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Effect of Late versus Early Chronotype on Fuel Metabolism During Exercise

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PURPOSE: Late chronotypes are characterized by low insulin sensitivity and metabolic inflexibility. However, it is unclear whether people classified as late chronotype have altered fuel selection during exercise. **METHODS:** Middle-aged adults with obesity and metabolic syndrome were classified as early (Morning-Eveningness Questionnaire (MEQ); MEQ = 63.4±0.9, n= 18 (15 F), 54.6±1.1 years, 3.5±0.1 ATP III criteria) or late (MEQ= 46.7±1.4, n= 22 (18 F), 54.9±1.8 years, 3.6±0.2 ATP III criteria) chronotype. Carbohydrate and fat utilization were measured using indirect calorimetry to determine respiratory gases (VO2 and VCO2) at rest, 55% and 85% VO_{2max}, along with heart rate and rating of perceived exertion (RPE), for 15-minute treadmill stages. Metabolic flexibility (MetFlex, △RQ) from rest to exercise during each stage was also calculated. Maximal aerobic capacity (VO_{2max}), body composition (DXA), and insulin sensitivity (euglycemic hyperinsulinemic clamp, 40mU/m^2/min, 90 mg/dl) were also determined. **RESULTS:** Age, BMI, body fat and ATP III criteria were similar between groups. However, late chronotype exhibited lower VO_{2max} (P=0.01) and insulin sensitivity (P=0.01). Resting fat oxidation rates were also lower in late compared with early chronotype (1.23±0.11 vs. 1.88±0.24 mg/kg-LM/min, P=0.03). Compared to rest, both groups relied on carbohydrate during exercise at 55% VO_{2max}. At 85% VO_{2max} though, late chronotype utilized more carbohydrate as a percent of energy expenditure (84.1±4.2 vs. 72.2±3.9 %, P=0.05) despite similar heart rate and RPE. Interestingly, resting fat oxidation correlated with MetFlex at 55% (r=0.57, P=0.005) and 85% VO_{2max} (r=0.68, P=0.004), as well as insulin sensitivity (r=0.47, P=0.04). **CONCLUSIONS:** People with late chronotype have reduced resting fat oxidation and capacity to switch towards carbohydrate during exercise in relation to insulin sensitivity. Whether these differences in fuel use promote chronic disease risk awaits further work.

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