Abstract:

Background: Subfertility in obese women is associated with chronic pituitary suppression, reduced sensitivity to GnRH and decreased sex steroid production. We have found evidence for a combined effect of hyperinsulinemia and high circulating fatty acids to acutely (4h infusion) suppress pituitary gonadotropin secretion and are currently investigating the effects of one-month exposure to a eucaloric high-fat diet (HFD) on gonadotropin levels in lean women. The aim of this study is to examine the effect of the one-month HFD on physical activity and body composition.

Methods: 18 normal weight (BMI < 25 kg/m^2), normally cycling female participants of reproductive age were given a one-month eucaloric HFD, from the onset of menses in one cycle through the next, with 48% calories from fat. A Fitbit was provided to monitor changes in daily activity and sleep throughout the study. Measurement of gonadotropin pulsatility and reproductive hormones were done using frequent blood sampling and daily urine excretion, respectively. These measurements were obtained for a total of 4 menstrual cycles: 1 pre-diet cycle, the HFD cycle, and 2 post-diet cycles. DEXA body composition was measured at baseline and at the end of the 2^{nd} post diet cycle. Pre and post diet comparisons were done using linear mixed model testing and reported as estimated means ± standard error.

Results: Mean number of daily steps were (8,518 ± 2,891) pre diet, (8,681 ± 2,519) during the diet and (7,699 ± 3,474) post diet with a P value of 0.16. Daily active calories were ((1,982 ± 267) pre diet, (2,001 ± 244) during the diet and (1,919 ± 283) post diet with a P value of .09. Means in the HFD cycle did not differ from the pre-diet cycle. Daily sleeping minutes pre diet were pre diet were (420 ± 63), (425 ± 56) during the diet and (402 ± 62) post diet, with no statistical difference between the 3 time points at a P value of .08. WASO incidents pre diet were (2.56 ± 4.04), (2.07 ± 3.31) during the diet and (2.00± 3.53) post diet, with a P value of .02. This significance was attributed to participant variation where one participant had 18 WASO incidents as well as unsatisfactory data collection and specificity from the participants not wearing the fitbit at night as well as the low specificity of detection from the fitbit model that was used. BMI did not significantly differ between pre-diet (21.52 ± 1.90) and post-diet (21.52 ± 1.73) with a P value of 0.97. DEXA body composition measurements indicated a statistically significant decrease in total fat percentage, (31.3 ± 5.6) pre diet and (29.9 ± 5.6) post diet with a P value of <.01, which does not appear clinically significant as the difference of less than 1% falls within the anticipated measurement error of the method. Visceral fat volume (cm3) differed significantly between pre diet (308 ± 123) and post diet (287 ± 121) with a P value of .03. Total fat mass showed a significant pre diet (18,486 ± 4,391), and post diet (17,710± 4,478) with a P value of <.01. Trunk fat also showed a significant difference between pre diet (7,569 ± 2,569), and post diet (7,122± 2,638) with a P value of <.01.

Conclusions: A one month HFD intervention does not significantly change daily steps, calories burned or sleeping minutes in healthy normal weight women of childbearing age. Our study does show a change in wake after sleep onset incidences although more data collection is needed with higher specificity of detection in better sleep tracking models. If accurate, this significance is

thought to be attributed to the timing of food ingestion as well as the types of fat consumed (mono vs polyunsaturated fats) although further studies are needed to draw an association. Our study showed an interesting significant decrease in in total percent fat, total fat mass, visceral fat volume as we as trunk fat with no changes in BMI. This was thought to be due to fat redistribution as well as other external factors including the timing of the intervention. Several previous studies have shown an association between increased fat intake and a decrease in body fat composition although our study aims to focus on the results of this body re-composition on reprometabolic hormones and its effects on fertility. Our study shows that a one month HFD intervention might have an effect on sleep/wake cycles with a decrease in body fat composition. Longer intervention time is needed to make a correlation between these fat intake and body fat percentage and long term consequences on reproductive hormones is to be elucidated in future studies.