Objective

To compare the effects of various dietary fibers on the progression of Type 2 diabetes mellitus (T2DM) in a novel, spontaneous rodent model, the Nile rat, and determine the efficacy of carrot fiber to act as a superior, low-cost alternative to other leading fibers on the market.

Rationale

Dietary modulation is a primary consideration in the prevention and management of Metabolic Syndrome (MetS) and T2DM. The Nile rat is a novel model for T2DM and MetS that, like humans, responds favorably to increased fiber consumption and low glycemic load diets. While cellulose (insoluble fiber) and inulin (soluble) are among industry standards, a new source of fiber, carrot pomace powder (CPP), has shown to be even more effective at preventing T2DM than inulin, the gold-standard fiber used in health food products. CPP, the material leftover from carrot processing, is 50% fiber (a blend of soluble and insoluble) and contains beneficial plant polyphenols and phytosterols. These studies further tested this fiber to better understand its efficacy in preventing, delaying, or reducing T2DM.

Study Design

In two studies, 3 week old male Nile rats were fed either semi-purified control diet or the same diet with one of five fibers (10% fiber w/w) for 10 weeks.

Fibers: Cellulose (insoluble), Inulin (soluble), CPP (60-mesh & 120-mesh), Hydrobind™ (insoluble CPP).

Current Market

The global market for dietary fiber is projected to reach $3.35 billion by 2017 and $4.31 billion by 2020. Large and broad scale market currently exists for fiber foods to support digestive health and stabilize blood glucose. Can be used in a variety of functional foods and beverages, animal feed, pet food, bakery and confectionary products, pharmaceuticals, and nutraceuticals.

Future Developments

• Identify and enlist industrial partner-sponsor
• Clinical study in humans
• Incorporate CPP into the food supply and the nutraceutical market

Acknowledgments

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Figure 1. In two studies, 3 week old male Nile rats were fed either semi-purified control diet or the same diet with five fibers (10% fiber w/w) for 10 weeks.

• Fibers: Cellulose (insoluble), Inulin (soluble), CPP (60-mesh & 120-mesh, soluble and insoluble), Hydrobind™ (insoluble CPP)

Figure 2. (A) At 10 weeks on diet (n=10), CPP-60 mesh gave the lowest blood glucose in all three measures, fasting blood glucose (FBG), 30-minute oral glucose tolerance test (30-OGTT), and random blood glucose (RBG). At RBG, inulin, CPP 60 mesh, and CPP 120 mesh were significantly lower than the control. (B) When the results from the two studies were pooled (n=28), CPP 60-mesh was the only diet in which both RBG and 30-OGTT were significantly lower than the control and the cellulose diet.

Figure 3. Fecal output per 24h associated with the diets

• CPP 60 mesh had the lowest percent incidence of diabetes compared to all tested fibers and revealed the least amount of organ damage.

Figure 4. Diet effects on Nile rat organ size

• CPP 60 mesh performed the best in both studies. It produced the lowest blood glucose for all 3 glucose measures: fasting (FBG), 30-OGTT, and RBG.

Figure 5. Hepatomegaly from fatty liver (NAFLD) in T2DM vs control