PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
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Pakistan Journal of Nutrition 10 (2): 176-181, 2011
ISBN 1680-5194

The Effects of Using Thyme on Iron Status in the Elite Sportsmen

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Abstract: This study aims to investigate the effects of using thyme on iron and iron related hematological parameters elite athletes. The subject group of the research was composed of 12 male wrestlers who have competed in various age categories of Turkish National Team and who were still competent for the medal in Turkey Championships. The subjects, all of whom have been carrying out actively, for at least 2 months, their applicable exercises were subjected to the thyme loading session without any interference in their training sessions. Each person was offered after meals, three times a day for duration of 35 days total, thyme tea which had been brewed 1 gram dried thyme in boiled water of 150 cm^3 for ten minutes. Before and after the thyme loading period, blood samples were collected and analyzed the levels of Hemoglobin (HGB), Erythrocyte (RBC), Ferritin (F), Transferrin (T) Serum Iron (SI) and Iron Binding Capacity (IBC) was accomplished by means of the brand OLYPUS AU640 hemacytometer. The amount of Transferrin Saturation (TS) was calculated using the formula, "SI X 100/IBC". In this study it was observed that the applicable levels were within, before and after thyme loading, the normal clinical values. However, a significant decrease, after 4-week thyme loading, for the concentration levels of HGB, RBC and SI ($p<0.05$) and a significant increase for the level of IBC ($p<0.01$) were identified. As a result, it was observed that the thyme which has been known for its numerous benefits has, besides its positive effects, some adverse effects on the iron status in the sportsmen. Therefore, supplemental iron loading, coupled with giving beverages such as tea, green tea, thyme, etc. all containing catechin as active substance might be required for the performance sportsmen.

Key words: Thyme, sportsman, iron status

INTRODUCTION

The plants such as tea, green tea, thyme, etc. all of which the active substances are flavonoids have been used for long years to cure the health problems. There are polyphenols, flavonoids and catechins, one of the sub-classes of the flavonoids, in tea plants in different amounts. The studies accomplished shown that these substances have a high antioxidant capacity (Schwarz *et al*., 1996; Yoshino *et al*., 1994). It was claimed that aforestated substances have made well many diseases such as cancer, heart diseases, alzheimer's disease and many other diseases (Serafini *et al*., 1996).

The catechins, one of the sub-classes of the flavonoids, are being known as the fundamental compound among human nutrients (Bilaloglu and Harmandar, 2001). Therefore, the studies carried out revealed that the concentrations of Epicatechin (EC), Epicatechin Gallate (ECG), Epigallocatechin (EGC) and Epigallocatechin Gallate (EGCG), all of which have been isolated from the catechins, have high Antioxidant Capacity (AOC) levels (Hodgson *et al*., 2000; Powers and Edward, 1994).

The thyme, originally found at environments of Mediterranean Region and have been used widely as a curing plant in the fields of alternative medicine, is a plant which is recommended to be used for curing various diseases and it has an antioxidant activity and phenolic substance content at high levels (Yen *et al*., 1997; Zheng and Wang, 2001).

The thyme contains flovins and flavonoids (Haraguchi *et al*., 1996; Miura and Nakatani, 1989). The flavonoids have antiinflamatory effects. And they reduce the peroxidation of lipid (Gonzalez-Segovia *et al*., 2008). Also, they have some anticancerogen effects (Tsuji *et al*., 2006).

The thyme has some durable phenolic compounds which are the sub-compounds of the flavonoids (Zheng and Wang, 2001). The thyme goes under the same family as rosemaries. Its main antioxidant compound was decomposed as phenolic glycoside. Muskat contains 2-allilfenols and several lignans. It was determined that aforegiven compounds have enduring AOC. Additionally, the capsaicin, a new and enduring Antioxidant (AO), was isolated from the aforementioned spicy (Serafini *et al*., 1996).

The thyme has more iron content than thistle seeds, sesame and black cumin seeds. However, its percentage of absorption and usage is more below than of subject plants (Abujadayil *et al*., 1999).

It was claimed in some studies that the thyme, besides its antioxidant effects, might increase the sportive performance (Davis *et al*., 2009a). Therefore, it is also informed that the thyme, although there are some investigations which claim that it has no effect on endurance capacity (Eichenberger *et al*., 2009; Utter *et al*., 2009; Dumke *et al*., 2009), the guarcetin increases the endurance capacity and delays fatigue during

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training, maintaining mitochondrial biogenosis for the sedentary persons (Davis *et al*., 2009a; Davis *et al*., 2009b). In addition, it is claimed that the flavonoids increase both the antioxidant capacity and swimming performance by retarding the fatigue in rats. It is claimed, in addition to above, that the thyme also increases the endurance capacity, affecting the metabolism of fat (Yu *et al*., 2010). For aforementioned reasons, sportsmen are advised to consume thyme.

However, some studies pointed out that the usage of iron in thyme was in low levels although it has more available iron content in it (Abujadayil *et al*., 1999); that the flavonoids, most important active substance of the thyme, reduced the content of iron and copper and declined the activities relating to the structures of iron and copper; that the metal chelation of flavonoids was in high levels and also the flavonoids play an important role for the metal-overloaded diseases (Mira *et al*., 2002) and that some flavonoids transferred the iron in ferritin and so reduced it (Abujadayil *et al*., 1999).

It is an important subject, in the light of aforegiven data, to investigate the effects of the thyme which has high flavonoid concentration relating to the iron status during training sessions. The study accomplished, focused mainly on this point, aimed to investigate the effects of thyme loading on the iron status in the professional sportsmen.

MATERIALS AND METHODS

Subject: 12 male wrestlers, all of whom have no harmful habits (smoking, alcohol, narcotics, etc.), diseases or disabilities and all of them have taken their place in the Turkish National Team for the categories of youngsters and adults or maintained their degrees among the first three ones for the national championships were assigned as the subjects. After the subjects were informed of all details of the study and they read the Ethical Principles Applied for Medical Researches on Human Participants as specified in the Helsinki Declaration of World Medical Association, the subjects were made to sign relevant forms about volunteer participation.

Preparation of the thyme tea: After the thyme plant was collected from mountains of the Central Anatolian Region (Nigde Melendiz), it was dried in the shade places, weighed as small handful of 1 gram and then packed. The subjects consumed after meals, three times a day for a length of 35 days total, the thyme tea which had been brewed in boiled water of 150 cm^3 for ten minutes. Daily number of usage and dosage were fixed in accordance with the recommendations and instructions, directed to the adults, of the Committee of Vegetal Medical Products, European Medicines Agency (EMEA, 2007). Therefore, the records of nourishment habits, three times daily, of the volunteers participated in the research were kept accordingly, the subjects were prevented from taking vitamins and all of them were subjected to the same nourishment schedule with particular care during the session.

Measures: Heights and weights of the volunteers were measured by means of a height/weight scale, brand Seca. Venous blood samples of the volunteers in sitting position were collected, after a resting period of 48 h, before and after thyme loading process. It was determined that the concentration levels of Hemoglobin (HGB), Erythrocyte (RBC), Ferritin (F), Transferrin (T), Serum Iron (SI) and Iron Binding Capacity (IBC) was accomplished by means of the brand OLYPUS AU640 hemacytometer. Therefore, the percentage of the transferrin saturation was calculated using the formula "SI X 100/IBC".

Statistics: The cross-comparisons of the differences in data of the subjects were carried out applying the Wilcoxon Signed Rank Testing. The level of insignificancy was set as 0.05 and 0.01.

RESULTS

The studies carried out revealed that the decrease observed in the concentration levels of saturation for HGB, RBC, serum iron and transferrin after thyme loading was significant. Meanwhile, the decrease in iron binding capacity was significant ($p<0.01$).

Initial notable finding for the study was the significant decrease in levels of HGB and RBC concentration after thyme loading which lasted 35 days total. Though a decrease was observed in HCT values, such a decrease was insignificant. Whereas the normal values of hemoglobin level were 14-18 g/dl, the level was 4.50 to 5.90 M/uL for RBC concentration and it was between 40 and 45% for HCT concentration in adults (Guyton and Hall, 2006). The levels for sportsmen were within the normal limitations for this study. However, some decreases were observed after loading thyme.

The serum iron is a measurement of the atom number of iron relating to the transferrin concentration. It was between 75 and 175 µg/dl in adults. Therefore, total iron binding capacity was correlated with free area of iron binding in the transferrin concentration, its normal value being between 250 and 410 µg/dl. The saturation of transferrin concentration is the ratio of serum iron to iron binding capacity total and its level is 20-50% under normal conditions (Rosenzweig and Volpe, 1999). In this research, while the concentrations of serum iron and iron binding were within normal limitations for both measures, the saturation of transferrin concentration was beyond the normal limitations for the first measure. In the study, while a significant decrease was determined in the level of serum iron concentration after loading thyme and significant increase was observed in the iron binding capacity. Accordingly, the transferrin saturation significantly decreased after loading thyme.

Table 1: Physical characteristics of the subjects

Variables	Ager (years)	Sports age (Years)	Height (cm)	Weight (kg)
Mean	21.66	12.25	171.00	74.11
Standard Deviation	3.16	4.02	3.82	9.42

Table 2: Variation of blood values before and after thyme loading

	Mean±Sd			
Variables	Before thyme	After thyme	Z-value	Sig.
HGB (g/dL)	16.058±00.488	15.518±00.4261	-2.405	0.016*
HCT (%)	45.263±00.865	44.255±01.163	-1.866	0.062
RBC (M/uL)	5.1618±00.102	4.918±00.248	-2.106	0.035*
Serum iron (µg/dl)	120.42±21.622	89.000±22.815	-2.357	0.018*
Iron binding capacity (ug/dL)	178.17±39.863	215.670±49.865	-2.670	0.008**
Transferrin saturation (%)	71.939±24.296	45.321±20.520	-2.513	0.012*
Ferritin (ug/L)	62.925±13.383	59.541±17.852	0.079	0.937
Transferrin (mg/dL)	252.09±23.522	247.220±20.541	-0.986	0.324

*p<0.05; **p<0.01

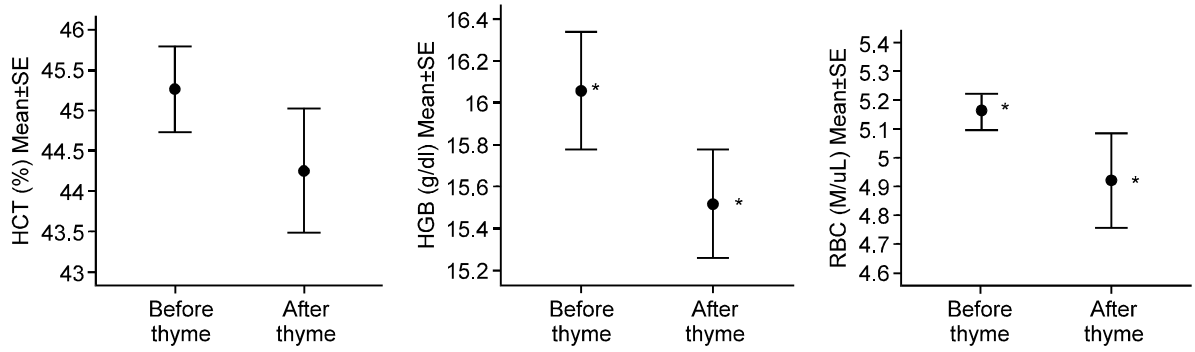

Fig. 1: HCT, HGB and RBC values (*p<0.05)

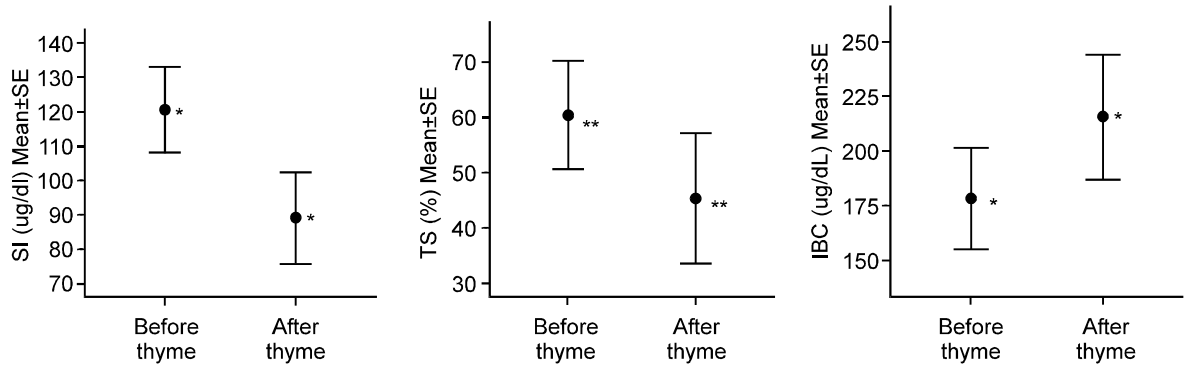

Fig. 2: SI, TS and IBC values (*p<0.05, **p<0.01). SI = Serum Iron; TS = Transferrin Saturation; IBC = Iron Binding Capacity

The level of serum ferritin concentration is a testing which gives the most sensitive data about iron stores. The normal value is between 20 and 300 ng/dl in male adults (Rosenzweig and Volpe, 1999). Therefore, the Transferrin is a kind of globulin which, after iron absorption, carries out the work of transferring to the relevant tissues and its normal value is 275-430g/dl (Guyton and Hall, 2006). In our study, both values were within the normal limitations for the measurement accomplished. On the other hands the decrease of both transferrin and ferritin was statistically insignificant.

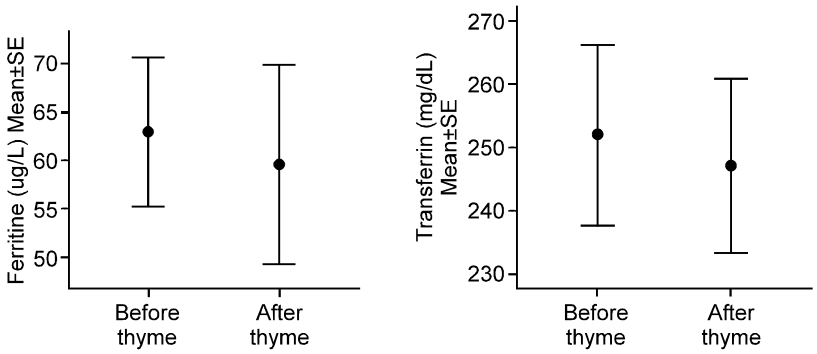

Fig. 3: Ferritin and transferrin values

DISCUSSION

The iron is one of the major elements which is required for the organism. Its most important function is to carry oxygen through hemoglobin concentration. The iron catabolizes, thanks to its transformation characteristics from ferrous state (Fe++) to ferric (Fe+++) state or vice versa, many events such as oxygenation, hydroxylation and many other metabolic phenomenon. The iron is a characteristic factor for exercise capacity, affecting not only the process relating to oxygen transfer for the training performance, but also the mitochondrial process. The studies performed revealed the importance of iron for training performances (Beard and Tobin, 2000; Suedekum and Dimeff, 2005). Therefore, its importance for training performance is unquestionable. For this reason, iron deficiency isn't a desired situation for sportsmen.

Total amount of the iron in the body is between 4 and 5 grams averagely, about 65% of it is in the form of hemoglobin, 4% approx. is in the form of myoglobin, 1 percent is in the form of various heme compounds that promote the intracellular oxidation, 0.1% is combined with the protein transferrin in the plasma blood and 15-30% is stored properly for later use, fundamentally in the reticuloendothelial system and liver cells, principally in the form of ferritin (Guyton and Hall, 2006).

The decrease of iron in the body is usually observed in three stages. First, when the iron is decreased in the stores of spleen, liver and bone marrow, also a proportional decrease occurs in the concentration of serum ferritin. Second is the process of iron decrease during circulation. It is characterized with the increase in the total iron binding capacity and the decrease in the serum iron capacity. Third stage is the decrease in the structure of hemoglobin and myoglobin relating to the oxygen transfer (Dallman, 1986).

The iron status is evaluated, for routine scanning, by measuring the levels of Hb and HCT. (Guyton and Hall, 2006) Since it is influenced by many factors, however, the findings revealed are limited (Rosenzweig and Volpe, 1999). For this reason, in the study the percentage values of serum iron, iron binding capacity, ferritin, transferrin and transferrin saturation, all of which are the parameters relating to the iron, were also evaluated accordingly.

Although, in this study, the level of iron was within normal limitations in the sportsmen, some significant decreases relating to the iron were determined in the parameters after thyme loading period. The decrease in the levels of Hb and RBC which directly affect the oxygen transfer capacity was significant. The studies carried out informed us that decreased levels of HCT and Hb also caused the $MaxVO_2$ to decrease (Beard and Tobin, 2000; Perkkio *et al*., 1985). In addition, the studies which revealed a lactate formation in higher levels for anemic ones during trainings applied at the same intensity as the control group, when cross-compared to, could be available in the literature (Perkkio *et al*., 1985). It makes us think, in the study, that the decreases in aforespecified levels in the sportsmen continuing their training schedules have been resulted from the decrease in the level of serum iron, the increase in the level of iron binding capacity and the decrease in the transferrin saturation. Primarily, the mechanism influencing the iron deficiency after loading thyme on the sportsmen must be disclosed. The studies performed that intensified training sessions in periods of 3, 6 or 12 months did not caused iron deficiency (Qian *et al*., 1999; Qian *et al*., 2002). There have no research about using thyme and iron status for sportsmen has been encountered in the literature. However, it is possible to obtain some studies about active substances and antioxidant mechanisms of the effects of the thyme are available. The studies give same opinions on the subject that the thyme, because of metal chelating characteristics usually of polyphenolic content on metal ions, is an effective antioxidant (Mira *et al*., 2002). Meanwhile, there are also some studies those pointing that the thyme has a rich iron content, but the level of usage of iron has been in low levels (Zheng and Wang, 2001). The studies accomplished state that the flavonoids in the thyme with chelating characteristics on

the iron (Fernandez *et al*., 2002) guercetin and myricetin particularly have high activities for decreasing the iron of relevant body section (Ren *et al*., 2008) and the iron chelating characteristics of the flavonoids has increased rather fairly at low pH. Moreover, extra emphasis was put on that the flavonoids, thanks to their chelating characteristics on metal ions, might play an important role for curing the diseases Wilson and hemocromotosis (Mira *et al*., 2002).

Conclusion: As a result, the thyme which is recommended for sportsmen to use has a negative effect on the iron and the parameters related to the iron for wrestlers. On the other hand, it can be stated that it is resulted from the chelating characteristics of the flavonoids and their sub-compounds found in the thyme on metal ions. It is advised that the thyme, which is recommended to be taken due to its numerous benefits, should be used with additional care by endurance sportsmen, particularly because of its iron binding characteristics. Perhaps, taking supplemental iron, in a controlled way, coupled with the thyme may be required. More comprehensive researches are needed on the subject aforedetailed.

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