

INVESTIGATION OF TOTAL, FREE AND BOUND LEPTIN IN OLYMPIC DEVELOPMENT ATHLETES.
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Introduction

Leptin, a hormone made by adipocytes and the protein product of the ob gene, is an important circulating signal for the regulation of body weight (Zhang et al., 1994). It interacts with specific receptors in the hypothalamus affecting appetite and satiety centers of the brain (Rohner-jeanrenaud & Jeanrenaud, 1996). Since its discovery in 1994, the physiological roles of leptin have broadened. Our ability to translate current leptin data into clinical utility is limited due to; 1) the lack of appropriate values for leptin in reference populations, and 2) differences in assay methodology.

Objective

This study examined normative reference ranges for total plasma leptin in elite athletes between 18-30 years of age who were involved in sport science support. The athlete’s height, weight, (calculated BMI), triglyceride, total cholesterol, HDL-cholesterol, LDL-cholesterol, glucose and insulin were measured to ensure that the athletes were within the healthy status range.

Design

Cross-sectional-descriptive study.

Setting

Human Performance Laboratory in University of Calgary, Calgary Laboratory Services, and Alberta Children’s Hospital, Calgary AB.

Subjects

Seventy-six elite male and female athletes.

Intervention/Main Outcome Measures

All subjects were sampled following at least a 12 hour fast. The volunteer’s height and weight were recorded at the time of blood collection and used to calculate their body mass index (BMI). Following procurement of the clinical specimens required by the sport centre, a second vacutainer (3ml) was

obtained. Triglyceride, total cholesterol, HDL-cholesterol, LDL-cholesterol (calculated), glucose

and insulin were analyzed according to established Calgary Laboratory Services methodology. Total plasma leptin was analyzed by enzyme linked immunosorbent assay (ELISA; Linco Research, Inc.). However, we were unable to determine free and bound values due to the current kit limitations and because the lab was being renovated during the study.

Main Results

Two athletes were excluded from results because they were over 30 years of age (N=76). The physical characteristics of the remaining athletes are included in Table 1.

Table 1. Participant characteristics of all athletes (n=74).

Variable	Mean ± S.D.
Age (yrs)	23.46±3.36
Height (cm)	174.31±7.57
Weight (kg)	72.09±9.23
BMI ($kg \cdot m^2$)	23.68±2.15
Fasting Glucose (mmol/L)	4.81±0.29
Total Cholesterol (mmol/L)	4.34±0.070
Triglyceride (mmol/L)	0.86±0.86
HDL-Cholesterol (mmol/L)	1.61±0.04
LDL-Cholesterol (mmol/L)	2.34±0.07
Total-C:HDL Ratio (mmol/L)	2.78±0.07
Insulin (pmol/L)	38.24±1.82
Leptin (ng/ml)*	5.91±4.44

*n=48, undetectable in 36 athletes

All athletes were considered healthy based on their lipid, insulin and glucose profile. Plasma leptin concentrations ranged from <0.5 – 19.15 ng/ml. The sample was separated by sex and divided into sprint and endurance athletes. Sprint sports included hockey, luge, skeleton and wrestling.

Endurance sports included biathlon, speed skating, track and field and cross-country skiing.

Leptin concentrations were undetectable (<0.5 ng/ml) in all cross-country skiers (n=11), all track and fielders (n=2), all male speed skaters (n=5), all male biathletes (n=5) and one female speed skater.

Sprint athletes (n=34) had a plasma leptin concentration of 6.58 ± 4.71 . There was a significant difference between female (n=27) and male (n=7) sprint athletes ($p=0.004$). There was no significant difference between sprint athlete leptin concentration and BMI ($p=0.67$).

The endurance group had many undetectable values, therefore the nonparametric Mann-Whitney Test was used to compare endurance versus sprint athletes. There was a significant difference between leptin concentration in the two groups ($p<0.0001$).

There was a significant difference in BMI between sprint and endurance athletes ($p=0.0006$). Sprint athletes had a BMI of 24.53 ± 2.25 and endurance athletes had a significantly lower BMI of 22.87 ± 1.73 .

Summary and Conclusions

This study demonstrates that plasma leptin concentrations in elite athletes range from <0.5 to 19.15 ng/ml. More specifically, endurance athletes have a significantly lower leptin concentration than sprint athletes. Additionally, endurance athletes have a significantly lower BMI than sprint athletes. Further research is needed with a larger sample size to confirm these results. Additionally, trying to increase the sensitivity of the ELISA kit will aid in increasing our understanding of leptin in elite athletes.

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Commentary

Leptin is a metabolic variable that does not respond to energy intake or exercise energy expenditure, but it does to the balance between the two. This initial study provides direct values for plasma leptin concentration in a variety of different athletes. Additionally, it provides healthy reference ranges for their lipid, glucose and insulin profile. The significantly lower leptin concentrations seen in endurance athletes relate to the lower BMI found in these athletes. The increase in aerobic capacity for endurance athletes enables them to have more efficient use of lipid metabolism through β -oxidation. This allows for a decrease in fat mass, and thereby, a decrease in leptin being produced and secreted from adipocytes. Furthermore, the significant difference in leptin concentrations across male and female athletes is in line with much of the published literature. As females tend to have a higher fat mass and BMI, they will also have higher amounts of leptin being released from their adipocytes. The analysis of elite athlete blood variables increases our physiological understanding of how training may affect leptin, BMI and health status. In order to more accurately compare and analyze leptin concentrations in this population, it is important to try and increase precision of current ELISA techniques. Presently it is unknown what role leptin plays in sport performance. However, as our understanding of leptin increases, it will be possible to identify if it plays a critical role in training prescriptions in some sports.