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RESEARCH ARTICLE

CLINICOPATHOLOGICAL EFFECTS OF HEAT STRESS ON BLOOD PICTURE OF JAPANESE QUAILS

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Abstract

This study aimed to evaluate the effects of heat stress on quail hematological parameters; two published papers on quails in 2013 were studied, analyzed and compared. Broiler Japanese quails *(Coturnix coturnix japonica)* were exposed to high ambient temperature (34^0C, 8hr/d, 0900-1700hr) in both papers. An increase in values of red blood cells count, white blood cells count, lymphocytes, heterophils and lymphocytes (H/L) ratio, Monocytes, packed cell volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration were recorded while a lower values of heterophils, basophils, eosinophils, mean corpuscular volume and hemoglobin concentration than normal were recorded in groups exposed to heat stress (34^0C) on day 42 in Japanese quails *(Coturnix coturnix japonica)*. Hemoglobin concentration was least affected. The obtained results indicated that, rearing quail birds under high environmental conditions during the fattening period has a great adverse effect on blood parameters. To help maintain Japanese quail as an essential animal model further heat stress related research on modern ways is needed.

Introduction:-

Broiler Japanese quail *(Coturnix coturnix japonica)* are farmed in large numbers, which are mostly kept to produce eggs that are sold worldwide and have tremendous potential for village and backyard production as well as an important laboratory animal (Lombin, 2007). High temperature is enough to elevate body temperature and also change circulating leukocytic components in broilers and increase in H/L ratio (Altan *et al*., 2000a and b). Heat stress not only adversely affects production performance but also inhibits immune function (Mashaly *et al*., 2004) and causes a reduction in antibody production in young chicks (Zulkifli *et al*., 2000). Blood parameters are considered pathophysiological indicators of the whole body. A number of hematological indices such as haematocrit value, hemoglobin concentration, red blood cells count and so on, are used to assess the functional status of the oxygen carrying capacity of the blood stream (Maheswaran, 2008). This study aimed to evaluate the effect of heat stress on quail hematological parameters.

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Materials and Methods:-

The studies were conducted in Egypt and Pakistan. A total of 300 and 600 quails were housed, reared and exposed to heat stress.

Statistical analysis:-

The results were expressed as mean ± SE. All the data were analyzed using a one way analysis of variances (ANOVA) followed by an LSD test using SPSS11.0 Statistical software (SPSS, Inc, Chicago, IL, 2001).

Results:-

The effects of heat stress on different hematological parameters were summarized in Table 01.

Table 01:- The effect of heat stress on different hematological parameters.

Parameters	Quails exposed to 34^0C in Khurshaid Anwar & Asim Aslam (2013)	Quails exposed to 34^0C in (Mahmoud *et al.,* 2013)	Reference values Ashraful Kabir(2013)&(Mahmoud *et al.,* 2013)
RBCs ($\times10^6$ /mm^3)	3.04 ±0.043	3.21±0.13	3.60±0.12
WBCs ($\times10^3$ /mm^3)	4.24 ±0.041	20.53±0.28	22.88±0.17
Lymphocytes (%)	54.19 ±.098	57.88±1.52	64.30 ± 3.47
H/L Ratio	0.62 ±0.02	0.50±0.01	0.27±0.0
Monocytes (%)	5.59 ±0.025	2.27±0.14	3.60 ± 0.97
PCV (%)	37.19±0.1	45.20±0.68	48.90±0.90
MCH (pg)		41.18±1.04	44.48±0.69
MCHC (%)		29.05±0.783	32.81±1.13
Heterophils (%)	33.6 ±0.129	28.81±0.52	19.69±0.55
Basophils (%)	1.63 ±0.013	1.81±0.21	0.63±0.18
Eosinophils (%)	2.21 ±0.02	9.19±0.49	4.38±0.53
MCV (fl)		142.66±5.23	136,71±4.04
HC (g/dl)		13.14±0.44	13.23 ± 0.22

Red blood cells (RBCs), white blood cells (WBCs), heterophils and lymphocytes (H/L) ratio, packed cell volume (PCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), mean corpuscular volume (MCV) and hemoglobin concentration (HC)

Discussion:-

The results in Table (1) cleared that there is an indirect relation between the heat stress and the decrease in number of RBCs, WBCs, packed cell volume, MCH, lymphocyte and MCHC in exposed quails. A significant ($p<0.05$) decrease in RBCs count was recorded in birds exposed to 34ºC. Similar results were obtained in Japanese quail exposed to 35ºC or 42ºC heat stress by Sturkie (1986), Osman (1996), Magda (1999) and Nadia (2003). This decrease in total number of RBCs may be due to the inhibition effect of heat stress on the life span of the present RBCs as well as the production of new RBCs from the bone marrow. The same results were recorded previously in Japanese quails by McFarlane and Curtis (1989), Magda (1999) and Nadia (2003). These results may be related to atrophy of all lymphoid Organs (thymus, bursa, spleen and liver) as their weights were significantly reduced by heat stress. This could have been a result of the reduction in feed intake, thereby providing fewer nutrients for the proper development of these organs Bartlett and Smith (2003). Moreover, (Gross *et al.,* 1980) reported that exposure of birds to high environmental temperature causes an increase in the plasma corticosterone which subsequently depresses the activity of the lymphoid organs and total leucocytes count. These results are in accordance with those of Yahav and Hurwitz (1996), Nadia (2003) and (Gharib *et al*., 2005). (Vo *et al*., 1978) and Deyhim and Teeter (1991) suggested that the reduced blood hematocrit in heat-stressed birds can be attributed to hemodilution, while Nadia (2003) mentioned that heat stress leads to significant decrease in mononuclear cells. These results are in agreement with the results of Osman (1996), Magda (1999) and Nadia (2003) who indicated that heat stress decreases the mean corpuscular hemoglobin value. (Grey *et al*., 1989), Mcfarlane and Curtis (1989), (Altan *et al*., 2000 a, b) and Nadia (2003) reported that exposure of broilers or quail to heat stress results in decreased lymphocytes. The results in Table (1) indicated an indirect relation between the degrees of temperature used in heat

stress and the increase in MCV, heterophil value in heat stressed birds. Only a significant ($p<0.05$) difference was observed between birds reared at 34, 40 and 22ºC. Similar results were obtained in Japanese quail and broilers exposed to 35 and 42ºC heat stress by (Vo *et al*., 1978), (Yahav *et al*., 1997) and Nadia (2003). The data demonstrated in Table (1) showed a direct relation between the temperature of heat stress and the increase in heterophil cells in exposed quail. The highest significant ($p<0.05$) value of heterophil cells was recorded in birds exposed to 40ºC. These results are in accordance with those of Mcfarlane and Curtis (1989), Nadia (2003), (Mashaly *et al*., 2004) and (Faisal *et al*., 2008). The results in table (1) showed a positive relation between the degree of temperature used in heat stress and the increase in H/L ratio in quail. Analysis of variance of the results cleared a significant increase in H/L ratio with increasing environmental temperature. These results are in agreement with Osman (1996), Magda (1999), (Altan *et al*., 2000a, b), Nadia (2003), (Gharib *et al*., 2005), (Faisal *et al*., 2008) and Al–Ghamdi (2008). They reported that, Heterophil /Lymphocyte ratio was significantly increased during heat stress. According to Aengwanich and Chinrasri (2003) and Abou (Abou-El-Soud *et al*., 2006), the H/L ratio measures the physiological change in organs such as an atrophy of the bursa of fabricius and thymus that is influenced by the effect of corticosteroids, as corticosteroids cause the release of heterophils.

An increase in heterophils and reduction in lymphocytes in heat stressed birds as the heterophil to lymphocyte ratio has been altered and proposed as sensitive and reliable measures of stress in broilers (Gross and Sigel, 1983; Maxwell and Robertson, 1998). Table (1) showed a significant increase in eosinophil percentage with increasing environmental temperature. On the contrary, these results were disagreed with the findings of Mcfarlane and Curtis (1989) and (Altan *et al*., 2000 a,b) who observed an insignificant decrease in eosinophils % in young chicks (10-17 days of age) that exposed to 30.4- 34.8ºC hot environment. However, Nadia (2003) stated that exposing Japanese quails to heat stress resulted in decreased eosinophils %. Concerning the effect of heat stress on Monocyte percentage, Table (1) indicated a significant increase in basophils percentage for birds exposed to 34ºC. These results are in agreement with the report of (Grey *et al*., 1989) who found that exposure of 8 weeks old white leghorn chickens to chronic heat stress (32ºC for 4 days) resulted in an increase of about 20 % in basophiles. On the contrary, these results disagreed with the findings of Mcfarlane and Curtis (1989) and Nadia (2003) who stated that heat stress induces significant decrease in basophils %.

Conclusion:-

From the obtained results of this study, it could be concluded that, rearing quail birds under high environmental conditions (29, 34, 36 and 40ºC) during fattening period led to adverse effects on quail hematological parameters. Meanwhile, 22ºC could be considered as the optimum degree for raising quail chicks. Exposure of Japanese quails to chronic heat stress decreased the number of WBCs, RBCs, PCV %, Hemoglobin concentration (g/dl), and lymphocyte% and increased the heterophils cells%, H/L ratio, eosinophil %, Monocyte %, basophils %.

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