



Synbiotic supplementation improves response to iron supplementation in IDNA female athletes in-training

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ABSTRACT

Objective: Iron deficiency (ID) affects ~30% of female athletes, and its consequences are highly relevant to athletic performance. Poor iron (Fe) uptake remains a major factor in the development of ID. While animal studies suggest that prebiotics may improve Fe uptake, this has not been well-studied in humans. The main objective of the proposed study is to determine the effects of synbiotic supplementation on the Fe status of ID female athletes during Fe repletion. **Methods:** At the beginning of a training season, the Fe status of 28 female athletes was screened. Twenty eligible athletes (Hgb:12.3±0.9g/dL; sFer:18.1±9.2µg/L) were randomized to receive either a daily synbiotic supplement (5g prebiotic fiber + 8 billion CFU probiotic *B. lactis*) or placebo, along with Fe supplement (140 mg FeSO₄/d) for 8 weeks using a double-blind design. Fe status was assessed at baseline, mid-point and after the trial. **Results:** Nineteen athletes (n=9 supplement, 10 placebo) completed the trial and there was no difference in compliance between groups (6818±917 mg FeSO₄; 51.6±6.7 packets consumed over 8 weeks), and no supplement-related GI symptoms were reported. After controlling for baseline Fe status, regression analyses revealed improvements in log sFer in the supplement group after both 4 and 8 weeks (p=0.01 and p=0.05, respectively), compared to placebo. **Conclusions:** We observed that synbiotic supplementation along with FeSO₄ improved athletes' Fe status over 8 weeks. This preliminary data is essential to advance our understanding of how Fe uptake in active women can be enhanced by synbiotic supplementation, as well as by foods containing pre- and probiotics.

BACKGROUND AND OBJECTIVES

Iron deficiency (ID) is one of the most prevalent nutrition deficiencies in the world. One of the most susceptible populations to developing ID is female athletes (~30%) and its consequences are relevant to athletic performance (1, 2). Current literature suggests that prebiotic supplementation may improve Fe bioavailability in animal models, however, there are no studies examining the effects of synbiotic supplementation on Fe uptake in female athletes (3-5). **This study aimed to understand if Fe uptake can be enhanced with synbiotic supplementation in female athletes with ID.**

METHODS

For this RCT, female athletes (Division III; basketball, cross-country, field hockey, lacrosse) were recruited at the beginning of a training season (4.6±2.3 training days/week at baseline). Fe status was screened (n=28), then athletes (n=20) were randomized to receive either synbiotic supplementation (*Regular Girl*®, 5g prebiotic fiber + 8 billion CFU probiotic *B. lactis*) or a placebo, along with a daily Fe supplement (140 mg FeSO₄/d) for 8 weeks using a double-blind design. Fe status and body composition was assessed at baseline, mid-point and after the trial. Athletes completed a daily training, medication and GI symptom log. Nineteen athletes completed the trial, and no differences were observed in compliance between groups (6818±917 mg FeSO₄; 51.6±6.7 packets consumed over 8 weeks), and no supplement-related GI symptoms were reported in daily logs. **Statistical analyses:** Descriptive data are presented as means±SD and frequencies. Linear regression and General Linear Model (GLM) analyses were used to examine group, time and group x time effects of all continuous variables over the 8-week RCT. P<0.05 was considered significant for main effects.

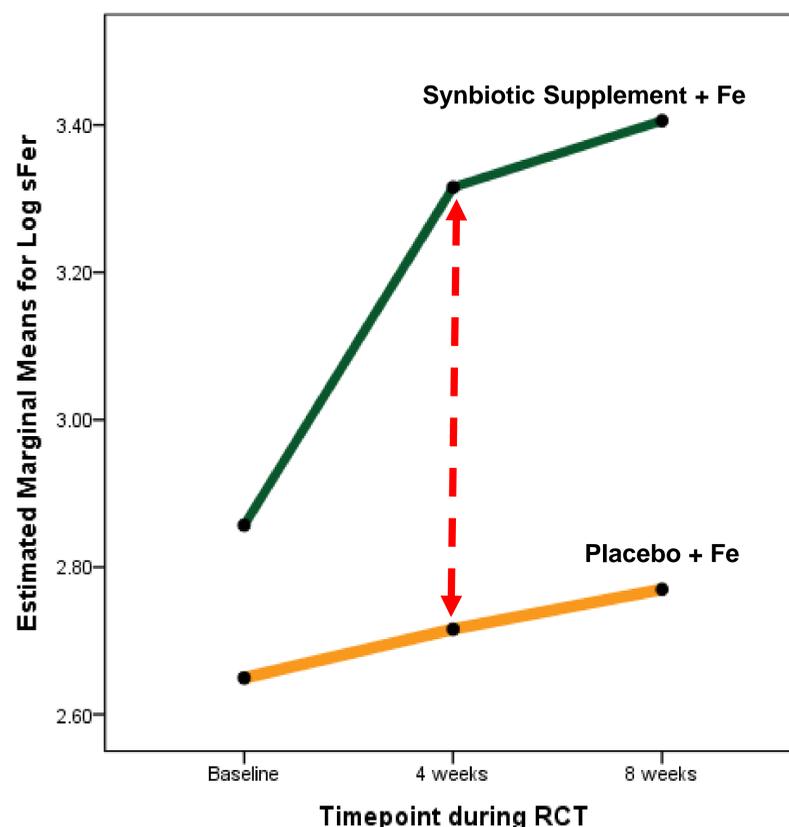
RESULTS

Table 1. Iron status of female athletes enrolled in an 8-week RCT

	Synbiotic Supplement + FeSO ₄ (n=9)	Placebo + FeSO ₄ (n=10)
Synbiotic supplement consumed over 8w	~255 g prebiotic fiber + 407 billion CFUs probiotic <i>B. lactis</i>	---
sFer (µg/L)^{a,d}		
Baseline	19.7±9.4	16.6±9.3
Midpoint ^b	27.8±10.3	16.4±7.2
Endpoint ^c	40.2±42.3	18.3±10.4
Hgb (g/dL)		
Baseline	12.4±0.6	12.1±1.1
Midpoint	13.5±1.1	13.1±1.1
Endpoint	13.3±0.5	13.1±1.1

GLM: ^aTime effect, p=0.03; ^{b,c}Group effect: p=0.008, p=0.04; ^dTime X Group effect, p=0.17

Figure 1. Change in log sFer status with daily FeSO₄ & either Synbiotic Supplementation or Placebo over an 8-week RCT



BL-MP: Log sFer improved by 41% in the Supplement group ($\beta=0.46 \pm 0.16$, $p=0.01^*$), compared to 0% in the Placebo group.

BL-EP: Log sFer improved by >100% in the Supplement group ($\beta=0.50 \pm 0.23$, $p=0.05^*$), compared to 10% in the Placebo group.

**All regression analyses were controlled for BL sFer.*

SUMMARY AND CONCLUSIONS

Uptake of FeSO₄ was significantly improved with consumption of a synbiotic supplement at 4 weeks, and improvements in sFer status were sustained over the 8 week trial compared to FeSO₄ plus placebo. While this was a smaller sample, if synbiotic supplementation can enhance the uptake of FeSO₄ in ID female athletes during repletion of Fe status, it could conceivably improve the Fe bioavailability of non-heme Fe sources and mixed meals (e.g. heme + non-heme sources of Fe). Non-heme Fe is the most abundant source of dietary Fe worldwide, so using a synbiotic supplement could aid in ameliorating ID in women around the globe.

Conclusions and Clinical Implications: In addition to screening the Fe status of female college athletes at the beginning of a season, athletes with a history of anemia or ID should receive counseling regarding Fe supplementation and high-Fe food choices, as well as serial monitoring of their Fe status (Hgb, sFer). **It may also be beneficial to receive dietary counseling on pre- and probiotic food choices, and/or synbiotic supplementation to maximize Fe bioavailability.**

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