

Abstract

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Effects of biotin deficiency on pancreatic islet morphology, insulin sensitivity and glucose homeostasis.

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BACKGROUND: Several studies have revealed that physiological concentrations of biotin are required for the normal expression of critical carbohydrate metabolism genes and for glucose homeostasis. However, the different experimental models used in these studies make it difficult to integrate the effects of biotin deficiency on glucose metabolism.

OBJECTIVE: To further investigate the effects of biotin deficiency on glucose metabolism, we presently analyzed the effect of biotin deprivation on glucose homeostasis and on pancreatic islet morphology.

METHODS: Three-week-old male BALB/cAnN Hsd mice were fed a biotin-deficient or a biotin-control diet (0 or 7.2 μmol of free biotin/kg diet, respectively) over a period of 8 weeks.

RESULTS: We found that biotin deprivation caused reduced concentrations of blood glucose and serum insulin concentrations, but increased plasma glucagon levels. Biotin-deficient mice also presented impaired glucose and insulin tolerance tests, indicating defects in insulin sensitivity. Altered insulin signaling was linked to a decrease in phosphorylated Akt/PKB but induced no change in insulin receptor abundance. Islet morphology studies revealed disruption of islet architecture due to biotin deficiency, and an increase in the number of α -cells in the islet core. Morphometric analyses found increased islet size, number of islets and glucagon-positive area, but a decreased insulin-positive area, in the biotin-deficient group. Glucagon secretion and gene expression increased in islets isolated from biotin-deficient mice.

CONCLUSION: Our results suggest that biotin deficiency promotes hyperglycemic mechanisms such as increased glucagon concentration and decreased insulin secretion and sensitivity to compensate for reduced blood glucose concentrations. Variations in glucose homeostasis may participate in the changes observed in pancreatic islets.

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