

OR31-07: Increased Caloric Intake Improves Regularity of Menses and Is Associated with Increased TT3 and Leptin in Exercising Women with Oligo/amenorrhea: The "REFUEL" Randomized Controlled Trial

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Exercising women often fail to consume adequate energy intake relative to energy expenditure and are thus susceptible to menstrual disturbances and poor bone health secondary to energy deficiency. Ideal treatment plans are to increase energy intake to reverse energetic suppression.

The purpose of this study was to determine if REFUEL, a 12-month randomized controlled trial (RCT) of increased energy intake, improves menstrual frequency and markers of energetic status in exercising women with oligo/amenorrhea.

Young, exercising women with oligo/amenorrhea were randomized into two groups. The treatment group (Oligo/Amen+Cal, n=32) increased energy intake 20-40% above baseline energy needs and the Oligo/Amen Control group (n=30) maintained exercise and eating habits for the 12-month intervention. Menses was tracked throughout the intervention by menstrual calendars and daily urine samples, energetic status was assessed by body composition and total triiodothyronine (TT3) and leptin concentrations. Conditional recurrent events Cox Proportional Hazards model tested the effects of the intervention and multi-level modelling assessed relationships among variables. There was a significant group*time interaction for body mass, percent body fat, fat mass, and TT3 concentrations ($p < 0.03$), such that Oligo/Amen+Cal women gained more body and fat mass and had a greater increase in TT3 during the study compared to Oligo/Amen Controls. Specifically, Oligo/Amen+Cal women (21.6 yrs, BMI: 20.2 kg/m²) increased energy intake by 353 kcal/d and gained 1.9 kg of body mass, corresponding to increased fat mass (1.2 kg) and leptin (64%). Oligo/Amen Controls (20.9 yrs, BMI: 21.3 kg/m²) had no change (-32 kcal/d) in energy intake ($p < 0.001$ vs. Oligo/Amen+Cal) and minimal change in body mass (0.8 kg; $p = 0.04$ vs. Oligo/Amen+Cal), fat mass (0.4 kg; $p = 0.08$ vs. Oligo/Amen+Cal), and leptin (21% increase, $p = 0.07$ vs. Oligo/Amen+Cal). Controlling for baseline BMI and menstrual status, the intervention increased the likelihood of experiencing menses ($p < 0.001$) such that Oligo/Amen+Cal women were twice as likely (104% increase) to experience menses during the intervention compared to Oligo/Amen Controls. Further, the higher the BMI at baseline, the greater the likelihood of experiencing a menses such that for every kg/m² increase in BMI the likelihood of menses increased by 10%.

Overall, a nutritional intervention designed to increase energy intake by a moderate amount in exercising women with oligo/amenorrhea successfully improved body mass and fat mass, concentrations of metabolic hormones, and the likelihood of experiencing menses compared to oligo/amenorrheic women who maintained exercise and eating habits. As such, treatment plans designed to increase energy intake can be successful in reversing energetic suppression and recovering menses.