

# Effects of Gymnastic Exercise on the Body Iron Status and Hematologic Profile

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## Abstract

Although, iron depletion is a common disorder among athletes, little data exist regarding the effect of gymnastic training on iron status. The objective of this study was to evaluate the effect of gymnastic exercise on body iron status and hematologic profile. The present investigation involved 35 male gymnasts aged from 6 to 14 yrs. Serum ferritin level, total iron binding capacity (TIBC), iron and transferrin saturation, along with hematological indices (RBC, Hb, Hct, MCV, MCH, MCHC) were analyzed in venous blood samples before starting the exercise course and 10 weeks later. The second readings of serum ferritin level, RBC, Hct, and Hb were decreased significantly ( $p < 0.05$ ) as compared to the baseline values, whereas TIBC increased significantly ( $p < 0.02$ ). We concluded that gymnastic training is associated with a reduction in the body iron stores, leading to early stages of iron depletion which might compromise the health and performance of athletes.

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**Keywords** • Iron status • gymnastic • exercise

## Introduction

**I**ron deficiency is the most prevalent nutritional problem in the world. Two-thirds of children and women of childbearing age living in most of the developing countries are estimated to suffer from iron deficiency and one third are prone to disorders of iron-deficiency-like anemia.<sup>1</sup> Exercise can influence erythropoiesis and red cell survival in a variety of ways. A number of mechanisms have been proposed that could lead to mild changes in the hemoglobin (Hb) level or red cell mean corpuscular volume (MCV). In addition, athletes may be at high risk of developing iron stores depletion.<sup>2</sup> Factors affecting the hematological profile of athletes include gastrointestinal bleeding, hematuria, sweating, menstruation and heavy exercise.<sup>3</sup>

The objective of the present study was to determine the effect of gymnastic exercises on body iron status and hematologic profile.

Thirty-five male gymnasts with a mean  $\pm$  SD age of  $9.02 \pm 1.8$  (range 6–14) year with an average daily exercise period of 2–2.5 hrs (non-endurance, moderate and intensive training) were enrolled into the study. Iron supplements were not used by any of the participants within two months before and during the study. Each gymnast was well-rested before the test and had no hard physical activity during the preceding 48 hrs. Venous blood samples were obtained at the start of the sport course,

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**Table 1: Hematologic profile and body iron status of gymnast athletes, before and 10 weeks after a training course.**

Parameter	Before exercise (X±SD)	After 10 wks (X±SD)	p value
RBC(×10 <sup>12</sup> /l)	5.15±0.49	4.86±0.42	0.00
Hct (%)	39.0±2.4	37.0±2.5	0.00
Hb (g/dl)	13.1± 0.9	12.8±0.9	0.04
MCV (fl)	78.3± 5.8	78.5±6.2	0.39
MCH (pg)	26.1±2.2	26.1±2.4	0.94
MCHC (g/dl)	33.0±0.9	33.3±0.7	0.06
Serum iron (µg/dl)	77.6±32.8	72.9±23.8	0.47
TIBC (µg/dl)	323.1± 51.0	343.7±49.0	0.02
Ferritin (µg/l)	30.3±16.3	24.0±12.9	0.01
Transferrin Saturation (%)	25.7±12.9	22.6±11.2	0.22

and 10 weeks later. Serum ferritin, iron, total iron capacity binding (TIBC), transferrin saturation, red blood cell count (RBC), hemoglobin (Hb), hematocrit (Hct), MCV, mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC) were measured.

It was found that TIBC increases significantly ( $p < 0.02$ ) over the study period (Table 1). RBC, Hct, Hb and serum ferritin level were significantly decreased ( $p < 0.05$ ).

Our findings indicate that gymnastic reduces the body iron stores. Several studies have indicated that certain sports, particularly running, increase the incidence of iron depletion,<sup>4-6</sup> however, iron deficiency anemia is rare.<sup>7</sup> Other studies<sup>8,9</sup> suggested that in athletes, especially young females, reduced serum ferritin level might be the first indication of iron deficiency at a time where Hb and serum iron concentrations, transferrin saturation and RBC are not yet affected. Iron stores were consistently lower in male gymnasts than in male non-gymnasts. Adolescent athletes of both genders, gymnasts in particular, are prone to develop non-anemic iron-deficiency.<sup>10</sup> As elite athletes become younger with more intensive training beginning at younger ages, the probability of observing this phenomenon in childhood increases.

Qian *et al.* showed that the increase in the length of exercise does not induce a further remarkable decrease in plasma Hb and Hct.<sup>11</sup> This result indicates that a true iron deficiency cannot develop even if under longer periods of strenuous exercise.

Compromised body iron status can affect performance as well as general health of athletes.<sup>1,12</sup> Since we found that gymnastic exercises are associated with a reduction in iron stores, which can lead to iron deficiency, continuous monitoring of iron status in gymnasts is recommended.

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#### References

- 1 Scrimshaw NS. Iron deficiency. *Sci Am* 1991; **265**: 24-30.
- 2 Balaban EP. Sports anemia. *Clin sports Med* 1992; **11**: 313-25.
- 3 Chatard JC, Mujika I, Guy C, Lacour JR. Anaemia and iron deficiency in athletes. Practical recommendations for treatment. *Sports Med* 1999; **27**: 229-40.
- 4 Rowland TW, Stagg L, Kelleher JF. Iron deficiency in adolescent girls. Are athletes at increased risk? *J Adolesc Health* 1991; **12**: 22-5.
- 5 Nickerson HJ, Holubets MC, Weiler BR, et al. Causes of iron deficiency in adolescent athletes. *J Pediatr* 1989; **114**: 657-63.
- 6 Robertson JD, Maughan RJ, Milne AC, Davidson RG. Hematological status of male runners in relation to the extent of physical training. *Int J Sport Nutr* 1992; **2**: 366-75.
- 7 Clarkson PM. Micronutrients and exercise: anti-oxidants and minerals. *J Sports Sci* 1995; **13**: 11-24.
- 8 Karamizrak SO, Islegen C, Varol SR, et al. Evaluation of iron metabolism indices and their relation with physical work capacity in athletes. *Br J Sports Med* 1996; **30**: 15-9.
- 9 Spodaryk K. Iron metabolism in boys involved in intensive physical training. *Physiol Behav* 2002; **75**: 201-6.
- 10 Constantini NW, Eliakim A, Zigel L, et al. Iron status of highly active adolescents: evidence of depleted iron stores in gymnasts. *Int J Sport Nutr Exerc Metab* 2000; **10**: 62-70.
- 11 Ming Qian Z, Sheng Xiao D, Kui Liao Q, Ping HO K. Effect of different durations of exercise on transferrin-bound iron uptake by rat erythroblast. *J Nutr Biochem* 2002; **13**: 47-54.
- 12 Weaver CM, Rajaram S. Exercise and iron status. *J Nutr* 1992; **122**: 782-7.