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The Mechanisms by which Excessive Potassium Intake Improves Insulin Resistance

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Summary

A potassium-depleted diet has been known to lead to insulin resistance, a resistance that was reversed when potassium was resupplied. Currently, no information under other circumstances; however, this mineral appears to have a close association with insulin resistance.

In current studies, we investigated the effect of high potassium diet on insulin sensitivity in high fat (HF) diet fed male Wistar rats, whereby insulin sensitivity was measured directly using the hyperinsulinemic-euglycemic glucose clamp studies (at 25 mU/kg/min insulin infusion rate) after a 12-h fast. Male Wistar rats were fed normal chow diet, or 60% HF diet containing with either 8% potassium-chloride or not, for 4 weeks.

In control animals, in the basal state, HF feeding led to a ~33% increase in body weight, ~30% increase in fasting insulin levels, no change in fasting plasma glucose levels, and ~15% increase in hepatic glucose output (HGO). During the clamp studies, the glucose infusion rate (Ginf) required to maintain euglycemia, and the insulin stimulated glucose disposal rate (ISGDR), were decreased by ~15% and ~19% in the HF diet fed control rats, respectively, and the ability of insulin to suppress HGO was impaired by ~58%, indicating an insulin resistant state. The HF containing potassium diet also led to a ~33% increase in body weight. In the basal state, HF containing potassium diet fed rats exhibited decreased insulin levels (~20%) but no change in fasting glucose levels compared to the HF diet fed controls. Furthermore, HF containing potassium diet fed rats exhibited decreased plasma renin activity and angiotensin 2 levels but no significant change in plasma aldosterone levels. In the clamp studies, the potassium fed animals exhibited increased Ginf (~30%) and ISGDR (~35%) and decreased HGO (~27%) compared to the HF fed controls. Consistent with the clamp data, the insulin-stimulated phosphorylation of Akt was significantly enhanced in liver and skeletal muscle.

These results indicate that high potassium diet improves the insulin resistance by decreasing plasma renin activity and angiotensin II levels.

In conclusion, high potassium diet has beneficial effects on whole body insulin sensitivity in an insulin resistant state.