

# THYROID HORMONE LEVEL AND RELATIVE LIVER WEIGHT IN MALE TURKEYS IN RELATIONSHIP WITH THEIR WELFARE\*\*

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**Abstract:** The objective assessment of poultry welfare is presently a global problem, which is directly related to poultry products. The investigations on the possibilities for evaluation of the physiological comfort of turkeys by the use of alternative indicators are scarce. The aim of the present study was to determine the reliability of liver weight and thyroid hormone level in male turkeys from Local Bulgarian hybrid as indicators of their welfare. Plasma thyroxine levels were determined by radioimmunoassay method (RIA).

The relative liver weights and plasma thyroxine levels of the I-st group turkeys (Local hybrid, reared on the litter) were significantly higher than in the II-nd one (Local hybrid, reared on the slat floor). A correlation between plasma thyroxine levels and plasma corticosterone levels in male turkeys, raised on the litter was established.

A close relationship was found between liver weight, plasma thyroxine levels and the status of poultry welfare.

**Key words:** poultry welfare, turkeys, plasma T4, correlation between T4 and corticosterone; relative liver weight.

## Introduction and literature review

The objective assessment of poultry welfare is presently a global problem, which is directly related to poultry products. Investigations on the possibilities for evaluating the physiological comfort of turkeys by use of alternative indicators are scarce.

Corticosterone is the main hormone associated with welfare worsening in birds. (*Broom 1993, Broom and Johnson 1993, Puppe 1996, Fraser, 2003.*). Changes in corticosterone levels may have secondary effects on

other hormone systems, such as the production of thyroid hormones. The thyroidal function is linked to the energy metabolism and the growth rate in growing poult. Many investigators suggest that elevated T4 may be related to the metabolic effects that are required for regrowth and regeneration (Guzmán *et al.*, 2000; Davis *et al.*, 2000; Decuyper and Kuhn, 1988.).

Thus, increases in plasma corticosterone levels and plasma thyroxine levels (T4) in poult are most likely related to the adaptation to changes in metabolic demands caused by physiological stress.

All this calls for the study on the correlation between plasma thyroxine levels and plasma corticosterone levels in connection with the poultry welfare.

Many authors ascertain that responses by welfare worsening in birds included decreased body weight and increased relative liver weight. (Puvadolpirod and Thaxton, 2000; Decuyper and Kuhn, 1988; Decuyper *et al.* 1983).

The aim of the study is to investigate the reliability of some physiological and morphological parameters - plasma thyroxine levels; correlation between plasma thyroxine levels and plasma corticosterone levels and relative liver weight in male turkeys from Local Bulgarian hybrid, raised on different floor types, as indexes of their welfare.

## Materials and methods

Two consecutive experiments on a total of 80 male turkey broilers from the Local Bulgarian hybrid were performed. Local Bulgarian hybrid was made by White Beltsville turkey and White imperial turkey. Each experiment included two groups - group I: Local hybrid, raised on the litter and group II: Local hybrid, raised on the slat floor.

The slat floor was wooden with width of grids being 40 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.

Blood samples were obtained from six male turkeys from each group at the 98-th and at the 112-th day of age. Blood samples were collected from wing veins within 50-60 s after the capture of each bird. Plasma blood samples were packed on ice until they could be centrifuged and the plasma be frozen.

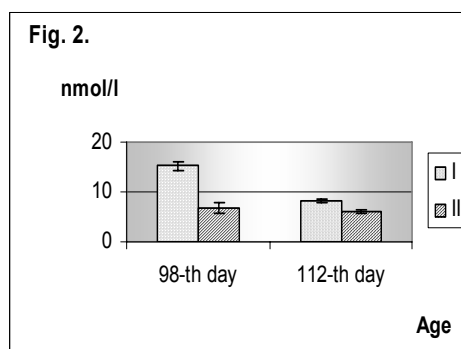
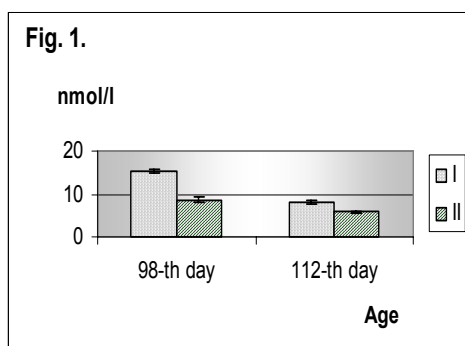
Plasma thyroxine levels were determined by radioimmunoassay method (RIA), using RIA-kit, Code: B-R-A-H-M-S. Liver weights were defined by

balance methods.

The results from the investigation on relative liver weight, plasma thyroxine (T4) levels as indexes of turkeys' welfare were analyzed by the program STATISTICA/ 2-way ANOVA. Simple correlation between plasma T4 levels and plasma corticosterone was calculated using Pearson's correlation coefficient. Mean differences of date were tested with Bonferroni's test. The graphics were made in Microsoft Excel 2000.

## Results of investigations and discussion

The male turkeys from Local hybrid from I<sup>st</sup> group (raised on litter) had significantly higher plasma thyroxine levels than the II<sup>nd</sup> one (raised on slate floor) at the 98-th day of age and at the 112-th day of age in both experiments (Fig.1 and Fig.2). During the Experiment I thyroxine levels in broiler turkeys, raised on the litter at the 98-th day of age were:  $15,32 \pm 0,59$  nmol/l significantly higher, than in broilers on the slat floor:  $8,68 \pm 0,65$  nmol/l,  $p < 0,01$  and at the 112-th day of age were:  $8,08 \pm 0,42$  nmol/l than in broilers on the slat floor:  $5,85 \pm 0,28$ ,  $p < 0,01$ . This tendency was maintained during Experiment II,  $p < 0,01$  (Fig.2). Thyroxine levels in broiler turkeys,



**Fig.1.** Plasma T4 levels of Local Bulgarian hybrid at 98-th and 112-th days. Experiment I  
**Fig.2.** Plasma T4 levels of Local Bulgarian hybrid at 98-th and 112-th days. Experiment II

raised on the litter (I<sup>nd</sup> group) at the 98-th day of age were:  $15,2 \pm 0,93$  nmol/l significantly higher, than in broilers on the slat floor:  $6,87 \pm 1,13$  nmol/l,  $p < 0,01$  and at the 112-th day of age were:  $8,18 \pm 0,39$  nmol/l than in broilers on the slat floor:  $6,06 \pm 0,38$ ,  $p < 0,01$ .

The thyroxine levels in turkeys from Local Bulgarian hybrid, raised on the litter could be due to the higher plasma corticosterone level, registered in these broilers at the 98-th day of age (Bozakova and Popova-Ralcheva, 2006). This data caused by the elevated aggressiveness, manifested by the rearing of turkey broilers on litter (Bozakova, 2003). The aggressiveness on its turn causes stress, indicated by the increased plasma corticosterone level (Rushen, 1996; Popova –Ralcheva et al., 2002-a; Popova –Ralcheva et al., 2002-6.). Decuypere et al. (1983) suggested that corticosterone can affect circulating triiodothyronine and thyroxine by altering the activity of liver T4-5monodeiodinase and by influencing the hypothalamo-hypophyseal-pituitary axis involved in thyrotrophin-stimulating hormone secretion. Thus, increases in plasma corticosterone levels and plasma thyroxine levels in poult are most likely related to the adaptation to changes in metabolic demands caused by physiological stress (Guzmán et al., 2000; Davis et al., 2000; Decuypere and Kuhn, 1988). The aggressiveness, anxiety and food restriction of poults causes discomfort and as a result, a non-specific adaptive response of the organism, manifested by the activated hypothalamic-pituitary-adrenal system (Edens et al., 1991; Siegel, 1971; Siegel, 1980).

Based on these data we conclude that the increased thyroxine level is a criterion for significant worsening of the poultry welfare (discomfort with a great increase of corticosterone level).

In this relation the study includes a correlation between plasma thyroxine levels and plasma corticosterone levels in male turkeys from Local Bulgarian hybrid, raised on different floor types, as an index of their welfare, (Table 1.)

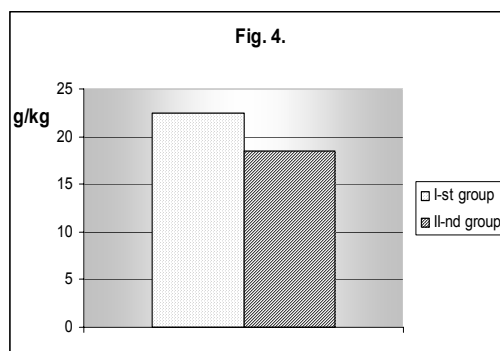
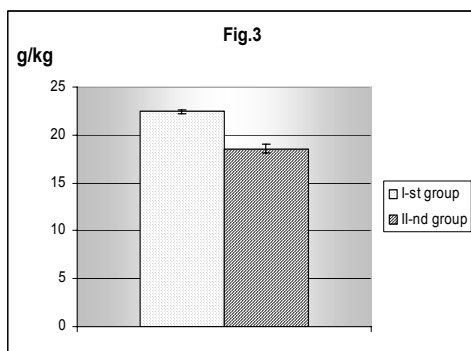
**Table 1. Correlation (r) between plasma thyroxine levels and plasma corticosterone levels in male turkeys from Local Bulgarian hybrid**

Experiment/ Group	Correlation r T4/Cort.	
	98-th day	112-th day
I / 1	0,44	0,25
I / 2	0,73	0,32

A correlation between plasma thyroxine levels and plasma corticosterone levels in male turkeys from Local Bulgarian hybrid, raised on the litter was established. During Experiment I a correlation (r) between plasma thyroxine levels and plasma corticosterone levels was ascertained in broiler turkeys

from I<sup>st</sup> group and II<sup>nd</sup> group at the 98-th day of age. This correlation was positive and moderate,  $0,3 < r < 0,5$  in turkeys from I<sup>st</sup> group and the correlation was positive and intense,  $0,7 < r < 0,9$  in turkeys from II<sup>nd</sup> group. A positive correlation was found in male turkeys at the 112-th day of age, Experiment I.

A positive and intense correlation between plasma corticosterone levels and plasma thyroxine levels (T4) in poults is most likely related to a non-specific adaptive response of the organism, manifested by the activated hypothalamic-pituitary-adrenal system (*Edens et al., 1991; Siegel, 1971; Siegel, 1980*).



**Fig.3. Relative livers' weight of Local Bulgarian hybrid at 115 days. Experiment I**  
**Fig.4. Relative livers' weight of Local Bulgarian hybrid at 115 days. Experiment II**

Based on these data we conclude that the positive and intense correlation between plasma thyroxine levels and plasma corticosterone levels in male turkeys from Local Bulgarian hybrid, raised on different floor types, could be used for a criterion for significant worsening of the poultry welfare.

Similar pattern was found in the dynamics of the relative liver weight of turkeys from Local Bulgarian hybrid at 115 days, raised on different floor types. The relative liver weights in male turkeys, raised on the litter (I<sup>st</sup> group) were significantly higher, than those in broilers on the slat floor (II<sup>nd</sup>) during both Experiments  $p < 0,01$ , (Fig.3 and Fig.4). These data caused by the elevated aggressiveness, manifested by the rearing of turkey broilers on litter (*Bozakova, 2003*). Many authors ascertain that responses by discomfort in birds included decreased body weight and increased relative

liver weight. (*Puvadolpirod and Thaxton, 2000; Decuyper and Kuhn, 1988; Decuyper et al. 1983*).

Basing on these data we conclude that the relative liver weight in male turkeys from Local Bulgarian hybrid, raised on different floor types, could be used for a criterion for significant worsening of the poultry welfare.

## Conclusions

Interpreting the plasma thyroxine levels; correlation between plasma thyroxine levels and plasma corticosterone levels and relative liver weight in male turkeys from Local Bulgarian hybrid, raised on different floor types, as indexes of poultry welfare, we could conclude that:

1. The increased thyroxine level could be used for a criterion for significant worsening of the poultry welfare.
2. The positive and intense correlation between plasma thyroxine levels and plasma corticosterone levels in growing male turkeys could be used for a criterion for significant worsening of the poultry welfare.
3. The relative liver weight in male turkeys is a reliable criterion for significant worsening of the poultry welfare.

## NIVO HORMONA TIROIDNE ŽLEZDE I RELATIVNA TEŽINA JETRE KOD ČURANA SA ASPEKTA DOBROBITI ŽIVOTINJA

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### Rezime

Objektivna ocena dobrobiti živine je globalni problem, koji se direktno odnosi na živinske proizvode. Ispitivanja mogućnosti ocene dobrobiti odnosno komfora ćurki sa fiziološkog stanovišta korišćenjem alternativnih indikatora su retka. Cilj ovog istraživanja je bio određivanje pouzdanosti težine jetre i nivoa hormona tiroidne žlezde kod ćurana lokalnog bugarskog hibrida kao indikatora njihove dobrobiti. Nivoi tiroksina u plazmi su određivani metodom radio-imunološke analize (RIA).

Relativne težine jetre i nivoi tiroksina u plazmi u I grupi ćurana (lokalni hibrid, odgajan na prostirci) su bili signifikantno viši nego u II grupi (lokalni hibrid, odgajan na rešetkastom podu). Korelacija između nivoa tiroksina i nivoa kortikosterona u plazmi ćuranaodgajanih na prostirci je ustanovljena.

Takođe je utvrđena bliska veza između težine jetre, nivoa tiroksina u plazmi i stanja životinja sa stanovišta doborbiti.

**Ključne reči:** dobrobit živine, ćurke, plazma T4, korelacija između T4 I kortikosterona, realtivna težina jetre

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