OBJECTIVE — The purpose of this study was to examine the relationship between changes in insulin sensitivity and subsequent changes in fat mass in obese Hispanic children over 3 consecutive years.

RESEARCH DESIGN AND METHODS — In a longitudinal research design, insulin sensitivity (S_i) of 96 research participants was determined at baseline and 1 year later. Body adiposity was assessed at four assessments.

RESULTS — The change in S_i during the first year of the study was a significant predictor of further fat mass development (P < 0.05). Considering different directions of S_i change, S_i was a strong predictor for further fat mass development only in the group that decreased their S_i (P < 0.05).

CONCLUSIONS — The results show that the direction of change in insulin sensitivity at an early age is an important independent predictor for further fat mass development and emphasize the importance of insulin sensitivity as a primary target for long-term obesity prevention, as well as the significance of early age intervention.

Insulin Sensitivity as an Independent Predictor of Fat Mass Gain in Hispanic Adolescents

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H ispanic youth are disproportionately affected by the pediatric obesity epidemic and the associated comorbidities such as type 2 diabetes (1). Although the pathogenesis of type 2 diabetes in children remains unclear, it likely involves characteristics similar to those of adults (2), including the negative effect of increased adiposity on insulin sensitivity and subsequent β-cell failure (3,4). While insulin resistance traditionally has been examined as a consequence of increased adiposity, there is evidence that insulin resistance at an early age in turn may increase adiposity in adolescents and early adulthood (5). The purpose of this study is to further clarify whether changes in insulin resistance early in life are related to fat mass development later in life in Hispanic adolescents.

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Received 6 May 2009 and accepted 27 July 2009. Published ahead of print at http://care.diabetesjournals.org on 12 August 2009. DOI: 10.2337/dc09-0833.

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RESULTS — In a longitudinal research design, insulin sensitivity (S_i) of 96 research participants was determined at baseline and 1 year later. Body adiposity was assessed at four assessments.

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Diabetes Care 32:2114–2115, 2009

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Data analysis

Change in S_i for all 96 participants and for the two groups with the different direction of S_i change was determined by subtracting S_i at the first follow-up from baseline S_i. Subsequent changes in fat mass were analyzed as a function of change in S_i over the remaining 2 years using repeated-measures ANCOVA. Whether changes in fat mass determined further S_i development was tested in the same way. All analyses were adjusted for baseline fat mass, fat-free mass at all visits, baseline S_i, change in S_i, age, Tanner stage, and sex.

RESULTS — S_i decreased significantly over the period of 3 years from 2.4 ± 1.4 ([1 × 10^{-4} \text{ min}^{-1} / \mu \text{U/ml}]^3 at baseline to 1.5 ± 0.79 ([1 × 10^{-4} \text{ min}^{-1} / \mu \text{U/ml}]^3 at the fourth consecutive annual assessment (P < 0.05), while fat mass increased from 21.8 ± 8.7 to 28.9 ± 10 kg (P < 0.05). For the whole group, the change in S_i during the first study year was a significant predictor of further fat mass development (P < 0.05), independent of fat-free mass, change in S_i, age, Tanner stage, and sex. In return, the change in fat mass between baseline and the first follow-up was not related to a change in S_i over the following 2 years.

When comparing a subgroup that significantly increased their S_i during the initial study year (n = 17) with a group that...
decreased in \(S_i\) \((n = 79)\) during that time, the change in \(S_i\) was a strong predictor for further fat mass development only in the group that decreased their \(S_i\) \((P < 0.05)\), not in the group that increased in \(S_i\) during the first year. Fat mass increased from 21.3 ± 7.5 to 26.2 ± 10.9 kg in the group that increased in \(S_i\) and from 21.9 ± 8.9 to 29.4 ± 9.9 kg in the group that decreased in \(S_i\) during the initial study year. Baseline \(S_i\), age, fat mass, lean body mass, and specific fat compartments (intra-abdominal and subcutaneous abdominal adipose tissue) were not different between the two groups.

**CONCLUSIONS** — The main finding of the analysis is that the first-year change in \(S_i\) was an independent predictor of subsequent gain in fat mass over the next 2 years, specifically in those who decreased in \(S_i\). The result was independent of fat-free mass, sex, age, and Tanner stage and is in accordance with a recently published study reporting preteen insulin resistance as a predictor for weight gain (5).

While a decrease in insulin sensitivity traditionally has been looked at as a consequence of increased body adiposity, the present study shows that insulin resistance in turn might also be a cause of increased body adiposity. Hispanic youths are more likely to be insulin resistant than their Caucasian peers, independent of body adiposity (2), predisposing them to an even higher disease risk. We can only speculate on the possible mechanisms behind that relationship, but among other possibilities it very well might involve the effects of insulin resistance on the brain. Insulin receptors have been located in areas that are important for the motivational regulation of food intake (9). Recently, evidence emerged that insulin resistance in the brain might co-occur with insulin resistance in the periphery (10). Sufficient insulin supply, transport, and reception in the brain are thus essential for the maintenance of energy balance. Considering this evidence, the present study might be supportive of the idea that the natural defense against excessive weight gain through adiposity signaling can be undermined by acquired resistance to adiposity-regulating hormones (11,12). The results of the present study show that the change in insulin sensitivity at an early age is an important independent predictor for further weight gain and emphasize the importance of insulin sensitivity as a primary target for long-term obesity prevention in addition to it being a secondary target to weight loss.

Acknowledgments — This study was supported by the National Institutes of Health (R01 DK 59211), the American Diabetes Association (7-05-MN-22), and in part by the General Clinical Research Center, National Center for Research Resources (grant MO1 RR 00043). No potential conflicts of interest relevant to this article were reported.

We thank Courtney Byrd-Williams and Emily Ventura for their help with the manuscript preparation and their contribution to the discussion of the results.

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