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Original Contribution

BEHAVIOUR OF TURKEY BROILERS WITH AND WITHOUT MUSCLE DYSTROPHY UNDER CONDITIONS OF ANIMAL WELFARE OR STRESS

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ABSTRACT

The aim of the present study was to produce experimental muscular dystrophy in 40 broiler turkeys under conditions of high animal welfare or stress and to study the behaviour of the broilers under these conditions. Muscular dystrophy was induced via supplementation of 4% fat with peroxide number 5.0 in a balanced but vitamin E deficient starter forage containing selenium (Se) and fed to four groups of broiler turkeys subjected to different conditions. The results indicated clearly that muscle dystrophy in turkey broilers, under stress, exerted a strong effect on the feeding behaviour manifested in reduced frequency of feeding and increased frequency of drinking, as well as on the flocking behaviour, shown by increased frequency of resting and lower frequency of walking. Without muscular dystrophy stress had an insignificant impact on these behaviours.

Key words: muscular dystrophy, broiler turkeys, welfare, stress, ingestive behaviour, gregarious behaviour, sexual behaviour, and agonistic behaviour

INTRODUCTION

Stress and Animal Welfare (AW) are essential with regard to aetiology, pathogenesis, clinical manifestation, prognosis and healing time of animal diseases

The most exact criterion for determination of AW level in birds is their behaviour (1-3).

Having studied fear reactions in animals and their relationship with AW, Vandenheede (4) recommended the performance of a more accurate evaluation of rearing conditions and to maintain a high AW level.

Sherwin and Kelland (1) investigated behaviour patterns in turkeys as a parameter of their welfare. The authors determined comfort behaviour in birds assuming that rearing them in smaller groups with lesser density improved AW. Rarely, an aggressive behaviour was observed and the social behaviour was better exhibited.

The aggressive behaviour in turkeys manifested through pecking, was studied by Martenchar et al. (3). The introduction of metal objects and straw in the rearing premises resulted in enhanced aggressive behaviour and worsened AW of turkeys.

Popova-Ralcheva et al. (5) established that the ethological parameters "aggressiveness" and "corticosterone level" could be used as indicators of stress level in ISA broiler hybrids.

In turkey-broilers from the BUT-9 hybrid, reared on slatted floor, Bozakova (6) determined reduced locomotor activity and increased number of rest episodes whereas in the StZ-1 hybrid – reduced aggressiveness that was beneficial for birds' welfare.

According to Broom (7) the health is the principal factor of AW. Similar to welfare, the health condition could be "good" and "poor" or to vary between these two states. Here, the systemic defence mechanisms that counteract the microorganisms or metabolic disturbances should also be taken into consideration. The author considers that the health is an element of animal welfare and that the disease has always a negative impact upon it. The contrary is valid too – the poor animal welfare influences adversely animal health.

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Because of the few literature data on the relationship of behaviour, health status, welfare and stress in animals, we aimed to study the behaviour of turkey broilers, with or without muscle dystrophy and reared in conditions of either high animal welfare or stress.

MATERIALS AND METHODS

1.Animals and protocol design

The experiments were carried out in the Experimental Base of the Department of Internal Diseases, Faculty of Veterinary Medicine, Trakia University, Bulgaria. They were conducted on 40 one-day old broiler turkeys from the Stara Zagora-1 hybrid, created in the Hybrid Poultry Centre of the Institute of Agriculture – Stara Zagora.

The birds were identified by wing marks. From the 1st to the 14th day of life, all turkeys were put under the same regimen of feeding and rearing. By day 14, they were initially divided into 2 equal (n=20) groups: the control birds were fed with a starter ration whereas in the assay group, birds were fed with a vitamin E deficient forage and they were supplemented with 4% oxidized fat (fat exposed to atmospheric oxygen and sunlight for a long time), with peroxide number 5 (allowed peroxide number 0.20). The prophylactic programme was carried out in both groups except that Seled (a dose of 0,06mg/kg) was not administered to the experimental group during period 2 (period 1:days 8-13-period 2:days 28-30) in order to enhance the development of muscular dystrophy. When turkeys were 40 day-old and the clinical signs of muscular disease were evident, each group (control and assay) was again divided into 2 equal groups (n=10) according to animal welfare conditions). The group I (stemming from the control group-healthy birds) and the group III (stemming from the assay group-birds with muscular dystrophy) were reared under high welfare condition (favourable microclimatic conditions: temperature, humidity, ammoniac concentrations and light intensity ranged between 28-30°C, 51-52%, 5-8mg/l and 100-120 lux respectively). On the other hand, the group II (healthy birds) and IV (diseased group) were subjected to an environmental stress (unfavourable microclimatic conditions: high temperature (31-35°C), high humidity (55-57%), high ammoniac concentrations (20 μg/l) and weak light intensity (21-23 lux). The microclimatic parameters were monitored on a daily basis. In the centre of each section there was an infrared lamp with a power of 250 W with option for regulation of the height and the power depending on the air temperature for the respective period. The ventilation was natural, by opening the windows, depending on the microclimatic parameters of the premises. The temperature and the relative air humidity were measured with a minimum-maximum recording thermometer, the velocity of the air motion – with a catathermometer, the light intensity – with a luxmeter, the concentration of ammonia – with indicator tubes. During the first weeks the forage was put into disinfected plastic dishes and thereafter – in a tubular feeder for each section with option for regulation of the height. Thus, a feeding front not less then 6 cm was ensured conforming to the manufacturer's recommendations (Manual B.U.T.2000). The watering during the first weeks was done with 2 x 2.5 l vacuum watering trays and afterwards – with two large watering trays of 10 l each ensuring a drinking front of 3,5 cm vs. the recommended 3 cm (Manual B.U.T.2000). The bedding consisted of wood shavings with a thickness of 8-10 cm, conforming to zoo hygienic requirements with manual cleansing. Prior to the treatment of diseased turkeys, 2 control birds (one from the group I and one from the group II) and 2 diseased birds, reared in high animal welfare and 2 reared under stress were euthanised by cervical dislocation for determination of musculature and internal organ changes and blood was sampled from the wing vein in all birds. Treatment with Seled (Natrii selenis-0, 06g;D-l-a tocopheroli acetas-2, 5 g; cholecalciferolum-0, 063 g and excipientes ad 100 ml; Vet Prom JSC, Radomir, Bulgaria) in a dosage 0,06mg/kg was initiated in the group III (morbidity rate: 80%) and the group IV (morbidity rate: 100%) per os, for 7 days. Controls group (I and II) was not treatment with Seled.

2. Behaviour analysis

Each two weeks the behaviour was recorded by momentary visual observations at 10-minutes interval for 12 hours (from8 to 20h), by the methods of Shervin and Kelland (1) and Popova-Ralcheva (8,9). The ingestive behaviour (ingestion of food and water), the gregarious behaviour (resting, movements and dust bathing), the sexual behaviour and agonistic behaviour (conflicts) were studied.

3.Statistical analysis

The data were statistically processed by Student's test for comparing the different groups within them when a significant effect was evidenced by ANOVA.

Differences were considered as significant when p values were less than 0.05.

RESULTS AND DISCUSSION

The monitoring of feeding behaviour in turkey broilers reared under either high AW or stress prior to the treatment (**Table 1**) showed a higher frequency of feeding in control birds reared under high AW (2.66±0.432) than under stress (2.33±0.243), the difference being significant ($p<0.05$). In birds with muscle dystrophy, the number of feeding birds sharply decreased, especially in the group reared under stress (1.38±0.249) than in the high animal welfare group (1.77±0.211), significant at $p<0.01$. The differences between diseased birds reared under high AW and stress and the respective control groups was also significant ($p<0.01$), manifested with lower frequency of feeding, especially among diseased and stressed turkey broilers.

	Groups	*Temperature (°C)*	*Humidity, (%)*	*NH3 (µg/l)*	*Lux (Lx)*	*Ventilation (m/s)*
High welfare Groups I, III	40 days	29.00±0.19	52.80±0.50	5.0±0.2	100.0±1.2	0.260±0.004
	40-50 days	29.00±0.24	52.00±0.42	6.0±0.1	120.0±1.2	0.270±0.005
	50-60 days	28.00±0.24	51.00±0.44	8.0±0.1	100.0±1.5	0.260±0.004
Stress conditions Groups II, IV	40 days	31.00±0.25	57.00±0.43	20.0±0.10	21.0±0.5	0.260±0.004
	40-50 days	34.00±0.24	55.00±0.52	20.0±1.00	23.0±0.5	0.270±0.005
	50-60 days	35.00±0.24	55.00±0.52	20.0±1.00	21.0±0.4	0.260±0.004

Table 1. *Microclimatic conditions for healthy groups (I and II) or birds with muscular dystrophy (groups III and IV) during growth period*

The opposite tendency was observed in the drinking behaviour. In both control and diseased turkey broilers, the frequency of drinking was higher in groups reared under stress – 2.77±0.226 in stressed controls and 1.38±0.141 in controls reared under high AW ($p<0.01$). For turkeys suffering from muscle dystrophy, the frequency of drinking was 3.15±0.281 and 0.92±0.133 ($p<0.01$), respectively. At the same time, in diseased turkey broilers reared under high AW conditions, the frequency of drinking was reduced (0.92) vs the respective control group (1.38±0.141 at $p<0.01$), whereas in diseased and stressed turkeys increased (3.15±0.281) compared to respective controls (2.77±0.226 at $p<0.01$). These data showed that muscle dystrophy did not enhance thirst in birds but, combined with stress, was higher.

The flocking behaviour is represented by resting, walking and dust bathing behaviours. The analysis of resting episodes showed that both control groups, reared under high AW or stress, had similar number of resting turkey-broilers (2.15±0.272 and 2.33±0.500; the difference being insignificant). In diseased turkeys, the number of lying birds sharply increased (4.69±0.526 in the high AW group and 4.92±0.671 in the stressed group) being significantly higher than respective controls (2.15±0.272 and 2.33±0.500; $p<0.01$). Simultaneously, it was insignificant between both diseased groups (the high AW and the stressed ones) despite the higher number of lying stressed birds.

The observation of the walking behaviour showed significantly more walking turkey broilers in the control high AW group (3.84±0.406) than in the control stressed group (2.46±0.539; $p<0.01$). The number of walking birds with muscle dystrophy was highly reduced to 2.46±0.528 (high AW) and excessively reduced under stress (0.46±0.200), with significant differences vs the respective control groups as well as between both diseased groups (from $p<0.01$ to $p<0.001$).

The dust bathing behaviour is observed only in single turkey-broilers from control groups. The sexual behaviour manifested in feather puffing was not observed; that was expected with regard to birds' age.

Behaviour	*Prior to treatment*			*After treatment*		
	n	***x ± Sx***	***p***	***n***	***x ± Sx***	***p***
INGESTIVE BEHAVIOUR						
Feeding						
I.Controls-high animal welfare	10	2.66 ± 0.432	I, II< 0.05	9	2.62 ± 0.452	I, II-
II. Controls-stress	10	2.33 ± 0.243	III, IV< 0.05	9	2.00 ± 0.609	III, IV< 0.01
III. Diseased –high animal welfare	10	1.77 ± 0.211	I, III< 0.01	8	2.08 ± 0.278	I, III< 0.01
IV. Diseased-stress	10	1.38 ± 0.249	II, IV< 0.01	8	1.85 ± 0.295	II, IV< 0.01
Drinking						
I Controls-high animal welfare	10	1.38 ± 0.141	I, II< 0.01	9	1.62 ± 0.140	I, II-
II. Controls-stress	10	2.77 ± 0.226	III, IV< 0.01	9	1.77 ± 0.181	III, IV-
III. Diseased –high animal welfare	10	0.92 ± 0.133	I, III< 0.01	8	1.23 ± 0.223	I, III< 0.05
IV. Diseased-stress	10	3.15 ± 0.281	II, IV< 0.01	8	1.15 ± 0.218	II, IV< 0.01
GREGARIOUS BEHAVIOUR						
Resting	10	2.15 ± 0.272	I, II< 0.05	9	2.23 ± 0.312	I, II-
I Controls-high animal welfare	10	2.33 ± 0.500	III, IV< 0.05	9	2.61 ± 0.680	III, IV< 0.05
II. Controls-stress	10	4.69 ± 0.526	I, III< 0.01	8	2.54 ± 0.443	I, III-
III. Diseased –high animal welfare	10	4.92 ± 0.671	II, IV< 0.01	8	2.15 ± 0.281	II, IV-
IV. Diseased-stress						
Movement	10	3.85 ± 0.406	I, II< 0.01	9	2.76 ± 0.203	I, II< 0.05
I Controls-high animal welfare	10	2.46 ± 0.539	III, IV< 0.01	9	3.31 ± 0.368	III, IV-
II. Controls-stress	10	2.46 ± 0.528	I, III< 0.01	8	3.62 ± 0.412	I, III< 0.01
III. Diseased –high animal welfare	10	0.46 ± 0.200	II, IV< 0.01	8	3.23 ± 0.377	II, IV-
IV. Diseased-stress						
Dust bathing	10	0.15 ± 0.030	I, II> 0.05	9	0.15 ± 0.030	I, III-
I Controls-high animal welfare	10	0.08 ± 0.020		9	-	
II. Controls-stress	10	-		8	0.54 ± 0.050	
III. Diseased –high animal welfare	10	-		8	-	
IV. Diseased-stress						
SEXUAL BEHAVIOUR						
I Controls-high animal welfare	10	-		9	0.08 ± 0.020	
II. Controls-stress	10	-		9	-	
III. Diseased –high animal welfare	10	-		8	0.08 ± 0.020	
IV. Diseased-stress	10	-		8	-	
AGONISTIC BEHAVIOUR						
I Controls-high animal welfare	10	0.23 ± 0.050	I, III< 0.05	9	0.69 ± 0.080	I, II< 0.01
II. Controls-stress	10	-		9	0.23 ± 0.030	I, III< 0.01
III. Diseased –high animal welfare	10	0.08 ± 0.020		8	0.08 ± 0.030	
IV. Diseased-stress	10	-		8	-	

Table 2. *Behaviour of turkey-broilers with muscular dystrophy, reared under conditions of either animal welfare or stress*

After treatment, the trend toward higher number of feeding birds in control turkeys reared under high AW (2.62±0.452) than in stress (2.00±0.609) was preserved, although the difference was not significant. The pre-treatment phenomenon of lower numbers of feeding birds with muscle dystrophy was present also, with lower numbers in stressed than in high AW birds (1.85±0,295 vs 2.08±0.278, respectively). At the same time the feeding in treated birds increased from 1.77±0.211 (pre-treatment) to 2.08±0.278 (after treatment) in the high AW group and from 1.38±0.249 to 1.85±0.295 respectively in stressed turkey-broilers, significantly at $p<0.01$.

These results showed that after the treatment, the appetite of turkey-broilers

increased but there are the difference between those reared under stress or under high AW conditions of feeding it is higher of AW birds.

The water drinking behaviour was considerably reduced in diseased stressed turkeys – from 3.15±0.281 prior to treatment to 1.15±0.218 after treatment, with significant difference ($p<0.01$).

At the same time, the difference between both control groups – reared under either stress or high AW (respectively 1.77±0.181 and 1.62±0.140) was not significant and was similar to that in both healed groups with muscle dystrophy (1.15±0.18 under stress and 1.23±0.223 under high AW). The results showed that after treatment, only stress without muscle dystrophy, influenced slightly drinking behaviour than when combined with the disease.

The flocking resting behaviour in diseased turkey-broilers was sharply diminished from 4.69±0.526 (pre-treatment) to 2.54 (after treatment) for high AW birds, and from 4.92±0.671 (pretreatment) to 2.15±0.443 (after treatment) in stressed birds ($p<0.01$). The number of cured resting birds reared under high AW (2.54±0.443) and stress (2.15±0.281) are similar to values of respective controls (2.23±0.312 and 2.61±0.680).

The walking behaviour, the increase in the number of walking cured turkey-broilers reared under high AW conditions, should be noted (3.62±0.412 after treatment vs 2.46±0.528 pre-treatment, $p<0.01$) and particularly the increase of healed stressed birds (3.23±0.377 and 0.46±0.200 respectively; $p<0.01$).

Also, after the treatment of diseased turkeys in high AW conditions, some birds exhibited dust bathing behaviour (0.54±0.050), whereas prior to the treatment, such were not present.

After the treatment, there were also single birds exhibiting sexual behaviour (0.08±0.02 in controls and healed birds with muscle dystrophy under high AW conditions). In those reared under stress, the sexual behaviour was lacking in both controls and healed diseased turkeys, showing that stress postponed the sexual maturation of turkey-broilers.

The aggressive behaviour was better exhibited after the treatment, but it was not due to the treatment itself, because such behaviour was expected especially in turkey broilers from both control groups whereas cured birds reared under high AW showed the same level of aggressiveness as prior to the treatment (0.08). In diseased stress birds, there were no turkey-broilers with aggressive behaviour either prior to or after the treatment. According to Yang et al. (10), Hocking et al. (2) the aggressive behaviour of birds is directly related to testosterone concentration that is responsible for the sexual maturation of birds. In our experiment, we observed a sexual behaviour only in single birds reared under high AW and no one from those reared under stress. Taking into consideration the reports of other authors, we assume that the low level of aggressiveness was due to the lack of sexual maturation in turkey-broilers. This was more evident in those reared under stress that evidently had a negative effect upon this process.

From the analysis of the behaviour in turkey broilers prior to and after treatment it could be concluded that the muscle dystrophy had an impact mainly on the feeding, drinking and flocking behaviour of birds, leading to decreased number of feeding birds and increased number of those drinking water. At the same time, this influence was stronger when combined with stress.

The effect of disease on the flocking behaviour was manifested by higher number of resting and reduced number of walking birds, especially among those reared under stress.

The flocking dust bathing behaviour is generally characteristic of comfortably feeling birds, and that is why it was not observed in any from affected turkey broilers.

Broom (7) considers also that the disease had a negative effect on animal or avian behaviour. The authors assumed that the morbidity rate and the behaviour are in the so-called cause-effect relationship. From one part, the adverse rearing conditions result in reduced animal welfare and increased susceptibility to disease whereas from the other, the appearing disease could result in altered behaviour as a welfare factor.

In our experiments, the untreated muscle dystrophy had also an effect on the various patterns of behaviour in turkey broilers, as already described.

Our results differed from those of Brambell (11, 12), who had studied the influence of the level of stress upon avian behaviour. Slightly stressed birds exhibited enhanced feather grooming and preening, whereas heavily stressed birds – an intensive walking to and fro. The author, however, studied another type of stress, causing fear in birds.

In our experiment, the character of

stress is different (poor microclimatic rearing conditions), its effect was different from those described by Brambell – lower number of walking birds, less evident in control stressed turkey broilers, but when combined with muscle dystrophy, the reduction was strong.

CONCLUSION

The muscle dystrophy in turkey broilers, combined with stress, exerted a strong effect upon the consumption behaviour manifested by reduced number of feeding and increased number of drinking birds, as well as upon the flocking behaviour, through increased number of resting and lower number of walking birds. Without muscle dystrophy, the stress had an insignificant impact on consumption and flocking behaviour of birds.

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