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Increased intestinal permeability, measured by serum zonulin, is associated with metabolic risk markers in overweight pregnant women.

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Abstract

BACKGROUND: Increased intestinal permeability with subsequent metabolic endotoxemia, i.e., elevated circulating levels of bacterial lipopolysaccharide, LPS, has been introduced as a novel initiator of obesity related metabolic disturbances in non-pregnant individuals. The objective was to investigate the extent to which intestinal permeability, measured by serum zonulin concentration, is related to metabolic endotoxemia and metabolic risk markers in overweight pregnant women.

METHODS: This was a cross-sectional study including 100 pregnant overweight women in early pregnancy. Serum zonulin was analyzed using ELISA, and markers for metabolic endotoxemia (LPS), inflammation (high-sensitive C-reactive protein and glycoprotein acetylation GlyA), glucose metabolism (fasting glucose and insulin), and lipid metabolism were measured.

RESULTS: Higher serum zonulin concentration associated positively with LPS ($P=0.02$), inflammatory markers ($P<0.001$), insulin ($P<0.001$), insulin resistance ($P<0.001$), and triglycerides ($P=0.001$), and negatively with insulin sensitivity ($P=0.001$) (ANOVA with Tukey's corrections or Kruskal-Wallis nonparametric test with Bonferroni correction for zonulin quartiles). All the observed associations were confirmed ($P<0.015$) in a linear regression model adjusted with potential confounding factors. Both LPS and GlycA showed positive relationship with insulin resistance, serum insulin, triglycerides, total and LDL-cholesterol and negative relationship with insulin sensitivity ($P\leq0.03$) in the univariate linear regression. Positive relationship was also found between LPS and HDL-cholesterol ($P=0.03$).

CONCLUSIONS: Our findings suggest that increased serum zonulin concentration, i.e., increased intestinal permeability, contributes to metabolic endotoxemia, systemic inflammation, and insulin resistance in overweight pregnant women. By reinforcing intestinal barrier, it may be possible to manipulate maternal metabolism during pregnancy with subsequent health benefits.

KEYWORDS: Intestinal permeability; Low grade inflammation; Metabolic endotoxemia; Overweight; Pregnancy

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