Metabolic Effects of Onion and Green Beans on Diabetic Patients


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TJOKROPRAWIRO, A., PIKIR, B.S., BUDHIARTA, A.A.G., PRANAWA, H., SOEWONDO, H., DONOSEPOETRO, M., BUDHIANTO, F.X., WIBOWO, J.A., TANUWIDJAJA, S.J., PANGEMANAN, M., WIDODO, H. and SURJADHANA, A. Metabolic Effects of Onion and Green Beans on Diabetic Patients. Tohoku J. exp. Med., 1983, 141, Suppl., 671-676 — A comparative study, using a crossover design, was carried out on 260 well controlled diabetic out-patients to investigate the metabolic effects of the A (50% cal carbohydrate, 30% cal fat, and 20% cal protein) and the B-diets (Study I), since the adherence of diabetic patients to the A-diet is very poor, and uncontrolled diabetes ensues. In Indonesian rural areas traditional medicines are still widely preserved; onion and green beans represent two of the frequent ones. Being faced with such facts, two separate randomized crossover studies were performed on 20 cooperative diabetic outpatients each; paired t-test was used for statistical analysis. Half of the patients were assigned to the B-diet (68% cal carbohydrate, 20% cal fat, 12% cal protein) plus 3 × 20 g fresh onion per day (Study II), or plus 3 × 200 g green beans per day (Study III) in the first week, and the B-diet only in the second week; the other half was assigned the other way around. Well and poorly controlled diabetics were used as experimental patients of Study II and Study III, respectively. Study I demonstrated that the B-diet showed potent hypocholesterolemic effect (31.75 mg%, p < 0.001), maintained diabetic state, and did not raise the fasting serum triglyceride level. Study II resulted in significant decrease in blood sugar level (4.37 mg%, p < 0.05) in the onion treated group, however, no blood lipid levels-changes occurred during both diets. Study III showed significant falls in blood sugar (33.08 mg%, p < 0.01), cholesterol (6.83 mg%, p < 0.05) and triglyceride (8.10 mg%, p < 0.05) levels during green bean diet. In conclusion, the consumptions of onion and green beans as adjuncts to the B-diet may be beneficial to the dietary treatment for diabetics. As pre-study serum levels of cholesterol and triglyceride of Study II and III were quite normal, the hypothesis was advanced that capsuled onion extract (in higher dose) and green beans might show apparent clinical results in hyperlipidemic patients. If such is the case, this finding may be of real value in the therapeutical implication attempting to prevent or minimize diabetic angiopathies. ——— onion ; green bean
Diet appears to be an essential part of diabetic treatment; not only does it help to control diabetes, it also reduces the severity of the disease. The diabetic prescribed in the Diabetic Clinic of the Department of Medicine Airlangga University Dr. Soetomo Hospital Surabaya, has been fundamentally Western in type since 1965. Such a diet (referred to as the A-diet) comprised 50% of carbohydrate, 30% of fat and 20% of protein calories, and to be given in three equidistant meals daily. In fact, the A-diet was poorly adhered by our diabetic patients, and uncontrolled state ensued, hence, the B-diet was composed. The latter was a new dietetic regimen for patients with diabetes mellitus, which was composed and adapted to the eating habits of the Indonesian people. Such a diet comprised 68% calories as carbohydrate, 20% as fat and 12% as protein, and to be given in six equidistant meals daily.

In Indonesian rural areas traditional medicines are still widely prescribed; onion and green beans represent two of the frequent ones. Previous investigations (Jain et al. 1974; Sainani et al. 1976; Pipir et al. 1980; Tjokroprawiro 1980) reported hypoglycemic and hypolipidemic properties of onion and green beans, however, no complete data to be resulted in.

Being faced with such problems, three sequential randomized crossover-studies were carried out on diabetic patients to investigate the metabolic effects of the A-and the B-diets, onion, and green beans.

**Materials and Methods**

Cooperative non-insulin dependent diabetic out-patients who have no apparent complications and perfectly adhere to the instructions of studies to be chosen as experimental subjects. Study I (the A- vs. the B-diets), Study II (the onion- vs. the non-onion diets) and Study III (the green bean-vs. the non-green diets) were separately performed, however, all of them were randomized crossover designed; both diets of each study to be given in one week dietary period each, for each patient. The purpose of crossover design in these investigations was to minimize the existence of the biologic variability from subject to subject.

Paired t-test was used for statistical analysis for each study.

**Study I (the A- vs. B-diet)**

This investigation was designed to know the metabolic effects of both diets in which blood sugar, cholesterol and triglyceride levels were used as parameters. The principle characteristics of the A- and B-diets can be seen in Table I.

The B-diet is given in 6 meals daily with a caloric percentage as follows: 6.30 a.m. - 20% cal, 9.30 a.m. -10% cal, 0.30 p.m. -25% cal, 3.30 p.m. -25% cal, 3.30 p.m. -10% cal, 6.30 p.m. -25% cal, 9.30 p.m. -10% cal. The B-diet is enriched with fiber (derived from vegetables); the A- and B-diets were isocalorically maintained. 260 well controlled diabetic out-patients were selected for experimental subjects, thus, half of the patients were randomly assigned to the A-diet in the first week and the B-diet in the second week; the other half was assigned the other way around.

**Study II (the onion- vs. the non-onion diets)**

This study was proposed to investigate the metabolic effects of onion; average blood sugar (the average of fasting = FBS and 2hr postbreakfast = 2hPB), serum cholesterol and
triglyceride levels were chosen as parameters. 20 well controlled diabetic out-patients were used as experimental subjects. Half of the patients were randomly subjected to the onion diet (the B-diet plus $3 \times 20$ g fresh onion per day) in the first week and the non-onion diet (the B-diet only) in the second week; the other half was subjected to the other way around.

*Study III (the green bean- vs. the non-green bean diets)*

Similar to Study II, this investigation was performed; however, 20 poorly controlled untreated diabetic out-patients were selected for experimental subjects. The B-diet plus $3 \times 200$ g green beans per day was referred as to the green bean diet, whereas the B-diet only

**Table 2. The A- vs, the B-diets, 260 well controlled diabetic out-patients; randomized crossover study (one week dietary period for each type of diet)**

<table>
<thead>
<tr>
<th></th>
<th>FBS (mg%)</th>
<th>2hPB (mg%)</th>
<th>Chol (mg%)</th>
<th>TG (mg%)</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>92.75</td>
<td>126.08</td>
<td>269.78</td>
<td>125.77</td>
<td>260</td>
</tr>
<tr>
<td>B</td>
<td>89.93</td>
<td>122.07</td>
<td>238.03</td>
<td>124.18</td>
<td>260</td>
</tr>
<tr>
<td>Change</td>
<td>2.82</td>
<td>4.01</td>
<td>31.75</td>
<td>1.59</td>
<td></td>
</tr>
<tr>
<td>$p$</td>
<td>$0.2^*$</td>
<td>$0.02^*$</td>
<td>$&lt;0.001^*$</td>
<td>$0.60$</td>
<td></td>
</tr>
</tbody>
</table>

* Significant.

FBS, fasting blood sugar; Chol, cholesterol; 2hPB, 2 hr post-breakfast; TG, triglyceride.

**Table 3. The onion vs. the non-onion diets, 20 well controlled diabetic out-patients, randomized crossover study (one week dietary period for each type of diet)**

<table>
<thead>
<tr>
<th></th>
<th>FBS + 2hPB (mg%)</th>
<th>Chol (mg%)</th>
<th>TG (mg%)</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-onion</td>
<td>119.46</td>
<td>212.90</td>
<td>137.25</td>
<td>20</td>
</tr>
<tr>
<td>Onion</td>
<td>108.74</td>
<td>195.70</td>
<td>109.00</td>
<td>20</td>
</tr>
<tr>
<td>Change</td>
<td>10.72*</td>
<td>17.20</td>
<td>28.25</td>
<td></td>
</tr>
</tbody>
</table>

*(p < 0.05) (p = 1.07) (p = 1.05)*

* Significant.

The average blood sugar level was lowered (10.72 mg%, $p < 0.05$) during the onion diet; however, no hypocholesterolemic (17.20 mg%, $p < 1.07$) and hypotriglyceridemic (28.25 mg%, $p = 1.05$) effects were found during the onion diet, even though decreases in the levels of both parameters could be demonstrated (the prestudy levels of such parameters were too low, esp. for triglyceride).
as the non-green bean one.

RESULTS

Study I

The results of Study I can be seen in Table 2.

In fact, no hypertriglyceridemia was found during the B-diet. Interestingly, the B-diet showed potent hypocholesterolemic action; however, no apparent hypoglycemic effect was obtained during the B-diet (the prestudy blood sugar levels were too low).

Study II

The metabolic effects of onion can be seen in Table 3.

Study III

The results of this study (Table 4) show the metabolic effects of green beans.

<table>
<thead>
<tr>
<th>Table 4. Green bean- vs. non-green bean diets, 20 poorly controlled untreated diabetic out-patients, randomized crossover study (one week dietary period for each type of diet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FBS + 2hPB(\frac{mg%}{2})</td>
</tr>
<tr>
<td>---------------------------</td>
</tr>
<tr>
<td>Non-green bean</td>
</tr>
<tr>
<td>Green bean</td>
</tr>
<tr>
<td>Change</td>
</tr>
<tr>
<td>(p &lt; 0.01)</td>
</tr>
</tbody>
</table>

* Significant.

Apparent hypoglycemic and also hypolipidemic effects of green beans could be demonstrated in this investigation, even though the hypolipidemic effects of green beans were too low in the clinical point of view (note per-study levels of lipid were too low, 155.70 mg\% and 132.29 mg\% for cholesterol and triglyceride, respectively).

DISCUSSION

As seen in Table 2, the B-diet showed hypoglycemic (2.82 mg\% for FBS and 4.01 mg\% for 2hPB, \(p = 0.02\) for each) and hypocholesterolemic (31.75 mg\%, \(p < 0.001\)) effects, even though the former was unmeaningful for the clinical reasons. Probably, the hypoglycemic action of the B-diet would be more apparent if, the pre-study levels of blood sugar were high. It is likely that these patients have still enough “insulin reserve” in their pancreas, moreover, the moderately high carbohydrate in the B-diet may improve glucose uptake which is associated with an increased efficiency of peripheral carbohydrate utilization (Himsworth 1934; Tjokroprawiro 1978).

There is no evidence that any of factors provided for the B-diet, i.e. reduction of dietary fat, substitution of polyunsaturates for saturates, low in cholesterol intake, high in fiber, frequent meal, and moderately high carbohydrate consump-
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tion, is more successful than any of the others in lowering the serum cholesterol level. In fact, combined metabolic interrelation of all these factors might have given such a result. Presumably the B-diet leads to less efficient reabsorption of bile acids (Whyte et al. 1983), and an increased excretion of bile acids ensues (Portman et al. 1955, 1958).

No hypertriglyceridemia was found during the B-diet, even though it is a high carbohydrate dietetic regimen. It is likely that the B-diet was given in six equidistant meals, thus, each carbohydrate loading in such a diet was not too high. Table 3 showed that fresh onion (3 × 20 g daily) significantly decreased blood sugar level (10.72 mg%, \( p < 0.05 \)), even though there were decreases in serum cholesterol (17.20 mg%, \( p = 1.07 \)) and triglyceride (28.25 mg%, \( p = 1.05 \)) levels; however, such effects were statistically insignificant. Hypothetically, both hypoglycemic and hypolipidemic effects would be obtained if, i.e. pre-study levels of parameters were high, dietary period was longer, and onion dose was increased (capsuled onion extract). Such hypothesis is likely in line with the findings reported by Jain et al. in 1974.

As seen in Table 4, the average blood sugar level during the green bean diet is 33.08 mg% lower than that during the non-green bean diet, and such a difference is statistically significant (\( p < 0.01 \)); additionally, hypocholesterolic (6.83 mg%, \( p < 0.05 \)) and hypotriglyceridemic (8.10 mg%, \( p < 0.05 \)) effects of green beans was demonstrated (even though the decreases in lipids were clinically insignificant).

There is no indication which of the factors belonging to the green bean diet, i.e. the B-diet’s component, fibers or the insulin-like substance is more successful in lowering the blood sugar and lipid levels; in fact, the combined metabolic interrelation of such factors might have given the results. It is perhaps of great importance that the considerable effect of absorption and transit time during green bean consumption was the most effective factor in lowering post breakfast glucose concentration. We speculate that combined effect of green bean and high carbohydrate diet of the B-diet appears to show an increased efficiency of peripheral glucose utilization, or green bean consumption may potentiate the metabolic effect of a high carbohydrate diet.

The hypolipidemic effects of green beans may be of real clinical value if, pre-study levels of such lipids apparently high, however, to investigate this hypothesis, further study should be perfectly carried out.

References

levels of patient with diabetes mellitus. XVth International Congress of Internal Medicine, Hamburg, 18th-22nd August.


