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Original article

INVESTIGATING THE EFFECT OF STRESS FACTOR ON HOMEOSTASIS AND FERTILITY OF FERTILE QUAILS

A.A. Taghiyev, A.Ya. Mammadova

Abstract

During the study, the influence of stress factors on the physiological state and productivity of quails was clarified and measures were taken to prevent such situations from occurring. For the first time, the research work was carried out on the "Texas albino" breed of quails created in the USA with a high live mass. Measures were taken to prevent the causes of diseases among quails and changes in homeostasis caused by temperature stress in spring and summer.

Purpose. Taking into account the above, we aimed to investigate the causes of diseases and changes in homeostasis among quails as a result of temperature stress in spring and summer.

Materials and methods. During the study, when the quails were kept in open-air 3-story cages under the shed, the air temperature, humidity, and air current speed, which affect the clinical-physiological condition of the quails, were determined 3 times a day. To control these indicators, a barothermohygrometer was used. Quails suspected of having the disease and less active in the cage were selected and it was clarified how leukocytes, which are indicators of homeostasis, change in the quail body. The effect of temperature stress caused by high temperature in June, July, August on homeostasis indicators was determined in quails, and measures were taken to reduce this abnormal effect.

Results. "Betafin", "Mikitov", "Anti stress Forte Wsp" preparations were used to prevent changes in homeostasis when quails were kept during temperature stress.Those preparations were added to the water and feed taken by the quails 3-4 hours before the start of temperature stress. During the study, the morpho-biologicalindicators of the quails' blood and the quality indicators of the eggs obtained from quails were also determined, and it was determined that the applied preparations were effective during temperature stress.

Conclusion. In order to prevent changes caused by temperature stress in homeostasis when quails are kept outdoors under a shed during the summer months, on the days when the air temperature rises, “Betafin”, “Mikitov”, “Anti stress Forte Wsp” should be added to the food and water they drink before 10:00 a.m.

Keywords: quail; homeostasis; disease; diagnose; leukocytes; stress; temperature; fertility; quail’s egg; anomalies

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Научная статья

ИССЛЕДОВАНИЕ ВЛИЯНИЯ ФАКТОРОВ СТРЕССА НА ГОМЕОСТАЗ И ПЛОДОВИТОСТЬ ПЕРЕПЕЛОК-НЕСУШЕК

А.А. Тагиев, А.Я. Мамедова

Аннотация

В ходе исследования установлено влияние стрессовых факторов на физиологическое состояние и продуктивность перепелов и приняты меры по предотвращению возникновения подобных ситуаций. Впервые исследовательская работа проведена на выведенной в США породе перепелов «Техасский альбинос» с высокой живой массой. Приняты меры по предупреждению причин заболеваний перепелов и изменений гомеостаза, вызванных температурным стрессом в весенне-летний период.

Цель. Изучить причины заболеваний и изменений гомеостаза перепелов в результате температурного стресса в весенне-летний период.

Материалы и методы. В ходе исследования при содержании перепелов в открытых 3-этажных клетках под навесом 3 раза в сутки определяли температуру воздуха, влажность и скорость воздушного потока, влияющие на клинико-физиологическое состояние перепелов. Для контроля этих показателей использовали баротермогигрометр.

Отобраны перепела с подозрением на заболевание и менее активные в клетке и выяснено, как в организме перепелов изменяются лейкоциты, являющиеся показателями гомеостаза. У перепелов определено влияние температурного стресса, вызванного высокой температурой в июне, июле, августе,

на показатели гомеостаза и приняты меры по снижению этого аномального эффекта.

Результаты. Препараты «Бетафин», «Микитов», «Антистресс Форте Wsp» использовали для предотвращения изменений гомеостаза при содержании перепелов в условиях температурного стресса. Данные препараты добавляли в воду и корм, принимаемые перепелками, за 3-4 часа до начала температурного стресса. В ходе исследования также были определены морфобиологические показатели крови перепелов и качественные показатели яиц, полученных от перепелов, и установлено, что применяемые препараты эффективны при температурном стрессе.

Заключение. Для предотвращения вызванных температурным стрессом изменений гомеостаза при содержании перепелов на открытом воздухе под навесом в летние месяцы, в дни повышения температуры воздуха следует применять препараты «Бетафин», «Микитов», «Антистресс Форте Wsp». добавлять в пищу и воду, которую они пьют до 10:00.

Ключевые слова: перепелка; гомеостаз; болезнь; диагностика; лейкоциты; стресс; температура; плодовитость; перепелиное яйцо; отклонения

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Introduction

A lot of scientific research work has been conducted on the effects of temperature stress on birds and it has been proven that under the influence of temperature stress, various productivity indicators (meat, eggs, bird's feather) in birds are low and great changes occur in the clinical-physiological state of the body. Many scientists [1; 2; 3; 12] show that stress occurs not only due to temperature changes, but also during transportation of quails from one area to another. They explained this by the variations that occur when determining the leukoformula during the blood examination. A researcher working in the field of physiology shows that [8] if the stress continues for a long time, due to the fact that the coefficient of tolerance against heat decreases, great changes occur in the body, which is reflected in the blood.

Homeostasis is a Greek word derived from the words "homois" and "stasis", which means that the body remains unchanged in the same form. For the first time, this term - the word homeostasis - was used by Walter Cannon in 1932 [6; 7].

Homeostas hormones in birds, as in all mammals, is usually understood as a combination of internal processes involving the endocrine system, and metabolism. A lot of research work has been carried out in this field, the negative effects of high temperature on birds in the countries where temperature is monitored have been researched, and the changes in homeostasis in the body have been studied. Many scientists [5; 9; 10; 14] used to show that homeostasis means only the internal environment of the body - blood, lymph, intercellular fluid, and nowadays these indicators mean the content of all physiological processes occurring in the body. Farmers and private farm owners in Azerbaijan who keep quails in spring and summer keep quails in outdoor cages from May 15 to October 15. Cages are usually made of light construction material and placed under the shed in areas without two-way air flow.

During the first days, under the influence of temperature stress, internal diseases of a non-infectious nature and non-contagious due to violations of zoohygienic sanitary rules are often observed among quails [4; 11; 12; 13].

Many researchers working in this field [7] indicate that noise, nutrients, storage conditions, air pressure indicators, changes in body PH and vibration cause stress in birds. They came to the conclusion that when the movement of vibrations is 140-160 times per minute, stress occurs in birds. Scientists clarified the formation of stress when determining the leukocyte formula. When the vibrations in the area where the birds are kept are 140-160 times per minute, the amount of eosinophils increases by 69.9%, the amount of basophils by 58.06%, the amount of lymphocytes by 19.4%, and the amount of nucleated neutrophils by 70.6% exceeds the physiological norm.

Purpose

Taking into account the above, we aimed to investigate the causes of diseases and changes in homeostasis among quails as a result of temperature stress in spring and summer.

Materials and methods

The study was conducted in the Azerbaijan State Agrarian University's "Education-Experimental Center for Quail Breeding", in the vivarium of the "Veterinary Medicine" Faculty, and laboratory examinations in the laboratory No. 23 of the Department of Anatomy, Pathanatomy and Pathophysiology. During the study, when the quails were kept in open-air 3-story cages,under the shed, the air temperature, humidity, and air current speed, which affect the clinical-physiological condition of the quails due to changes in atmosphere, were

determined 3 times a day. A barothermohygrometer was used to monitor these indicators. Suspected diseased quails, which were less active in the cage, were selected, and how leukocytes, which are indicators of homeostasis, change in the quail body was determined.

When determining the amount of leukocytes in the blood, leukocyte index and the index of adaptation to stress, it was determined using accordingly

$X = \frac{A \times 4000 \times M}{H}$, here: X - amount of leukocytes in 1μl of blood, A - the amount of leukocytes counted in 100 large squares, M - degree of dilution of blood (20), H - the number of small squares (16x25=400) in 25 large squares, 4000 - the volume of the counting chamber on the small square - 1/4000 μl;

$Li = \frac{L}{H}$, here: Li - leukocyte index, L - lymphocyte leukocytes, H - were neutrophilic leukocytes;

$LİQ = \frac{L}{G}$, here: LİQ - lymphocytic granulocyte index, L – lymphocyte leukocytes, G - the ratio of granulocytes to the total number formulas. Urit - 332 and Urit - 800 Vet equipment were used during the blood examination to prevent temperature stress that may occur as a result of high temperature. Weather information was used from publicly available internet resources to determine when temperature stress would occur, so the amount of temperature in the environment.

In order to eliminate the danger during temperature stress, we set the safety index (SI(security index)) in quails every time. The safety index was determined by the following formula. The experiment was conducted according to the following scheme.

$$SI=(1,8\ T^0 + 32)+\text{relative humidity\%}$$

Table 1.

Scheme of conducting the experiment

Groups	Feed additives	Substances used to reduce the effects of temperature stress
I experiment group	MR + Mikitov	0,5 qr - for 1 kq food
II experiment group	MR + Betafin	0,1qr -for1 litr water
III experiment group	MR +Anti stress forte WSP	0,8 qr - for 1 litr water

Note: MR-main ration

The applied substances were applied 2 h before the onset of temperature stress. In order to increase the nutritional value of the feed in all groups, 5 g

of sprouted wheat and 2 g of Aydag zeolite were added to the feed ration in all groups.

During the study, the productivity of quail birds during high temperature stress was also determined. Productivity of older quails before stress and after taking preventive measures, their live weight and ovarian productivity were determined based on generally accepted methods.

Results and discussion

We first determined how the safety index changed in fertile quails under the shed during the temperature stress period when the air temperature was 36-38 ^{0}C. When determining the safety index (SI), the temperature and relative humidity were examined at a distance of 20 cm from the cages and between the first,third floors of the cage.When clarifying the safety index in all three groups with the formula specified in the methodology of the research, it was found that the safety index in all groups varied from the norm (normally 150) to 166 in the first group, 169 in the second group, and 167 in the third group, which means that the fertile quails are stressed during the temperature stress period. The temperature tolerance and safety index against temperature stress were determined that the safety index was higher in the quails kept on the third floor of the cages, because temperature was hotter in above than floor. This caused more changes in the blood and productivity indicators of the quails. During the period when the temperature is high under the shed, at the same time, the heat resistance index (HRI) of quails was measured by Yu.A. Rauschenbach's methodology.From the obtained results, it was clear that the heat resistance index (HSI) was 81.72; 80.36 and 80.93 in all three groups and it causes temperature stress in quails. During this period, the quails were inactive and refused to eat food, they tried to drink a lot of the cool water provided for them. Usually, the heat resistance index is considered normal when it varies between 83-85. From the results obtained above,it is clear that temperature stress makes the heat resistance index significantly lower than the physiological norm,so it is 1,28-3,28 in the first experimental group; 2,64-4,64 in the second and 2,07-4,07 in the third experimental group. In this period, the effect of the substances applied during temperature stress on the morphological parameters of the blood of fertile quails was also investigated.

Taking into account the above, the feed additives «Betafin», «Mikitov» and «Anti stress forte WSP» were added to the feed and water of the quails, starting from around 10:00 a.m during the period when the temperature would be at a high level, in order to increase the resistance of the quails to temperature stress.

Table 2.

The effect of the substances applied during temperature stress on the morphological parameters of the fertile quail's blood (M ± m)

Indicators	Groups		
	I	II	III
Erythrocytes, 10^{12}/l	3,06 ± 0,21	2,86 ± 0,19	3,04 ± 0,12
Leucocytes, 10^{9} /l	26,11 ± 0,71	27,31 ± 0,54	26,42 ± 0,34
Hemoglobin, q/l	94,4 ± 2,19	91,7 ± 3,09	93,7 ± 1,93
Hematocrit, q/l	38,11 ± 2,04	38,66 ± 2,17	38,89 ± 1,49

In order to get more accurate information about the changes that occur in the body of quails during temperature stress, we investigated how the leukocyte formula of quails is affected during temperature stress. The obtained results are shown in table No. 3.

Table 3.

The effect of the substances applied on leukocyte indicators of fertile quail's blood (M±m)

Indicators	Groups		
	I	II	III
Leucocyte, 10^{9} /l	26,11 ± 0,41	27,31 ± 0,54	26,42 ± 0,34
Pseudoeosinophils, %	20,2 ± 1,68	20,9 ± 1,19	20,1 ± 1,7
Eosinophils, %	3,3 ± 0,42	3,1 ± 0,53	3,4 ± 0,71
Monocytes, %	3,7 ± 0,32	2,2 ± 0,36	3,4 ± 0,25
Basophils, %	0,5 ± 0,51	0,5 ± 0,53	0,6 ± 0,52
Lymphocytes, %	72,31 ± 2,12	73,3 ± 2,17	72,5 ± 2,49

As can be seen from table No. 3, all the applied preparations caused the physiological parameters of blood to be maintained around physiological norms, especially in groups I and III, despite the high temperature in the area where the quails were kept. It was determined that the morphological indicators of the blood of the fertile quails kept in the II group were at the lower limit of the physiological norms.Determination of morphological indicators of blood showed that all three preparations applied in June and July showed that the homeostasis of quails changed suitable to the physiological norm. As can be seen from Table 3, the amount of leukocytes in all groups was found to be at the upper limit of the physiological norm.The amount of leukocytes in experimental group I was equal to 26.11× 109 /l, in experimental group II 27.31× 109 /l, and in experimental group III 26.42 × 109 /l. Here, it was

clarified that the amount of leukocytes in mother quail kept in group II was 1.2 × 109 /l higher than group I, and 0.89 × 109 /l higher than group III. At the same time, it was determined that the number of lymphocytes was higher in experimental group II than in experimental groups I and III (73.3%). In this period, we determined that the blood of fertile quails in the I group was 72.3% and in the III group it was 72.5%. Again, it was clarified that the substance applied in experimental group II could not fully prevent stress during temperature stress. Therefore, it is better to use «Betafin» and «Anti stress forte Wsp» substances in experimental groups I and III. Nevertheless, all three drugs can be used to prevent temperature stress of quails. During the study, the biochemical parameters of quails were investigated after the application of substances used to prevent temperature stress. The obtained results are shown in table No.4.

Table 4.

Effect of substances applied during temperature stress on biochemical parameters of blood of fertile quails (M±m)

Indicators	Groups		
	I	II	III
The protein, q/l	35,1 ± 0,04	34,8 ± 0,03	35,9 ± 0,04
Albumin, %	41,34 ± 0,04	40,9 ± 0,02	41,71 ± 0,02
Globulins, %	58,43 ± 0,02	58,96 ± 0,01	58,14 ± 0,03
Glucose, mmol/l	10,88 ± 0,02	10,74 ± 0,03	11,04 ± 0,03
Urea, mmol/l	0,43 ± 0,01	0,43 ±0,02	0,47 ± 0,01
Calsium(Ca), mmol/l	1,0 ± 0,01	0,9 ± 0,02	1,1 ± 0,12
Phosphorus (P), mmol/l	1,59 ± 0,02	1,58 ± 0,01	1,62 ± 0,02

During the period when the quails were kept under the shed in June and July, the examination of biochemical indicators after the application of substances on the days of temperature stress showed that the amount of total protein, albumin, globulin, glucose, urea, calcium and phosphorus in experimental groups I and III was around the physiological norm. However, as in the morphological indicators of the blood, the indicators in the II experimental group were again at the lowest limit of the physiological norm. The study of biochemical indicators once again showed that all three applied preparations are reflected in the prevention of temperature stress in quails.

The effect of substances applied during the period of temperature stress on productivity and quality indicators of eggs obtained from them was also investigated. The obtained results are shown in table No. 5.

Table 5.

Morphological indicators of the eggs taken from the White Texas bred quails during temperature stress (M±m)

Indicators	Groups					
	I		II		III	
	June (daily)	July (daily)	June (daily)	July (daily)	June (daily)	Jule (daily)
	150-160	280-210	150-180	210-250	150-180	180-210
Weight of egg, gr	11,06 ± 0,2	11,02 ± 0,3	11,34 ± 0,2	11,29 ± 0,3	11,08 ± 0,2	11,07 ± 0,3
Weight of egg yolk , gr	3,51 ± 0,1	3,44 ± 0,2	3,72 ± 0,2	3,61 ± 0,2	3,50 ± 0,3	3,47 ± 0,3
Weight of albumen(egg white),gr	6,38 ± 0,3	6,37 ± 0,1	6,40 ± 0,2	6,48 ± 0,3	6,39 ±0,1	6,43 ± 0,2
Weight of egg-shell,gr	1,17 ± 0,02	1,16 ± 0,01	1,22 ± 0,01	1,20 ± 0,01	1,19 ± 0,01	1,17 ± 0,1

As can be seen from table No. 5, the Mikitov feed supplement applied in experimental group II during the period of temperature stress had a positive effect on the productivity of quails during temperature stress and the quality indicator of the eggs.Thus, the weight of the eggs from the II experimental group is 11.29-11.34 g, the weight of the yolk is 3.61-3.72 g, the weight of the egg white is 6.40-6.48 g, and the weight of the egg shell is 1.20-1.22 g, it was determined that the indicators of egg quality were low in experiment groups I and III.The highest variability was found to be significantly lower in the weight of egg yolk and eggshell in experimental groups I and III. From the obtained results, it became clear that in the experiment group where "Mikitov" feed supplement was applied, despite the fact that the blood indicators were at the lower limit of the physiological norm during the period of temperature stress, the egg productivity of the fertile quails kept in this group was high.

Conclusion

In order to prevent changes caused by temperature stress in homeostasis when quails are kept outdoors under a shed during the summer months, on the days when the air temperature rises, "Betafin", "Mikitov", "Anti stress Forte Wsp" should be added to the food and water they drink before 10:00 a.m.

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