Iron Status of Female Fencers

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ABSTRACT

The purpose of the present study was to analyze the iron status of female fencers. Total ten (10) female fencing trainees of Sports Authority of India, Sports Training Centre (STC), Patiala, having age between 12 to 17 years, were the subjects of the present study. The subjects were analyzed for dietary iron intake, hemoglobin, serum iron and serum ferritin. Mean and standard deviation statistical procedures were used to interpret the obtained values. The results of female fencers showed that the mean value of iron intake (14±5.3) was less than the recommended dietary allowance, for dietary iron intake; and the value of serum ferritin (14.83±4.70) was less than the reference range; while the values of mean hemoglobin (12.73±1.54) and mean serum iron (55.39±32.47) were within the reference range. Therefore, it was concluded that the female STC fencers had low level of stored form of iron and their dietary iron intake is also lower than the recommended level.

INTRODUCTION

Fencing is one of the four sports which have been featured at every modern Olympic Games since the 1896 1st Olympic Games. Currently, three types of weapons are used in Olympic Fencing: Foil, epee and sabre; in which both men and women compete. The target areas, as well as, the blade, differ for the three weapons. The sport traces its origin to ancient times, as fencing was an ancient form of combat in warfare. Today, the competitive element has been distilled from its violent origins to create a sport of agility, speed and endurance.

Foil is a light thrusting weapon; the valid target is restricted to the torso; the double hits are not allowed.

Epee is a heavier thrusting weapon; the valid target area covers the entire body; the double hits are allowed.

Sabre is a light cutting and thrusting weapon; the valid target area includes almost everything above the waist (excluding the back

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of the head and the palms of the hands); the double hits are not allowed.

Correctly organized nutrition, for a fencer, during the periods of intense physical and psychological loads, increases their working capacity and creates the foundation for achieving high level of physical performance. It is important to maintain proper records of micro-nutrients like iron, essentially consumed by the players, which will change their physiological capacities in relation to performance that would help in to achieve optimal performance. Maintaining an optimal nutritional status is critically important to the athlete, wishing to attain the peak performance. Consequently, the fact that iron deficiency is being increasingly observed in athletes, involved in heavy training, has generated considerable concern. Although, the effects of exercise on iron metabolism have yet to be clearly determined, the practical implications of this deficiency, in athletes, are significant. The healthy adult has only 3 to 5g of total body iron. Despite these minute quantities, iron is essential for life. As an integral constituent of hemoglobin, myoglobin and several enzymes, iron plays a vital role in the transport of oxygen and carbon dioxide and in the process of cellular respiration (Krause & Mahan, 1979). In the body, 60 to 70% of the iron is classified as essential or functional iron, and is incorporated into hemoglobin, myoglobin and certain respiratory enzymes. Hemoglobin is a substance contained in the red blood cells, which binds oxygen and carbon dioxide for transport to and from the working tissues. Myoglobin is the muscle counter-part of hemoglobin, which binds oxygen for storage within the muscle, providing an immediately available source of oxygen to the muscle. Cytochromes are electron transport enzymes that contain iron. Other iron-containing enzymes which are important in respiration include catalase, peroxidase and alphaglycerophosphate dehydrogenases, and xanthine oxidase (Dallman, 1974). The remaining 30 to 40% of the total body iron is classified as storage iron and serves as a reserve for a ferritin and hemosiderin in the liver, bone marrow and spleen (Krause & Mahan, 1979). As a result, the adequacy of iron in the body is closely linked to health, fitness, and sport performance; given the great importance of aerobic metabolism during exercise — even hard or maximal exercise — and recovery from exercise. Thus, the interest of athletes in iron adequacy is justifiable. The commonly used definition for anemia, regardless of its cause, is a low hemoglobin concentration. If iron deficiency is an underlying etiology, then, by definition, an individual must have depleted iron stores, low ferritin in plasma (Int. Conrol Group, 1985; Skikne, Flowers & Cook, 1990). Iron deficiency occurs when the body's iron stores become depleted and a restricted supply of iron to various tissues becomes apparent (Bothwell et al, 1979). The bio-availability of iron is both a function of its chemical form and the presence of food items that promote or inhibit its absorption. Ascorbic acid and meat are known as the most powerful of these enhancers of nonheme iron absorption; whereas, the list of inhibitors is much longer. In contrast to heme iron absorption, many factors affect nonheme iron absorption that includes bran; hemicellulose; cellulose; pectin; phytic acid, which is found in wheat and soy products; and polyphenolic compounds (Carpenter & Mahoney, 1992; Davis, Malecki & Greger, 1992). Heme iron is an important dietary source of iron because it is more effectively absorbed than the nonheme iron; thus, vegetarians can be at a relatively greater risk for iron deficiency, especially if food restriction is part of the dietary self-control exerted by female athletes. From 5% to 35% of heme iron is absorbed from a single meal; whereas, nonheme iron absorption from a single meal can range from 2% to 20%, depending on the iron status of the individual and the ratio of enhancers and promoters in the diet. (Bjorn-Rasmussen et al, 1974; Conrad, 1993) Many organs show morphologic, physiologic, and biochemical changes with iron deficiency, in a manner related to the turnover of essential iron-containing proteins. Sometimes, this occurs even before a significant decrease in hemoglobin concentration occurs (Dallman, 1986). Iron deficiency is associated with altered metabolic processes, including mitochondrial electron transport, neurotransmitter synthesis, protein synthesis, and others. Several parameters are used to assess the iron status, some of them are as follows :

Hemoglobin : The hemoglobin concentration shows the capacity of the blood to absorb atmospheric oxygen in the lungs and carry it to the tissues.

Iron : The iron concentration (in the serum) informs us about the amount that is available for uptake by the tissues.

Total iron binding capacity (TIBC) : The TIBC represents the amount of iron that the plasma can carry.

Transferrin saturation : The transferrin saturation shows how saturated the iron transport system is.

Soluble transferrin receptor & Ferritin : The soluble transferrin receptor and ferritin concentrations reflect the amount of iron stored in the tissue (Mougios, 2006).

METHODOLOGY

The participants of the present study were ten (10) female STC fencers, having age between 12 to 17 years, training at SAI Sports Training Centre, Patiala.

Dietary Iron Intake

To know the dietary iron intake of the participants, 3-day dietary recall method was used. For determining the iron intake of each participant, 24 hours recall method, for three days, was used. The direct interview method was used to collect the data from the informants. The total iron intake of the fencers was worked out with the help of ***Nutritrust Pro 1.00 software.***

Blood Sampling

Fasting (Twelve hours) 3ml blood sample was collected from antecubital vein between 07.00 am to 09.00 am.

Instrument Used

1. Semi-auto analyzer
2. Centrifuge machine
3. Elisa reader

Biochemical Parameters Assessed

1. Serum Iron (μg/dl)
2. Serum Ferritin (ng/ml)
3. Hemoglobin (gm/dl)

Standard procedures were used to assay above mentioned biochemical parameters.

RESULTS & DISCUSSION

The statistical analyses of data, on selected biochemical parameters, are presented in this section. The data obtained on Iron Intake, Hemoglobin, Serum Iron and Serum Ferritin has been analyzed. The results obtained are presented in the following Tables.

Table-1 : Mean and standard deviation of Iron Intake of female STC fencers.

Sports disciplines	Iron intake Mean± SD (mg)	RDA of iron (mg/day)
Fencing n = 10	14±5.3	30

Table 1 shows the mean and standard deviation of Iron Intake of female STC fencers. The mean iron intake of female STC fencers was found to be lower than the recommended dietary allowance of iron intake.

Table-2 : Mean and standard deviation of Serum Iron Level of female STC fencers.

Sports disciplines	Serum Iron Mean± SD (μg/dl)	Reference value (μg/dl)
Fencing n = 10	55.39±32.47	35-145μg/dl

Table 2 shows the mean and standard deviation of Serum Iron of female STC fencers. The mean Serum Iron of female STC fencers is found to be within reference value.

Table-3 : Mean and standard deviation of Serum Ferritin Level of female STC fencers.

Sports disciplines	Serum Ferritin Mean± SD (ng/ml)	Reference value (ng/ml)
Fencing n = 10	14.83±4.70	20-212.3 ng/ml

Table 3 shows the mean and standard deviation of Serum Ferritin level of female STC fencers. The mean Serum Ferritin of female STC fencers was found below the reference value of Ferritin.

Table-4 : Mean and standard values of Hemoglobin Level of female STC Fencers.

Sports disciplines	Hemoglobin Mean± SD (gm/dl)	Reference value (gm/dl)
Fencing n=10	12.73±1.54	12-16

Table 4 shows the mean and standard deviation of Hemoglobin level of female STC Fencers. The mean Hemoglobin of female STC Fencers was within the reference range.

The fencers were analyzed for dietary iron intake, serum iron, serum ferritin and hemoglobin level. The aim of present study was to evaluate the iron status of female STC Fencers. In the present study, it was found that the mean dietary iron intake of female STC fencers was lower than the recommended dietary allowance of iron intake. The mean value of serum ferritin was below the reference value of serum ferritin. If the ferritin level is low, there is a risk for lack of iron, which could lead to anemia. Low ferritin levels (<50 ng/ml) have however been associated with the symptoms of restless legs syndrome, even in the absence of anemia and sickness. In the setting of anemia, serum ferritin is the most sensitive lab test for iron deficiency anemia. Low ferritin may also indicate vitamin C deficiency. In this study, the mean value of serum iron of female STC fencers was found to be within the reference value of serum iron. The mean value of hemoglobin of female STC fencers was within the reference range.

CONCLUSION

Women were chosen as the study group because they are at greater risk of developing iron deficiency than men. After completion of this study, it was concluded that the female fencers have adequate level of serum iron but there serum ferritin level is below the desirable range, which shows that the iron storage of female fencers is low because iron is stored in human body in the form of ferritin. Female fencers show normal level of hemoglobin. The female fencers were not anemic; it is unlikely that their low ferritin concentrations were associated with specific symptoms, but low stores do indicate the risk of becoming anemic at times of increased stress or when there is excessive blood loss. It is important to increase female fencer's knowledge of iron-rich foods and the dietary constituents that enhance and inhibit the absorption of non-heme iron. It is particularly important for members of these groups to consume recommended amounts of iron and to pay attention to dietary factors that enhance iron absorption. If appropriate nutrition intervention does not promote normal iron status, iron supplementation may be indicated.

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