Fat and Circadian Rhythms

Fat can be categorized by function and location (Gimble & Floyd, 2009). Brown fat (BAT), typically found in infants (but now also found in small amounts in some adults) serves a thermogenic purpose and is sensitive to cold exposure (Gimble & Floyd, 2009). White fat (WAT) is what is commonly referred to as "fat" and is abundant, sometimes accounting for over 50% of body mass in the morbidly obese individual (Gimble & Floyd, 2009). In addition to being energy storage, WAT also acts as an endocrine system by secreting adipokines (a type of cytokine which are protein messengers to cells) such as adiponectin (regulate glucose, fatty acid breakdown), leptin (regulates amount of stored fat via hunger sensation), lipin (affect lipogenesis and lipolysis), resistin (affecting obesity, insulin, and diabetes), visfatin (affecting blood glucose), and serine protease inhibitors (Gimble & Floyd, 2009).

Adipose physiology seems to be correlate with circadian rhythms--adipokines, adiponectin, and leptin levels seem to have a 24 hour cycle (Gimble & Floyd, 2009). When a body's circadian rhythms deviate (especially for extended periods of time without re-regulating), the risk of obesity is greater along with comorbidities of cardiovascular disease, diabetes, and metabolic syndrome risk factors (Gimble & Floyd, 2009).

People who have night eating syndrome consume over 25% of their daily energy intake between dinner and breakfast (typically late at night or in the twilight hours) (Gimble & Floyd, 2009). The peak leptin and corticosterone levels of people who have night eating syndrome have been found to have shifted 1-3 hours off-normal phase (Gimble & Floyd, 2009). Jet lag and travel can also impact the risk of obesity by temporarily dysregulating the natural circadian rhythm of adipose tissue (Gimble & Floyd, 2009).

Mohebbi and Azizi (2011) studied fat oxidation at different intensities in morning and evening with a group of 22 men (10 obese, 12 normal weight). Both groups were tested on a treadmill with the intensity of exercise increasing until maximal oxygen uptake VO_{2max} could be determined (Mohebbi & Azizi, 2011). Morning exercise started at 8am after 8-12 hours of fasting from the previous night; evening exercise started at 8pm after 5-6 hours of fasting (Mohebbi & Azizi, 2011). Mohebbi and Azizi (2011) found that regardless of exercise intensity, evening fat oxidation rates and energy expenditures were higher than in the morning in both groups (obese and normal weight men). Mohebbi and Azizi (2011) noted that other studies found body temperature, mean power and peak power, aerobic power, time to exhaustion, and peak oxygen consumption to be higher in the evening than morning. Rate of perceived exertion also tended to be less in the evening. Mohebbi and Azizi (2011) recommended exercise in the evening to facilitate fat oxidation and to decrease fat mass.

On a personal note, I remember when fat tissue was thought of as fairly "inactive" so to speak--it is just there. It is pretty amazing to learn the active roles fat actually plays and how so many bodily systems are interrelated.

Chung 11.13.2014

References

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