# 825.10 The Effect of Soluble Fiber on Glucose Tolerance and Antioxidant Status in Insulin-Resistance Rats

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## Abstract

To investigate the effectiveness of a fruit and vegetable supplement on glucose tolerance and insulin responsiveness, two groups of rats (n=5/group) were fed a high fat/sucrose (HF/S) diet previously shown to induce insulin resistance (Grimditch, AJCN 48:38, 1988). The treatment group (T) consumed soluble fiber in the form of a proprietary fruit and vegetable powder dissolved in gelatin cubes (200 mg/5 mg cube) daily. The placebo group (P) consumed gelatin cubes only. A control group (C) was fed standard chow. All food and water were provided ad libitum. After 7 wks, an oral glucose tolerance test was performed. Following an overnight fast, an initial blood sample (300 µl) was obtained by tail bleeding, after which rats were administered a 2g/kg body w t dose of a 50% dextrose solution by gavage. Blood samples (300µl) were obtained at 15,30, 60, and 120 min after dosing.

| | Glucose AUC (mg/dl/120 min) | | | Insulin AUC (ng/mg/120 min) | | |
|---|---|---|---|---|---|---|
| | Basal | Stimulated | Total | Basal | Stimulated | Total |
| Control | 11280×368 | 4310×677 | 15590×334* | 46×14 | 53×13* | 99×26* |
| Treatment | 12816×535 | 4844×933 | 17660×710 | 160×48 | 196×51 | 356×69 |
| Placebo | 12696×585 | 6683×902 | 19379×786 | 173×57 | 199×37 | 371×37 |

Values are mean×SE. *Sig. Dif. From HF/S fed animals (P<0.02)

Antioxidants retinol, and α-tocopherol were measured in each animal's pooled GTT plasma samples.

| Antioxidant | Control | Treatment | Placebo |
|---|---|---|---|
| Retinol | 0.30×0.02 | 0.36×0.01* | 0.33×0.01 |
| α-Tocopherol | 4.32×0.19** | 8.56×0.62 | 9.29×0.59 |

Values are mean×SE. Retinol,α-Tocopherol = (µg/ml);
*Sig. Dif. From Control, P<0.05; **Sig. Dif. From HF/S fed animals, P<0.01

The HF/S fed animals were glucose intolerant and insulin resistant relative to the control animals, as indicated by greater glucose and insulin AUC. The data suggest this was due to a difference in basal AUC. T rats tended to have a lower insulin -stimulated glucose AUC than P rats, suggesting that the fruit-vegetable supplement was having a positive effect on glucose control. Vit. E was increased in both HF/S groups relative to control group. Retinol was significantly increased in T rats compared with C, indicating an enhancement in antioxidant status with the fruit/vegetable extract. These data can also be interpreted to suggest that ingestion of a soluble fruit/vegetable supplement does not have a deleterious effect on glucose tolerance in insulin resistant animals. Thus, the nutritional benefits of a fruit/vegetable supplement can be gained without causing an adverse effect on glucose regulation.


## Purpose

To determine if the addition of a soluble fruit/vegetable extract to a high-fat/sucrose diet would attenuate the dietary- induced glucose intolerance and insulin resistance

## Methods

Female Sprague-Dawley rats were divided into 3 diet groups:
Control - standard chow
Treatment - high fat/sucrose + 200 mg extract /5 ml gelatin/day
Placebo - high fat/sucrose + 5 ml gelatin/day

OGTT: 2g/kg of 50% dextrose solution; blood samples at 0, 15, 30, 60, & 120 min after dosing by tail bleeding

Each rat's pooled plasma samples were analyzed for antioxidants, retinol and vitamin E

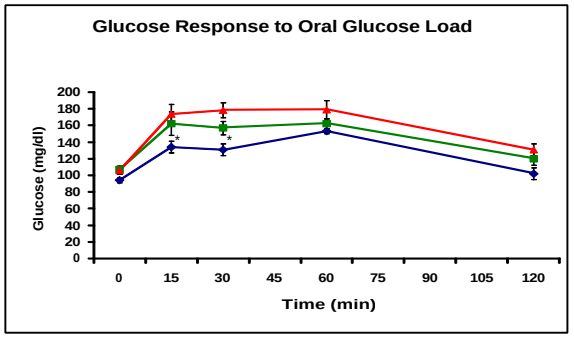
$^{3}$H-2-deoxyglucose uptake was measured in red quadriceps muscle

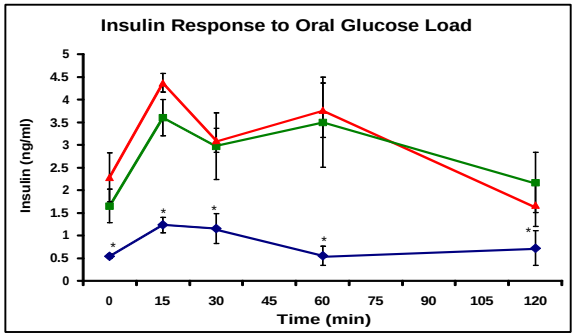
## Introduction

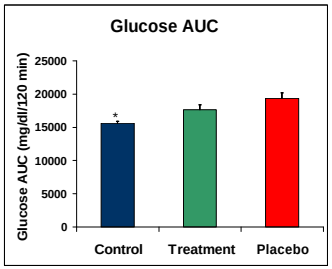
Although dietary fiber improves glucose control in type 2 diabetes and lowers the risk of obesity, ingestion of large amounts of fiber is necessary to achieve this effect. Popular U.S. foods are not high in dietary fiber, suggesting that the use of a palatable, natural fruit-vegetable supplement may provide an effective alternate source of dietary fiber. Since water soluble fiber appears to be more effective in attenuating postprandial glucose excursions than insoluble fiber, which makes up the majority of fiber in mixed diets, a soluble fiber extract has the potential to increase fiber intake to appropriate levels without the attendant gastrointestinal discomfort associated with insoluble fiber.

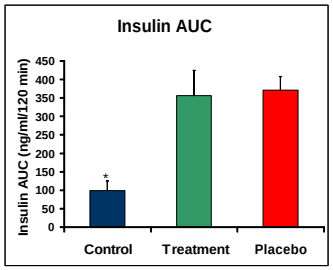
## Results

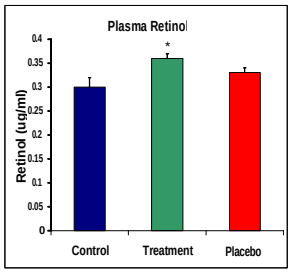
Glucose AUC and insulin AUC were significantly greater in HF/S rats than in control rats indicating glucose intolerance and insulin resistance. T rats tended to have a lower insulin stimulated glucose AUC than P rats. Vitamin E was significantly increased in HF/S rats relative to control rats. Retinol was significantly increased in T rats compared with C rats. 2-Deoxyglucose uptake was higher in HF/S rats than in control rats.

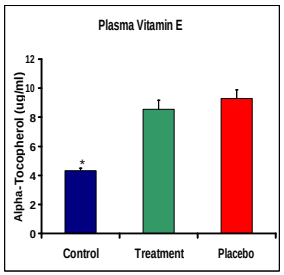


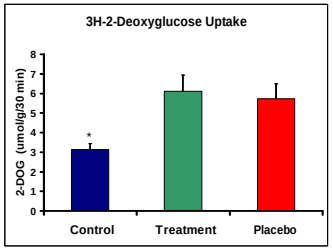




## Conclusions

A soluble fruit-vegetable extract can have beneficial effects on glucose control in insulin resistant rats by delaying glucose absorption from the gut and/or increasing hepatic extraction of insulin. However, the extract may have to be combined with a complex carbohydrate diet to achieve maximal effects. Antioxidant status in HF/S fed rats can also be improved by supplementing the diet with the fruit-vegetable extract.