

## Adrenal glands- and testes - function as an indicator of welfare in male but turkeys

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### ABSTRACT

In the present study an evaluation on animal welfare (AW) in male turkey BUT 9 was performed through the relative weight of adrenal glands and testes, plasma corticosterone and testosterone levels. The worsening of poultry welfare is often due to continued influence of physiological stress by unsuitable technological breeding. The aim of the study was to determine the reliability of the same indicators in the appraisal of poultry welfare of male turkeys BUT 9, reared on the litter and on a slat floor.

Two consecutive experiments on a total of 80 male turkey broilers from the hybrid BUT 9 were performed. Each experiment included two groups- group I: turkeys, reared on a litter and group II: turkeys, reared on a slat floor. The birds were housed in daily controlled microclimatic conditions. The breeding period lasted from the age of 1 to 115 days.

Adrenal weights and plasma corticosterone levels of the turkeys from II<sup>nd</sup> group (hybrid BUT 9, reared on a slat floor) were significantly higher than the birds from I<sup>st</sup> one (hybrid BUT 9, reared on a litter). On the contrary testes' weights and plasma testosterone levels in II<sup>nd</sup> group (BUT 9 on a slat floor) were insignificantly higher than I<sup>st</sup> group (hybrid BUT 9 hybrid, reared on a litter) during the two experiments.

These results show that the weight of adrenal glands and plasma corticosterone levels can be used as reliable indicators for the worsening of the poultry welfare of male turkeys, reared on a slat floor. Unlike relative testes' weight and plasma testosterone levels are unreliably to be used as an evaluation of the poultry welfare of BUT 9.

Keywords: poultry welfare, male BUT 9 turkeys, slat floor, litter, adrenal- and testes-weights, plasma corticosterone and testosterone levels, aggressiveness.

### INTRODUCTION

The objective assessment of poultry welfare is presently a global problem. Summarizing the definitions suggested by many investigators- Broom (2000), Boom (2001), Fraser et al. (2003) we could say that the term "welfare" comprehends the physiological comfort in a certain moment. The majority of

investigators use adrenal- and testes weights, as well as plasma corticosterone and testosterone levels as indices of worsening of the poultry welfare.

The disruption of turkeys' physiology comfort is due to the pain, caused from the unsuitable technological housing- Noll et al.(1994), Simpson and Nakau (1987) and Andrews et al. (1990).

Therefore testes-weights and plasma testosterone levels, especially before puberty, could be used as indicators of worsening of bird's welfare - Popova-Ralcheva et al. (2002-a,b); Popova –Ralcheva (1994).

The aim of the study is to investigate the reliability of some morpho-physiological parameters - adrenal- and testes-weights, plasma corticosterone- and testosterone levels, as indicators of welfare in male BUT 9 turkeys, reared on different floor types.

#### MATERIAL AND METHODS

Two consecutive experiments on a total of 80 male turkey broilers (BUT 9) (40 birds per experiment) were performed. Each experiment included two groups- groups I: turkey broilers, reared on a litter and group II: turkey broilers, reared on a slat floor. The slat floor was wooden with width of grids being 38 mm and that of slots – 18 mm. The turkeys were housed in daily controlled microclimatic conditions, and were fed *ad libitum* with a balanced diet according to their age. The breeding period lasted from the age of 1 up to 115 days.

Plasma corticosterone and testosterone levels were determined by radioimmunoassay (RIA)- plasma corticosterone level was determined by RIA method of Etches (1976) and plasma testosterone level - by RIA method of Cantley et al. (1975). Adrenal- and testes weights were defined by balance methods. The results from the investigation on relative weight of adrenal glands and testes, plasma corticosterone and testosterone levels as indicators of turkeys' welfare were analyzed by the program STATISTICA / ANOVA/ Nonparametric Tests/ Mann-Whitney Method.

#### RESULTS AND DISCUSSION

The plasma corticosterone level is used of majority investigators as an indicator of worsening of the poultry welfare- Broom (2000), Broom (2001), Fraser et al. (2003), Hocking et al. (1999), Popova-Ralcheva et al. (2002-a,b).

Male BUT 9 broilers from II<sup>nd</sup> group (birds, reared on a slat floor) had significantly higher plasma corticosterone levels than the I<sup>st</sup> one (birds, reared on a litter) in both experiments (Fig.1 and Fig.2). Corticosterone levels in turkey broilers, raised on the slat floor were significantly higher, than in broilers on the litter during the Experiment I at 98- and at 112-days of age ( $p<0.01$  and  $p<0.05$ ; Fig.1). This tendency was maintained during the Experiment II at both ages ( $p<0.01$ ; Fig. 2).

The higher corticosterone levels in BUT 9 turkeys, raised on the slat floor could be due to the pain, caused from the breast blisters, founded only in broilers from II<sup>nd</sup> group (hybrid BUT 9, reared on a slat floor). Noll et al. (1994), Simpson and Nakaue (1987), Andrews et al. (1990) and Platz et al. (2003) have announced that the number of breast blisters in turkeys housed on a slat floor is increased. The pressure, exerted by the slat floor on turkey breasts, could explain those results. Based on these data we conclude that the increased corticosterone level is a reliable criterion for worsening of the poultry welfare, due to pain, caused from the pressure of the slat floor on broilers, reared on a slat floor.

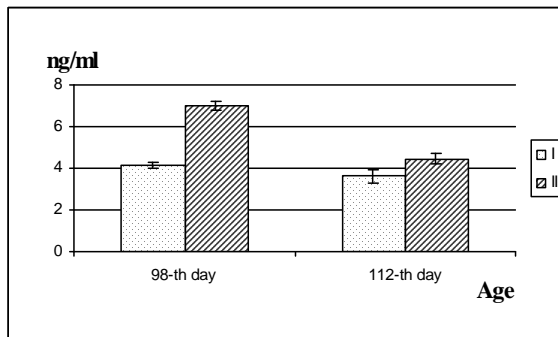


Fig.1. Plasma corticosterone levels of BUT 9 at 98 days  $p<0.01$  and at 112 days,  $p<0.05$ . Experiment I

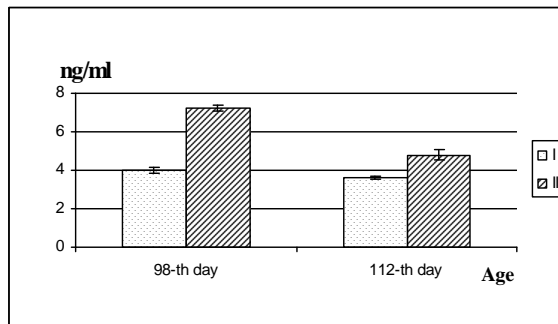


Fig 2. Plasma corticosterone levels of BUT 9 at 98 and 112 days,  $p<0.01$ . Experiment II

Similar pattern was found in the dynamics of the relative weights of adrenals in male turkeys. The relative weights of adrenal glands in male turkeys, raised on the slat floor were significantly higher, than in broilers on the litter during the both Experiments ( $p<0.01$ ; Fig.3 and Fig.4).

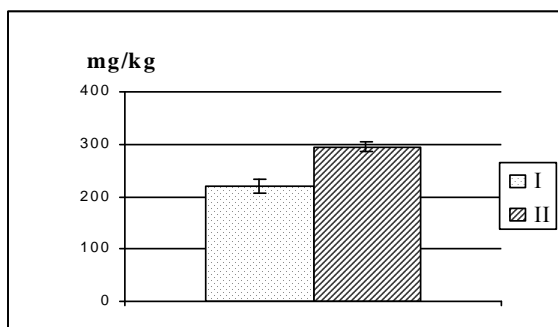


Fig. 3. Relative weight of turkeys' adrenal glands at 115 days,  $p < 0.01$ . Experiment I.

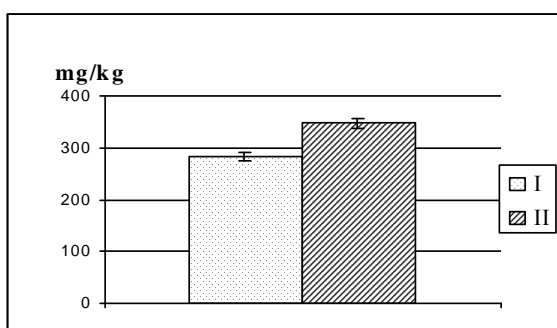


Fig. 4. Relative weight of turkeys' adrenal glands at 115 days,  $p < 0.01$ . Experiment II

The pressure, exerted by the slat floors is a cause for the pain of broilers from II<sup>nd</sup> group (birds, reared on a slat floor). This causes discomfort and as a result, a nonspecific adaptive response of the organism, manifested by the activated hypothalamic-pituitary-adrenal system, adrenal hypertrophy, increased synthesis and release of adrenal glucocorticoids, of which corticosterone is the essential one in poultry (Siegel, (1971); Siegel (1980)). Based on these data we conclude that adrenal weights are reliable indicators of stress and they cause worsening of the poultry welfare.

On the contrary, plasma testosterone levels in II<sup>nd</sup> group (birds on a slat floor) were insignificantly higher than I<sup>st</sup> group (BUT 9 hybrid on a litter) during the two experiments at 98- and at 112-days of age ( $p > 0, 05$ ; Fig.5 and Fig. 6.). The higher testosterone levels in BUT 9 turkeys, raised on the slat floor could be due to the more intensive growth of broilers on this floor type (Bozakova, 2003). Cecil and Bakst (1991), Massa et al. (1980), Balthazart and Hirschberg (1979) have established that the relative testes' weight and plasma testosterone level in male birds increase during age, especially before puberty.

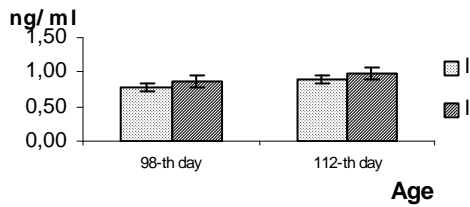


Fig. 5. Plasma testosterone levels of BUT 9 at 98 and 112 days,  $p > 0.05$ . Experiment I.

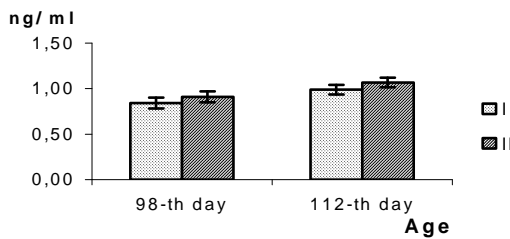


Fig.6. Plasma testosterone levels of BUT 9 at 98 and 112 days,  $p > 0.05$ . Experiment II

Hocking et al. (1999) have found abnormal behaviour, related with lower plasma testosterone levels in male BUT 9 turkeys by imbalanced diet. We couldn't be categorical about the reliability of the testosterone level as an indicator of worsening of the welfare in BUT 9 turkeys.

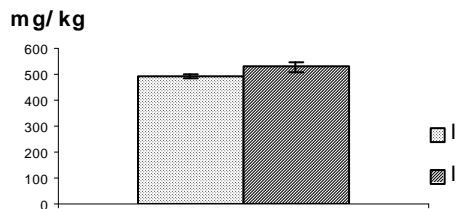


Fig. 7. Relative testes' weight of BUT 9 at 115 days,  $p > 0.05$ . Experiment I

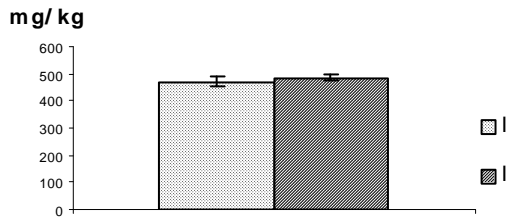


Fig. 8. Relative testes' weight of BUT 9 at 115 days,  $p > 0.05$ . Experiment II

Similar pattern was found in the dynamics of the relative weights of testes in male turkeys. The relative weights of testes in male turkeys, raised on the slat floor (II<sup>nd</sup>) were insignificantly higher, than in broilers on the litter (I<sup>st</sup> group) during the both Experiments,  $p > 0,05$  (Fig.7 and Fig.8).

The higher relative testes' weights of turkeys, raised on the slat floor (II<sup>nd</sup> group) could be due to the more intensive growth of broilers on this floor type (Bozakova, 2003). Platz et al. (2003), Bacon et al. (2000), Cecil and Bakst (1991) and Young and Rogers (1978) have established that relative testes' weight and plasma testosterone levels in male birds increase during age, especially before puberty.

We couldn't be categorical about the reliability of the relative testes' weights as an indicator of worsening of the welfare in BUT 9 turkeys. The present results should be interpreted very carefully, considering the duration and intensity of the stressors, as well as the other welfare criterions.

## CONCLUSIONS

Interpreting the relative weight of adrenal glands and testes, plasma corticosterone- and testosterone level as criterions of poultry welfare, we could conclude that:

1. The weight of adrenal glands and plasma corticosterone level can be used as reliable indicators for worsening of the poultry welfare of turkey broilers, raised on the slat floor. The worsening of the bird's welfare is due to the pain, caused from the pressure, exerted by slat floors on turkey breasts.

2. The relative testes' weight and plasma testosterone level are unreliably to be used as an evaluation of the poultry welfare of BUT 9.

## REFERENCES

- Andrews, L.P., T.S. Whiting, and L. Stamps, 1990. Performance and carcass quality of broilers, grown on raised floorings and litter. *Poultry Sci.* 69: 1644-1651.

- Bacon WL, Kurginski-Noonan BA, Yang J, 2000. Effects of environmental lighting on early semen production and correlated hormonal responses in turkeys, *Poultry Science*, Nov;79(11):1669-78.
- Balthazart J. and Hirschberg D., 1979, Relationships between the daily variations of social behaviour and of plasma testosterone levels in the domestic duck *Anas Platyrhynchos* L., *Hormones of the Behavior*, 12: 253-263.
- Bozakova, N., 2003. Researches and estimation on animal welfare of turkey-broilers on different floor types, *Proceedings of the XI International Congress In Animal Hygiene*, Mexico City, Vol. 2:653-657.
- Broom, D. M., 2001. Assessing the welfare of hens and broilers, *Proc. Aust. Poultry Science Sym.*: 13.
- Broom, D. M., 2000. Welfare assessment and welfare problem areas during handling and transport, *CAB International 2000, Livestock handling and transport*: 43-61.
- Cantley, T.C., Garverick, C.J., Bierschwal, C.E. Martin, R.S. Youngquist. 1975. *Journal of Animal Science*, 41:1666-1673.
- Etches, R.J., 1976. Plasma concentration of corticosterone in chickens, *Steroids*, 28:769-771.
- Fraser D., 2003. Emerging animal welfare standards and their implications for animal hygiene, *Proceedings of the XI-th International Congress in Animal hygiene*, Mexico, Volume1: 61-66.
- Hocking P. M., Maxwell MH, Mitchell MA., 1999. Welfare of food restricted male and female turkeys., *Br Poult Sci Mar*;40(1):19-29.
- Massa R., Davies D. T., Bottoni L., 1980. Mating behavior and fertility in domestic chickens, *Journal of Endocrinology*, 84; 223-230.
- Nool, S.L., C.J. Clanton, D.A. Halvorson, K. A. Janni, 1994. Effect of slotted flooring and ventilation rate on turkey performance, *Proceedings of the 8th Congress on Animal Hygiene*, St. Paul, Minnesota, USA, *Environmental and Management Systems for total Animal Health Care in Agriculture*: PO96-PO99.
- Platz S., J. Berger, F. Ahrens, U. Wehr, W. Rambeck, W. Amselgruber and M. H. Erhard, 2003. Health, productivity and behaviour of conventional turkey breeds under ecological outdoor rearing conditions, *Proceedings of the XIth International Congress in Animal hygiene*, Mexico, Vol. 1:259-264.
- Popova –Ralcheva S., Hadjiiliev V., Gudev D., Alexandrov A. and Sredkova V., 2002-a. Ethological and Physiological Indices for Well- being in Broilers under Different Systems of Management, *Bulgarian Journal of Agricultural Science*, 8 : 635-639.
- Popova –Ralcheva S. 1994. Influence of ACTH on the corticosterone- and testosterone levels and sexual behaviour of Plymouthrock cocks, *Animal sciences*, 1-4: 273-276. (Bg.)

- Popova –Ralcheva S., Hadjiiliev V., Gudev D., Alexandrov A. and Sredkova V., 2002-b. Reliability of Well-being Indicators in Broilers ISSA, Bulgarian Journal of Agricultural Science,8:233-238.
- Siegel H. S., 1971. Adrenals, stress and the environment, World's Poultry Science Journal ,16: 79-82.
- Siegel H. S., 1980. Physiological stress in birds, Bio Science 30: 529-534.
- Simpson, G. D. and H. S. Nakaue, 1987. Performance and carcass quality of broilers, reared on wire flooring, plastic inserts, wood slats or plastic coated expanded metal flooring, each with or without padded roosts. Poultry Sci. 66: 1624-1628.
- Young C. E. and Rogers L., 1978. Maintenance of male sexual Behaviour by combined Treatment with Oestrogen and Dihydrotestosterone in domestic Chickens, Hormones of the Behavior, 10: 107-117.