

## **Effect of ascorbic acid orally administration on the thyroid hormones (T3 and T4) before and after physical activity Arab-race horses**

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### **ABSTRACT**

*The aim of this study was to investigate the effect of orally administration of ascorbic acid on the levels of thyroid hormones (T3 and T4) in arabic horses. Forty arabic horses (average age 4-9 years and average body weight 450-550 kg) clinically healthy were used. Animals were divided randomly in two groups of control and treatment. Then treatment group was given orally ascorbic acid (20gram) for one month daily. After this time, blood samples collected through jugular vein puncture at rest and immediately after galloping in 2160 meters. Results showed that T3 and T4 significantly increased ( $p<0.05$ ) and ascorbic acid significantly decreased ( $p<0.05$ ) in control and treatment groups after exercise compared with before galloping. In conclusion, we can suggest that the administration of ascorbic acid does not effect on the levels of thyroid hormones (T3 and T4) in arabic horses.*

**Key words:** Ascorbic Acid, T3, T4, Arabic Horse

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### **INTRODUCTION**

The horse breeding and equestrian sport has been grown considerably during these years. The importance of nutrition and how to breed and manage the horse has become more in progress than before. Because most of these animals are used in racing and equestrian, horses that have higher sort power, there is also higher value. Now, in equestrian sport to raise the sport power of horses, the drugs and different substances are used which prescription of most of them is unlawful or may cause severe side effects after administration of them, such as some steroid hormones, ephedrine, caffeine and etc.

Hence, appropriate methods medication that can boost sport power of horses without any problems is of particular importance [9,14]. Based on studies, in cases of increasing need for energy like during pregnancy, increased physical activity, during lactation and exposure to stress, free radicals are also produced more than that they are due to high metabolism of carbohydrates, fat and proteins. Antioxidants such as ascorbic acid, vitamin E, selenium, glutathione each by preventing the harmful effects off free radicals, prevent tissue damages [1,8,9,12,20].

Ascorbic acid is a non-enzymatic antioxidant water soluble material and similar to vitamin E has not accumulation in the cell membrane properties and usually found inside and outside cells and yet cases of poisoning that may result from excessive consumption of supplement except reduction has not been reported which is dissolved by removing ascorbic acid from the diet.

Ascorbic acid is synthesized by glucose and other hexose sugars in the body of horse's with the investigations in the field of horse's medicine [12]. Harper (2003) stated that ascorbic acid produced in the body of horses is not able to provide this material in the conditions of stress and high physical activities [7]. In this regard, by measuring of this material in Icelandic horses it was determined that it is serum level in horses is less than the rest [15].

Dayton et al., (2002) Showed that ascorbic acid can reduce the damage of free radicals, reduce oxidative damages and increase their respiratory function during an exercise [4]. In another study that conducted in 2002 by Kirschvink et al. (2002) stated that administration of ascorbic acid antioxidants such as ascorbic acid and vitamin E, causing improvement of resistance to physical exercises and reduction of degrees of inflammation of air Hungarian in endoscopic examination [11].

Also, other studies showed that because of antioxidant effects ascorbic acid have physiological damage reduction effects and oxidative stress in physical exercise [2].

Among the endocrine gland, thyroid gland is located in the neck near the larynx and because of secretion and production of specific elements and substances has a particular importance. Effective hormones on thyroid gland metabolism are T4 and T3. T4 or thyroxin has important metabolic functions in the body, like increasing oxygen consumption by cells, glycolysis or glucose uptake, regulation of heart rate efficiency and effect on fat metabolism [5,8,9,10,13,14].

During physical activity due to increasing of body metabolism, secretion and release of these hormones are stimulated by thyroid stimulating hormone but in endurance racing long distances, mean serum levels of these hormones decreases [6]. In cases where there are hypothyroidism or serum levels of thyroid hormones are lower than normal values, loss in sport power of horses could be occurred because of various reasons such as primary lack of iodine at the diet, neoplastic and feeding by goitrogenic substances [9,13,14].

Available information in relation horses sport is more about Standardbred, Thoroughbred, Quarter and Iranian two blood horses that each of them pay to evaluate the sport performance of horses with different criteria such as muscle enzymes, lactate, and heart rate [8,9,14,16] but there aren't any researches on the effect of ascorbic acid on thyroid hormones. As regards, use of drugs that can increase sport power of horses without side effects has been considered by researcher and on the other hand legal prohibition of prescription of most of these drugs at competition time aren't allowed. Beside in addition, changes in thyroid hormones is in relation to sport power of horses. So, the aim of this research to assess ascorbic acid oral administration of ascorbic acid as a safe antioxidant on serum values of thyroid hormones in Arabian horses of Tabriz province of Iran. For this purpose serum levels of these hormones at rest and after exercise were studied.

## MATERIALS AND METHODS

The study was conducted in late spring. Forty Arab horses whit 4-9 years of age and 450-550 kg that were in the same physical and physiological conditions were selected through Tabriz equestrian clubs. Randomly divided in to two group of twenty horses as control and treatment groups. Horses were on average 4-9 years of age and had an average body weight (BW) of 450-550 kilograms (kg). Animals were randomly allocated in two groups consisting of control and treatment groups.

Horses were evaluated according to the history, the absence of any previous illness and the absence of drug or dietary supplement. General Clinical examinations were performed whit recording the details.

Dietary of control and treatment groups were similar. Twenty grams of pure acid ascorbic was added to morning dietary of treatment group for a month. During this period, every forty horses were under control in similar conditions of management.

After this stage, all horses were examined again and the blood samples were collected from jugular vein using venoject tubes. Equestrian club track were measured precisely for the area of environment. The both After 3-5 minutes of strolling in the riding track, the sharp gallop and gallop rush were done with club's equestrian from a start point to a distance of 2160 meters (m). For assimilating all stages of research, physical exercise were done at 10-14 o'clock [11]. After covering desired distance, horses were brought into the hall immediately and the blood samples were collected from jugular vein using venoject tubes. The bloods were allowed to clot at room temperature and then centrifuged at  $1900 \times g$  for 15 minutes. The serum values of T3 and T4 were measured by standard method of ELISA. Data were expressed analysed as mean $\pm$ SEM and were analysed by one - way ANOVA and tukey complementary test. The level of significance between groups was set for  $p < 0/05$ .

**RESULTS**

The serum concentrations of (T3) and T4 serum levels of in control and treatment group of horses at rest and after exercise are presented in table 1. The results showed a statistical significant increasing ( $p<0/05$ ) of the mean serum concentrations of T3 and T4 in both control and treatment group after exercise in comparison with the time before exercise but the mean serum concentrations of ascorbic acid in both control and treatment group was reduced decreased significantly ( $p<0/05$ ) after exercise .

**Table 1: The comparison of serum values of T3 and T4 in control and treatment groups before and after exercise in Arabic horses.**

	Ascorbic acid ( mg/dl )	T3 ( U/L )	T4 ( U/L )
<b>Control group before exercise</b>	0.57 ± 0.009	130.55 ± 2.27	2.12 ± 0.05
<b>Control group after exercise</b>	<sup>a</sup> 0.47 ± 0.008	<sup>a</sup> 204.5 ± 2.19	<sup>a</sup> 3.38 ± 0.075
<b>Treatment group before exercise</b>	0.63 ± 0.01	130.3 ± 2.1	2.05 ± 0.047
<b>Treatment group after exercise</b>	<sup>a</sup> 0.55 ± 0.01	<sup>a</sup> 200 ± 1.98	<sup>a</sup> 3.23 ± 0.069

Data are expressed as mean ±SEn  
a: Statistically significant (  $p<0.05$  )

**DISCUSSION**

Whit regard to the results of in this study, the mean serum concentrations of T3 and T4 hormones were increased in both groups after physical activity but ascorbic acid was decreased after physical activity. This decrease is due to its use in animal body during exercise and against oxidative stress that is seen in both groups after physical exercise.

According to some researches, ascorbic acid with its antioxidant effect prevents tissue damages from free radicals and finally prevents from tissue damage and destruction [1,8,9]. Snow et al. (1987,1990) showed oral daily doses of 20gr vitamin C for 28 days can increase serum concentrations of that in horses but with one administration this increasing would not occur [17,18]. Loscher et al. (1984) were assessed the bioavailability of the intramuscular, intravenous, subcutaneous and oral administration methods concluded that intramuscular and sub cutaneous methods are not suitable for administrations because of stimulus [12].

In another study , administration of 10 mg/kg ascorbic acid had no effect on blood cortisol level in healthy horses and horses with the heaves illness [3].The results of this study showed serum level of thyroid hormones was increased after physical activity. Increasing serum level of thyroxin and triiodotyronine is the sings of stimulation of the secretion and releasing of them because of increasing of their metabolism which is consistent with previous studies [5,6,8,9,10,13,14,19]. Because of that there weren't any significant difference between control and treatment group in the serum concentrations of thyroid hormones after ascorbic acid administration, it could be concluded that ascorbic acid administration has no effect on thyroid hormones changes before or after the exercise and therefore it does not have any effect on increasing metabolism. However, more research is needed for the effect of this drug on other breeds (because of biological differences and differences in species) in similar conditions.

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Administration of <sup>131</sup>I in the treatment of GD. [D3]. Patient follow-up after <sup>131</sup>I therapy for GD. [D4] Treatment of persistent Graves' hyperthyroidism following radioactive iodine therapy. Some of the most profound effects of increased thyroid hormone levels are on the cardiovascular system (20). The complications of untreated thyrotoxicosis include loss of weight, osteoporosis, atrial fibrillation, embolic events, and even cardiovascular collapse and death (21,22). The cellular actions of thyroid hormone are mediated by T<sub>3</sub>, the active form of thyroid hormone. T<sub>3</sub> binds to nuclear receptor proteins that function as transcription factors to regulate the expression of many genes. Nongenomic actions of thyroid hormone also regulate important physiologic parameters. T<sub>3</sub> is the "active" thyroid hormone, which stimulates activity in almost every cell in the body, apparently by binding to nuclear membrane receptors that control gene expression. Crucially, T<sub>3</sub> serves to regulate the body's metabolic rate by increasing aerobic mitochondrial function. Drugs.com explains that T<sub>3</sub> may be preferred over T<sub>4</sub>, "when a rapid effect or rapidly reversible effect is desired, or when gastrointestinal absorption processes or peripheral conversion of T<sub>4</sub> to T<sub>3</sub> is impaired." Regulating T<sub>3</sub> dosage is more difficult, however, because of its potency, and "rapid onset of action may also produce adverse cardiac effects as a result of abrupt changes in metabolic demands" (Drugs.com).

translate them from English into Russian: 1. Adding a little neodymium metal to magnesium alloys greatly strengthens them. 2. All methods of measuring temperature changes are based on the ways in which materials change physically when heated. 8. 3. Animals obtain their nitrogen from eating plants or other animals. 4. Drinking extra water will help prevent some unwanted effects of sulfa medicines. 5. Effective antimicrobial therapy depends on maintaining an optimum and stable level of the drug in the serum and body tissues. 6. Getting enough light and raw materials for growth is important for s... As thyroid activity is essential for proper development, metabolic regulations and for maintenance of energy balance, we aimed to review literature data concerning the effects of quantity and type of protein consumed on thyroid axis activity. A better understanding of this issue could also improve either the results of nutritional interventions for preventing/treating thyroid axis disorders or the efficiency of animal breeding. The source of consumed protein has a significant impact on the thyroid hormone status. The long-term insufficient intake of dietary essential amino acids alters thyroid axis activity [43,44]. The deficiencies of these nutrients vary in their individual effects on thyroid hormone plasma concentrations. Carew et al. Cross talk between ascorbic acid and plant hormones during pathogenesis. The Combined synergistic effect of AA induced ABA and GA3 in signal transduction has been extensively studied using the cereal aleurone layer (Ritchie and Gilroy, 1998; Lovegrove and Hooley. Katay et al (2011) reported that the effect of ascorbigen and 1-methyl ascorbigen on the disease resistance in bean against fungal pathogen *Uromyces phaseoli* and also suggests that effectiveness of protection depended on the dosage of the applied 1-methylascorbigen and on the time interval between the chemical pretreatment and inoculation.