



## EFFECT OF SUPPLEMENTATION OF BITTER GOURD JUICE ON BLOOD GLUCOSE LEVEL OF TYPE 2 DIABETICS

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### ABSTRACT

A study was conducted to see the effect of bitter gourd juice on blood glucose level of type 2 sedentary diabetics (N=20, twelve females & eight males) with mean age  $53 \pm 5.72$  yrs for females &  $59.75 \pm 3.20$  yrs for males. Freshly extracted concentrated whole bitter gourd juice (75 g) was supplemented daily for 90 days in the morning. A significant reduction in mean fasting & post meal blood glucose levels by 22.40 & 42.0 mg/dl in females & 29.0 & 41.93 mg/dl in males was observed indicating positive impact of the supplementation. A post experimental decrease of 1.76 & 0.99 % in glycosylated hemoglobin level (HbA<sub>1c</sub>) was noticed for females & males, respectively. For both genders, there was post experimental decrease in weight, body mass index (BMI) & waist to hip ratio (WHR). Mean daily energy intake of subjects was found to be ranged between 2325-2580 kcal. Excess consumption of energy, protein & fat was noticed among both genders as compared to recommended dietary allowances. Post experimental increment in mean daily fiber intake of subjects was noticed. It is concluded that supplementation of bitter gourd juice for a period of 90 days brought about significant reduction in fasting & post meal blood glucose levels in type 2 diabetics.

**Keywords:** bitter gourd, type 2 diabetes, fasting blood glucose, body mass index.

### INTRODUCTION:

Diabetes mellitus is a group of disease characterized by high blood glucose concentrations resulting from the defects in insulin secretion, insulin action, or both. It is characterized by high blood sugar level (hyperglycemia) and high level of sugar in urine (glycosuria) (Khanna, 1997). Diabetes prevalence in India indicates that the epidemic is progressing rapidly across the nation. Near about 65 million people live with diabetes in India & near about 80 million people are on the threshold with pre-diabetes (Kochhar, 2008).





Diet is a primary therapy for non insulin dependent diabetes mellitus and is important adjective treatment in insulin dependent diabetes mellitus. Fortunately, traditional diets in many parts of the world are well adapted to the current concepts of non insulin dependent diabetes (NIDDM) management - a diet low in fat and high in complex carbohydrates is effective. Simple dietary advice for diabetic patients only include the avoidance of sugar and sugary foods, regular meals, small snacks between the meals and half of the usual portions of the local staple carbohydrate food for overweight patients not on insulin. However, no general suggestions have been made for the consumption of specific food with hypoglycemic properties (Gill et al., 1997).

Among several home remedies that have proven beneficial in controlling diabetes, perhaps the most important is the use of bitter gourd. It has lastly been established that bitter gourd contains a hypoglycemic effect or insulin like principle designated as “plant insulin” which has been found valuable in lowering blood and urine sugar levels (Bakhru, 2000). Bitter gourd is used medicinally mainly for the treatment for the type 2 diabetes mellitus.

Bitter gourd is naturally rich in beneficial phytochemicals; the various known therapeutic properties of compounds in the bitter gourd include antibiotic, antimutagenic, antioxidant, antiviral, antidiabetic, and immune-enhancing properties, among many others. There are three groups of compounds in bitter gourd on that scientists have found to be responsible for its blood sugar lowering action: **Charantin:** a compound of mixed steroids that has been found to be more effective than one oral hypoglycemic drug, tolbutamide. **Polypeptide P:** An insulin-like polypeptide which appears to lower blood sugar in diabetics. **Oleanolic Acid Glycosides:** These compounds have been found to improve glucose tolerance in diabetics by preventing the absorption of sugar from the intestines. Bitter gourd has also been linked to effects of increasing the





number of beta cells in the pancreas as well, and as a result improving the body's capability to produce insulin ([www.bittermelon.org](http://www.bittermelon.org)). The characteristic bitter flavor of bitter melon is due to some extent to a group of compounds called cucurbitacins. Bitter melon demonstrates significant blood sugar control after food intake and overall blood-sugar lowering effects. The extract of bitter melon produces a 10-15 percent reduction in glycosylated hemoglobin A<sub>1</sub>C (an indicator of average blood sugar levels over time) after 7 weeks of use. Bitter melon boosts insulin secretion, improves the ability of cells to absorb glucose and hinders the release of glucose from the liver (Khanna et al., 1999).

Despite considerable progress in the management of diabetes mellitus by medicines, the search for natural antidiabetic agent is still going on. Present research is an attempt to see the effect of supplementation of bitter melon juice on blood glucose level of type 2 diabetics.

#### **MATERIALS AND METHODS:**

**Sample Population:** A total of twenty (N=20, females-12 & males-8) type 2 diabetics (sedentary) free from serious complications were purposively selected from Nagpur city, Maharashtra. Subjects were from age group 50-60 yrs with mean age of females & males as  $53 \pm 5.72$  &  $59.75 \pm 3.20$  yrs, respectively. Duration of diabetes was found to be ranged between 5-18 years. Inclusion criteria for subjects included fasting blood glucose level  $\geq 120$  mg/dl, post meal blood glucose level  $\geq 180$  mg/dl & glycosylated hemoglobin level (HbA<sub>1</sub>C) greater than 7%. Subjects were followed for a period of one month & no treatment was given during this period except the medicine prescribed by the doctor & this period was treated as self control i.e. pre experimental. Blood samples were analyzed after one month's period. All subjects were instructed to maintain their pre-existing oral hypoglycemic treatment and dietary patterns.





**Supplementation of Bitter Gourd Juice:** Freshly extracted 75 g of concentrated bitter gourd juice was given daily (between 8.30-9.00 am) to each subject for a period of 90 days. Juice was given to each subject before taking breakfast.

**Pathological Analysis of Blood:** Before (pre experimental) & after (post experimental) feeding trial, fasting blood glucose, post meal blood glucose & glycosylated hemoglobin (HbA<sub>1c</sub>) levels of subjects were determined.

**Anthropometric Measurements:** Pre & post experimentally, anthropometric measurements of subjects like height, weight, waist & hip circumferences were recorded. Body mass index (BMI) & waist hip ratio (WHR) were also calculated. BMI classification given by WHO (WHO, 2011 & Bamji et al., 2005) was used to see the subject's category.

**Dietary Information & Nutrient Intake:** Daily food intake data of each subject was recorded. This was done for consecutive seven days. Intake of macro nutrient, energy & total dietary fiber (TDF) was calculated based on seven day's dietary recall (Gopalan et al., 2012).

**Statistical Analysis:** Data was tabulated & mean, range, standard deviation & percentage values were derived. Comparisons were done using student's 't' test & correlated 't' test. A level of significance at both 5 % & 1 % levels was used to test the significance.

## **RESULTS AND DISCUSSION:**

Table I shows effect of supplementation of bitter gourd juice on fasting & post meal blood glucose levels & glycosylated hemoglobin % of subjects.







**Table I: Data on Blood Glucose & Glycosylated Hemoglobin Levels of Subjects (Pre and Post Experimental)**

Parameters	Females (n = 12)		Males (n = 8)	
	M±SD	t Value	M±SD	t Value
<b>Fasting Blood Glucose (mg/dl)</b>				
Pre Experimental	<b>168.60±35.88</b>	6.65†	<b>174.80±33.22</b>	8.79†
Post Experimental	<b>146.20±41.12</b>		<b>145.80±35.34</b>	
<b>Post Meal Blood Glucose (mg/dl)</b>				
Pre Experimental	<b>261.80±22.79</b>	7.51†	<b>275.50±32.10</b>	8.65†
Post Experimental	<b>219.80±30.99</b>		<b>233.57±25.88</b>	
<b>HbA<sub>1c</sub> (%)</b>				
Pre Experimental	<b>10.31±0.77</b>	4.56†	<b>9.29±1.86</b>	3.99†
Post Experimental	<b>8.55±1.22</b>		<b>8.30±1.50</b>	

† - significant difference at both 5% and 1% levels (p<0.01)

‡ - significant difference at 5% but insignificant at 1% level (0.01<p<0.05)

Values without any mark show insignificant difference at both 5% and 1% levels (p>0.05)

The pre experimental mean fasting & post meal blood glucose levels were 168.60 & 261.80 mg/dl in females and 174.8 & 275.5 mg/dl in males. Overall, males exhibited higher levels of fasting & post meal blood glucose as compared to females, pre & post experimentally.

Significant reduction in post experimental fasting & post meal blood glucose levels was noticed in both the genders (t = 6.65-8.79, p<0.01). The mean reduction in the fasting blood glucose levels was recorded as 22.40 mg/dl in females & 29.0 mg/dl in males whereas the mean reduction in the post meal blood glucose levels was recorded as 42.0 mg/dl in females & 41.93 mg/dl in males indicating positive effect of supplementation of bitter gourd juice in lowering blood glucose level among non insulin dependent diabetics. Similar hypoglycemic effects of bitter gourd juice were reported among diabetics in earlier studies (Grover & Gupta, 1990 & Ahmad et al., 1999).

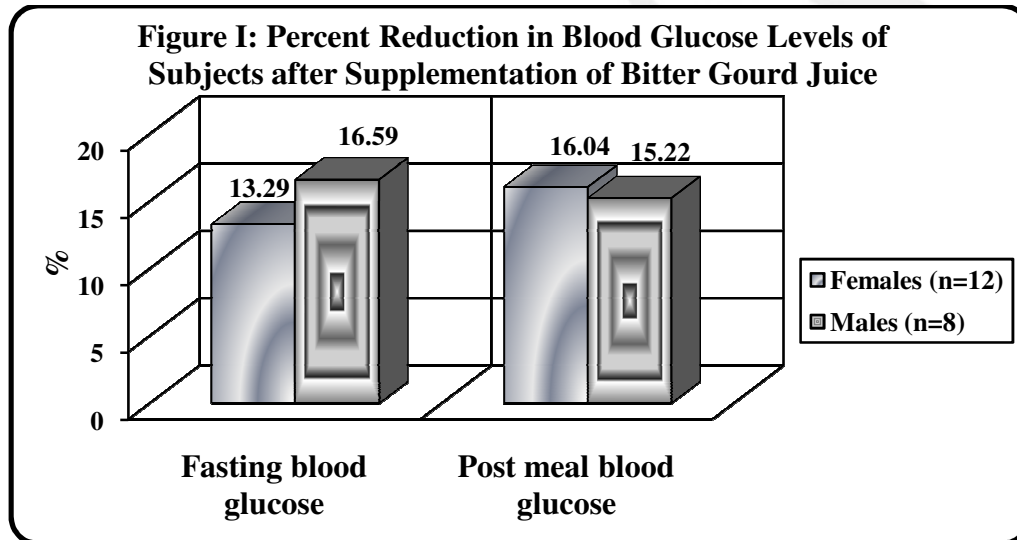
HbA<sub>1c</sub> is the record of glucose level over the preceding three months. Pre experimental mean values of HbA<sub>1c</sub> were above 9% (Table I). Post experimental reduction in mean glycosylated hemoglobin level of





subjects was noticed. At the end of supplementation, there was a significant reduction of HbA<sub>1c</sub> in both the genders (t = 4.56 in females & 3.99 in males, p<0.01).

Figure I shows percent reduction in blood glucose levels after supplementation of bitter gourd juice.



Among male diabetics, % reduction in fasting blood glucose level was more (16.04%) as compared to females (13.29%). Percent reduction in post meal blood glucose levels of females & males was 16.59 & 15.22, respectively.

Data on selected anthropometric indices of subjects is presented in Table II.





**Table II: Anthropometric Indices of Subjects (Pre and Post Experimental)**

Parameters	Females (n = 12)		Males (n = 8)	
	M±SD	t Value	M±SD	t Value
<b>Height (cm)</b>	<b>157±5.55</b>	-	<b>169±4.221</b>	-
<b>Weight (kg)</b>				
Pre Experimental	<b>66±11.91</b>	3.53†	<b>73±5.37</b>	4.54†
Post Experimental	<b>63±8.75</b>		<b>70±5.94</b>	
<b>BMI (kg/m<sup>2</sup>)</b>				
Pre Experimental	<b>26.72±5.24</b>	2.76¶	<b>25.53±2.34</b>	2.19¶
Post Experimental	<b>25.51±5.41</b>		<b>24.48±2.34</b>	
<b>Waist Circumference (cm)</b>				
Pre Experimental	<b>35±2.09</b>	2.11¶	<b>35.5±3.00</b>	2.40¶
Post Experimental	<b>34.5±2.09</b>		<b>35±3.00</b>	
<b>Hip Circumference (cm)</b>				
Pre Experimental	<b>39.5±2.25</b>	1.68	<b>40.5±4.79</b>	1.10
Post Experimental	<b>39±2.25</b>		<b>40±4.79</b>	
<b>Waist Hip Ratio</b>				
Pre Experimental	<b>0.89±0.054</b>	1.35	<b>0.88±0.05</b>	1.11
Post Experimental	<b>0.88±0.054</b>		<b>0.87±0.9</b>	

† - significant difference at both 5% and 1% levels (p<0.01)

¶ - significant difference at 5% but insignificant at 1% level (0.01<p<0.05)

Values without any mark show insignificant difference at both 5% and 1% levels (p>0.05)

The data clearly indicates that the body weights of female & males diabetics were 66 & 73 kg, respectively which were significantly reduced to 63 & 70 kg (p<0.01). Similarly, there was a reduction in BMI of subjects after supplementation of bitter gourd juice. BMI of females was reduced from 26.72 to 25.51 kg/m<sup>2</sup> while it reduced from 25.53 to 24.48 kg/m<sup>2</sup> in males. Pre & post experimentally, 66.66% females fell in the category of obesity grade I whereas 75% males fell in the category of obesity grade I.

The mean pre experimental WHR was 0.89 & 0.88 in females & males, respectively which decreased to 0.88 in females & 0.87 in males. The differences were found insignificant (p>0.05).





Data on daily mean intake of energy & energy giving nutrients by subjects is demonstrated in Table III.

**Table III: Data on Daily Nutrient Intake of Subjects (Pre and Post Experimental)**

Parameters	Females (n = 12)			Males (n = 8)		
	M±SD	't' Value	RDA*	M±SD	t Value	RDA*
<b>Energy (kcal)</b>						
Pre Experimental	2545±345	<b>0.90</b>	<b>1875</b>	2580±400	<b>1.11</b>	<b>2425</b>
Post Experimental	2374±235			2325±320		
<b>Carbohydrate (g)</b>						
Pre Experimental	482.99±65.95	<b>1.05</b>	-	408.81±58.90	<b>0.22</b>	-
Post Experimental	467.72±53.89			412.34±60.77		
<b>Protein (g)</b>						
Pre Experimental	55.50±5.89	<b>1.00</b>	<b>50</b>	67.35±3.10	<b>1.32</b>	<b>60</b>
Post Experimental	53.25±1.58			65.69±5.56		
<b>Fat (g)</b>						
Pre Experimental	43.45±5.48	<b>0.56</b>	<b>20</b>	48.86±6.10	<b>0.96</b>	<b>20</b>
Post Experimental	42.25±2.22			45.67±6.54		
<b>Total Dietary Fiber (g)</b>						
Pre Experimental	14.15±4.59	<b>1.33</b>	<b>25</b>	12.50±2.90	<b>1.11</b>	<b>25</b>
Post Experimental	18.65±3.50			15.80±8.10		

† - significant difference at both 5% and 1% levels (p<0.01)

¶ - significant difference at 5% but insignificant at 1% level (0.01<p<0.05)

Values without any mark show insignificant difference at both 5% and 1% levels (p>0.05)

\* RDA (Recommended Dietary Allowances)ICMR/NIN, 2010.

The mean nutrient intake of the diabetic subjects compared with the RDA showed that there was an excess intake of energy, protein & fat but deficient intake of dietary fiber. However, after supplementation of bitter gourd juice, the intake of energy, carbohydrate, protein & fat was reduced (p>0.05) & intake of fiber was increased (p>0.05) (Table III). Mean daily intake of carbohydrate was found to be more than 400 g in both genders.







## **CONCLUSION:**

The present study confirmed that consumption of bitter gourd juice is effective in reducing blood glucose & glycosylated hemoglobin levels in type II diabetics. The effect can be more prominent when supplemented for a longer period of time. Bitter gourd juice supplementation is also effective measure to bring favorable improvement of health of subjects in terms of weight & BMI reduction.

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