An Interdisciplinary Study to Examine Obesity and Inactivity as Early Predictors of Gestational Diabetes

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Introduction

Gestational Diabetes (GD) is a serious condition that affects approximately 9% of pregnancies and is characterized by an insufficient response of blood glucose to the actions of insulin. In early pregnancy, GD can result in birth defects, over-nutrition, and large babies that increase risks of childbirth. The offspring are more likely to develop obesity and diabetes within their lifetimes. The risks of these disorders perpetuate a transgenerational cycle of obesity and diabetes, underscoring the need for effective interventions that reduce maternal obesity and GD. The current standard of care involves testing for GD during month six of pregnancy, however earlier prediction of GD could lead to earlier lifestyle intervention and a better outcome for both mother and baby.

OBJECTIVE

Obesity and inactivity are major modifiable risk factors for GD. It is unknown which of these risk factors is most predictive of insulin resistance during pregnancy. This interdisciplinary study involving nursing and exercise science examines which early measures of obesity and inactivity can serve as early clinical predictors of gestational insulin resistance or GD.

Body Composition During Pregnancy

Pregnant women have extremely variable amounts of water accumulation. For this reason, reliable body composition measures have been difficult to obtain during pregnancy. However, recent technology has made this measure much more accurate by using a device that incorporates body water into its calculations. The InBody 720 uses bioelectrical impedance analysis to determine density and composition of the body.

RESULTS

Figure 1. Adiposity is a better predictor of insulin resistance than physical activity in low active group. Plots depict bivariate correlations. HOMA-IR, homeostasis model assessment of insulin resistance.
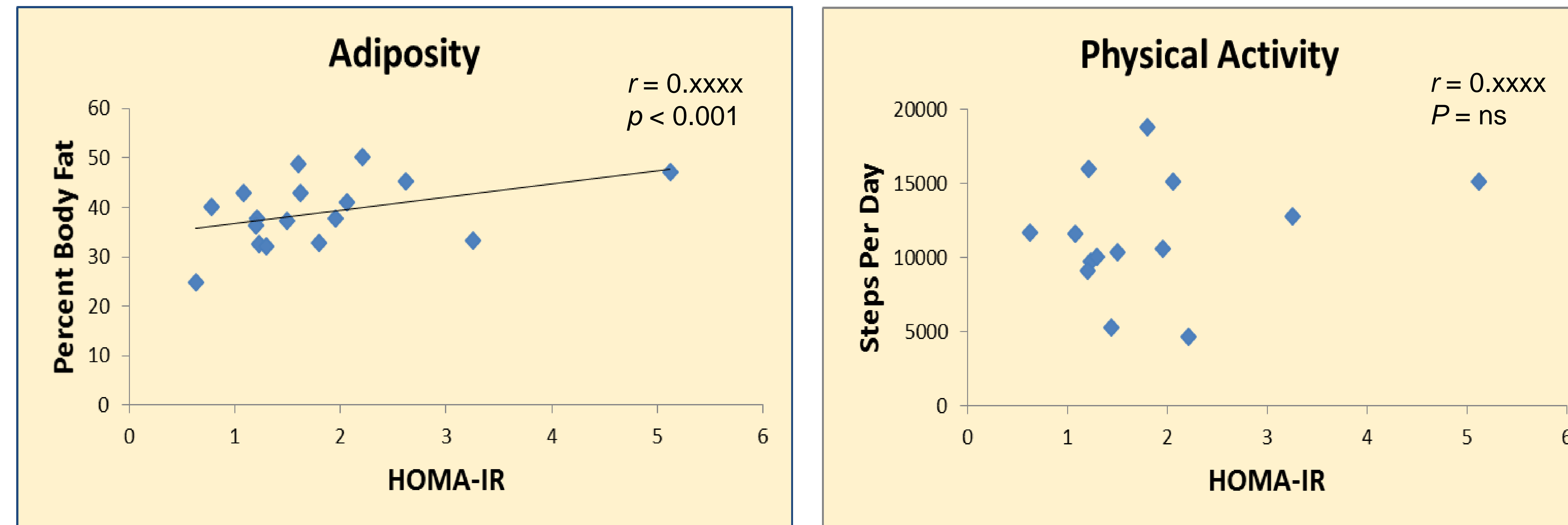
*Relationship between HOMA-IR and body fat was strong in the low-active groups (r=.85, p<.05) but not in the high-active group (r=.56, p=.20)

Table 1. Summary of Linear Regression Analysis for Variables Predicting Insulin Resistance

Group	Variables	β	p	Model R^2	F	p
All Women	HOMA-IR			.421	3.628	.065
N=20	Body Fat	.615	.033			
	Steps per day	.403	.135			

Table 2. Participant Characteristics
Participants were divided by activity level (median step count) into low-active and high-active physical activity groups. With the exception of steps per day, no differences in means were observed.

	Primigravida Women		
	ALL	Low Active	High Active
N	20	9	10
Age (years)	27.6 ± 5.0	26.1 ± 4.7	29.0 ± 5.2
BMI (kg/m^2)	30.6 ± 7.8	32.4 ± 9.0	28.8 ± 6.4
% Body Fat	39.0 ± 9.1	39.2 ± 9.9	38.8 ± 8.8
Glucose (mg/dl)	77.9 ± 4.2	75.7 ± 3.6	80.1 ± 7.7
Insulin (μU/ml)	9.5 ± 5.1	8.3 ± 1.8	10.7 ± 7.1
HOMA-IR	1.9 ± 1.1	1.5 ± 0.4	2.2 ± 1.6
Steps per Day	10868 ± 4248	7581 ± 3036	14156 ± 2204

*Data are reported as mean± standard deviation, unless reported otherwise.

METHODS

Twenty nulliparous pregnant women were recruited from a local OB/Gyn clinic. Inclusion criteria: first pregnancy, aged 18 -34 years, body mass index 20-35 kg/m^2. Exclusion criteria: Nicotine or illicit drug use; previous diabetes; any condition or medication known to affect metabolism. Subjects visited the KSU exercise science laboratory for body measures between 17-20 weeks. Body Composition. Percent body fat was assessed with bioelectrical impedance analysis (InBody 720). Physical Activity/Inactivity Assessment. 10-second motion data information was collected for 7 days with accelerometry. Steps per day were averaged from the four most compliant days. GDM Risk (Insulin Resistance). Fasting blood glucose and insulin were collected at weeks 24-28 of gestation. HOMA-IR (Homeostasis Model Assessment of Insulin Resistance) was computed as: fasting insulin (μIU/ml) x fasting glucose (mmol/ml)/22.5.

CONCLUSIONS

❖ Percent body fat is a stronger predictor of insulin resistance than physical activity in low active, but not highly active women.

❖ These early findings suggest that low physical activity and higher percent body fat may be an important risk factor of insulin resistance in pregnancy.

❖ Small sample size is a limitation, but study design is strong and continuance of study over the next year will yield stronger conclusions