

A study on hypoglycemic effect of mango leaves (*Mangifera indica* Linn.) on type II diabetic patients (30-70 years)

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ABSTRACT

Mangifera indica Linn leaves have been claimed to possess anti-diabetic properties by many investigators. Antioxidant is the property of phytochemicals which are non-nutritive plant chemicals that have protective or disease preventing properties because they function as free radical scavengers. Mango leaves possess a potential hypoglycemic effect as these influence blood sugar level, insulin level and mango leaves containing tannins as gallic acid (antioxidant) protects the beta cells from killing themselves thus protecting beta cells from apoptosis. Considering the beneficial effect of mango leaves powder, the present study was undertaken to study the effect of mango leaves powder on blood glucose levels and insulin levels. 50 respondents were selected for the study through purposive sampling technique residing in Modinagar and Muzaffarnagar and divided into two groups, experimental and control. General profile, medical history, type of treatment, dietary history, life style pattern, anthropometric measurements, biochemical assessment clinical assessment and dietary pattern (Nutrient intake through 3 day food recall method for 3 consecutive days) were assessed through questionnaire cum interview method. After collecting all the information from the respondents, 5g/day mango leaves powder was distributed only to experimental group for 3 months. After intervention of mango leaves powder, anthropometric parameters, biochemical parameters (both in fasting and post-prandial state), clinical symptoms (polyuria, polyphagia, polydypsia, eye complaints etc.) and dietary pattern (nutrient intake through 3 day food recall method for 3 consecutive days) were assessed. The study concluded that intervention of mango leaves powder, which have antioxidants as tannins (Gallic acid) 15 per cent, fibre 1.6 per cent and β -carotene 490 I.U. per 100 g of mango leaves powder on a daily basis effectively reduced weight, elevated blood glucose level and relief in symptoms of type II diabetes mellitus patients.

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Key Words : Hypoglycemic effect, Mango leaves, Diabetic patients

INTRODUCTION

Mango leaves possess a potential hypoglycemic effect as these influence blood sugar level and mango leaves containing tannins as gallic acid (Antioxidant) protects the beta cells from killing themselves thus protecting beta-cells from apoptosis and cures the disease pancreatitis which produces insulin and when it becomes inflamed and scarred, it may not be able to produce enough of insulin hormone.

METHODOLOGY

Mango leaves powder was prepared for diabetic type-II patients for that mango leaves were washed, dried in shade and then ground to a fine powder and stored and 5 g/ day was supplemented to type-II diabetic patients *i.e.* 1 teaspoonful (2.5 g) of this powder in the morning and evening.

Fifty respondents were selected for the study and

divided into control (n=25) and experimental (n=25) groups (Table A).

Dietary history:

Food habits, consumption of fruit and beverages, nutrient intake through 24 hour recall method for 3 consecutive days.

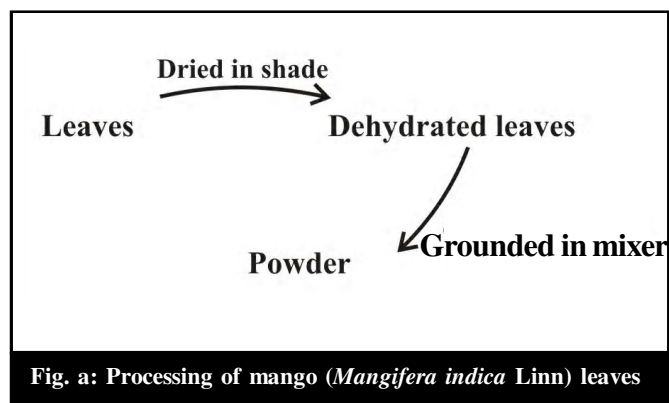


Fig. a: Processing of mango (*Mangifera indica* Linn) leaves

Table a: Distribution of respondents on the basis of age, sex and religion

| Parameters | Category | Group I (n=25) | | Group II (n=25) | |
|----------------|-----------|----------------|-------|-----------------|-------|
| | | No. of resp. | % age | No. of resp. | % age |
| Age (years) | 30-40 | 2 | 8 | 3 | 12 |
| | 41-50 | 10 | 40 | 8 | 32 |
| | 51-60 | 7 | 28 | 8 | 32 |
| | 61-70 | 6 | 24 | 6 | 24 |
| Sex | Female | 18 | 72 | 14 | 56 |
| | Male | 7 | 28 | 11 | 44 |
| Religion | Hindu | 24 | 96 | 25 | 100 |
| | Muslim | 1 | 4 | 0 | 0 |
| | Any other | 0 | 0 | 0 | 0 |
| Type of family | Nuclear | 15 | 60 | 20 | 80 |
| | Joint | 35 | 40 | 50 | 20 |
| Type of work | Sedentary | 12 | 48 | 8 | 32 |
| | Moderate | 13 | 52 | 17 | 68 |

Anthropometry:

Height, weight, B.M.I.

Biochemical parameters:

Fasting blood glucose, post- prandial blood glucose.

Clinical signs:

Polyphagia, Polydypsia, fatigue, polyuria, eye complaints, constipation etc.

OBSERVATIONS AND ASSESSMENT

In ‘dietary history’ majority of the respondents were taking meals 4 times a day *i.e.* 72 per cent and 80 per cent followed by 3 meals day *i.e.* 16 per cent and 12 per cent and the rest were taking < 3 meals and >4 meals per day in group I and group II, respectively (Table 1 and 2). In which majority of the respondents *i.e.* 64 per cent and 40 per cent respondents were restricting sweet food in their diet, followed by 52 per cent and 60 per cent respondents restricting candies in their diet followed by starchy food and spicy food in group I and group II, respectively and in which apple was consumed weekly by 48 per cent and 44 per cent respondents followed by

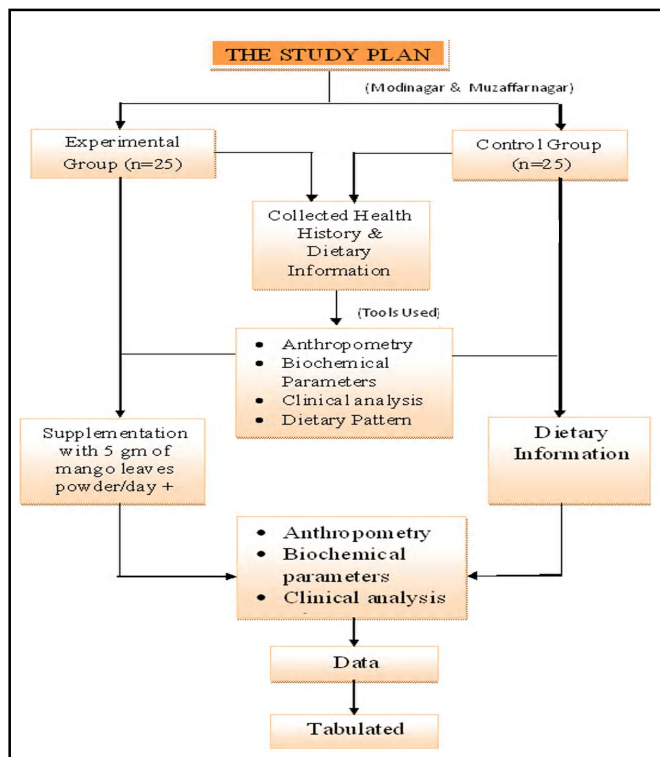


Fig b: Study plan

Table 1: Complications with diabetes

| Complications | Group-I (n=25) | | Group-II (n=25) | |
|---------------------|-------------------|----|-------------------|----|
| | No. of Respondent | % | No. of Respondent | % |
| High cholesterol | 6 | 24 | 8 | 32 |
| High blood pressure | 8 | 32 | 12 | 48 |
| Asthma | 2 | 8 | 1 | 4 |
| Any other | 9 | 26 | 4 | 16 |

Table 2: Type of medicine

| Treatment | Group-I (n = 25) | | Group-II (n = 25) | |
|--------------|-------------------|------|-------------------|------|
| | No. of respondent | %age | No. of respondent | %age |
| Ayurvedic | 12 | 48 | 0 | 0 |
| Allopathic | 7 | 28 | 15 | 60 |
| Homeopathic | 2 | 8 | 2 | 8 |
| Naturopathic | 2 | 8 | 0 | 0 |
| Any other | 2 | 8 | 2 | 8 |

monthly, mango was consumed occasionally by 76 per cent, 28 per cent and 40 per cent respondents were consuming papaya monthly followed by 68 per cent and 72 per cent who were consuming guava daily, 48 per cent and 68 per cent were never consuming banana and the rest were consuming weekly, monthly and occasionally in group I and group II, respectively.

In lifestyle pattern majority of the respondents *i.e.* 92 per cent and 100 per cent were not smoking cigarette in which majority of the respondents *i.e.* 32 per cent and 24 per cent respondents said that their diabetes interferes slightly with social activities, 20 per cent and 32 per cent respondents said that their diabetes interfered slightly with hobbies as recreational activities, 24 per cent and 52 per cent respondents said that diabetes interferes slightly with household chores and 32 per cent and 36 per cent respondents said that diabetes interferes slightly with shopping and errands and rest said that diabetes interferes moderately, quiet a bit and almost totally with social

activities, hobbies, household chores and shopping and errands in group I and group II, respectively in which 28 per cent and 24 per cent respondents preferred to do exercise and the rest were not preferring to do exercise in which 60 per cent and 64 per cent were never doing stretching exercises followed by 36 per cent and 24 per cent were doing walk for exercise 1-3hr/wk, 100 per cent respondents were never doing swimming exercises, 96 per cent and 100 per cent respondents were never doing bicycling and 32 per cent and 40 per cent respondents were doing yoga and meditation for <30 min/wk in group I and group II, respectively.

In anthropometric parameters, there was no difference seen in mean height of the respondents of group I and group II as compared to standard and also no difference was found between group I and group II before and after the intervention period and there was insignificant difference seen in the mean weight of the respondents of group I and group II as compared to standard before and

Table 3: Anthropometric parameters of group I

| Parameters | Standard | Before | | | After | | | t-test |
|-------------|----------|-------------|-----------|------|-------------|-----------|-------|--------|
| | | Mean ± S.D. | Mean diff | % | Mean ± S.D. | Mean diff | % | |
| Height (cm) | 170.87* | 159.48±8.10 | -11.39 | 93.3 | 159.48±8.10 | -11.39 | 93.22 | 1 |
| Weight (kg) | 65.48* | 68.84±10.95 | +3.36 | 105 | 62.80±9.02 | -2.68 | 95.00 | 0.04 |

shows the insignificant level of the value at 0.05

* B.Srilakshmi (2007)

Table 4: Anthropometric parameters of group II

| Parameters | Standard | Before | | | After | | | t-test |
|-------------|----------|-------------|-----------|-------|-------------|-----------|--------|--------|
| | | Mean ± S.D. | Mean diff | % | Mean ± S.D. | Mean diff | % | |
| Height (cm) | 170.87* | 163.04±9.64 | -7.83 | 95.41 | 163.04±9.64 | -7.83 | 95.41 | 1 |
| Weight (kg) | 65.48* | 67.48±9.05 | +2 | 103.0 | 66.32±9.01 | +0.84 | 101.28 | 0.02 |

shows the insignificant level of the value at 0.05

* B. Srilakshmi (2007)

Table 5: Biochemical parameters: effect of mango leaves powder intervention on blood glucose level of respondents of group I and group II

| Blood glucose levels | Group-I (n=25) | | | | Group-II (n=25) | | | |
|---|----------------|------------|--|--------------------|-----------------|--------------|--|-------------------|
| | Before | After | Increase/decrease after intervention (mg/dl) | t-test | Before | After | Increase/decrease after intervention (mg/dl) | t-test |
| | mean ± S.D. | mean ±S.D. | | | mean ±S.D. | mean ±S.D. | | |
| Fasting blood glucose level (80-110 mg/dl) | 183.6±59.06 | 118±40.57 | -65.6 | 3.67 ^{\$} | 156±26.71 | 142±31.02 | -14.00 | 2.05 [#] |
| Post prandial blood glucose level (P.P.) (80-160 mg/dl) | 202.44±37.29 | 101±30.20 | -101.44 | 3.01 ^{\$} | 208.0±38.93 | 195.36±39.55 | -12.64 | 1.06 [#] |

shows the insignificant level of the value at 0.05

\$ Shows the significant level of the value at 0.05

Table 6: Clinical symptoms of diabetes

| Symptoms | | Group I | | | Group II | | |
|---|------------|--------------------|-------|-------------------|--------------------|-------|-------------------|
| | | No. of respondents | | x ² | No. of respondents | | x ² |
| | | Before | After | | Before | After | |
| Polydypsia | Yes | 9 | 5 | | 13 | 11 | |
| | No | 14 | 18 | 6.1 ^S | 12 | 12 | 4.8 [#] |
| | Don't know | 2 | 2 | | 0 | 2 | |
| Polyphagia | Yes | 14 | 11 | | 7 | 8 | |
| | No | 8 | 14 | 6.2 ^S | 13 | 12 | 3.45 [#] |
| | Don't know | 3 | 0 | | 5 | 5 | |
| Polyuria | Yes | 11 | 4 | | 11 | 10 | |
| | No | 11 | 20 | 6.3 ^S | 10 | 12 | 4.2 [#] |
| | Don't know | 3 | 1 | | 4 | 3 | |
| Nausea or Vomiting | Yes | 6 | 6 | | 4 | 6 | |
| | No | 14 | 14 | 1.64 [#] | 21 | 19 | 2.32 [#] |
| | Don't know | 5 | 5 | | 0 | 0 | |
| Abdominal pain | Yes | 8 | 8 | | 4 | 8 | |
| | No | 16 | 16 | 2.3 [#] | 18 | 14 | 3.01 [#] |
| | Don't know | 1 | 1 | | 3 | 3 | |
| Morning headaches | Yes | 8 | 5 | | 8 | 7 | |
| | No | 14 | 17 | 4.2 [#] | 13 | 14 | 3.02 [#] |
| | Don't know | 3 | 3 | | 4 | 5 | |
| Night sweats | Yes | 7 | 2 | | 12 | 10 | |
| | No | 18 | 23 | 5.9 ^S | 9 | 10 | 4.0 [#] |
| | Don't know | 3 | 0 | | 4 | 5 | |
| Fatigue | Yes | 15 | 11 | | 10 | 12 | |
| | No | 8 | 12 | 4.0 [#] | 12 | 8 | 3.4 [#] |
| | Don't know | 2 | 2 | | 3 | 5 | |
| Dry mouth | Yes | 12 | 4 | | 13 | 10 | |
| | No | 11 | 18 | 6.1 ^S | 12 | 13 | 5.90 ^S |
| | Don't know | 2 | 3 | | 0 | 2 | |
| Severely high blood glucose (300mg /100 ml of blood) | Yes | 17 | 6 | | 7 | 5 | |
| | No | 8 | 19 | 7.2 ^S | 13 | 16 | 3.02 ^S |
| | Don't know | 0 | 0 | | 5 | 4 | |
| Shakiness and weakness | Yes | 18 | 10 | | 11 | 11 | |
| | No | 5 | 9 | 4.0 [#] | 10 | 8 | 5.0 [#] |
| | Don't know | 2 | 6 | | 4 | 6 | |
| Chest pain | Yes | 13 | 9 | | 4 | 5 | |
| | No | 11 | 16 | 3.8 [#] | 21 | 20 | 2.0 [#] |
| | Don't know | 0 | 0 | | 0 | 0 | |
| Eye complaint | Yes | 20 | 8 | | 4 | 7 | |
| | No | 5 | 14 | 7.3 ^S | 18 | 14 | 3.1 [#] |
| | Don't know | 0 | 3 | | 3 | 4 | |
| Cuts and sores do not heal properly | Yes | 10 | 7 | | 8 | 10 | |
| | No | 10 | 13 | 5.0 [#] | 13 | 11 | 2.2 [#] |
| | Don't know | 5 | 5 | | 4 | 4 | |
| Lost consciousness | Yes | 2 | 1 | | 12 | 10 | |
| | No | 23 | 24 | 1.2 [#] | 9 | 12 | 2.0 [#] |
| | Don't know | 0 | 0 | | 4 | 3 | |
| Severely low blood sugar (70ml/100ml of blood) | Yes | 11 | 2 | | 10 | 11 | |
| | No | 14 | 23 | 8.1 ^S | 12 | 14 | 4.25 [#] |
| | Don't know | 0 | 0 | | 3 | 0 | |
| Constipation | Yes | 20 | 8 | | 12 | 15 | |
| | No | 5 | 17 | 6.3 ^S | 10 | 5 | 4.2 [#] |
| | Don't know | 0 | 0 | | 3 | 5 | |

shows the insignificant level of the value at 0.05

\$ shows the significant level of the value at 0.05

Table 7: Mean nutrient intake by the respondents of group I and group II intervention of mango leaves powder

| Nutrients | R.D.A. | Group I | | | Group II | | | t-test |
|------------------|--------|----------------|--------------------|-----------------|------------------|--------------------|-----------------|-------------------|
| | | Mean ± S.D. | Deviation from RDA | % intake of RDA | Mean ± S.D. | Deviation from RDA | % intake of RDA | |
| Energy (Kcal) | 2350* | 1873.48±238.85 | -476.52 | 80% | 1718.00± 294.35 | -631.50 | 73.12% | 0.04 [#] |
| Protein (g) | 55* | 60.78±10.25 | +5.78 | 110.50% | 61.08 ± 11.62 | +6.08 | 111.05% | 0.02 [#] |
| Carbohydrate (g) | 488* | 222.94±45.33 | -265.06 | 45.68% | 213.86 ± 47.68 | -274.14 | 43.82% | 0.06 [#] |
| Fat (g) | 20* | 46.10±10.73 | +26.10 | 230.50% | 47.27 ± 15.07 | +27.27 | 236.35% | 0.03 [#] |
| Fiber (g) | 35* | 14.24±6.41 | -20.76 | 40.68% | 13.30 ± 8.48 | -21.70 | 38% | 0.04 [#] |
| β-Carotene (µg) | 2400* | 1531.25±411.14 | -868.75 | 63.80% | 1589.84 ± 687.88 | -810.16 | 66.24% | 0.02 [#] |

the sign shows the insignificant level of the value at p 0.05.

* ICMR (2007)

Table 8: Mean nutrient intake by the respondents of group I (Experimental group) before and after intervention of mango leaves powder

| Nutrients | R.D.A. | Before | | | After | | | t-test |
|------------------|--------|------------------|--------------------|-----------------|------------------|--------------------|-----------------|-------------------|
| | | Mean ± S.D. | Deviation from RDA | % intake of RDA | Mean ± S.D. | Deviation from RDA | % intake of RDA | |
| Energy (Kcal) | 2350* | 1873.48 ± 238.85 | -476.52 | 80 | 1890.22 ± 287.70 | -459.78 | 80.43 | 0.82 [#] |
| Protein (g) | 55* | 60.78 ± 10.25 | +5.78 | 110.50 | 60.38 ± 11.00 | +5.38 | 109.78 | 0.89 [#] |
| Carbohydrate (g) | 488* | 222.94 ± 45.33 | -265.06 | 45.68 | 198.34 ± 40.23 | -289.66 | 40.64 | 0.04 [#] |
| Fat (g) | 20* | 46.10 ± 10.73 | +26.10 | 230.50 | 39.02 ± 10.52 | +7.02 | 195.1 | 0.06 [#] |
| Fiber (g) | 35* | 14.24 ± 6.41 | -20.76 | 40.68 | 19.23 ± 10.80 | -10.77 | 54.94 | 1.02 [#] |
| β-Carotene (µg) | 2400* | 1531.25 ± 411.14 | -868.75 | 63.80 | 1741.25 ± 501.23 | -658.75 | 72.55 | 0.83 [#] |

the sign shows the insignificance level of the value at p 0.05.

* ICMR (2007)

after the intervention period and slight difference was seen in mean weight of the respondents of group I as compared to group II after intervention in which there was high prevalence of grade II obesity *i.e.* 40 per cent and 48 per cent respondents were having BMI in the range of 30-40 in group I and group II (Table 3 and 4).

In biochemical assessment of the respondents, there was significant difference found in the fasting blood glucose level by 35.72 per cent and post-prandial blood glucose level by 50.18 per cent in group I and there was no significant difference found in the blood glucose level of the respondents in group II after intervention period (Table 5).

Clinical Symptoms:

In clinical assessment there was significant difference seen in clinical symptoms namely polydipsia, polyuria, polyphagia, night sweats, dry mouth, severely high blood glucose level, eye complaints, severely low blood sugar level and constipation in group I and there was no significant difference found in all the symptoms of group II after the intervention period (Table 6).

In dietary pattern, it was concluded that there was

no difference, found in mean nutrient intake (energy, protein, carbohydrate, fat, fibre, β-carotene) of group I and group II and insignificant difference was found in mean value of fibre and β-carotene of group I before and after intervention because mango leaves powder contain some amount of fibre and β-carotene (Table 7 and 8).

Conclusion:

The study concluded that consuming mango leaves powder has high content of antioxidants as tannins (Gallic acids) 15 per cent, moderate content of fibre 1.6 per cent and b-carotene 490 I.U. per 100 g of mango leaves powder and had a significant hypoglycemic effect with reduction in fasting blood glucose level by 35.72 per cent and 50.18 per cent in post-prandial blood glucose level and weight by 10 per cent, difference seen in nutrient intake with increase in fibre intake by 14.26 per cent and increase in β-carotene by 8.75 per cent and significant difference was found in relief of clinical symptoms like polyuria, polyphagia, polydipsia, night sweats, dry mouth, severely high blood glucose level, severely low blood glucose level and constipation in group I and relief in dry mouth and severely high blood glucose level in group II.

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