

Iron Deficiency in Female Adolescent Athletes – Prevalence, Mechanisms and Diagnostics

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Avhandlingen baseras på följande delarbeten.

- I Landahl G, Adolfsson P, Börjesson M, Mannheimer C, Rödger S. Iron Deficiency and Anemia: A Common Problem in Female Elite Soccer Players. *Int J Sport Nutr Exerc Metab.* 2005; 15:689-694
- II Sandström G, Börjesson M, Rödger S. Iron Deficiency in Adolescent Female Athletes – Is Iron Status Affected by Regular Sporting Activity? *Clin J Sport Med.* 2012; 22:495-500
- III Sandström G, Kaijser B, Rödger S, Börjesson M. *Helicobacter pylori* antibodies and Iron Deficiency in Female Adolescents. *Under revision in PLoS one*
- IV Sandström G, Rödger S, Jacobsson S, Börjesson M. Evaluation of Iron Status in Female Adolescent Athletes. *Submitted to Br J Sport Med*

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IRON DEFICIENCY IN FEMALE ADOLESCENT ATHLETES - PREVALENCE, MECHANISMS AND DIAGNOSTICS

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Abstract

Background: Iron deficiency (ID) is a very common condition and the most common nutritional deficiency in the world. ID mostly affects females, both athletes and non-athletes. Several underlying mechanisms are identified, such as insufficient dietary intake and losses by menses. In the athlete group different additional mechanisms are discussed including the existence of “sports anaemia” and in recent years the effect of inflammation due to physical activity and its effect on iron status has been highlighted. The inflammatory response complicates the diagnostic process and alternative laboratory methods have been proposed to improve diagnostics.

Methods: To study the prevalence of ID and iron deficiency anaemia (IDA) we used two different populations, first the female national soccer team (individuals aged 19-28 years), secondly a population of adolescent female athletes as well as a control group of adolescent non-athletes in a senior high school was studied. All participants filled in a questionnaire and blood samples comprising blood status, iron status including soluble transferrin receptor and hepcidin, and inflammatory markers as well as *Helicobacter pylori* antibodies were collected. Different methods for detection of ID were compared.

Results: The initial study showed a prevalence of ID of 57% and IDA of 29%. In the following study we found ID in 52% of the athletes and 48% of the non-athletes. IDA was seen in 8.6% of the athletes and 3.3% in the control group. The athletes had a significantly better diet and less loss by menses. Serum hepcidin was significantly higher in the athlete group and serum ferritin was the test that identified most individuals with ID.

Conclusion: Our studies revealed a high prevalence of ID in both the older elite soccer players as well as in the adolescent young female athletes. The prevalence of IDA was higher in the elite soccer player. In the adolescent athlete group we found a higher iron intake, as well as significantly less menstrual bleeding, but no difference in occurrence of ID. Serum hepcidin was significantly higher in the athlete group compared to the non-athletes. Hepcidin down regulates ferroportin, which results in decreased dietary iron absorption. Thus this could be a mechanism behind sports related iron deficiency. For diagnosis, serum ferritin remains the most sensitive tool, but *Helicobacter pylori* antibodies and serum hepcidin may be used in cases of non-responders to iron treatment.

Keywords: iron deficiency, iron deficiency anaemia, female adolescents, physical activity, inflammation, *Helicobacter pylori*

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