

## THE VARIATION OF TRIIODOTHYRONINE (T<sub>3</sub>) LEVEL IN MILKING COWS EXPOSED TO DIRECT SOLAR RADIATION

## VARIAȚIILE NIVELULUI TRIIODOTIRONINEI (T<sub>3</sub>) LA VACI DE LAPTE EXPUSE RADIAȚIEI SOLARE DIRECTE

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### REZUMAT

Verile foarte călduroase din ultimii ani, cu radiație solară intensă, ne-au determinat să studiem efectul acestor radiații asupra vacilor de lapte. În lucrare ne-am propus să determinăm nivelul triiodotironinei (T<sub>3</sub>), hormon tiroidian care variază în cazul expunerii organismului bovin la stresul caloric. Determinările s-au efectuat pe 2 a loturi de câte 10 vaci de lapte, unele menținute în grajd pe toată perioada și altele care au fost scoase pe pășune, în zile cu radiație solară intensă. Determinările s-au realizat prin metoda RIA, la Clinica de Endocrinologie din Cluj-Napoca, utilizând serul obținut din sânge recoltat dimineața și seara. Rezultatele obținute arată o scădere semnificativă a nivelului triiodotironinei la vacile expuse direct radiației solare. Aceste rezultate concordă cu cele din literatura de specialitate.

### ABSTRACT

Very hot summers, during the last years, with intense solar radiation, determined us to study the effect of this radiation on milking cows. In the paper we have determined the level of triiodothyronine (T<sub>3</sub>), thyroid hormone, which varies in the case of cow's organism exposure to heat stress. The determinations were made on two groups of ten milking cows per each, one group maintained in the stable for all the period and another on the pasture during the days with intense solar radiation. The determinations were made using RIA method, in Endocrinology Clinic in Cluj-Napoca, using the serum obtained from the blood drawn in the morning and evening. The results show a significant decrease of the triiodothyronine level in cow's expose to direct solar radiation. These results are concordant with those in the literature.

**Keywords:** triiodothyronine (T<sub>3</sub>), cows, solar radiation, RIA test

### **DETAILED ABSTRACT**

Due to the fact that in the summers of the last years the solar radiation was very intense and the temperatures of the air were very increased, we want to study these influences on milking cows. In order to find out if they are submitted to heat stress, due to the intense solar radiation we have determined the level of triiodothyronine (T3), as an indicator for heat stress. For this purpose we have selected 20 cows belonging to Romanian Spotted race (Romanian Simmenthal), bred in the same conditions, in the same farm and in about the same physiological state (third or fourth lactation period). The cows were divided into two groups, each of 10 cows, the first one maintained in the stable, for all the period of the experiment and the other kept on the pasture during the daytime. In each group the blood samples, used for triiodothyronine determination, were drawn in the morning and in the afternoon. The period of experiment was sunny days of August comparing with October. The level of triiodothyronine was determined in the Clinic of Endocrinology Cluj-Napoca, using RIA-T3 test, on blood serum. The most significant differences were obtained in the cows on the pasture, comparing with the values obtained in the morning, on the same group of cows. We can conclude that these differences are due to direct solar radiation. Some differences are also recorded in the cows maintained in the stable on the blood samples drawn in the afternoon, comparing with the morning, but the differences are not so significant as they were in the first case.

In conclusion we may say that in cows exposed to solar radiation we recorded a significant decrease of triiodothyronine, as a result of heat stress. These data are concordant with the data found in the literature.

## INTRODUCTION

During the summer days of the last 3-4 years in our region there were recorded increased temperatures and very high values of solar radiation. These facts lead us to the idea of studying the influence of very intense solar radiation on milking cows and to find out if they are submitted to heat stress. A very known indicator for revealing the heat stress is the level of thyroid hormones represented by triiodothyronine (T<sub>3</sub>) and thyroxin (T<sub>4</sub>) hormones. In this paper we have determined the level of triiodothyronine in different groups of cows exposed to direct solar radiation.

## MATERIAL AND METHOD

On the purpose of studying the influence of solar radiation on milking cows there were selected healthy cows, belonging to Romanian Spotted race, in the same physiological state and about the same age (during the third and fourth lactation period), bred in the same farm. In order to reduce the other influences, beside the solar radiation, the cows were raised in the same conditions, feed with the same fodder, which was fresh cut green grass, and the water was from the city source, at their disposal. The cows received the same feed, green grass cut from the same pasture with 20% total mixed ratio supplements. The cows were divided in two different groups; each formed by 10 cows. The groups of cows were formed as follows:

**Group A** – represented by 10 cows kept in the stable during all the period of the experiment. In this group there were drawn blood samples in the morning (9<sup>00</sup> - 10<sup>00</sup> a.m.) and in the afternoon (16<sup>30</sup>) in order to determine the level of triiodothyronine.

**Group B** – formed by 10 cows which were kept in the paddock from the morning till afternoon, exposed to solar radiation, without any kind of shade. The blood samples were drawn at the same moments of the day as in the group A.

In both of the groups the blood samples were drawn during hot days of August 2002 (9-th, 10-th and 11-th) and in October (8-th, 9-th, 10-th, 11-th and 12-

th). We have to mention that in the days chosen from August the solar radiation was very intense (472.6 cal/cm<sup>2</sup>/min) above the 10-th years mean for the same period (460.1 cal/cm<sup>2</sup>/min) and the fraction of insulation was 0.73. In October the solar radiation was 257.9 cal/cm<sup>2</sup>/min, comparing with 222.9 the 10-th years mean, and the fraction of insulation was 0.89. In the days 9-th, 10-th and 11-th of August it was shiny the highest temperatures of the air during the day were ranged between 34.4 °C and 35.1°C. During all the selected period of October there were recorded the temperatures of the air, between 17.8 °C and 18.5°C. In order to determine the level of triiodothyronine the blood serum and RIA-T<sub>3</sub> test was used. The determinations were made in Clinic of Endocrinology in Cluj-Napoca, Romania for each blood sample separately.

## RESULTS AND DISCUSSIONS

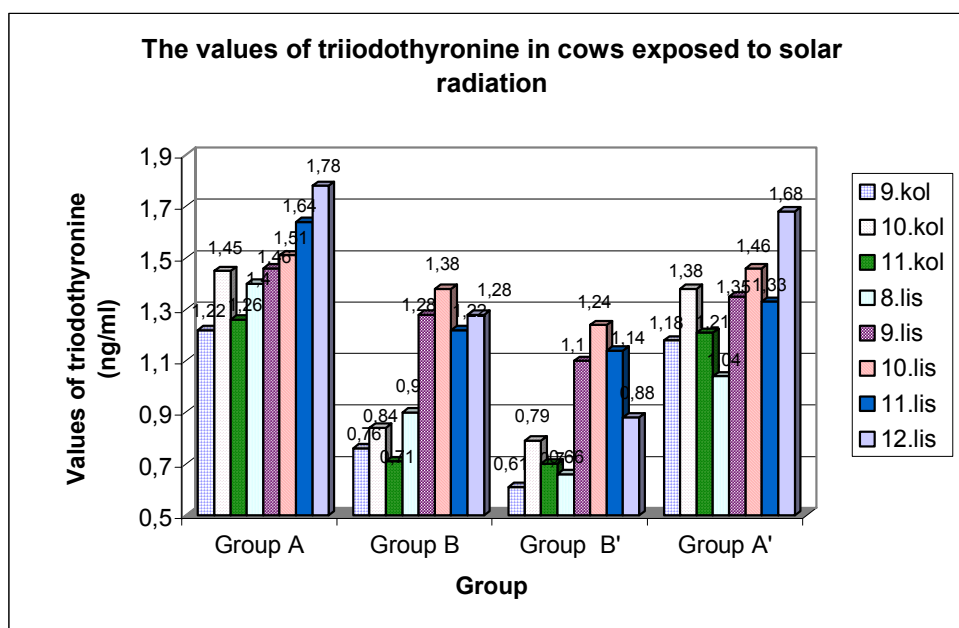
The RIA test is a modern technique for thyroid hormones dosing, which is based on immunologic methods, in which the hormone from the sample goes in competition with the marked hormone, on the purpose to occupy the sites for bounding the antibody anti-T<sub>4</sub>. The marking is realised with radioactive iodine. The antibody anti-T<sub>4</sub> is polyclonal and most frequently is obtained by rabbit immunisation. The mean values of the thyroxin obtained during the experimental period are presented in table 1. The data are obtained after the statistical processed of the primary data, obtained for each cow.

In the table 1 we have noted with Group A the group of cows kept in the stable and blood samples were drawn in the morning, and with Group A' the same group, but the blood samples were drawn in the afternoon. We have noted with Group B the group of cows kept in the paddock and the blood samples were drawn in the morning and with Group B' the same group, but the blood samples were made in the afternoon. The resulted data are presented in graphic 1.

Table 1: The mean values of triiodothyronine obtained during experimental period in cows exposed to solar radiation (ng/ml)

Group	9.08	10.08	11.08	8.10	9.10	10.10	11.10	12.10
Group A	1.22± 0.052	1.45± 0.07	1.26± 0.058	1.40± 0.176	1.46± 0.172	1.51± 0.06	1.64± 0.02	1.78± 0.058
Group B	0.76± 0.028	0.84± 0.10	0.71± 0.076	0.90± 0.03	1.28± 0.049	1.38± 0.07	1.22± 0.066	1.28± 0.03
Group B	0.61± 0.06	0.79± 0.05	0.70± 0.04	0.66± 0.06	1.10± 0.05	1.24± 0.12	1.14± 0.081	0.88± 0.037
Group A	1.18± 0.08	1.38± 0.08	1.21± 0.069	1.04± 0.05	1.35± 0.044	1.46± 0.052	1.33± 0.08	1.68± 0.02

Figure 1



From the data obtained it is to be noticed that in the group maintained in the paddock the values of triiodothyronine are more decreased comparing with the values obtained in the group maintained in the stable during all the summer. The most decreased values were obtained after the cows were exposed to direct solar radiation in the hot days of summer. Also in the group maintained in the stable was recorded a little decrease of the triiodothyronine in the afternoon due to the indirect heating, but is not very significant. The most significant are the differences between the mean values of group A which includes cows in the stable and the group B which is formed from the cows maintained in the paddock. Also very

significant are the differences between the group B and B' ( $p < 0.001$ ), that means the same group of cows, but the determinations were made in the morning (group B) and in the afternoon (group B'). These differences are due to direct solar radiation, because they means the difference of thyroxin level in the group of the cows in the morning (group B) and in the afternoon, after the cows were exposed to direct solar radiation (group B'). Due to the fact that the cows were the same race, age, physiological state, about the same milk production, feed with the same fodder and the drinking water was from the same source, we can conclude that the recorded differences

in the triiodothyronine level are due to the solar radiation.

The data obtained by us are correlated with the data quoted in the literature, which notify that in cow's organism exposed to heat stress are happening important changes of the main endocrine glands secretion, from which one of the most significant are the changes of thyroid activity. Many researchers recorded a decreasing of thyroid hormones in cows exposed to direct solar radiation. (Sober and al., 1980; Magdub and al., 1982; and Mohamed and Johnson, 1985, quoted by Alnaimy, 1992, Vanjonack and Johnson, 1975; Collier and col., 1982; Magdub and col., 1982, El-Masry, 1987; quoted by Alnaimy, 1992; Kamal and Ibrahim, 1969).

In hot environment, it is noticed that the level of energetic metabolism is most decreased in cows belonging to European cows, which has negative effects on milk and meat production.

Concluding we can say that the decreasing of the thyroid hormones during heat stressful conditions is

due to the decrease in basal metabolic rate and muscle activity in order to decrease heat production.

## CONCLUSIONS

- In cows exposed to solar radiation the values of the triiodothyronine decrease comparing with the cows maintained in the stable during all summer period when the solar radiation is high
- There are recorded decreasing of triiodothyronine in cows after the direct exposure to solar radiation, comparing with the values obtained in the same cow before the exposure.
- The values of the triiodothyronine vary according the solar radiation, they are more decreased when the solar radiation is high and increased when the radiation is low.
- The data obtained by us on Romanian Spotted are in correlation with the data from the literature, which notify a decreasing of the thyroid hormones in cows exposed to solar radiation.

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