

## Effect of Supplementation of Traditional Medicinal Plants on Serum Lipid Profile in Non-Insulin Dependent Diabetics

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**ABSTRACT** The effect of supplementation of powdered mixture of three traditional medicinal plants namely bittergourd, jambu and fenugreek seeds in raw and cooked form on serum lipid profile was studied in 60 non insulin dependent male diabetics. The patients were divided into two groups of 30 each. The patients of group I was given raw powdered mixture in the form of capsules and to the patients of group II this mixture was given in the form of salty biscuits. Supplementation of one gram of this powdered mixture for one and a half month period and then further increased to two gram to another one and a half month period to the diabetics significantly improved the serum lipid profile by lowering total, LDL-cholesterol, VLDL cholesterol level thus helping in retarding secondary complications of the disease.

### INTRODUCTION

The incidence of diabetes mellitus is increasing all over the world, affecting 150 million people. More than one fifth or 33 million of them are Indians according to International Diabetes Federation (IDF) India has been declared as "Diabetic Capital of the world" at the recent 2003 IDF Conference in Paris. The World Health Organisation (WHO) estimates a 170 percent increase from 84 to 228 million diabetes in developing countries by 2025. India will lead the pack followed by China and the United States (Bezbaruah, 2003).

Diabetes is associated with increased risk of developing CHD which appears earlier than with the general population, affects females almost as often as men and is more frequently fatal (NIH, 1995 and ADA 1988). Cardiovascular risk factors such as hypertension, low level of HDL and elevated level of triglycerides and have been shown to precede the onset of type I diabetes (Haffner, 1990 and Mykanen, 1993).

Medicinal plants and herbs are of great importance to the health of the individuals and communities. A scientific investigation of traditional herbal remedies for diabetes may provide valuable lead for the development of alternative drug and therapeutic strategies. Studies carried out at National Institute of Nutrition (NIN) revealed that fenugreek incorporated in the experimental diets of human subjects significantly reduces the serum

cholesterol, LDL/VLDL cholesterol and triglycerides level and they are likely to provide a significant reduction in LDL/VLDL fractions without altering the HDL fractions (Saibaba and Raghuram, 1997). The literature reports also indicate that daily ingestion of bittergourd improved the glucose tolerance in diabetic patients. Protein fraction gourdin extracted from bittergourd seeds reduces the blood sugar, cholesterol level and triglycerides levels in diabetic patients and have no side effects (Khanna, 1998). Similarly oral administration of jambu seeds in casein diets of rabbits significantly lowered the elevated post meal values of blood glucose, cholesterol, free fatty acids and triglycerides (Kedar and Chakrabarti, 1983).

Due to non acceptability of taste in their original form, it is not possible to continue the intake of these medicinal plants for longer period. Efforts are needed to develop some nutritional supplement using these traditional medicinal plants so that they can be incorporated in the diets of diabetics. Hence, the present study was planned to access the combined effect of powdered mixture of bittergourd, jambu seeds and fenugreek seeds on serum lipid profile in non insulin dependent diabetics.

### MATERIALS AND METHODS

**A. Procurement and Processing of Traditional Medicinal Plants:** The raw materials, bittergourd fruit (*Momordica*

*charantia*), fenugreek seeds (*Trigonella foenum graceum*) and jambu seeds (*Euglnia jambolana*) procured from local market of Ludhiana city in one lot and were used for the development of different products.

**Bittergourd:** Fresh, immature bittergourd fruit were washed in clean water and water was wiped off with clean muslin cloth and were cut into small pieces by stainless steel knife and then dried in oven at 60 to 65°C till complete drying and then converted to fine powder of 60 mesh sieve size in cyclotec mill. The fine powder of bittergourd was stored in airtight plastic container till further use.

**Fenugreek Seed:** Foreign materials were removed from fenugreek seeds and these seeds were washed in clean water to remove the dust. Then seeds were soaked in equal volume of water for overnight and excess water was drained off. The soaked seeds were dried in oven at 60-65°C till complete drying and ground to fine powder for preparation of products.

**Jambu Seeds:** The pulp of the jambu fruit was removed with stainless steel knife and seed coat was removed. The seed kernel were dried in an oven at 60-65°C till complete drying and ground to fine powder of 60 mesh sieve size in a cyclotec mill and stored in air tight plastic container and used for incorporation in various recipes.

The powdered form of fenugreek, bittergourd and jambu was mixed in equal proportion and salty biscuits using 500 mg. to 2 g of mixture of these medicinal plant were developed and were evaluated for organoleptic characters by twelve experts (staff and post graduate students) of Department of Food and Nutrition, College of Home Science, PAU, Ludhiana using nine point hedonic scale. On the basis of their judgement and composition, most acceptable level i.e. 500 mg. was selected for supplementation. The empty capsules of 500 mg. capacity were purchased from the medicine market and were filled with the prepared mixture. Filling was done using automatic filling machine and were given to the diabetic patients for three days for testing physiological functioning of gastrointestinal before starting the actual supplementation trial. No side effect and drug interaction was observed among subjects while combined mixture of these medicines were given to the diabetic subjects.

**B. Selection and Feeding of the Subjects.** Sixty NIDDM patients free from serious

complications were selected from PAU Hos:ital, Ludhiana. General information fo the subject is given in Table 1. After collecting and analyzing blood of selected 60 NIDDM subjects, were followed for one month period and no treatment was given during this period except the prescribed medicine which they were already taking and the period was treated as self control. After one month, fasting and post prandial blood samples were again collected and analysed. Then these subjects were divided into two groups of 30 each.

**Table 1: General information of the subjects**

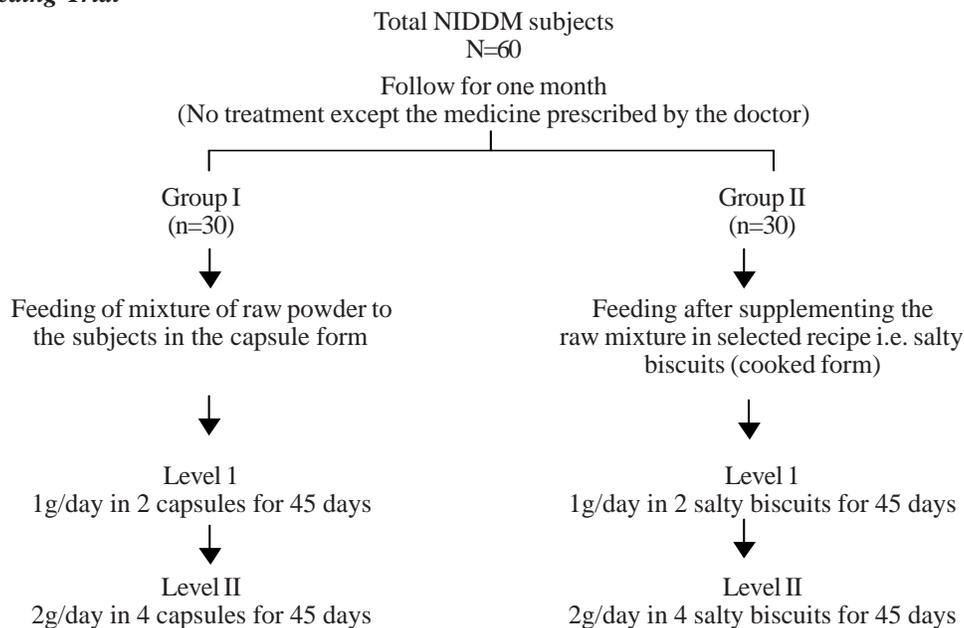
| S. No. | Variables          | Subjects (n=60) |       |
|--------|--------------------|-----------------|-------|
|        |                    | No.             | %     |
| 1.     | <i>Sex</i>         |                 |       |
|        | Male               | 60              | 100   |
| 2.     | <i>Age (Years)</i> |                 |       |
|        | 40-50              | 16              | 26.7  |
|        | 50-60              | 34              | 56.7  |
|        | >60                | 10              | 16.6  |
| 3.     | <i>Religion</i>    |                 |       |
|        | Sikh               | 35              | 58    |
|        | Hindu              | 25              | 42    |
| 4.     | <i>Education</i>   |                 |       |
|        | Illiterate         | 05              | 8.3   |
|        | Primary to middle  | 10              | 16.7  |
|        | High School        | 25              | 41.7  |
|        | Graduate to P.G.   | 20              | 33.33 |
| 5.     | <i>Occupation</i>  |                 |       |
|        | Service            | 50              | 83.33 |
|        | Retired            | 10              | 16.7  |
| 6.     | <i>Family Type</i> |                 |       |
|        | Nuclear            | 41              | 68.3  |
|        | Joint              | 19              | 31.7  |
| 7.     | <i>Family Size</i> |                 |       |
|        | Small (upto 4)     | 28              | 46.7  |
|        | Medium (4 to 8)    | 28              | 46.7  |
|        | Large (>8)         | 04              | 6.6   |
| 8.     | <i>Activity</i>    |                 |       |
|        | Sedentary          | 56              | 93.3  |
|        | Moderate           | 04              | 6.7   |

All the subjects were married at the time of study

**Group I :** Patients of group I were fed raw powder mixture in the form of capsules.

**Group II :** Patients of group II were fed powdered mixture in the form of salty biscuits.

To both the groups the mixture was given at two different levels i.e. 1 gm and 2 gm daily. Feeding at each level was done for one and a half month period. To subjects of group I, two capsules at 1 gm level and 4 capsules at 2 gm level daily were given along with the lunch and dinner. Similarly to the subjects of group II, 2

**Feeding Trial**

biscuits at 1 gm level and 4 biscuits at 2 gm level were given along with lunch and dinner. These supplements were distributed to the patients on weekly basis to ensure regular consumption of supplementations as per instructions given to them. During herbal medicine treatment, the patients were taking their regular diabetic pills to avoid any complications.

**C. Collection of Blood Samples:** Five ml of fasting and post prandial (2 hours after meal) blood samples of sixty selected NIDDM subjects were collected in the beginning, after one month period, after 45 days feeding and after 90 days feeding period.

**D. Analysis of Blood Samples:** The serum was analysed for triglycerides, cholesterol, high density lipoprotein cholesterol, low density lipoprotein cholesterol by using standard methods.

Serum total cholesterol was analysed by BIOTRON BTR 820 Auto Blood Analyser using enzymatic method (Richmond, 1973). Serum high density lipoprotein cholesterol (HDL-C) was measured by using BIOTRON, BTR 820 using phosphotungstate method (Lopes-Virella, 1997). The value of serum low density lipoprotein cholesterol (LDL-C) was calculated based on Friedwald's equation (Friedewald, 1972).

$$\text{LDL-cholesterol} = \frac{\text{Total cholesterol} - \text{Triglycerides} - \text{HDL-C}}{5}$$

Serum very low density lipoprotein cholesterol (VLDL-C) was calculated based on equation

$$\text{VLDL} = \frac{\text{Triglycerides}}{5}$$

Serum triglycerides were estimated by using Autopack Reagent Kit by method of enzymatic DHBC Colourmetric Method (Fossati and Principle, 1992).

**Statistical Analysis:** The data on serum = lipid profile was analysed statically. The mean, standard error, analysis of variance, CD value, t-value and their test of significance was calculated using a computer package programme (Cheema and Singh, 1990).

**RESULTS AND DISCUSSION**

The serum lipid profile of diabetics before and after supplementation of medicinal plants mixture at two different levels is shown in Table 2. It was found that mean initial value of triglycerides, total cholesterol, LDL cholesterol and VLDL-C was on the higher side in both the groups than the desirable value given by Raghuram (1993). It was observed in the present study that as the

Table 2: Serum lipid profile of diabetics before and after supplementation of medicinal plants\* mixture at two different levels (mg/dl).

| Serum lipid profile (mg/dl) | Group I (Raw form) n=30 |                 |            |              |               |               | Group II (Cooked form) n=30 |            |            |               |                       |  |
|-----------------------------|-------------------------|-----------------|------------|--------------|---------------|---------------|-----------------------------|------------|------------|---------------|-----------------------|--|
|                             | Control                 |                 |            | Supplemented |               |               | Control                     |            |            | Supplemented  |                       |  |
|                             | Initial level           | After one month | Level I    | Level II     | C.D. (P≤0.05) | Initial level | After one month             | Level I    | Level II   | C.D. (P≤0.05) | Normal* range (mg/dl) |  |
| Total triglycerides         | 180.7±2.56              | 177.0±2.60      | 166.5±2.73 | 148.7±2.66   | 7.53          | 179.3±2.92    | 177.6±2.87                  | 171.8±2.89 | 161.6±2.75 | 11.05         | <150                  |  |
| Total cholesterol           | 211.8±4.26              | 208.5±4.21      | 195.2±4.08 | 179.7±3.88   | 11.73         | 209.0±3.62    | 205.8±3.36                  | 198.3±3.49 | 187.9±3.48 | 9.96          | <200                  |  |
| HDL-C                       | 37.3±0.93               | 40.1±0.96       | 48.8±0.83  | 58.5±0.86    | 2.56          | 35.1±0.56     | 37.1±0.63                   | 42.9±0.61  | 50.9±0.58  | 1.70          | 30-70                 |  |
| LDL-C                       | 138.0±3.91              | 133.1±3.89      | 112.5±3.56 | 91.3±3.65    | 10.73         | 139.1±3.34    | 134.9±3.17                  | 121.1±3.25 | 104.8±3.26 | 9.29          | 80-160                |  |
| VLDL-C                      | 35.9±0.50               | 35.1±0.53       | 33.1±0.54  | 29.9±0.55    | 1.51          | 35.6±0.60     | 35.2±0.59                   | 34.3±0.59  | 32.3±0.54  | 1.65          | 20-40                 |  |

Medicinal plants - mixture of fenugreek, jamun and bittergourd seeds powder

Control - without supplementation

Supplementation

Level I - 1g/day of medicinal plant mixture for 45 days.

Level II - 2g/day medicinal plant mixture for 45 days.

\*Raghuram (1993)

level of supplementation of these medicinal plants mixture increased, there was significant ( $P \leq 0.05$ ) decrease in serum triglycerides, total cholesterol, LDL-C, VLDL-C in both raw and cooked form but increase in HDL-C with the increase in supplementation of medicinal plants was observed in both the groups (Fig. 1, 2 and 3). Ratio of total cholesterol to HDL-C and LDL-C to HDL-C was also reduced with the supplementation of medicinal plants mixture in both the groups which further decreased the risk for cardiovascular disease in diabetic patients (Table 2). Percent decrease in total triglycerides (18 and 10%), total cholesterol (15 and 11%) and LDL-C (34 and 25%), VLDL-C (17 and 9%) and percent increase in HDL-C (36 and 31%) was found when powdered mixture of these medicinal plants was given in raw and cooked form (Table 3).

Table 3: Percent change in serum lipid profile of the diabetic subjects when medicinal plants given in raw and cooked form.

| Serum Lipid Profile | Raw(%) | Cooked(%) |
|---------------------|--------|-----------|
| Triglycerides       | 18     | 10        |
| Total cholesterol   | 15     | 11        |
| LDL-C               | 35     | 25        |
| VLDL-C              | 17     | 9         |
| HDL-C               | 36     | 31        |

Studies reported that diabetic state, resulting from an impaired secretion and sensitivity of insulin may be responsible for high triglycerides level in serum than normal individuals, as the insulin stimulated the synthesis of adipose tissue by agency of lipoprotein lipase (Matshushita, 1982). Similar decrease in triglycerides and total cholesterol level of the diabetics were observed by feeding fenugreek seeds by various workers (Sharma, 1996). Fenugreek seed's gum and saponin fractions showed a hypocholesterolemic effect. Saponin of fenugreek may compete with cholesterol at binding site or interfere with cholesterol biosynthesis in liver. Soluble fibres like gums, pectins, mucilages may block cholesterol absorption in the intestine (Lansky, 1993). Presence of dietary fibre in fenugreek seeds, bittergourd and jambu seeds may affect serum cholesterol by reducing cholesterol and bile acid absorption by altering the metabolism and ratio of bile acid absorbed, by changing the intestinal secretion and hepatic production of lipoprotein (Chen, 1986). Gel forming properties

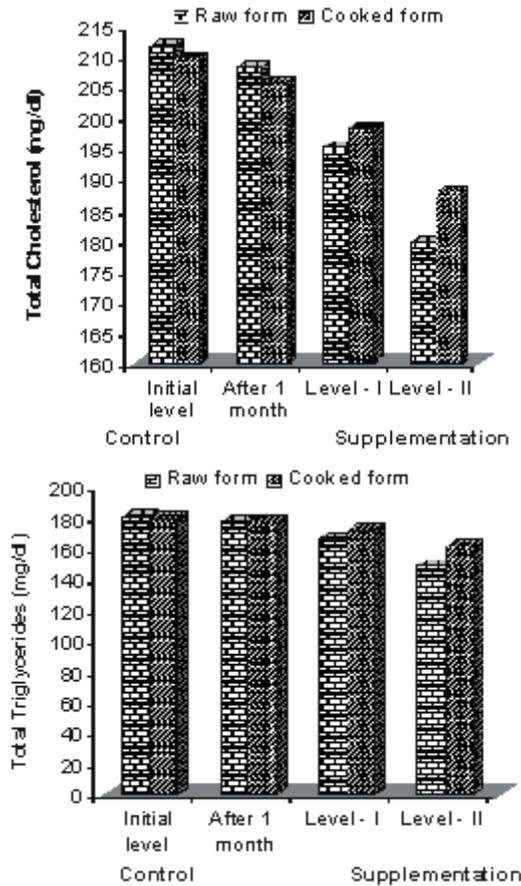


Fig. 1. Effect of supplementation of medicinal plants in raw and cooked form on total triglycerides and total cholesterol at different levels.

of some soluble dietary fibres maintain a more acidic pH of chyme which increases cholesterol ester formation. Since cholesterol are not absorbed directly by the mucosal cell which may explain cholesterol lowering effect (Chang, 1983).

Similarly, a significant increase in HDL-Cholesterol level in diabetic rats by fenugreek seeds has been reported earlier (Khosla, 1995). HDL-Cholesterol is considered to have anti-atherogenic properties, since there is negative correlation between HDL-cholesterol and risk of cardiovascular disease, HDL-C transports cholesterol from peripheral tissues to the liver thereby reducing the amount stores in tissue and decreasing the likelihood of getting atherosclerotic plaques (Eder, 1982).

Similar decrease in plasma LDL-C was observed with fenugreek seeds in diabetic rats.

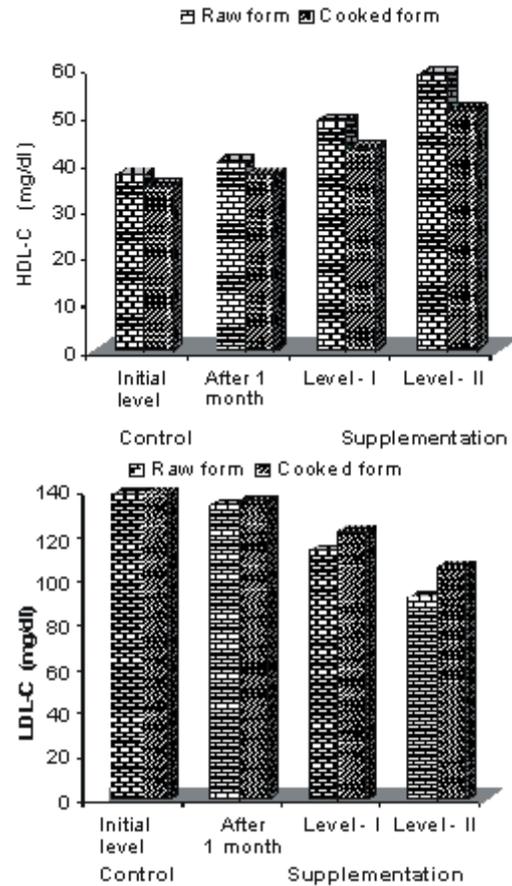


Fig. 2. Effect of supplementation of medicinal plants in raw and cooked form on HDL-C and LDL-C at different levels.

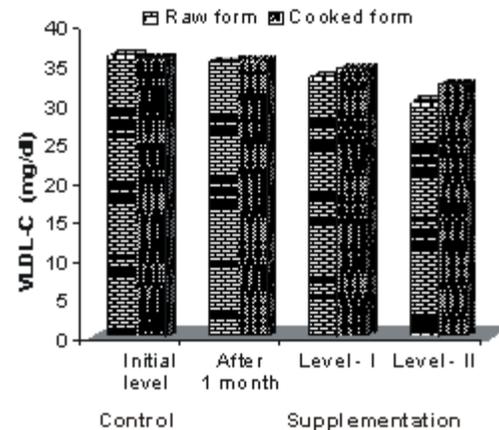


Fig. 3. Effect of supplementation of medicinal plants in raw and cooked form on VLDL-C at different levels.

Dietary fibre present in fenugreek seeds exerts a reduction mainly in LDL-cholesterol. The effect of dietary fibre on lipoprotein cholesterol is due to its association with absorption and transport of lipids (Kirby, 1981; Story, 1982). Results of the present study coincide with the result of various workers who showed a hypolipidemic effect of fenugreek seed and observed that there was significant reduction in total cholesterol, LDL, VLDL-C and triglycerides.

The results of the present study suggested that mixture of powdered bittergourd, fenugreek seeds and jambu seeds had a significant effect in lowering serum lipid profile.

### CONCLUSION

Supplementation of these medicinal plants mixture both in raw and cooked form showed a significant improvement in the serum lipid profile by lowering total, LDL-cholesterol, VLDL-cholesterol and triglycerides and by increasing HDL-cholesterol level thus helping in retarding the secondary complications. However the decrease in serum lipid profile was most significant ( $P \leq 0.01$ ) with raw form.

The traditional medicinal plants used in the present study quite acceptable by the diabetic subjects. So diabetic patients should be encouraged to include these medicinal plants in their daily diet to control lipid profile. Efforts can also made to commercialize these in the form of capsules for the convenience of the patients as it become difficult to consume these plants as such and preparation of the product with these medicinal plants is also a tedious process.

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