

## INSIGHTS

# Science for Kids: Effects of low-glycemic index diet on plasma adipokines in childhood obesity

Bharthi Mohan<sup>1</sup> and Karen Ward<sup>1</sup>✉

© The Author(s), under exclusive licence to the International Pediatric Research Foundation, Inc 2021

*Pediatric Research* (2021) 90:1096–1097; <https://doi.org/10.1038/s41390-021-01775-1>**INTRODUCTION**

In both the developing and developed world, childhood obesity has become an epidemic. In the United States, between the years 2017 and 2018, the prevalence of obesity was 19.3% in children aged 2–19 years, which affected approximately 14.4 million children and adolescents.<sup>1</sup> Increase in obesity may be due to changes in lifestyle, including diet, physical activity, and built-in living environments.<sup>2</sup> Interesting electronic gadgets for kids that keeps them glued to the screen, less exercise and physical play, staying at home, and processed foods including sugary beverages are some of the reasons that have led to this epidemic. Obesity increases the risk for health problems such as sleep apnea, swelling of joints, and metabolic syndrome, which is a combination of hypertension, high blood sugar levels and diabetes, and increased levels of blood lipids. Metabolic syndrome increases lifetime risk for heart attack, stroke, and type II diabetes.<sup>3</sup> Therefore, childhood obesity can lead to long-term health issues and decrease children's productivity and lifespan.

The fat cells, otherwise called adipocytes, release adipokines, which are cell signaling proteins.<sup>4</sup> Adipokines have a large role in the metabolism of muscles, liver, and other organs. Adiponectin, leptin, visfatin, and resistin are adipokines that have been investigated in this study of obese children. Insulin is a hormone that allows the cells of the body to accept and break down glucose, or sugar, for energy for the body. When the body builds a resistance to insulin, the body has higher amounts of sugar in the blood since the insulin is not doing its job. The body produces more insulin to counter insulin resistance, which is detrimental to the system. Adiponectin increases insulin sensitivity. Leptin suppresses appetite and allows for higher energy expenditure; however, high leptin levels in obesity are associated with leptin resistance. Visfatin acts in a similar manner as insulin, by helping the body break down glucose for energy; however, there is no clear evidence that visfatin has any correlation to insulin resistance. Resistin which is a cytokine, a protein important for cell signaling released by fat cells, may cause inflammation.

Obesity prevention and treatment require changes in lifestyle such as healthier diets and increased physical activity. Typically, physicians recommend a low-fat, high-fiber diet for obese children. Another important factor in the diet is the glycemic index (GI, ranges from 1 to 100), which rates foods containing carbohydrates on how much they boost blood sugar. Foods that have an index of 100 boosts blood sugar by 100% and are equivalent to pure sugar. Foods like vegetables and fruits, which contain complex carbohydrates and fiber, have a low GI and might help obese children.<sup>5</sup> In this study, the control group follows a conventional diet advised by doctors with low

fat and high fiber content. The intervention is a low-GI diet for 6 months and the authors investigated the effects of low-GI diet on adipokines in obese children.

**METHODS**

Visutharanukul and colleagues report a secondary analysis of a randomized controlled trial (RCT) of 70 obese children at Chulalongkorn University, Thailand, investigating insulin resistance, body composition, and anthropometry, which was published in 2015.<sup>6</sup> In this RCT, 70 participants with an average age of 12 years and with an eligible body mass index (BMI), a model to classify obese people by a weight-to-height index, were enrolled in this study. The eligible BMI for this study was higher than the International Obesity Task Force cut-off of 30 kg/m<sup>2</sup>. The participants were randomized into the intervention group, which had the low-GI diet, and the control group, which continued on a low-fat, high-fiber diet (<https://www.health.harvard.edu/diseases-and-conditions/glycemic-index-and-glycemic-load-for-100-foods>). All participants had instructions to increase their amount of physical activity and had monthly visits for 6 months. The participants' blood was drawn on the first and sixth visits. This secondary study assessed levels of the adipokines and Homeostatic Model Assessment for Insulin Resistance (HOMA-IR), which were compared between the intervention group and controls and between the first and last visit for the two groups. HOMA-IR is a model that calculates insulin resistance by the amount of fasting insulin and fasting glucose in the blood (<https://www.omnicalculator.com/health/homa-ir>). The primary outcome was the difference in adipokines, including plasma leptin, adiponectin, resistin, and visfatin between the randomized groups after 6 months. The secondary outcomes were correlations between the adipokines and BMI z-score, body composition, and other clinical outcomes.

**RESULTS AND DISCUSSION**

In this study, 52 of the 70 participants followed up with all six visits and approximately half of the participants in both groups were physically active. When both groups were compared at the first and last visit, there was a significant decrease in their levels of insulin and HOMA-IR, which means their insulin sensitivity increased. However, there were no differences in the adipokines between the low GI group and the controls (no change in the primary outcome). There were nonsignificant decreased levels of leptin and visfatin and increased levels of adiponectin for the low-GI diet group between the

<sup>1</sup>St. Thomas Episcopal School, Houston, TX, USA. ✉email: [info@pedres.org](mailto:info@pedres.org)

Received: 19 July 2021 Accepted: 26 July 2021

Published online: 20 October 2021

first and last visit. The body composition also did not change significantly between the first and last visit. One interesting finding was that the more leptin a participant had at the first visit (baseline leptin), the lower the probability of changing one's fat mass index (FMI) (<https://ffmcalculator.org/>), which calculates the fat mass in proportion to one's height. Both groups had a decrease in the BMI z-score. There was a correlation between the change in leptin and change in BMI and FMI, but the magnitude of the correlation was not significant.

Overall, between the first and sixth months of the low-GI diet, there were no significant differences in the adipokines: leptin, visfatin, resistin, and adiponectin. While there was no major difference in adipokines, insulin and HOMA-IR did have a significant decrease. Leptin was associated with BMI, FMI, and waist circumference. The authors' comment, "The effect of low-GI diet in our study may not be strong enough to demonstrate any significant change of leptin either within the group or between groups".

### IMPACT OF THE STUDY FOR CHILDHOOD OBESITY

Throughout the world, obesity has increasingly become more common in children, and optimizing their diets may be one way of preventing or treating obesity. This study was the first to compare plasma adipokines in obese children on a low-GI diet to children on a conventional diet. The key finding the authors observed was that baseline leptin levels may determine how easily one may be able to change his or her fat mass. This will help doctors identify children who are at high risk for continuation of obesity and figure out more intensive ways to help them lose weight and stay healthy. In addition, baseline leptin may also triage patients in research studies, so research interventions may be focused on these children who are hard to treat.

#### PEDIATRIC RESEARCH

### Science For Kids

Summary by Bharthi Mohan and Professor Karen Ward  
St. Thomas Episcopal School, Houston, Texas, USA

## Effects of Low-Glycemic Index Diet on Plasma Adipokines

### STUDY

- Randomized control trial of 70 obese children
- Low-GI diet (intervention group) vs. conventional low-fat high-fiber diet (control)
- Monthly visits for 6 months

### KEY FINDINGS

- Baseline leptin levels may determine how easily one may be able to change fat mass

### What is the impact of this study?

- Physicians can identify children who are at high risk for obesity progression and figure out more intensive ways to help their patients
- Focus research interventions in the high-risk group who have high baseline leptin



### Lifestyle Changes

Processed foods, lack of exercise, and electronic can contribute to obesity.

### Obesity Leads to Health Issues

Children can develop sleep apnea, diabetes, and hypertension from obesity.



Visit our slide show with the QR code!



SCAN ME

### REFERENCES

1. CDC. *Childhood Overweight & Obesity. Overweight & Obesity* (CDC, 2021). Accessed in 2021.
2. Sallis, J. F. & Glanz, K. The role of built environments in physical activity, eating, and obesity in childhood. *Fut. Child.* **16**, 89–108 (2006).
3. Zimmet, P. et al. The metabolic syndrome in children and adolescents. *Lancet* **369**, 2059–2061 (2007).
4. Valle, M. et al. Low-grade systemic inflammation, hypoalbuminemia and a high concentration of leptin are present in very young obese children, and correlate with metabolic syndrome. *Diabetes Metab.* **31**, 55–62 (2005).
5. Kong, A. P., Chan, R. S., Nelson, E. A. & Chan, J. C. Role of low-glycemic index diet in management of childhood obesity. *Obes. Rev.* **12**, 492–498 (2011).
6. Visuthranukul, C., Sirimongkol, P., Prachansuwan, A., Pruksananonda, C. & Chomtho, S. Lowglycemic index diet may improve insulin sensitivity in obese children. *Pediatr. Res.* **78**, 567–573 (2015).

### COMPETING INTERESTS

The authors declare no competing interests.

### ADDITIONAL INFORMATION

**Supplementary information** The online version contains supplementary material available at <https://doi.org/10.1038/s41390-021-01775-1>.

**Correspondence** and requests for materials should be addressed to Karen Ward.

**Reprints and permission information** is available at <http://www.nature.com/reprints>

**Publisher's note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.