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INSULIN AND GLUCOSE: BIOMARKERS OF APPETITE FOLLOWING ACUTE EXERCISE

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Introduction:

Exercise is a common weight loss strategy, but compensatory increases in energy intake and compensatory decreases in non-exercise physical activity often result in less weight loss than predicted.[1] Individual differences in appetite indices may affect the degree of energy intake compensation, and thus the degree of weight loss with exercise interventions.[2] Gastrointestinal hormones that are known biomarkers of appetite regulation include ghrelin, PYY, and glucagon like peptide-1.[3-6] However, due to more intensive and costly processing procedures required to quantify plasma levels of these hormones, they are not frequently measured in exercise interventions. Research has suggested that glucose and insulin levels may play a role in meal initiation, and therefore they may serve as hormonal indices of appetite regulation.[3] However, they have not been well-studied in the context of appetite regulation following exercise. The purpose of this secondary analysis of a previously conducted trial (NCT03143868) was to 1) determine if glucose and insulin are correlated with subjective indices of appetite regulation following acute exercise and 2) determine if differences in glucose and insulin values exist between an acute bout of resistance vs. aerobic exercise.

Methods:

Men and women 18-55 yrs with overweight or obesity (25-39 kg/m^2) not meeting national physical activity guidelines of 150 minutes per week were eligible for enrollment. Following informed consent and baseline testing, participants completed two study conditions (1. Acute aerobic exercise (AEx) and 2. Acute resistance exercise (REx)) in a randomized, counterbalanced order. Participants reported to the clinical research unit for testing after an overnight fast. Blood was drawn in the fasted state for glucose and insulin. Appetite was rated using 100 mm visual analogue scales for hunger, satiety, and prospective food consumption. A standardized breakfast meal was provided (25% of individual total daily energy needs). Blood draws and appetite ratings were repeated every 30 minutes for 3 hours, except at the 60-minute time point as participants were completing their assigned exercise bout. 35 minutes post-meal participants completed 45 minutes of either AEx or REx. The statistical analyses included Pearson's correlations to determine the relationship between biomarkers and subjective appetite, as well as paired sample t-tests to determine if differences in appetite ratings or biomarkers were present between AEx and REx. Data are presented as mean ± SD.

Results:

n=19 participants (9 women; age: 34.5±7.1 yrs; BMI 28.5±4.6 kg/m^2) were included in this analysis. Insulin AUC (area under the curve) was positively correlated with satiety following both AEx and REx (AEx r=0.558, p=0.013; REx r=0.631, p=0.006;). Glucose was not significantly correlated with subjective appetite ratings following either aerobic or resistance

exercise ($p>0.05$ for all). At the 90-minute time point, insulin was greater in the resistance condition than the aerobic condition (REx 34.72±28.3; AEx 22.9±10.8, $p = 0.042$). No differences in subjective appetite ratings were detected between aerobic and resistance exercise.

Conclusions:
Insulin may be an appropriate biomarker for subjective satiety, but glucose levels following acute exercise are not indicative of subjective appetite. Future research should be done to evaluate if post-exercise energy intake is correlated with either insulin or glucose, and if energy intake differs between exercise modality.

References:

1. Melanson EL, Keadle SK, Donnelly JE, et. al. Resistance to exercise-induced weight loss: compensatory behavioral adaptations. *Med Sci Sports Exerc*. 2014;10:424. doi:10.1249/MSS.0b013e31828ba942
2. Goltz, et al. Interindividual responses of appetite to acute exercise: a replication crossover study. *J ACSM*, 2018
3. Graaf CD, Blow WA, Smeets, PA et al. Biomarkers of satiation and satiety. *Am J Clin Nu*. 2004;79:946-961. doi:10.1093/ajcn/79.6.946
4. Martins C, Morgan LM, Bloom SR, Robertson MD. Effects of exercise on gut pepetides, energy intake and appetite. *J Endocrinol*. 2007;192(2):251-8. doi: 10.1677/JOE-06-0030
5. Schubert MM, Sabapathy S, Leveritt M, Desbrow B. Acute exercise and hormones related to appetite regulation: a meta-analysis. *Sports Med*, 2014;44(3):387-403. doi: 10.1007/s440279-013-0120-3
6. Halliday TM, White MW, Hild AK, Conroy MB, Melanson EL, Cornier MA.Appetite and energy intake regulation in response to acute exercise. *Manuscript in preparation*
7. Martins C, Morgan L, Truby H. A review of the effects of exercise on appetite regulation: an obesity perspective. *Int J Obes*, 2008; 32(9):1337-47. doi: 10.1038/ijo.2008.98