Pretreatment Fasting Plasma Glucose and Insulin Determine Long-Term Dietary Weight Loss Success on Low-Carbohydrate vs. Low-Fat Diet

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INTRODUCTION

• The struggle to curb the current obesity epidemic by an optimal diet for weight management has largely failed, giving rise to numerous fad diets.

• Calorie restriction, although effective in the short-term, is frequently hampered by biochemical feedback mechanisms that stimulate appetite, reduce dietary compliance, and ultimately lead to rebound of energy intake and weight gain. Chronic studies of low-fat versus low-carbohydrate diets have yielded inconsistent and conflicting results, which are likely explained by metabolic heterogeneity resulting from the different subject populations.

• Collectively, these observations underscore the fact that single dietary weight loss/maintenance strategies are inappropriate for persons or determinants of dietary weight loss are essential.

• In a few small studies, small 6-121 subjects studies have attempted to establish whether insulin and/or insulin secretory capacity predict weight loss via low-carbohydrate dietary strategies and weight regain following low-carbohydrate dietary strategies. Results have been inconclusive.

• Attempts to establish whether pre-treatment insulin status predicts or determines weight loss remain elusive.

• The purpose of this analysis was to explore fasting plasma glucose and insulin as predictors of weight loss and maintenance during 24 months of either a low-carbohydrate, high-protein, high-fat diet, or a high-carbohydrate, low-fat, low-calorie diet.

RESULTS

In the original 26-month study1, the overall subject population was 615 ± 79.5200 years of age with a mean BMI of 34.7 ± 3.5 kg/m2. Both diet intervention groups were balanced with respect to age, gender, race/ethnicity, and anthropometric measures.

• Differences in body weight change between FPI levels were noted at 3, 6, 12, and 24 months (Figure 1). Subjects with low FPI lost significantly more weight on a low-fat diet (∆diets = -7.19 ± 2.52 kg, P < 0.006).

• Conversely, pre-treatment FPI was determinant of response to a low-fat/hypocaloric diet: subjects with high FPI maintained a lower weight and fewer kilograms of weight loss compared to subjects with prediabetes and low FPI (Figure 2). Differences in body weight responses were observed between the two diets at any time point.

Fasting Plasma Insulin as a Predictor of Weight Loss

• Fasting plasma insulin (FPI) levels were used to stratify subjects as being normoglycemic (FPG < 100 mg/dL) or having prediabetes (FPG ≥ 100 mg/dL) and median fasting plasma insulin (FPI) levels (n=66), Low Fat: normoglycemic (n=103), low-fat, low-calorie diet (open triangles, n = 145). Data presented as mean ± SEM.

• In a 24-month study, the overall subject population was 578 ± 79.5200 years of age with a mean BMI of 34.7 ± 3.5 kg/m2. Both diet intervention groups were balanced with respect to age, gender, race/ethnicity, and anthropometric measures.

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• This was a re-analysis of a previously reported study in which subjects were randomized to receive either a low-carbohydrate, high-protein, high-fat diet, or a low-fat, low-carbohydrate, low-fat, hypocaloric diet for 24 months (Figure 3).

• For this re-analysis, baseline fasting plasma glucose (FPG) levels were used to stratify subjects as being normoglycemic (FPG < 125 mg/dL) and median fasting plasma insulin (FPI) levels (n=154). RESULTS

• Significant differences in body weight response were observed between subjects with low FPI (Figure 4). While both Pheung et al.26 and Yosef et al.27 were unable to achieve significant differences in body weight when subjects with low and high FPI were compared on a low-fat diet and a low-carbohydrate diet, respectively, results have been inconclusive.

• Differences in body weight change between FPG and FPI levels, and a trend in the combination (FPI) levels were analyzed by general linear mixed model comprising fixed (gender, baseline weight, and random effects). A priori analysis of FPI was established for statistical significance.

• Despite two profoundly different diets eliciting nearly identical changes in body weight, low-carbohydrate diet subjects were more likely to attain a healthy BMI and maintain weight lost than low-fat diet subjects, and weight regain was significantly greater with the low-fat diet. While a greater response to a low-fat diet in this analysis appears to conflict with previous reports with subjects having insulin sensitivity, this may be due to the differing confounding factors (e.g. pre-treatment insulin status, race/ethnicity, and gender) that may affect dietary responses to either a low-fat or low-carbohydrate diet.

• Combination of pre-treatment insulin with FPI predicted additive biomarkers of dietary response (Figure 5). Subjects who were normoglycemic or had prediabetes (n=41) and had low FPI levels and subjects with high FPI and had a high FPI (n=15). Both diet intervention groups were balanced with respect to age, gender, race/ethnicity, and anthropometric measures.

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CONCLUSIONS

• These novel results, along with other analyses of large international diet studies presented at this congress (T38, T39, LS-T16, LS-T18, T33, T-106, 2012-08, 2013-08), demonstrate that novel accessible biomarkers such as fasting plasma glucose and plasma insulin levels and strong predicators of dietary weight loss success and represent a significant step forward in personalized weight management.

REFERENCES


