



RESEARCH ARTICLE

CONSUMPTION PATTERN OF BITTER GOURD (*Momordica charantia* L.) AMONG TYPE II
DIABETICS

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ABSTRACT

India is considered as the diabetes capital of the world with 41 million Indians having diabetes. Socioeconomic environment influences occupation, lifestyle, and nutrition of social classes which in turn would influence the prevalence and profile of glucose intolerance and diabetic complications. Even today, about 80 per cent of the population in developing countries depends on traditional medicine, Bitter Melon is one of the traditional medicine which is a good source of phenolic compounds. It is evidenced reported that only 58.7 per cent of the subjects generally believed that bittergourd is good for health, 27.3 per cent reported bittergourd decreases the sugar level and a few (5.3 5) members informed that it reduces the stomach infection.

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INTRODUCTION

The global prevalence of diabetes is estimated to increase, from 4 per cent in 1995 to 5.4 per cent by the year 2025. India is considered as the diabetes capital of the world with 41 million Indians having diabetes. Every fifth diabetic in the world is an Indian (Joshi and Parikh, 2007). Epidemiological studies conducted in India, showed that not only the prevalence was high in urban India but it was also increasing (Ramachandran, 2007) (Mohan *et al.*, 2003). Socioeconomic environment influences occupation, lifestyle, and nutrition of social classes which in turn would influence the prevalence and profile of glucose intolerance and diabetic complications (Smith *et al.*, 2011). Even today, about 80 per cent of the population in developing countries depends on traditional medicine, Bitter Melon is one of the traditional medicine which is a good source of phenolic compounds. Therefore, these natural plant phenolics can be a good source of biologically active compounds that may be applied in many food systems to enhance food values and special nutritional qualities. However studies are needed using more genetically diverse varieties to pin point the bioactive and functional compounds and their physiological properties (Islam, *et al.*, 2011).

A wider spectrum of assessing the usage pattern of bitter gourd is the essential primary step to proceed with the laboratory and clinical trials. Hence the present study was undertaken with the following objectives.

- Elicit data on demographic profile, lifestyle pattern, personal and family history of diabetic subjects
- Obtain details on consumption of bitter gourd among diabetics
- Find out the awareness and usage of bitter gourd among selected health workers

MATERIALS AND METHODS

A group of 150 diabetics, both male and female above the age of 25 years diagnosed clinically and biochemically to have diabetes mellitus were selected for the present study from diabetic clinics in around Coimbatore District, Tamil Nadu. Information regarding the socio-demographic and dietary profile of the selected subjects were collected through administering interview method by a pre-tested questionnaire. The relevant data on family and personal diabetic history of the subjects were recorded. Awareness about the control and management of diabetes, consumption of functional foods like bitter gourd and other vegetables was noted. Anthropometric measurements namely height and weight were recorded and BMI was calculated for all the subjects. Pre, post prandial blood glucose levels and glycosylated haemoglobin levels at the time of personal interview were noted from the medical reports of the 150 diabetics.

RESULTS AND DISCUSSION

Socio Economic Status

Socio-economic status and its constituent elements are accepted as being determinants of health. Certain risk factors implicated in the development of diabetes are also known to be associated with socioeconomic status. The socio economic factors like age, gender, marital state, occupation and education of the 150 diabetic subjects are given in (Smith, *et al.*, 2011) Table 1.

Type 2 diabetes is associated with older age and an important risk factor for diabetes. From the Table it is apparent that out of 150 subjects surveyed, majority (62.7 %) were female followed by male (37.3 %). The prevalence of diabetes was at higher range (35.3 %) in the age group of 51- 60 years and it is almost same (34.7 %) among above 60 years old. The data indicates that after 40 years people

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Table 1. Socio Economic Details of the Diabetic Subjects

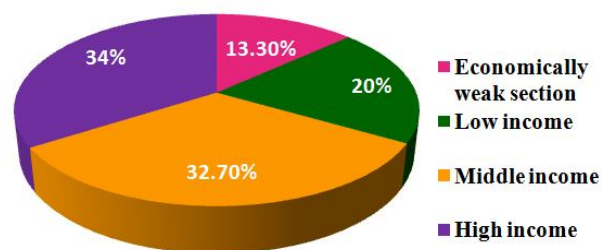
Socio Economic Details	Male		Female		Total	
	Number	Per cent	Number	Per cent	Number	Per cent
Age(Years)						
30-40	4	7.1	5	45.4	9	6.0
41-50	19	33.9	17	18.1	36	24.0
51-60	15	26.8	38	40.4	53	35.3
>60	18	32.2	34	36.1	52	34.7
Marital status						
Single	3	5.4	3	3.2	6	4.0
Married	52	92.8	56	59.6	108	72
Separated/divorced	1	1.8	3	3.2	4	2.7
Widowed	0	0.0	32	34.0	32	21.3
Occupation						
Non farm labour/Daily wage	10	17.9	4	4.3	14	9.4
Business	12	21.4	1	1.1	13	8.7
Government employee	7	12.5	7	7.4	14	9.3
Private employee	10	17.9	2	2.1	12	8.0
Artisan/ Carpenter	2	2.6	0	0.0	2	1.4
Housewife	0	0.0	67	71.3	67	44.7
Retired	15	26.8	13	13.8	28	18.7
Education						
No formal education	1	1.8	10	10.6	11	7.4
Few years primary	2	3.6	7	7.4	9	6.0
Completed primary	8	14.3	15	16.0	23	15.3
Few years secondary	6	10.7	9	9.6	15	10.0
Completed secondary	14	25.0	28	29.8	42	28.0
High school	3	5.4	6	6.4	9	6.0
College/Graduate	19	33.9	17	18.1	36	24.0
Professional	3	5.4	2	2.1	5	3.3

start catching diabetes and the maximum occurrence taken place at 50-60 years and thereafter. Among the selected diabetics majority of the male (92.9 %) and among the female 59.6 per cent married and 34 per cent were widowed. The data reflect that with regard to occupation majority of the male were retired (26.8 %) followed by business sector (21.4 %) and majority of the female were housewives (71.3 %). Among the surveyed diabetics, female diabetics were educated compared to male diabetics and 28 per cent had completed secondary level. In the present study it can be noted that 33.9 per cent of male and 18.1 per cent female were graduates and only 7.3 per cent were illiterates.

Religion

Among the 150 selected diabetic subjects, 83.9 and 88.3 per cent of male and female belonged to Hinduism while 14.3 and 8.5 per cent of the male and female were Christians and only a minimum of 1.8 and 3.2 per cent of the male and female followed Islamic religion.

countries occurs in the higher socio-economic groups and this is also true for the Indian population. The research conducted by Boddula *et al.*, (2008) on 1,112 affluent adult Indian subjects found the prevalence of Type 2 diabetes to be 21.1 per cent the highest prevalence of Type 2 diabetes reported from within India to date.

**Fig.1. Income level of the diabetic subjects****Table 2. Mean Anthropometric Measurements of the Diabetics**

Anthropometric measurements	Male			Fe male		
	Reference value *	Mean \pm SD	Excess/ Deficit	Reference value *	Mean \pm SD	Excess/ Deficit
Height (cm)	173	165.1 \pm 10.	- 7.9	161	153.9 \pm 7.7	-7.1
Weight (Kg)	60	70.09 \pm 10.9	+ 10.1	55	64.60 \pm 11.5	+9.6
BMI	20.3	25.84 \pm 4.3	+ 5.5	21.2	27.34 \pm 5.1	+6.1

* (ICMR 2010) (Nerurkar *et al.*, 2010).

Income levels

The income levels of the diabetics is depicted in Figure 1. The prevalence of diabetes, appears directly related to urbanization, rise in income levels and consequent change in lifestyle. The total prevalence was found to be highest in Chandigarh at 13.6 per cent of the population, and both urban and rural prevalence rates were found to be high, at 14.2 and 8.3 per cent respectively. Tamil Nadu was second in total prevalence with 10.4 per cent of the population suffering from it (Pallavi, 2011). Diabetes has been generally considered a disease of the rich and affluent. This study was also in par with the above study. About 34 per cent of the diabetics belongs to high income group followed by 31.7 per cent in middle income and only 20 per cent of the diabetics were in economically weak section. The highest prevalence of Type 2 diabetes in developing

Mean Weight, Height and BMI

Table 2. reveals the mean weight, height and BMI of the selected diabetics

It is clear that overweight was predominant among the diabetic subjects. The mean height of the diabetic male and female were lower than the reference value by 7.9 and 7.1 cm respectively. The mean weight of the diabetic male and female were 70.09 and 64.6 kg which were well above to the standard reference weight as recommended by the ICMR (2010) conforming even modest changes in weight was associated with substantial increase in diabetes risk (Boddula *et al.*, 2008). Mean Body Mass Index determined for the diabetic male and female were 25.84 and 27.34 respectively which shows that they were in preobese category which is also associated

with increased risk of diabetes. Mean BMI value of the selected female diabetics was greater than that of male.

Classification of Diabetics According to BMI

BMI of the selected subjects computed were classified according to WHO (2004) classification and presented in Figure 2.

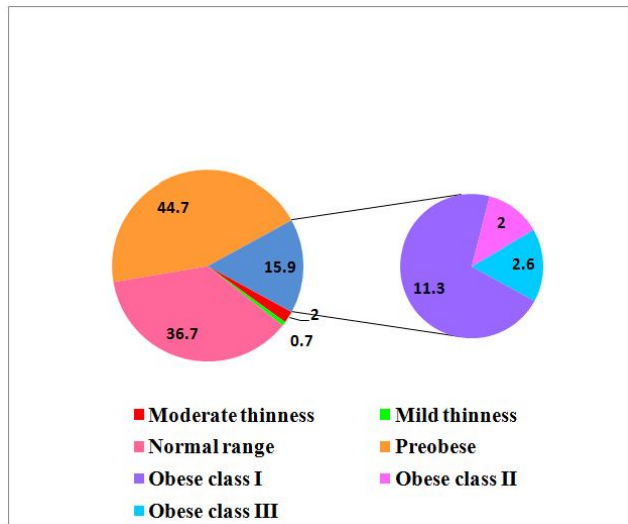


Fig. 2. Classification of Diabetics According to BMI

An increase in body fat is generally associated with an increase in risk of metabolic diseases such as type 2 diabetes mellitus (WHO, 2007) (Banerjee *et al.*, 2004). The above Table revealed that higher per cent (44.7) of the diabetics were in pre obese class. Individuals in the upper normal-weight and slightly overweight BMI range have a relatively high prevalence and are at increased risk of having the metabolic syndrome. Therefore, screening in individuals with normal or slightly elevated BMI is important in the prevention of diabetes and cardiovascular disease (WHO, 2012). About 36.7 per cent of the diabetics were in the normal range, whereas 11.3 per cent were in grade I obesity. Only minimum (2 and 0.7 %) per cent of the diabetics were in the underweight category of moderate and mild thinness.

Mean Biochemical Parameters

Table 3. Depicts the mean biochemical parameters of the selected diabetics

Table 3. Mean Biochemical Parameters of the Diabetics

Bio chemical parameters (mg/dl)	Reference value *	Male Mean \pm SD	Female Mean \pm SD
Fasting blood sugar level	≥ 126	133.26 \pm 50.42	143.53 \pm 54.49
Post prandial blood sugar level	≥ 200	220.60 \pm 82.69	220.24 \pm 79.69
HbA1c (%)	≥ 6.5	8.12 \pm 1.84	8.56 \pm 1.79

*NDEP,2011

Elevated blood glucose at all times was the commonest finding in type 2 diabetic patients. The observed patterns of mean fasting blood glucose in 94 female diabetics were especially higher (143.53 mg/dl) than 54 male diabetics (133.26) which was well above than the reference value. It is increasingly recognized that postprandial hyperglycemia is an important component of the overall glycemic burden, though there is as yet a paucity of data showing that lowering of postprandial plasma glucose (PPG) reduces risk of T2DM complications (St-Onge *et al.*, 2004). The mean post prandial levels of the male and female subjects were 220.60 and 220.24 mg/dl. HbA1c values reflect overall glycemic exposure over the past 2-3 months and are determined by both fasting (FPG) and postprandial plasma glucose (PPG) levels (Blevins, 2011). Among the 150 surveyed diabetics the mean HbA1c levels were 8.56 per cent for female subjects and 8.12 per cent for the male subjects respectively.

The data collected revealed that 43 subjects were in the fair control category (7-8 % of HbA_{1c}) followed by 40 diabetic subjects in the unsatisfactory control (8-10 %) and 31 subjects were in the poor control category (>10 %) of HbA_{1c} levels. About 36 subjects had good control over their HbA_{1c} level less than <5.6 per cent.

Frequency of Visit to Clinics by the Subjects

Frequency of visit to clinics by the selected subjects is given in Table 4.

Table 4. Frequency of Visit to Clinics

Frequency	Number	Per cent
Weekly	0	0
Monthly	71	47.3
More than six times a year	55	36.7
Two to six times a year	15	10
Once a year	6	4
Less than once a year	3	2
Total	150	100

The above Table reveals that the majority (47.3%) of the selected diabetics were health conscious and knew the importance of visiting the clinics regularly and visiting the clinics once in a month. Around 36.7 per cent of the selected subjects were visiting the hospitals more than six times a year. Only a minimum of 2 and 4 per cent of the diabetics were going to the hospitals occasionally and once in a year. None of the diabetics visited the doctor every week because they got their own glucometer to monitor the blood glucose levels and that was considered less expensive.

Table 5. Mean Monthly Medical Expenditure of the subjects

Expenditure details ***	Male N=56	Female N=94
Mean monthly income	18,780	12,843
Diabetes medicine	1,020	1,008
Doctor visits	229	230
Blood analysis	258	296
Mean expenditure total	1507	1534
Proportion of income spent (%)	8.02	11.94

Mean Monthly Medical Expenditure of the Subjects

Table 6. Presents the mean monthly medical expenditure of the subjects studied.

The above Table highlights that the mean monthly income of the male and female subjects were Rs. 18,780 and Rs.12,843 respectively. The mean expenditure incurred by the male and female diabetes were Rs. 1507 and Rs. 1534 respectively. About 11.94 per cent and 8.02 per cent of the income was spent towards hypoglycemic drugs, doctors fee and blood analysis by the female and male subjects respectively. Diabetes being a life-long disorder is an expensive ailment for a very large proportion of subjects in developing societies. In India the money spent was from the family's financial resources. Although the amount spent by the upper and the lower class persons were similar, the per centage of the income spent was higher among the latter, due to their lower earning (Mohan, *et al.*, 2003).

Life style, Eating habits and Physical activity

Majority (70.7 %) of the type II diabetics opined that the way of their living affected their blood glucose level. A higher per centage (81.3) of the subjects stated that the eating habit and physical activity play a major role in maintaining the blood glucose level. The same percentage of the subjects changed their physical activity and 88 per cent of the subjects followed inclusion of fiber rich foods and exclusion of roots and tubers after the diagnosis of diabetes as they were aware of the principles of the diabetic diet advocated by doctors and dietitians. Twenty and 14 per cent of the subjects had no knowledge about the eating habits and physical activity in relation to blood glucose respectively. This might be due in part to a lack of specificity in advice, possibly arising from a lack of detailed knowledge concerning the foods and physical activity, eating habits and beliefs of these subjects. Proper education and awareness programmes have previously been shown to change the attitude of the public regarding diabetes (Woerle *et al.*, 2007)

Details on Bitter gourd Consumption

About 137 diabetic subjects had the awareness on the health effect of bittergourd

Health Benefits of Bitter Gourd

Table 6. Shows the health benefit of bitter gourd as considered by the diabetics. Bitter melon has been used in various Asian traditional medicine systems for a long time. It is evidenced from the Table that 58.7 per cent of the subjects generally believed that bitter gourd is good for health, 27.3 per cent reported bitter gourd decreases the sugar level and a few (5.3 5) members informed that it reduces the stomach infection. In Ayurveda, the fruit is considered as tonic, stomachic, stimulant, emetic, antibilous, laxative and alterative (Sathish Kumar *et al.*, 2010).

Table 6. Health Benefits of Bittergourd

Health benefits	Number	Per cent
Good for health	88	58.7
Blood sugar level decrease	41	27.3
Reduce stomach infection	8	5.3
Do not know	13	8.7
Total	150	100

Frequency and Quantity of Bitter gourd Consumption

One hundred and forty four subjects consuming bitter gourd and 97 subjects remove seeds before cooking and 44 subjects consuming bitter gourd with seeds. Frequency and quantity of bitter gourd consumption is presented in Table 7.

Table 7. Frequency and Quantity of Bittergourd Consumption N=150

Frequency	Quantitying					
	< 100		100-200		> 200	
	Number	Per cent	Number	Per cent		
Daily	5	3.3	0	0	Nil	
More times a week	23	15.3	7	4.7	Nil	
Once a week	55	36.7	14	9.3	Nil	
Once a month	28	18.7	2	1.3	Nil	
Occasionally	10	6.7	0	0	Nil	

Table 8. Form and Frequency of Bitter gourd Consumption

Mode of preparation	Daily	2-3 times in a week	Once in a week	Once in a month	Occasionally	Total
Raw - salad	0	0	0	1	0	1
Tea/Soup	0	0	1	0	0	1
Juice	1	5	6	1	1	14
Boiled/Cooked	0	4	7	2	0	13
Stewed	2	1	0	0	9	12
Gravy	2	26	56	26	0	110
Deep fat fried	0	0	5	3	2	10
Shallow fat fried	2	17	39	14	0	72

Out of 150 diabetic subjects, 36.7 and 9.3 per cent were consuming bitter gourd once in a week with the quantity of less than 100g and 100-200g respectively followed by 18.7 and 1.3 per cent of the diabetics consuming less than 100g and 100-200g of bitter gourd once in month. About 6.7 per cent of diabetics consumed less than 100g bitter gourd occasionally. Only a negligible number (5) of subjects of consumed bitter gourd on daily basis.

Form and Frequency of Bitter Gourd Consumption

Table 8. Gives the details concerning the form and frequency of bitter gourd consumption

Folk wisdom has it that bitter melon helps to prevent or counteract type-II diabetes. Oral administration of fresh fruit juice (dose, 6 c.c. /kg. body wt.) lowered the blood sugar level in normal and alloxan-diabetic rabbits (Sathish Kumar *et al.*, 2010) Bitter melon juice is a potent inhibitor of lipogenesis and stimulator of lipolysis activity in human adipocytes and prove to be an effective complementary or alternative therapy to reduce adipogenesis in human (Sathishsekar and Subramanian, 2005). Majority of the diabetics consumed bitter gourd as curry form once in a week (56 subjects) followed by 26 subjects consuming two to three times per week and once in month. Shallow fat frying is the next popular method of cooking among diabetics, 39 subjects consumed once in a week and 17 and 14 subjects had two to three times per week and once in month respectively. Bitter gourd was consumed as fresh juice by only five and six subjects, two to three times in a week and once in a week and only one subject consume juice daily, once in a month and occasionally. Five, three and two subjects consumed deep fat fried bitter gourd in the form of chips once in a week, once in a month and occasionally respectively.

Purchase of Bitter Gourd

It is welcoming to note that among the selected diabetics 57.3 per cent procured bitter gourd freshly from the daily market. Around 38 per cent of the diabetics purchased from street vendors because it is easily available at door steps. Only 2 per cent of the diabetics had bitter gourd creeper in their own garden and cultivated the fruits.

Treatment Done for the Bitter Gourd before Cooking

As majority of the subjects prepared curry with tamarind no pre cookery was treatment done by the subjects. Few of the diabetics (5.3 and 6.7 %) soaked the cut bitter gourd bits in tamarind juice and salt water before cooking to remove bitterness. Only one member soak the bitter gourd after cutting in rice washed water and one subject left out the bits exposing to atmosphere for some time to remove bitterness.

Conclusion

The present study reveals that 10 % of the monthly income is spent towards diabetes medicine, doctor's visit and blood testing. Majority of the diabetics consumed bitter gourd in curry form ie. less than 100 g per week. This shows that the subjects were not aware about the frequent usage and method of preparation of bitter gourd as a remedy for diabetes. Further studies are needed to create awareness, identify the active components in bitter gourd and their mechanism in controlling diabetes.

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