Hepcidin is Not a Viable Predictor of Low Energy Availability Status in Collegiate Basketball Athletes

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ABSTRACT

Background: Low energy availability (LEA) occurs when an athlete does not have sufficient dietary calory intake to meet the metabolic demands of their sport. LEA can be difficult to measure as it requires several days of diet and physical activity tracking. Thus, a biomarker to indicate LEA risk may be advantageous. Hepcidin, a peptide hormone responsible for iron homeostasis, has been suggested as a potential biomarker of LEA as elevated levels have been reported in war fighters and endurance athletes, though, it has not been well-studied in team sport athletes. **Purpose:** To evaluate the viability of hepcidin as a biomarker of LEA in collegiate basketball athletes. **Methods:** National Collegiate Athletic Association Division I basketball athletes,9 women (height=174.6 cm; body mass=75.8 kg; fat free mass=56.7 kg; percent body fat=25.2%) and 12 men (height=196.5 cm; mass=92.4 kg; fat free mass= 77.8 kg; percent body fat= 15.8%), participated in this study. Athletes arrived at the laboratory following an overnight fast. Fat free mass (FFM) was determined from dual-energy x-ray absorptiometry. A resting venous blood sample was collected, centrifuged, and resulting serum stored at -80 °C until hepcidin analysis using ELISA. For the next four days, athletes completed food logs and wore heart rate monitors during physical activity for subsequent determination of energy intake (EI) and energy expenditure (EEE), respectively. EI and EEE were averaged across the 4-day period. LEA was calculated as (EI – EEE) / FFM (kcals/kg of FFM). Athletes were considered LEA if their energy availability was <30 kcals/kg of FFM. A one-way analysis of variance (ANOVA) was conducted to identify differences in hepcidin concentrations between athletes with LEA and athletes with adequate energy availability. Further, linear regression was used to evaluate the ability of hepcidin to predict energy availability, expressed as kcals/kg of FFM. Alpha was set to $p<0.05$. **Results:** 75% (n=9) of the men athletes and 44% (n=4) of the women athletes were identified as having LEA. Athlete characteristics are described in table 1. No significant difference in serum hepcidin concentration was detected between energy availability groups ($p=0.868$). Further, serum hepcidin was not a significant predictor of energy availability ($p=0.859$, $R^2=0.002$). **Conclusion:** Hepcidin may not be a viable predictor of LEA in men and women collegiate basketball athletes. It is possible that a greater degree of LEA (i.e., less calorie intake and/or greater energy expenditure) may be necessary to elevate concentrations of hepcidin. **Practical Applications:** Evaluating the LEA via biomarkers, particularly serum hepcidin, is not well established and practitioners are recommended to exercise caution if using this method. It is recommended to consult with a sports dietitian regarding options for LEA assessment if evaluation of EI and EEE is not feasible.

BACKGROUND

- Low energy availability (LEA) occurs when an athlete does not consume sufficient energy to maintain the metabolic demands of their sport
- LEA can be difficult to measure as there are no current gold standard guidelines
- A biomarker to indicate LEA risk may be advantageous
- Hepcidin, a peptide hormone responsible for iron regulation, has been suggested as a potential marker of LEA risk but data is lacking in team sport athletes

PURPOSE

To evaluate the viability of hepcidin as a biomarker of LEA in collegiate basketball athletes

PRACTICAL APPLICATIONS

It is recommended practitioners working with recreational women athletes provide nutrition education resources to improve upon nutrition knowledge which may positively impact body composition and RMR.

METHODS

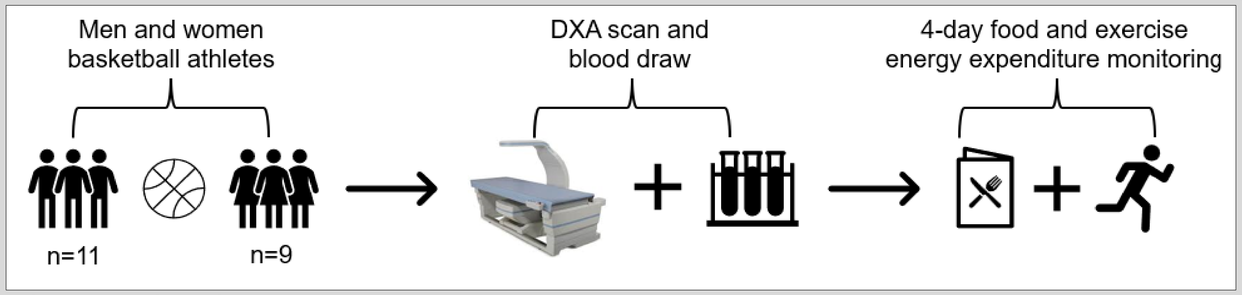


Figure 1: Study Design.
11 men and 9 women, Division I, collegiate basketball athletes participated in this study. Following an overnight fast, athletes arrived to the laboratory and underwent a dual-energy x-ray absorptiometry scan to obtain fat free mass (FFM), followed by a blood draw. Over the next 4 days, athletes took photos of everything they ate and drank with a description of what was in the food or drink. Additionally, they wore Polar Team Pro monitors which tracked heart rate and GPS metrics. These metrics were then used in an algorithm to calculate exercise energy expenditure.

- All food and drink logs were analyzed by a registered dietitian in NutritionistPro
- Energy intake (EI) and exercise energy expenditure (EEE) were averaged across the 4 days
- The below calculation was used to establish energy availability status

  EI kcals– EEE kcals/kg of FFM
- Hepcidin was analyzed through ELISA

Statistical Analysis

- A one-way analysis of variance (ANOVA) was conducted to identify differences in hepcidin concentrations between athletes with LEA and athletes with adequate energy availability.
- Linear regression was used to evaluate the ability of hepcidin to predict energy status
- Alpha was set to $p<0.05$

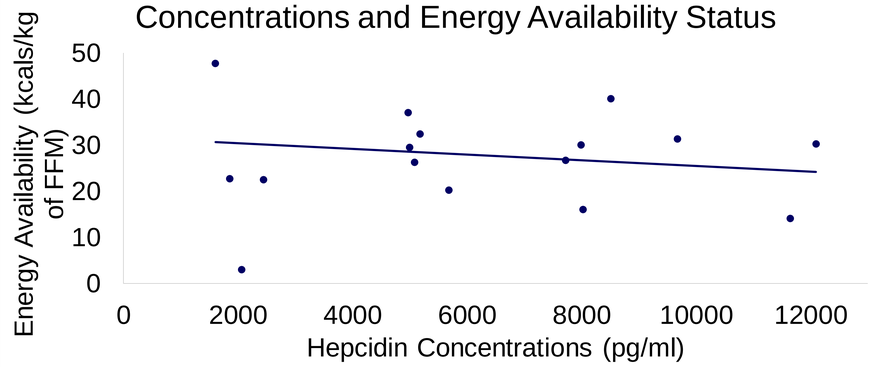
RESULTS

- Table one describes athlete characteristics
- 75% of men athletes and 44% of women athletes were identified as having LEA
- No significant differences were identified between energy availability groups (p=0.868)
- Serum hepcidin was not a significant predictor of energy availability (p=0.859, $R^2=0.002$; Figure one)

Table One. Participant Characteristics

	Men with LEA (n=9)	Men with Adequate Energy (n=3)	Women with LEA (n=4)	Women with Adequate Energy (n=5)
Energy availability (kcals/kg of FFM)	18.6±12.0	33.4±4.5	22.2±12.3	40.6±8.1
Hepcidin (pg/ml)	6324.8±4093.9	8399.0±4471.3	6229.2±1598.9	5227.5±2575.5
Body mass (kg)	95.8±11.7	82.2±8.8	77.4±11.0	70.0±6.7
Percent body fat	19.3±10.6	14.6±1.1	29.9±10.9	22.7±2.4
Fat free mass (kg)	77.0±12.4	70.2±7.8	54.2±11.2	54.0±3.5

Figure One: Relationship between Serum Hepcidin Concentrations and Energy Availability Status



CONCLUSION

- Hepcidin may not be a viable predictor of LEA in men and women basketball athletes from one blood draw
- Long-term evaluation of hepcidin and LEA may be warranted to establish a stronger relationship in basketball athletes
- This relationship may be more pronounced in endurance sports than team sports

Laboratory website

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