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Original Contribution

ETHOLOGICAL STUDY OF BROILER CHICKENS AFTER INDUCTION AND TREATMENT OF MUSCULAR DYSTROPHY

N. Bozakova, K. Stoyanchev, D. Girginov, T. Stoyanchev

Faculty of Veterinary Medicine,Trakia University, Stara Zagora

ABSTRACT

The changes in broiler behaviour are reliable indicators of their health status. The aim of the present study was to follow the behavioural changes of broiler chickens after induction and treatment of muscular dystrophy. The study was performed on 20 broiler chickens, reared under comfortable microclimatic conditions. The birds were divided into two groups: group I (control group) and group II – birds with nutritionally induced muscular dystrophy. The rearing period lasted from the age of 1 to 60 days. Chicken behaviour was recorded by momentary visual observation at 15-minute intervals for a total time of 6 hours. The ingestive behaviour the gregarious behaviour, the sexual behaviour and the agonistic behaviour were observed. The beginning of muscular dystrophy was manifested at the age of 33 days in group II with significantly higher number of lying chickens and a lower number of ingesting, walking and dust bathing birds compared to controls ($p<0.01$). At this time the number of conflicts in control birds was higher than in experimental birds ($p<0.01$). Three days after the end of the treatment the difference in the behaviour of birds from experimental and control groups disappeared.

Key words: chicken broilers; poultry welfare, muscular dystrophy; ingestive, gregarious, agonistic behaviour.

INTRODUCTION

The behaviour of birds is a reliable criterion for diagnosing diseases and for the efficacy of therapy. A similar view has been expressed by a number of authors – Mench and Siegel (1), Mench (2), Platz at al.(3), Hocking et al.(4), Martrenchar et al. (5) etc. Every deterioration of avian health alters their behaviour, as in muscular dystrophy.

From ethological studies in birds, the time of appearance of a given skeletal muscular disease could be detected with high precision (Duncan (6); Mench and Siegel (1), Mench (2)). The same is valid for the efficacy of the subsequent treatment and the health restoration thereafter.

Similar ethological investigations on the welfare of broiler chickens with experimentally provoked muscular dystrophy (MD) followed by therapy, are not available as far as we know.

The purpose of the present study was to follow out the alterations in the behaviour of broiler chickens after experimental dietary induction of muscular dystrophy (MD) and with regard to its therapy.

MATERIALS AND METHODS

1. Animals and protocol design

For the purpose of this study, a production experiment was performed in the experimental unit of the Department of Internal Non-infectious Diseases at the Faculty of Veterinary Medicine, Trakia University – Stara Zagora, with 20 one-day-old broiler chickens. The birds were reared from the age of 1 to 60 days under conditions, corresponding to the zoohygienic norms for this category of poultry during the summer period.

Broiler chickens were divided into 2 groups, 10 in each (5 female and 5 male) with average body weight of 55.00 g. The groups were as follows: group I – control (chickens without MD) and group II – chickens that, after the age of 14 days, were fed with a feed supplemented with 4% oxidized fat with peroxide number of 200.00 g (allowed

*** Correspondence to**: *Nadya Alexandrova Bozakova, Depatment of Animal Higiene, Ethology and Animal Protection, Faculty of Veterinary Medicine,Trakia University, Stara Zagora 6000; phone.:+359-42-699 570; E-mail:nadiab@abv.bg*

amount– 0.20 g) in order to induce MD. In both groups, an analogous prevention programme was applied with the exception of the fact that group II was not treated prophylactically with Seled between days 8-13 and 28-30 with regard to enhancing the appearance of the muscular dystrophy. The identification of the birds was done with wing marks.

Both groups were housed in different sectors of 4 m^2 in the same premises. The sectors were covered with a clean and dry 10-cm straw layer. In the centre of each sector was an infrared 250 W lamp. The chickens were reared under conditions of controlled microclimate maintained within the reference range of respective parameters. The ventilation was natural. Microclimatic parameters: temperature, humidity, ammoniac concentrations and light intensity were determined using routine methods.

The birds from the control group were fed a balanced poultry feed produced by Provimi-Zara – Stara Zagora. Based on their age, they received prestarter, starter and grower feeds. From the age of 14 to 60 days, the birds from the experimental group were given a diet poor in selenium, vitamin E and sulphur-containing amino acids, supplemented with 4% oxidized fat with peroxide number of 200.00 g (allowed amount – 0.20 g) in order to induce MD. The treatment of diseased broiler chickens began on the 42nd day with Seled-hydro, containing sodium selenite and vitamin E, produced by Vetprom AD – Radomir, at a dose of 1 ml/l drinking water for 5 days.

2. Behaviour analysis

The behaviour of broilers was monitored using ethogrammes. They were made by means of momentary visual observation at 15-minute intervals for 6 hours (from 9.00 a.m. to 3.00 p.m.) according to Popova-Ralcheva et al (7) and Bozakova (8). The ethological patterns were determined at the age of 33 days (at the time of the first positive test for MD according to Georgiev (9) and at the age of 50 days (3 days after the end of the therapy) when the MD test was negative in all experimental birds. During the ethological survey, the number of birds with a specified pattern of behaviour: ingestion (intake of water and feed), gregarious behaviour (resting, movements, dust bathing) according to Wojcik and Filus (10) and the agonistic behaviour were determined.

3. Statistical analysis

The statistical analysis of data was done with the non-parametric Mann-Whitney test and Descriptive Statistics (Statmost for Windows) and the figures were made in Microsoft Excel 2000.

RESULTS AND DISCUSSION

The studied birds were reared in conditions of ecological comfort during the summer period. The data on the air temperature and relative humidity, the concentration of ammonia, the lighting, the air velocity are given on ***Table 1***.

Table 1. *Microclimatic conditions for broiler chickens after induction and treatment of muscular dystrophy, reared under ecological conditions.*

Groups	***Age of days***	***Temperature (^{0}C)***	***Humidity, (%)***	***NH_3, (mg/l)***	***Lux , (lx)***	***Ventilation, (m/s)***
I II	1- 30 days	28.0±0.29	50.0±0.42	0.005±0.0002	70±6.77	0.26±0.004
	31- 40 days	29.0±0.19	52.8±0.50	0.005±0.0001	52.5±1.44	0.26±0.004
	41-50 days	29.0±0.24	52.0±0.42	0.006±0.001	47.5.0±1.44	0.27±0.005
	51-60 days	28.0±0.24	51.0±0.44	0.007±0.001	42.0±1.44	0.26±0.004

Comparing the average values of the temperature and relative air humidity during the rearing of broiler chickens with the reference norms given in Act № 44/20.04.2006 (11) for veterinary medical requirements of animal rearing facilities, it was established that they were within the allowed limits. The average air temperature varied between 28-29^{0}C (standard 32-18^{0}C).
The average relative air humidity was 50-52% (standard 50-80 % in the Act). The ammonia concentration during the entire period of rearing was 0.05-0.07 mg/l, that is, lower than the maximum allowed concentrations of 0.02 mg/l of this toxic substance for poultry rearing (Netsov and Stoyanchev (12).

The light intensity during the entire period was from 70 to 42lx, that corresponded to the reference range of 50-5 lx specified by the Act. The air velocity in the rearing premises was 0.26-0.27 m/s, that fell within the norms given by Act 44 – 0.2 to 0.3 m/s.

The obtained results showed that during the entire period of the study, the broiler chickens were reared under microclimatic conditions – air temperature, humidity and

velocity, light intensity and ammonia concentration, corresponding to zoohygienic requirements for this category of poultry, i.e. under conditions of ecological comfort.

The results of the MD test (***Table 2***) performed after Georgiev (9) showed that at the age of 33 days, in 2 broilers from the experimental group, the test was positive. After dropping the birds from a height of 1 m, they could not stand on their feet and did not run immediately after landing, but were lying down for about 2 minutes. After that, their gait was unstable and they climbed down again. By the age of 42 days, the MD test was positive in 8 experimental birds (80%). This was a signal for initiation of the therapy with Seled. The healing was intensive and as early as the 43rd day, only 3 birds responded positively to the test (30%). By the 48th day (6 days after the beginning of the treatment), the test was positive in only 1 bird. By the age of 50 days (i.e. 3 days after the end of the therapy), all tests were negative. It could be then summarized that the first clinical signs of MD, induced via the diet in broiler chickens, were manifested at the age of 33 days. The treatment with Seled-hydro at a dose of 1 ml/l drinking water for 5 consecutive days was successful and the complete healing occurred by the 50th day (3 days after the end of the therapy).

Table 2. *Incidence (%) of MD positive broiler chickens, after induction and treatment of dietary muscular dystrophy, (n=10).*

Groups	***Age of days***							
	After MD treatment				***After MD treatment***			
	n	28	33	42	n	43	48	50
I.	10	-	-	-	10	-	-	-
II.	10	0	20%	80%	10	30%	10%	0

The monitoring of the changes in the behaviour of broiler chickens (***Table 3***) at the age of 42 and 50 days, showed significant differences in the ingestive, gregarious and agonistic behaviour between both groups.

Table 3. Chicken behaviour in rearing under comfortable microclimatic conditions. Data are presented as mean ± SEM, n=10.

Behaviour:	***At the age of 42 days (clinical manifestation)***					***At the age of 50 days (3 days after the end of the treatment)***				
	I-st ***group***		II-nd ***group***			I-st ***group***		II-nd ***group***		
	X	±Sx	X	±Sx	p	X	±Sx	X	±Sx	p
Ingestive behaviour										
Feeding	3.20	0.51	2.40	0.27	< 0.01	3.50	0.37	3.50	0.27	>0.5
Drinking	2.42	0.48	1.50	0.17	< 0.01	1.80	0.13	1.70	0.21	>0.5
Gregarious behaviour										
Laying	2.30	0.30	3.70	0.30	< 0.01	2.50	0.22	2.20	0.29	>0.5
Movement	1.90	0.38	1.60	0.22	<0.05	1.80	0.25	1.77	0.22	>0.5
Dust bathing	0.80	0.29	0.30	0.15	< 0.01	0.44	0.16	0.60	0.22	< 0.01
Agonistic behaviour	0.30	0.15	0.10	0.10	< 0.01	0.20	0.13	0.20	0.13	>0.5
Sexual behaviour	0	0	0	0		0	0	0	0	

The observations on the ingestive behaviour showed that in birds affected by MD, the number of feeding birds was significantly lower (2.40±2.67) compared to controls (3.20±0.51; p<0.01). Similar data have been obtained in a similar ethological investigation in broiler turkeys after induction and treatment of MD (Stoyanchev et al. (13)).

The same tendency was present in water intake pattern. The drinking birds with MD were less compared to controls (1.50±0.166 and 2.42±0.480, respectively, at p<0.01). These data showed that the muscular dystrophy diminished the ingestive behaviour in birds due to the developing pathology. Similar data about lower numbers of feeding birds were scored by Wojcik & Filus (10) despite the fact that the birds spend twice more time at feeders. After treatment with Seled, the number of feeding and drinking

chickens were similar to those in controls (3.50±0.27 *vs*. 3.50±0.37, p>0.05; and 1.70±0.21 *vs*. 1.80±0.13 respectively; p>0.05).

The chickens with MD exhibited significant higher numbers of lying birds – 3.70±0.30 than those in the control group (2.30±0.30, p<0.01).

The higher number of resting birds could be explained by the pathological alterations in muscles (14, 15) and the easier exhaustion. Similar data for higher number of resting birds with skeletal and muscular diseases and myopathies have been reported in broiler chickens, ducklings and turkey broilers by Mench and Siegel (1); Mench (2); Weeks et al., (16); Nier et al. (15).

After the end of the therapy, the number of lying birds was almost equal to those in controls (2.20±0.29 vs 2.50±0.22; p>0.05), thus evidencing the efficacy of the applied therapy.

The examination of the locomotor activity in broiler chickens showed that in experimental birds, the number of walking broilers was significantly lower (1.60±0.22) than in controls (1.90±0.38; p<0.05). A similar tendency was observed in a similar experimental design with turkey broilers (Stoyanchev et al.(12)). The lower number of moving birds in group II could be explained with the dystrophic events occurring in striated muscles and therefore resulting in the problematic locomotion (14, 15). Comparable data about reduced moving intensity in broiler chickens, turkey broilers and ducklings are reported by Mench (2); Surai (14); Duncan (6) and others.

After the therapy with Seled, the number of moving birds in both groups was almost the same (1.77±0.22 and 1.80±0.25 in the experimental and control group respectively; p>0.05) that denoted the efficacy of the treatment.

The inspection of the dust bathing behaviour showed significantly lower number of dust bathing birds in the experimental group – 0.30±0.15 than in controls – 0.80±0.29, p<0.01. An interesting fact was that the number of dust bathing chickens from the experimental group was higher after the performed treatment compared to untreated ones – 0.60±0.221 vs 0.44±0.163, p<0.01. This could be attributed to the improved welfare of healing birds. According to Sherwin and Kelland (17) and Stoyanchev et al. (13), the better welfare correlated with increased dust bathing times.

Sexual behaviour was absent in all groups both prior to and after the Seled therapy that could be explained by the age of chickens (lack of sexual maturity). According to Yang et al. (18), Hocking et al. (4) the onset of sexual maturity in birds is directly related to testosterone concentrations.

The agonistic behaviour of experimental birds was significantly lower in MD birds than in controls -0.10±0.10 *vs*. 0.30±0.15, p<0.01. After the therapy with Seled the number of acts of aggression in control and diseased birds were equalized (0.20±0.13 and 0.20±0.13, p>0.05). Taking into consideration the views of Yang et al. (17) and Hocking et al.(4), that testosterone was responsible for the aggressive behaviour in birds, we assume that the induced muscular dystrophy had a negative effect on the normal manifestation of agonistic behaviour in broiler chickens.

CONCLUSION

The recapitulation of observed changes in the behaviour of broiler chickens with dietary induction of muscular dystrophy (MD) and after its treatment with Seled at 1 ml/l water for 5 consecutive days, yielded the following conclusions:

1. The beginning of MD in broiler chickens was manifested by the age of 33 days. The therapy with Seled-hydro was successful and occurred by the 50th day of age (3 days after cessation of the therapy).
2. The clinical manifestation of MD reflected negatively upon the ingestive behaviour of experimental birds, compared to control chickens – a reduction in the number of feeding and water drinking broilers was observed.
3. The dietary MD decreased the locomotor activity of broiler chickens – the number of resting birds increased and those of walking and dust bathing ones was lower.
4. The induced MD had a negative impact on the normal patterns of agonistic behaviour in broiler chickens.
5. The complete effect of the treatment of dietary MD was apparent three days after the cessation of the therapeutic protocol and was manifested with restoration of the ingestive, gregarious and agonistic behaviour patterns in experimental birds.

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