher respectively, as a litter and the wetting litter of wood shaving and sand were continually supplied by a fresh one. Floor brooders with gas heaters were used for brooding chicks. The brooding temperature was maintained at 35° C during the first five days of chick's age and then decreased by 2° C weekly until the end of the 4th week. The lighting program was 24 h light at the first five days of age, then decreased from 6 to 35 days of age (the end of the experimental) to 23 hours light and a 1-hour dark was applied. Feed and water were offered ad-libitum. Chicks were fed starter and grower diets. The basal diet was formulated according to the recommended requirements of NRC (1994) as shown in table (1).

Parameter estimated and data collection:

Blood plasma constituents:

Blood samples for chemical analysis were individually obtained from 4 birds randomly chosen from each treatment at the end of the experimental period (5 weeks of age) from the wing vein. Heparinized blood samples were centrifuged at 2500 rpm for 15- min. plasma samples were stored in the deep freezer at approximately -20°C, until the time of chemical analysis. The chemical analysis of blood sample were carried out by colorimetric method using commercial kit for determination of plasma Protein fractions (total protein, albumin, globulin and A/G ratio), Lipid profile (triglycerides, total cholesterol, low density lipoproteins (LDL) and high density lipoproteins (HDL)) , Liver function tests (aspartate aminotransferase (AST), alanine aminotransferase (ALT)), Kidney function tests (creatinine and uric acid) and Measurements of antioxidant capacities in plasma glutathione peroxidase (GPX) and malondialdehyde (MDA).

Statistical analysis:

Analysis of variance was calculated using **SAS** procedure guide **(SAS 2004)** using the following linear model:

$$X_{ijhk} = \mu + F_i + P_j + L_h + FP_{ij} + FL_{ih} + PL_{jh} + FPL_{ijk} + e_{ijhk}$$

Whereas:

μ = the overall mean.

F_i = the effect of the i^{th} flock age. (i, 1-2)

P_j = the effect of the j^{th} air pressure. (j, 1-2)

L_h= the effect of h^{th} litter types. (h, 1-3)

FP_{ij} = the interaction between i^{th} flock age and j^{th} air pressure. (2×2)

FL_{ih} = the interaction between i^{th} flock age and h^{th} litter types. (2×3)

PL_{jh}= the interaction between j^{th} air pressure and h^{th} litter types. (2×3)

FPL_{ijh} = the interaction between i^{th} flock age, j^{th} air pressure, and h^{th} litter types. (2×2×3)

e_{ijhk} = the experimental error, accordingly zero mean and variance = $\sigma^2 e$.

Significant differences among groups means were tested using Duncan multiple range test **(Duncan 1955).**

Results and discussion:

The obtained data presented in Table (2) showed that broilers produced from younger breeder flock had significantly ($p<0.001$) the higher levels of plasma TP, A and G (41.93, 18.64 and 23.51 g/dl, respectively) than the older ones. These results obtained may be attributed to high growth requirement **(Silva et al., 2007)** who found that according to flock age there was no difference in plasma total protein levels between 35 and 42 days of age, but the amount was lower at 21 days of age. These results disagreed with those reported by **(Thrall, 2007)** who stated that Globulin values did not vary by age, being within the usual range of 0.5 to 1.8 g/dL for the Gallus Gallus species.**Café et al., (2012)** demonstrated that globulin, albumin/ globulin were not affected by flock age. While, plasma total protein and albumin were found to be higher at 28 and 35 weeks of bird's age due to flock age.

Plasma protein fractions significantly ($p<0.001$) affected by air pressure, broiler chicks produced from eggs incubated at HAP showed significantly the higher plasma total protein (42.00), albumin (18.61) and globulin (23.16 g/dl).These results agreed with those reported by **(Daneshyar et al., 2009)** who found that treatment with hypoxia, plasma total protein was lower than normoxia-treated birds every week and over the whole experimental period, but this difference was only significant ($P \leq 0.05$) for wk 6.**Olanrewaju et al., (2010)** stated that due to the environmental conditions of hypoxia and normoxia, a substantial effect of plasma total protein was significantly ($P\leq 0.0002$) affected on d 56 of birds age.

Plasma total protein, albumin, globulin and A/G ratio concentrations had highly significant ($p<0.0001$) varied due to the effect of litter type, the higher concentrations of plasma TP, A and G (44.34, 19.85 and 24.56 g/dl, respectively) were found in broiler chicks reared on sand litter type. While the higher level of plasma A/G ratio (0.816 g/dl) was found in broiler chicks raised on WSH litter type. These results disagreed with those reported by**(Yildiz et al., 2014)** who found that plasma total protein, albumin and globulin levels were not vary significantly ($P>0.05$) due to litter types including polymer vermiculite and wood shaving.

The interaction between 33 WKS × HAP × S significantly ($p>0.001$) increased plasma TP, A and globulin when compared with different interactions applied.

Plasma triglycerides, total cholesterol, low density lipoprotein and high density lipoprotein:

Data presented in Table (3) showed that broiler chicks produced from older breeder flock recorded significant ($p>0.001$) the lower averages of plasma triglycerides, total cholesterol, LDL and the higher average of plasma HDL (87.48, 119.25, 44.86 and 75.31 g/dl, respectively) at 5 weeks of birds age. These results disagreed with those reported by **Café et al., (2012)** who demonstrated that in younger flocks, triglyceride and cholesterol concentrations, as well as HDL and LDL, were higher.

Broiler chicks produced from eggs incubated at LAP showed significantly ($p<0.0001$) the lower averages of plasma triglycerides, total cholesterol, and LDL (86.52, 118.56 and 44.66 g/dl, respectively) and the higher level of plasma HDL (74.80 g/dl) compared with the older ones. These results agreed with those reported by **Olanrewaju et al., (2010)** who stated that due to the environmental conditions of hypoxia and normoxia, a substantial effect of plasma cholesterol, triglycerides ($P\leq 0.0004$),and HDL ($P \leq 0.0001$) was observed on d 56 of birds age.

The lower significant plasma triglycerides, total cholesterol, LDL and the higher level of plasma HDL (81.13, 111.93, 36.97 and 76.25 g/dl, respectively) were showed by birds raised on PL litter type. These results agree with those reported by **Taherparvar et al., (2019)** who stated that the type of bedding material used influenced significantly ($P=0.040$, $P=0.036$ and $P=0.023$, respectively) on the concentration of several plasma blood metabolites namely the cholesterol, triglycerides, LDL and HDL.

The interaction between 43 WKS× HAP ×PL decreased significantly plasma triglycerides, total cholesterol and plasma LDL. When compared with different interactions applied.

Plasma aspartate aminotransferase (AST) and alanine aminotransferase (ALT):

Data presented in Table (4) revealed highly significant ($p<0.0001$) variation in plasma AST and ALT due flock age. The higher averages of plasma AST (246.61) and ALT (15.61 U/L) were found in broiler chickens produced from younger breeder flock, than the older ones. These results may be attributed to the serum activity of all enzymes modified with a consequence of bird-age have been showed by **(Silva et al., 2007)** who found that aspartate aminotransferase (AST) serum activity gradually decreased with increasing age due to higher bone growth, and AST was higher at 21 days of age compared with older age.

Broiler chicks produced from eggs incubated at HAP had significantly the higher averages of plasma AST and ALT (244.61 and 15.72 U/L, respectively).

These results disagreed with those reported **(Daneshyar et al., 2009)** who found that for the entire study period, there was no substantial difference between the two treatment conditions (normoxia and hypoxia) for plasma AST and ALT levels.

From data obtained in table (4) it was found the higher averages of both plasma AST and ALT levels were found in broilers raised on (S) litter type followed by those reared on (WSH) then by those raised on (PL), respectively. These results agree with those reported by**Taherparvar et al., (2019)** who stated that the type of bedding material used influenced significantly ($p \leq 0.001$and $P=0.035$) on the concentration of the hepatic enzymes AST and ALT, respectively. Also **Costa et al., (2020)** demonstrated that the types of litter affected the enzyme aspartate aminotransferase in birds raised on wood shavings, although these values were not increased to the point of influence on the physiological functions of broilers.

The interaction between 43 WKS× LAP ×PL and between 43 WKS× HAP ×PL decreased significantly plasma AST and ALT, respectively, when compared with different interactions applied.

Plasma creatinine and uric acid:

Broiler chicks produced from older breeder flock significantly ($p<0.0001$) decrease the level of plasma creatinine and uric acid (0.50 and 5.78 mg/dl, respectively) than the younger ones (table, 5). These results agree with those reported by**(Silva et al., 2007)** who stated that plasma creatinine and uric acid levels as a function of age, were also observed to be higher at 35 days of age than at the other 21-d and 42-d from broilers derived from 35 week- old-flock.

Data presented in Table. 5 revealed highly significant variation in plasma creatinine ($p>0.001$) and uric acid ($p>0.05$) due to the effect of air pressure it was found that broiler chicks produced from eggs incubated at LAP showed the lower averages of plasma creatinine (0.503 mg/dl) and uric acid (5.87 mg/dl). These results may be attributed to the components of the blood are especially responsive to changes in environmental conditions and are an important predictor of physiological responses to stress agents in birds. **Tawfeek et al., (2014)** demonstrated that there was a higher catabolic effect and concentration of adrenocorticotropic hormone that generated more uric acid and triglycerides in serum during hypoxic stress.

Plasma levels of creatinine (0.398 mg/dl) and uric acid (4.82) were found to be significant lower in broiler chicks raised on PL litter type followed by raised on WSH and S, respectively. These results agreed with those reported by **(Taherparvar et al., 2019)** who found that the type of litter material used influenced significantly ($P=0.008$) on the concentration of the plasma uric acid. They added that the major differences found for uric acid concentration were represented by broilers reared on sand litter type.

The interaction between 43WKS×HAP×PL significantly decreased plasma creatinine and uric acid than any other interaction applied.

Plasma glutathione peroxidase (GPX) and malondialdehyde (MDA):

Data presented in Table (6) revealed highly significant ($P<0.05$) variation in plasma levels of GPX and MDA due to flock age. Broiler chickens produced from older breeder flock had higher plasma GPX (319.77 mg/dl) and lower plasma MDA (2.27 mg/dl) than those of broiler chicks produced from the younger breeder flock. **Tawfeek et al., (2014)** stated that GPx activity in the blood plasma of the birds as one of the antioxidant enzymes and concentrations of malondialdehyde MDA, an indicator of lipid peroxidation in plasma and liver in normal rearing conditions, they found an improved in oxidative status due to age.

Concerning to the effect of air pressure, broiler chicks produced from eggs incubated at LAP significantly ($p>0.001$) increased plasma GPX (319.05mg/dl) and decreased plasma MDA (2.27mg/dl) than the HAP ones. These results agreed with those reported by **Pan et al., (2005)** who stated that when broilers were exposed to the hypoxia atmosphere for 3 weeks, the plasma MDA level increased. And disagree with those reported by **(Yang et al., 2014)** who found that the hypoxia environment appeared to raise the plasma MDA level ($P< 0.1$) and there were no variations between the hypoxia and normoxia groups ($P> 0.05$) in plasma GPX activity levels.

Significant ($p<0.001$) variations were found on plasma GPX and MDA due to the effect of litter type, it is observed that broiler chicks raised on (PL) litter type showed significantly the higher plasma GPX and lower MDA levels (347.83 and 2.01 mg/dl, respectively). These results agreed with those reported by **(Yildiz et al., 2014)** who found that MDA parameters varied significantly due to the kind of litter material. The interaction between 43 WKS × HAP ×PL and between 33 WKS × HAP × S. significantly increased plasma GPX and plasma MDA, when compared with different interactions applied.

According to the interaction between the studied factors, it could be concluded that the interaction between 43 WKS × HAP ×PL seemed to be adequate to achieve the favorable results.

Table 1. Ingredients and calculated analysis of the experimental diets:

Ingredients (%)	**Starting, (0-3 wks)**	**Growing, (3-5 wks)**
Yellow corn, ground	56.80	60.00
Soybean meal (44% CP)	31.00	29.00
Corn gluten meal (60% CP)	6.75	4.60
Vit & Min. premix*	0.30	0.30
Sunflower oil	1.7	3.00
Dicalcium phosphate	2	1.80
Limestone	1.00	1.00
Salt	0.30	0.30
DL-methionine	0.05	-
L- lysine	0.10	-
Total	**100**	**100**
Calculated analysis**		
Crude Protein (%) 23.00 21.00	23.00	21.00
ME (KCal/Kg diet)	3000	3100
Crude fiber (%)	3.26	3.51
Crude fat (%)	4.28	5.64
Calcium (%)	0.98	0.93
Available phosphorus (%)	0.46	0.41

*Each diet was supplied with2.5 kg/ton Vit. & Min. Mix (commercial source B. p. Max) Each 3 kg contains, Vit. A 10,000,000 MIU, Vit. D 2000,000 MIU, Vit. E 10,000 mg, Vit, K3 1000 mg, Vit, B1 1000 mg, Vit, B2 5000 mg, Vit, B6 1500 mg, Biotin 50 mg, BHT 10,000 mg, Pantothenic 10,000 mg, folic acid 1000 mg, Nicotinic acid 30,000 mg, Mn 60 gm, Zinc 50 gm, Fe 30 gm, Cu 4 gm, I 3 gm, Selenium 0.1 gm, Co 0.1 gm ** Calculated according to NRC" (1994).

Table 2. least – square means and standard error ($\bar{X} \pm S.E$) for plasma protein fractions (total protein, albumin, globulin and A/G ratio) of different experimental groups as affected by studied factors

Items		**Plasma (g/dl)**			
		total protein	**albumin**	**globulin**	**A/G ratio**
FA	**33 WKS**	41.93±0.13^{a}	18.64±0.09^{a}	23.51±0.10^{a}	0.799±0.005^{a}
	43 WKS	39.52±0.13^{b}	17.50±0.09^{b}	21.58±0.10^{b}	0.791±0.005^{a}
AP	**LAP**	39.46±0.13^{b}	17.53±0.09^{b}	21.93±0.10^{b}	0.800±0.005^{a}
	HAP	42.00±0.13^{a}	18.61±0.09^{a}	23.16±0.10^{a}	0.791±0.005^{a}
LT	**WSH**	42.20±0.16^{b}	18.95±0.11^{b}	23.25±0.13^{b}	0.816±0.006^{a}
	PL	35.65±0.16^{c}	15.40±0.11^{c}	19.83±0.13^{c}	0.760±0.006^{b}
	S	44.34±0.16^{a}	19.85±0.11^{a}	24.56±0.13^{a}	0.810±0.006^{a}
FA×AP×LT	**33 WKS × LAP ×WSH**	40.83±0.33^{e}	18.43±0.23^{de}	22.40±0.26^{de}	0.826±0.013^{a}
	33 WKS × LAP ×PL	38.63±0.33^{f}	17.00±0.23^{g}	21.63±0.26^{e}	0.786±0.013^{abc}
	33 WKS × LAP ×S	42.16±0.33^{d}	19.00±0.23^{cd}	23.16±0.26^{cd}	0.820±0.013^{a}
	33 WKS × HAP ×WSH	45.26±0.33^{b}	20.23±0.23^{b}	25.03±0.26^{b}	0.810±0.013^{ab}
	33 WKS × HAP ×PL	36.13±0.33^{g}	15.50±0.23^{h}	21.63±0.26^{e}	0.750±0.013^{cd}
	33 WKS × HAP ×S	48.60±0.33^{a}	21.70±0.23^{a}	27.23±0.26^{a}	0.803±0.013^{ab}
	43 WKS × LAP ×WSH	39.50±0.33^{f}	17.66±0.23^{fg}	21.83±0.26^{e}	0.810±0.013^{ab}
	43 WKS × LAP ×PL	34.80±0.33^{h}	15.10±0.23^{h}	19.70±0.26^{f}	0.770±0.013^{bcd}
	43 WKS × LAP ×S	40.86±0.33^{e}	18.00±0.23^{ef}	22.86±0.26^{d}	0.786±0.013^{abc}
	43 WKS × HAP ×WSH	43.23±0.33^{c}	19.50±0.23^{c}	23.73±0.26^{c}	0.820±0.013^{a}
	43 WKS × HAP ×PL	33.03±0.33^{i}	14.00±0.2^{3i}	16.36±0.26^{g}	0.733±0.013^{d}
	43 WKS × HAP ×S	45.73±0.33^{b}	20.73±0.23^{b}	25.00±0.26^{b}	0.830±0.013^{a}

Mean having similar letters in each column within each effect are not significantly different.

Table 3. least – square means and standard error ($\overline{X} \pm S.E$) for plasma triglycerides, total cholesterol, HDL and LDL of different experimental groups as affected by studied factors.

Items		Plasma (g/dl)			
		0	Total cholesterol	LDL	HDL
FA	33 WKS	89.85±0.30^{a}	122.41±0.48^{a}	48.40±0.21^{a}	73.96±0.29^{b}
	43 WKS	87.48±0.30^{b}	119.25±0.48^{b}	44.86±0.21^{b}	75.31±0.29^{a}
AP	LAP	86.52±0.30^{b}	118.56±0.48^{b}	44.66±0.21^{b}	74.80±0.29
	HAP	90.81±0.30^{a}	123.10±0.48^{a}	48.59±0.21^{a}	74.46±0.29
LT	WSH	90.22±0.37^{b}	122.94±0.59^{b}	49.51±0.26^{b}	73.42±0.36^{b}
	PL	81.13±0.37^{c}	111.93±0.59^{c}	36.97±0.26^{c}	76.25±0.36^{a}
	S	94.65±0.37^{a}	127.62±0.59^{a}	53.40±0.26^{a}	74.22±0.36^{b}
FA×AP×LT	33 WKS×LAP×WSH	87.60±0.75^{d}	120.76±1.18^{de}	46.53±0.52^{e}	74.23±0.72^{bc}
	33 WKS×LAP×PL	82.20±0.75^{e}	115.26±1.18^{f}	42.70±0.52^{g}	72.56±0.72^{cd}
	33 WKS×LAP×S	91.93±0.75^{c}	123.10±1.18^{de}	49.03±0.52^{d}	74.06±0.72^{bc}
	33 WKS×HAP×WSH	94.90±0.75^{b}	126.76±1.18^{bc}	53.70±0.52^{c}	73.06±0.72^{bcd}
	33 WKS×HAP ×PL	82.50±0.75^{e}	112.93±1.18^{fg}	37.13±0.52^{h}	75.46±0.72^{b}
	33 WKS×HAP×S	100.00±0.75^{a}	135.66±1.18^{a}	61.30±0.52^{a}	74.36±0.72^{bc}
	43 WKS×LAP×WSH	86.96±0.75^{d}	120.16±1.18^{e}	44.70±0.52^{f}	75.46±0.72^{b}
	43 WKS×LAP×PL	80.60±0.75^{ef}	109.90±1.18^{g}	37.10±0.52^{h}	78.23±0.72^{a}
	43 WKS×LAP×S	89.83±0.75^{c}	122.20±1.18^{de}	47.93±0.52^{de}	74.26±0.72^{bc}
	43 WKS×HAP ×WSH	91.43±0.75^{c}	124.06±1.18^{cd}	53.13±0.52^{c}	70.93±0.72^{d}
	43 WKS×HAP ×PL	79.23±0.75^{f}	109.63±1.18^{g}	30.96±0.52^{i}	78.76±0.72^{a}
	43 WKS×HAP ×S	96.83±0.75^{b}	129.53±1.18^{b}	55.33±0.52^{b}	74.20±0.72^{bc}

Table 4. Least – square means and standard error ($\overline{X} \pm \mathrm{S.E}$) for plasma aspartate aminotransferase and alanine aminotransferase of different experimental groups as affected by studied factors**.**

Items		Plasma (U/L)	
		AST	ALT
FA	33 WKS	246.61±2.03^{a}	15.61±0.21^{a}
	43 WKS	229.50±2.03^{b}	14.22±0.21^{b}
AP	LAP	231.50±2.03^{b}	14.11±0.21^{b}
	HAP	244.61±2.03^{a}	15.72±0.21^{a}
LT	WSH	242.33±2.49^{b}	15.58±0.26^{b}
	PL	218.00±2.49^{c}	12.25±0.26^{c}
	S	253.83±2.49^{a}	16.91±0.26^{a}
FA×AP×LT	33 WKS×LAP×WSH	239.33±4.99^{def}	15.33±0.52^{de}
	33 WKS×LAP×PL	233.33±4.99^{def}	13.33±0.52^{fgh}
	33 WKS×LAP×S	248.66±4.99^{bcd}	15.66±0.52^{cde}
	33 WKS×HAP×WSH	256.00±4.99^{bc}	17.00±0.52^{bc}
	33 WKS×HAP ×PL	223.33±4.99^{fg}	12.66±0.52^{gh}
	33 WKS×HAP×S	279.00±4.99^{a}	19.66±0.52^{a}
	43 WKS×LAP×WSH	232.66±4.99^{def}	13.66±0.52^{fg}
	43 WKS×LAP×PL	206.33±4.99^{gh}	12.00±0.52^{hi}
	43 WKS×LAP×S	228.66±4.99^{ef}	14.66±0.52^{ef}
	43 WKS×HAP ×WSH	241.33±4.99^{cde}	16.33±0.52^{bcd}
	43 WKS×HAP ×PL	209.00±4.99^{h}	11.00±0.52^{i}
	43 WKS×HAP ×S	259.00±4.99^{b}	17.66±0.52^{b}

Table 5. Least – square means and standard error ($\overline{X} \pm S.E$) for plasma creatinine and uric acid of different experimental groups as affected by studied factors.

Items		Plasma (mg/dl)	
		Creatinin	**Uric acid**
FA	**33 WKS**	0.54±0.008^{a}	6.10±0.049^{a}
	43 WKS	0.50±0.008^{b}	5.78±0.049^{b}
AP	**LAP**	0.503±0.008^{b}	5.87±0.049^{a}
	HAP	0.545±0.008^{a}	6.01±0.049^{a}
LT	**WSH**	0.555±0.010^{b}	6.35±0.060^{b}
	PL	0.398±0.010^{c}	4.82±0.060^{c}
	S	0.618±0.010^{a}	6.65±0.060^{a}
FA×AP×LT	**33 WKS×LAP×WSH**	0.526±0.020^{de}	6.26±0.120^{cd}
	33 WKS×LAP×PL	0.463±0.020^{fg}	5.53±0.120^{e}
	33 WKS×LAP×S	0.583±0.020^{bcd}	6.16±0.120^{d}
	33 WKS×HAP×WSH	0.603±0.020^{bc}	6.43±0.120^{cd}
	33 WKS×HAP×PL	0.410±0.020^{gh}	4.93±0.120^{f}
	33 WKS×HAP×S	0.703±0.020^{a}	7.26±0.120^{a}
	43 WKS×LAP×WSH	0.516±0.020^{ef}	6.06±0.120^{d}
	43 WKS×LAP×PL	0.376±0.020^{hi}	4.96±0.120^{f}
	43 WKS×LAP×S	0.553±0.020^{cde}	6.23±0.120^{d}
	43 WKS×HAP×WSH	0.576±0.020^{bcde}	6.63±0.120^{bc}
	43 WKS×HAP×PL	0.343±0.020^{i}	3.86±0.120^{g}
	43 WKS×HAP×S	0.633±0.020^{b}	6.93±0.120^{ab}

Table 6. least – square means and standard error ($\overline{X} \pm \mathrm{S.E}$) for plasma GPX and MDA of different experimental groups as affected by studied factors

Items		Plasma (mg/dl)	
		GPX	**MDA**
FA	**33 WKS**	307.05±2.07^{b}	2.40±0.024^{a}
	43 WKS	319.77±2.07^{a}	2.27±0.024^{b}
AP	**LAP**	319.05±2.07^{a}	2.27±0.024^{b}
	HAP	307.77±2.07^{b}	2.40±0.024^{a}
LT	**WSH**	298.91±2.54^{b}	2.46±0.029^{a}
	PL	347.83±2.54^{a}	2.01±0.029^{b}
	S	293.50±2.54^{b}	2.53±0.029^{a}
FA×AP×LT	**33 WKS×LAP×WSH**	300.33±5.08^{de}	2.46±0.059^{bcde}
	33 WKS×LAP×PL	332.00±5.08^{c}	2.16±0.059^{fg}
	33 WKS×LAP×S	308.66±5.08^{d}	2.40±0.059^{cde}
	33 WKS×HAP×WSH	291.00±5.08^{e}	2.56±0.059^{bc}
	33 WKS×HAP×PL	341.66±5.08^{bc}	2.00±0.059^{gh}
	33 WKS×HAP×S	268.66±5.08^{f}	2.80±0.059^{a}
	43 WKS×LAP×WSH	313.00±5.08^{d}	2.33±0.059^{def}
	43 WKS×LAP×PL	348.66±5.08^{b}	2.00±0.059^{gh}
	43 WKS×LAP×S	311.66±5.08^{d}	2.30±0.059^{ef}
	43 WKS×HAP×WSH	291.33±5.08^{e}	2.50±0.059^{bcd}
	43 WKS×HAP×PL	369.00±5.08^{a}	1.90±0.059^{h}
	43 WKS×HAP×S	285.00±5.08^{e}	2.63±0.059^{ab}

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بعض العوامل المؤثرة على مقاييس الدم فى دجاج التسمين

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هدفت هذه الدراسة إلى تقييم تأثير عمر القطيع, ضغط الهواء خلال فترة التفريخ و أنواع الفرشة على مكونات بلازما الدم فى دجاج التسمين. إستخدم فى هذة الدراسة عدد 600 كتكوت عمر يوم فاقسة (روص 308) أختيرت عشوائيا ومتجانسة فى وزن الجسم. الكتاكيت قسمت عشوائيا إلى 12 مجموعة متساوية فى تجربة عاملية 2×2×3 حسب عمر القطيع (القطيع الأصغر عمراً 33 أسبوع , القطيع الأكبر عمرا 43 أسبوع), وضغط الهواء (الطبيعى 100719 و العالى 1011000 باسكال) وثلاث أنواع من الفرشة (نشارة الخشب , البلاستيك , الرمل).

النتائج المتحصل عليها أوضحت أن كتاكيت التسمين المنتجة من القطيع الأصغر عمرا سجلت إرتفاعاً معنويا في مستويات البلازما من البروتين الكلى , الألبيومين و الجلوبيولين. بينما وجد أن الكتاكيت المنتجة من القطيع الأكبر عمراً خفضت معنوياً مستويات البلازما من الدهون الثلاثية , الكوليستيرول الكلى, الليبوبروتين منخفض الكثافة , الأسبرتات أمينو ترانسفيراز , الآنين أمينو ترانسفيراز, الكرياتينين, حمض البوليك و المالون داى ألدهيد. أوضحت كتاكيت التسمين المنتجة من البيض المفرخ عند ضغط الهواء المرتفع إرتفاعاً معنوياً فى مستويات البلازما من البروتين الكلى , الألبيومين, الجلوبيولين و المالون داى ألدهيد. بينما الكتاكيت المنتجة من البيض المفرخ عند ضغط الهواء المنخفض خفضت معنوياً مستويات البلازما من الدهون الثلاثية , الكوليستيرول الكلى , الليبوبروتين منخفض الكثافة, والأسبرتات أمينوترانسفيراز, الآنين أمينو ترانسفيراز, الكرياتينين, حمض البوليك, وزادت معنوياً مستويات البلازما من الليبوبروتين مرتفع الكثافة وإنزيم الجلوتاثيون بيروكسيديز. مكونات بلازما الدم أختلفت معنويا نتيجة تأثير أنواع الفرشة. حيث وجد أن كتاكيت التسمين المرباة على الفرشة الرمل أظهرت إرتفاعاً فى مستوى البلازما من البروتين الكلى , الألبيومين و الجلوبيولين. بينما إنخفضت مستويات البلازما من الدهون الثلاثية , الكوليستيرول الكلى, اللبوبروتين منخفض الكثافة, الأسبرتات أمينوترانسفيراز,الآنين أمينوترانسفيراز, الكرياتينين, حمض البوليك, المالون داى ألدهيد وأعلى المستويات من الليبوبروتين مرتفع الكثافة و الجلوتاثيون بيروكسيديز وجدت فى كتاكيت التسمين المرباة على الفرشة البلاستيك. بالنسبة إلى التداخل بين العوامل المدروسة, يمكن أن نوصى بأن التداخل بين القطيع الأكبر عمراً والمنتج من البيض المفرخ عند ضغط الهواء المرتفع والمربى على الفرشة البلاستيك يمكن أن يحقق نتائج إيجابية ومرضية لمقاييس الدم.

الكلمات المفتاحية: عمر القطيع , ضغط الهواء , نوع الفرشة , مقاييس الدم.