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## Circadian alignment and body composition in overweight/obese adults

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Male; Body Mass Index; Overweight; Circadian Clocks; Obesity; Body Composition; Adipose Tissue; Diabetes Mellitus; Abdominal Fat

## Abstract

Introduction: Misalignment between behaviors (i.e., eating/sleeping) and the circadian timing system promotes increased risk of diabetes and obesity. Though circadian disruption has been shown to be associated with higher body fat percentage (BF%) and abdominal fat distribution among healthy weight males, but not females, these relationships may be altered in individuals with higher body mass index (BMI) given the complex interaction between obesity and circadian metabolic mechanisms. We therefore tested the association between circadian alignment and body composition in individuals with overweight/obesity.

Methods: BF% and android-gynoid (AG) percent fat ratio were assessed using dual energy x-ray absorptiometry in 28 participants (15 female). Dim-light melatonin onset (DLMO; 3pg/ml threshold) was used as a marker of circadian phase, as determined from saliva samples across an ~8h evening in-laboratory stay in dim-light (<5 lux). Circadian alignment was determined via phase angle of entrainment, defined as the time difference between DLMO and diary-determined sleep onset over 7-days. Differences between females and males were assessed using independent t-tests and the relationships between phase angle of entrainment and body composition metrics were assessed using Pearson correlation analyses.

Results: There were no differences between groups in age (mean  SD, females vs. males, respectively; 34.2  8.2y vs.  37.2  8.3y; p=0.35), BMI (34.9  5.9kg/m2 vs. 31.0  6.5kg/m2; p=0.11), DLMO timing (19:35  1:15 vs. 19:37  0:57; p=0.95), or phase angle of entrainment (2.9  1.7h vs. 3.0  1.1h; p=0.77). Females had higher BF% than males (45  6% vs. 34  8%; p<0.01) and lower AG ratios than males (1.06  0.13 vs. 1.33  0.15; p<0.01). Phase angle of entrainment [i.e., later sleep] was negatively correlated with AG ratio only in males (r= -0.6; p=0.03) while phase angle of entrainment had a negative correlation with BF% only in females (r= -0.65; p=0.01).

Discussion: Alignment of the circadian system (i.e., smaller phase angle of entrainment) may be a contributing factor to poorer body composition and, particularly amongst males, metabolically unhealthy body fat distribution in individuals with overweight/ obesity. The mechanistic role of circadian timing on cardiometabolic disease risk may be differentially affected by sex and obesity, which could have implications for targeted interventions to improve health outcomes.

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