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The effect of the high environmental temperature on some blood parameters and the laying performance of Japanese quails with different body weights* (short communication)

Abstract

In this study, it was aimed to determine the effects of the high environmental temperature on blood parameters, egg productivity, egg weight and the eggshell thickness of the Japanese quails with different body weights. By this purpose, two temperature groups consisting of control (18-24 ^{0}C) and experiment (35 ^{0}C) groups and two weight groups as being heavy group (live weight > 27 g) and light group (live weight < 27 g) were constituted. At the end of the research, the effect of high temperature on some blood parameters were found as important statistically. The value of the egg productivity, egg weight and eggshell thickness were found lower at 35 C degree than the ones at 18-24 C degree in both weight groups.

Key Words: blood parameters, egg features, temperature, quail

Zusammenfassung

Titel der Arbeit: **Der Einfluss hoher Umgebungstemperatur auf einige Blutparameter und Legeleistung bei 240 Japanischen Wachteln mit unterschiedlichem Körpergewicht** (Kurzmitteilung)

Ziel der Untersuchung war der Nachweis des Einflusses hoher Umgebungstemperaturen auf einige Blutparameter sowie die Legeleistung, das Eigewicht und die Eischalendicke bei Wachteln. Die Versuchsgruppe wurde bei 35 °C, die Kontrollgruppe bei 18 – 24 °C gehalten. Jede dieser Gruppen bestand aus zwei unterschiedlichen Gewichtsgruppen von je < 27 g bzw. > 27 g Körpergewicht. Es ergab sich ein signifikanter Einfluss der Umgebungstemperatur auf die Blutparameter. Legeleistung, Eigewicht und Eischalendicke waren bei den Versuchstieren unabhängig von Körpergewicht signifikant niedriger.

Schlüsselwörter: Blutparameter, Legeleistung, Umgebungstemperatur, Wachtel

Introduction

The poultry animals are the homoeothermic so they are capable to fix their body temperatures at a fixed level. A certain balance should have been included between the temperature obtained from outside in addition to the temperature produced within the body and temperature lost in the body enabling to ensure this feature. Such feature is affected with the environmental temperature and the size of the body surface at significant levels. Since the body surface per unit live weight is smaller in big size animals, those animals have greater difficulty in temperature loss so they are affected more significantly with the high temperatures (HAFEZ, 1968; SALMAN et al., 1985; YALCIN, 1981).

When the poultry exposed to any of the stressors, firstly biochemical and physiological alarm reactions occur; these are listed as the increase of the blood pressure, increase of the breath speed. Depending on the increase of the respiration, blood acid-base equilibrium breaks and the levels of some blood components change accordingly. The

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high environmental temperature also causes the alteration of the some blood components and affects the electrolyte balance (calcium, sodium, potassium and HCO_3) negatively (ALTAN and OGUZ, 1996; DONKOH, 1989; POYRAZ et al., 1991).

In metabolism of poultry, there is a critical balance among the calcium, sodium, potassium and chloride and such balance, which becomes at optimum level, ensures the recovery of the egg productivity, feed efficiency and the egg quality. Particularly the formation of the eggshell is affected with the acid-base balance in blood (HUGLES, 1988; MONGIN, 1968; ODOM, 1989).

Some researchers have noted that the high environmental temperatures cause the significant economical loss by affecting egg productivity features negatively in poultry (ALTAN and OGUZ, 1996; DEATON et al., 1981; DEATON, 1983; EMERY et al., 1984; HORST and PETERSEN, 1975; HORST and BECKER, 1991; PEGURI and COON, 1987).

It hasn't been coincided the sufficient research related with this topic in quails. So, in this study, it was aimed to determine the effects of the high environmental temperature (35 C degree) on some blood parameters, egg productivity and some egg quality features of the quails with different body weights.

Material and Methods

The animal material of the research is constituted by total 240 quails *(Coturnix coturnix Japonica)*, which passed from the incubation at the same day. The chicks have been placed into motherhood machine for 1 week. After the first week, the chicks were separated to the temperature groups as control (18-24 C degree) and experiment (35 C degree). In both temperature groups, two weight groups were constituted as being heavy (live weight >27g) and light (live weight <27g) groups.

The heating process was achieved through the electrical thermostat adjusted radians in experiment group (35 C degree). It was applied the same lighting and feeding program in all of the quail groups. The quails were placed equally (3 pieces) into the cages consisting of four floors and each floor was considered as the repetition.

In order to identify the blood parameters, total 80 quails (40 males + 40 females) consisting of 40 from each temperature group including 20 quails from each weight group were used. Their bloods were taken by slaughtering at the end of 6 th week. Serum biochemical parameters were measured using biochemical auto-analyzer (Olympus AA-660).

By the purpose of identifying the egg productivity, total 160 female quails between 7th and 14th weeks were used. The egg weight and the shell thickness of total 320 eggs at the last week of the experiment (14th week) were investigated. In such examination, the sensitive scale of 0,01 g was used for the egg weighing and micrometer for the measurements of the shell thickness. The average of the values measured from the sharp, stubby and medium sides of the egg was considered as the shell thickness.

Regarding to the statistical evaluations, multivariate analysis was made to determine the effects of the temperature and the weight factors on investigated features. Such mentioned statistical analysis were achieved with SPSS 10 set program (OZDAMAR, 1997).

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Results

Blood Parameters: The average of the investigated blood parameters including standard errors with the statistical analysis results were given in Table 1 depending on the weight and temperature groups. From the investigated parameters, the effect of the temperature on others except AST, ALT and ALP in addition to the weight x temperature interaction on other parameters except AST, ALT, calcium and potassium were found significant statistically (P<0.05, P<0.01, P<0.001).

Table 1
The results of statistical analysis relating to blood parameters depending on control and experiment groups (Statistische Auswertung von Blutwerten in der Kontroll- und Versuchsgruppe)

Parameters		Control (18-24^{0}C) n=40		Experiment(35^0) n=40		p		
		Mean	S.E.	Mean	S.E.	W	T	W X T
Glucose (mg/dl)	Heavy	216.18	21.08	224.60	23.80	*	**	*
	Light	228.18	22.35	233.98	22.81			
T. Protein (g/dl)	Heavy	4.46	1.25	4.26	0.34	*	**	**
	Light	5.16	1.95	4.67	0.38			
Albumin (g/dl)	Heavy	1.97	0.46	1.80	0.71	***	***	**
	Light	2.30	0.65	1.90	0.92			
Urea (mg/dl)	Heavy	1.48	0.35	1.97	0.55	***	***	**
	Light	1.57	0.41	2.30	0.82			
AST (U/L)	Heavy	139.92	9.96	141.26	5.42	n.s.	n.s.	n.s.
	Light	140.93	8.14	141.01	6.50			
ALT (U/L)	Heavy	15.02	2.98	14.84	2.88	**	n.s.	n.s.
	Light	13.55	2.48	13.47	3.48			
Phosphorus (meq/L)	Heavy	4.26	1.29	3.99	1.33	**	*	*
	Light	3.90	1.24	3.85	1.21			
Sodium (meq/L)	Heavy	140.20	6.66	144.04	7.19	n.s.	**	*
	Light	142.32	4.96	144.92	4.14			
Calcium (mmol/L)	Heavy	5.42	2.87	5.09	2.97	**	**	n.s.
	Light	5.83	2.48	5.52	3.62			
Potassium (meq/L)	Heavy	6.98	1.25	5.82	1.29	*	**	n.s.
	Light	6.82	1.34	5.57	1.44			
ALP (mg/dl)	Heavy	349.08	24.81	343.04	24.80	**	n.s.	*
	Light	339.78	24.45	339.07	24.80			
Trigliserid (mg/dl)	Heavy	119.02	4.96	121.95	7.00	**	*	**
	Light	123.02	3.61	124.57	4.58			
T. Chol. (mg/dl)	Heavy	211.43	5.13	220.33	4.97	n.s.	**	**
	Light	214.05	5.36	220.85	5.36			

n.s.: P>0.05; significance *: P<0.05 **: P<0.01 ***: P<0.001 AST: Aspartate amino transferase; ALT: Alanine amino transferase; ALP: Alcaline phosphatase; T.Chol.: Total cholesterol; W : Weight; T: Temperature; W X T : The interaction of weight and temperature; S.E.= Standard Error

Egg Features**:** The statistical analysis results related to the features of egg yield, egg weight and shell thickness were given in Table 2 regarding to the temperature and weight groups. Regarding to the egg productivity, the effect of the temperature and the weight x temperature interaction was noted as the highest significant (P<0.001). The effect of both weight and temperature included in egg weight and the shell thickness are significant statistically (P<0.05, P<0.01).

Table 2
The results of statistical analysis relating to egg yield, egg weight and egg shell thickness depending on control and experiment groups (Statistische Auswertung von Legeleistung, Eigewicht und Eischalendicke in der Kontroll- und Versuchsgruppe)

Features		Control (18-24 ^{0}C)			Experiment (35 ^{0}C)			P		
		n	Mean	S.E.	n	Mean	S.E.	W	T	W X T
Egg yield (%) (7-14th week)	Heavy	40	65.76	11.25	40	57.33	9.02	*	***	***
	Light	40	64.38	10.83	40	50.63	9.09			
Egg weight (g)	Heavy	80	10.88	0.79	80	10.06	1.39	*	*	*
	Light	80	10.34	0.89	80	9.75	1.13			
Egg shell thickness (mm)	Heavy	80	0.23	0.95	80	0.20	1.15	*	**	n.s.
	Light	80	0.22	1.37	80	0.19	1.21			

n.s. : P>0.05 significance *****: P<0.05 ******: P<0.01 **** ***: P<0.001 W : Weight T : Temperature W X T : The interaction of weight and temperature; S.E.= Standard Error

Discussion

The effect of temperature on the glucose, protein, albumin, urea, phosphorus, sodium, calcium, potassium, trigliserid and cholesterol from the blood parameters, investigated in this research, has been found significant statistically. ALTAN and OGUZ (1996), has also pointed out that some variations occurred in blood components in the high environmental temperatures in quails.

The egg productivity decreased at 35 C degree in both weight groups. So-called reduction in egg productivity depending on high temperature in quails is in conformity with the findings of ALTAN and OGUZ (1996). Both egg weight and shell thickness, which were investigated as being one of the egg quality criteria considered in this research, were found low definitely at 35 C degree compared with 18-24 C degree, a decrease in heavy quails regarding to egg weight become more than the light ones. This research findings regarding to the negative effect of the high temperature on egg weight (DEATON, 1983; PEGURI and COON, 1987; SALMAN et al., 1985) and the shell thickness in poultry (ALTAN and OGUZ, 1996; MONGIN, 1968; ODOM, 1989; SALMAN et al., 1985) have also been supported by many researchers.

It was noted that the egg productivity and the eggshell formation were under the effect of the acid-base equilibrium in blood, and the breakage in quality of the eggshell, which was observed under the high temperatures, was caused by the alteration of

calcium, sodium, potassium and phosphorus levels (HUGLES, 1988; MONGIN, 1968; ODOM, 1989; POYRAZ et al., 1991).Therefore, in this research it is possible to consider that such decrease, which was sourced by the high temperature, in egg productivity and eggshell might be caused by such breakage of acid-base equilibrium due to the alterations in blood-electrolyte levels. Likewise, it was observed that the sodium has increased but the calcium, potassium and phosphorus decreased depending on the effect of high temperature in this research (Table 1).

As a result of this research, it was concluded that the high environmental temperature changed some blood parameters as well as to affect the egg productivity and egg quality negatively, particularly in heavy quails.

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