SUMMARY AND CONCLUSIONS
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Diabetes is the single most important metabolic disease and is, widely recognized as one of the leading cause of death and disability worldwide (Zimmet et al, 1999). The increase in the prevalence of diabetes is related to lifestyle and rapid socioeconomic changes (King and Rewers, 1991). Diabetes causes profound alterations in both the micro and macro vascular system affecting nearly every organ in the body. It magnifies the risk of vascular diseases several fold and is thus one of the major cause of morbidity and mortality worldwide (Huxley et al, 2006).

Different approaches have been used to reduce the incidence rate of the disease and to cure diabetes. The most popular approaches are the drug therapy, dietary therapy and recently the spices and the natural products therapy. Drug therapy is the most common approach but is costly and has side effects. The dietary therapy is most natural, economical and more feasible and often used in combination with drug to reduce the damage and to manage the condition. Proper dietary intake can reduce the incidence of the disease and can even decrease the severity of existing cases. The food quality and diabetes mellitus has close association with each other.

It is well recognised that foods are the main sources of nutrients used to meet our nutritional needs. However foods, particularly of plant origin, contain a wide range of non nutrient phytochemicals that are elaborated by plants for their own defence and other biological functions. When man ingests these plant foods to meet his nutritional needs, he also ingests a wide variety of these phytochemicals (Rao, 2003).

Policies aimed at reducing the incidence of the disease have typically emphasised on the fat and carbohydrate consumption. Less attention has been given to other dietary risk factors, specifically consumption of fruits and vegetables. Researchers have shown that at all stages of lifecycle, it is entirely possible to obtain all necessary nutrients from a vegetarian diet which should include satisfactory quantities of a variety of grains, vegetables, legumes, fruits, nuts and seeds (Lea and Worsely, 2003). Fruits and
vegetables contain many beneficial nutrients and phytochemicals that protect against cardiovascular diseases and diabetes (Liu et al, 2004).

A number of medicinal/culinary herbs have been reported to yield hypoglycaemic effects in subjects with diabetes. Botanical products can improve glucose metabolism and overall condition of persons with diabetes not only by hypoglycaemic effect but also by improving lipid metabolism, antioxidant status, and capillary function (Broadhurst, 1997).

Randomised clinical trials have demonstrated that diabetes can be prevented through lifestyle modifications. Lifestyle modifications, inclusive of dietary modification, regular physical activity and weight reduction are indicated for prevention of diabetes.

Education continues to be a key component in the prevention and treatment of diabetes. Diabetes education empowers people with diabetes by encouraging them to take responsibility for their health and enabling them to manage their condition themselves. The primary role of the education is to enhance the patient’s understanding of diabetes and provide patient detailed training on the non pharmacologic interventions used in the management. More importantly, patient education is essential if patients are to make beneficial changes in lifestyle and to maintain these changes over time (Tough 1985, Rosenstock 1991).

Keeping this background in mind the present study was planned with the following objectives

1) To study the fruit and vegetable consumption pattern among the population of Vadodara city in three seasons i.e. summer, monsoon and winter,
2) To study the impact of phytochemical rich fruit supplement (Amla) in the management of T2DM,
3) To assess the knowledge of the T2DM patients regarding various aspects of diabetes mellitus and
4) To study the impact of interpersonal counselling on the knowledge and physiological indicators (blood sugar, glycated haemoglobin and lipid profile) of T2DM patients.

Keeping the above objectives in mind the study was carried out in four phases

Phase I: Fruit and vegetable consumption pattern among the population of Baroda.

Phase II: Impact of phytochemical rich fruit supplement (Amla) in the management of T2DM.

Phase III: Impact of NHE on the knowledge of T2DM patients regarding various aspects of diabetes mellitus.

Phase IV: Impact of interpersonal counselling on the physiological indicators (blood sugar, glycated haemoglobin and lipid profile) of T2DM patients

**Phase I: Fruit and vegetable consumption pattern among the population of Baroda**

For the study 100 families were enrolled randomly from the four zones of Baroda city. Information was elicited from all the members of the household (n=365). Information regarding their economic status, level of education, medical history and anthropometric measurements was collected using pre-tested structured questionnaire. Information on fruit and vegetable consumption pattern, quantity and frequency of fruits and vegetables consumed was collected from all the subjects residing in a family, in all the three seasons. The salient observations that emerged out of this phase are as follows-

**Background information**

- All the subjects were well educated, well employed and belonged to the high socio-economic group
The overall prevalence of overweight and obesity was 35% and 15.2% respectively.

Among children, 25.4% were overweight and 9% were obese.

Prevalence of CDD's such as hypertension (15%), diabetes (13.6%) and CVD (8.5%) was also high.

**Fruit Consumption Pattern**

- The population studied consumed a wide variety of fruits in all the three seasons of which, the commonly consumed were lemon, banana and apple.
- The mean intake of the fruits by the adults was approximately 100 g/week.
- The average quantity of fruit consumed by children was 19 g/day or 135 g/week. The fruit intake was better for children than adults.

**Vegetable Consumption Pattern**

- Irrespective of the season, potato, onion and tomato were the most consumed vegetables.
- The average mean intake of vegetables in the summer season was highest than the other two seasons.
- The average green leafy vegetable, roots and tubers and other vegetables consumption by the adults was 80 g/day, 126 g/day and 208 g/day respectively.
- The average green leafy vegetable, roots and tubers and other vegetables by children was 88 g/day, 98 g/day and 331 g/day respectively.

Thus, it can be concluded that as a wide variety of fruits and vegetables are consumed by population, strategies needs to be developed for increasing the fruit and vegetable, particularly green leafy vegetables consumption in the general population, as fruit and vegetable consumption is directly related to the health status of the community.
Phase II: Impact of phytochemical rich fruit supplement (Amla) in the management of T2 DM.

For the study, forty five stable non insulin dependent diabetes mellitus subjects were enrolled from the various clinics of Vadodara city and then the subjects were divided into two groups, control group (N=17) and experimental group (N=28). The baseline data was collected on general information, background information, clinical information, anthropometry and 24 hour dietary recall along with fasting blood sugar, lipid profile and glycated haemoglobin.

The control group received no supplementation whereas the experimental group was given one amla approximately (35 grams) for a period of sixty days.

The salient features of this phase is given below

Baseline profile of the diabetic subjects

- The subjects were middle aged and majority of them were overweight as indicated by their BMI.
- The waist circumference for both male and female subjects was higher than the normal cut off value.
- The statistical analysis of the clinical profile for the control and the experimental group revealed that the baseline characteristics were similar in both the groups.

Background Information

- The habit of the consumption of tobacco, smoking and alcohol were seen in relatively few subjects and were comparable between the control and the experimental group.
- In both the groups (control and experimental), most of the diabetic subjects were doing exercise in the form of regular walk
Medical History

- Hypertension was a predominant complication and was present in 47% and 46% of the diabetic subjects in the control and experimental group respectively.
- About 70.5% and 67.8% of the subjects were obese in the control and experimental group respectively.

Nutrient Intake

- The calorie intake of the subjects between the two groups was comparable. The mean calorie intake of both the groups was approximately 1780 K cal.
- The protein and carbohydrate intake for the two groups was comparable to the RDA suggested by ICMR (2004) and ADA (2007).
- The fat consumption was higher than that recommended for healthy normal adults (ICMR, 2004) and diabetics (ADA, 2007). The percent calories coming from fat ranged from 29% to 34%, which is more than the recommended allowance of ≤ 20%
- Overall it was observed that the diet was high in fat, low in fibre and iron and was comparable between control and experimental groups.

Impact of Amla supplementation on the carbohydrate metabolism of T2DM subjects

- Supplementation of amla led to a non significant decrease in the FBS values in the experimental group. This was not accompanied by any change in the GHb levels.
- No significant variation was seen in FBS and GHb levels with regard to gender.
- Amla supplementation led to a significant reduction (37.9%) in the blood sugar values in those individuals who had fasting blood sugar greater than 150mg/dl. However the fall in FBS was accompanied by a non significant fall in GHb (2.7%) indicating transient reduction in blood sugar values.
Impact of Amla supplementation on the lipid profile of T2DM subjects

- Supplementation with amla for sixty days brought a desired significant change in the lipid profile of the diabetic subjects.
- There was 5.7% decrease in the total cholesterol (TC) values (190 vs 179 mg/dl). The atherogenic lipoprotein LDL-C decreased by about 9.4%. The HDL-C increased by about 5.5%. Further there was an 8.3% decrease in the Non HDL-C values which represents a mixture of atherogenic lipoproteins. There was a slight non significant reduction in the triglyceride (TG) values (145 vs 140 mg/dl)
- Favourable responses were seen in diabetic subjects who had TC > 200 mg/dl as compared to those having TC< 200 mg/dl. There was a 10.4% fall in TC, 14% in LDL-C and 14.4% in Non HDL-C in subjects having TC > 200 mg/dl. Surprisingly in both the groups an increase in HDL-C was seen. The trends noticed in experimental group were not seen in the control group
- A 23.4% reduction was observed in TG in those diabetic subjects who had TG> 150 mg/dl (188mg/dl vs. 144 mg/ dl p< 0.001). Concomitantly in these subjects a significant reduction in VLDL-C (38 mg/dl vs. 28 mg/dl p< 0.001) and Non HDL-C (158 mg/dl vs 145 mg/dl p< 0.001) was also seen

Impact of Amla supplementation on the atherogenic indices of T2DM subjects

- The favourable redistribution of lipoproteins with amla supplementation had a significant positive impact on the atherogenic indices lowering the risk of CHD in the diabetic subjects
- It is important to note that TG/H which represents the small dense lipoproteins was significantly lowered in subjects having TG > 150 mg/dl after supplementation (5.5 vs 4.0 p< 0.001)

Impact of Amla supplementation on the FBS, GHb, lipid profile and atherogenic indices of T2DM subjects in relation to their initial BMI and in T2DM subjects with hypertension as a complication
• BMI did not have any influence on the FBS and GHb values of diabetic subjects in experimental and control group subjects. However with regard to the lipid profile favourable changes in the lipid profile and atherogenic indices of the experimental subjects were seen in overweight and obese subjects as compared to those who had BMI <23

• No change was observed in the FBS and GHb values of the hypertensive diabetic subjects

• The desired redistribution of the lipoproteins was more pronounced in the normotensive diabetics as compared to the hypertensive diabetics in the experimental group

• Atherogenic indices were significantly lowered in both normotensives and hypertensives after the amla supplementation

• Amla supplementation did not have any impact on the FBS and GHb values of diabetic subjects who were overweight and hypertensive. Further the lipid profile of the subjects did not vary significantly, implying that greater than two risk factors (hypertension and overweight or obesity) may not bring about the desired results.

The impact of amla supplementation on the lipid profile merits attention. It is encouraging that amla with its vitamin C, polyphenols and a mixture of phytochemicals can act as a hypolipidemic agent reducing the risk of cardiovascular complications in diabetics. Thus amla may be used as a supportive therapy for diabetics.

**Phase III: Impact of NHE on the knowledge of T2DM patients regarding various aspects of diabetes mellitus**

For the study 117 diabetic subjects were enrolled from the various clinics of Baroda city and their knowledge regarding the disease was ascertained using a pre tested questionnaire.

**Baseline Profile**

• The subjects were middle aged
- Their waist circumference were above the cut off values recommended by the IDF  
- The waist to hip ratio for both the males and the females was higher than the recommended values  
- The duration of the disease of the subjects ranged from 7 months to 32 years.

**Medical History**

- Around 55% of the diabetic patients had hypertension as a complication.  
- The prevalence of CHD was low i.e. 9%  
- About 25% of the subjects were categorized as overweight and 55% were obese by Asia Pacific Classification

**Assessment of knowledge of T2DM subjects**

- Approximately 47% of the subjects came to know about their disease by chance. Majority of them took allopathic treatment  
- A variety of causative factors were identified by the patients but the responses were poor in terms of percentages  
- The knowledge of the subjects on the complications was low. Around 47% of the subjects said that heart diseases are a common complication of diabetes mellitus. Nearly half of the subjects did not know the importance of monitoring the blood glucose  
- About 47% of the subjects did not know about the signs and symptoms of the disease. Only a few were able to give the correct response. Most of the subjects could only recall the symptoms which they had experienced.  
- Only 30% of the subjects got their blood test done on a monthly basis. Further only 8.5% and 4.7% of the diabetics enrolled did self monitoring of sugar at home  
- Regarding the normal ranges of blood sugar, a higher percentage (3/4th) of the subjects either did not know the normal ranges or gave incorrect responses.
- When asked about the glycated haemoglobin, only 13% of the subjects had heard of it and only 7% knew what it indicates and only 15% had got it done as per records.
- Nearly one fourth i.e. 23% of the study subjects got their blood pressure (BP) checked once in two months and only 7% of them knew the correct BP values.
- About 26% of the subjects had never got their lipid levels checked.
- One third i.e. 64% of the subjects felt that they were overweight. Around 98% of the subjects had never heard of BMI and none of them knew the cut off points for the BMI.
- The knowledge of the subjects on the foods that should be avoided or are permissible was very limited. A large number of the subjects said that sweet foods should be avoided by diabetics.
- The overall mean scores were 10.8 against a maximum score of 70 indicating poor knowledge scores.

Thus, it is clear that the diabetic patients had poor knowledge about the clinical condition of diabetes mellitus. Most of the aspects related to diabetes mellitus needs to be addressed. Therefore, a need was felt for building capacities of the diabetic patients and it was attempted through interpersonal counselling.

For the study, out of 117 subjects sixty stable non insulin dependent diabetes mellitus subjects who were willing to participate were enrolled. The subjects were divided into two groups, control group (N=30) and experimental group (N=30). The baseline data was collected on general information, background information, clinical information, anthropometry and 24 hour dietary recall along with fasting blood sugar, lipid profile and glycated haemoglobin.

The control group received no counselling whereas the experimental group received one to one counselling on the knowledge and lifestyle related risk factors and it's management on a monthly basis (reinforcement was done after every one month) for a period of four months by means of booklet and flash cards. Due to ethical reasons the diabetics in the control group were
counselled after the study period. The results for this phase have been summed up below.

Impact of Interpersonal counselling on knowledge of diabetic patients

- After 4 months of intervention 73% of the subjects in the experimental subjects answered that the glucose levels in the blood are higher in diabetics.
- In the experimental group nearly 50% of the subjects gave correct signs and symptoms, and majority of them gave more than one correct response.
- After 2 and 4 months of intervention there was a remarkable improvement in the knowledge of the experimental subjects regarding the causes and complications of diabetes.
- After intervention 70% of the subjects knew that the main role of the drugs/insulin is to lower the blood sugar in contrast to only 37% before intervention.
- The correct range for fasting, random and post prandial blood sugars were given by 40%, 20% and 27% of the experimental subjects respectively after 4 months of intervention.
- After the intervention period 77% of the subjects were aware of the importance of monitoring blood glucose as against 33% before intervention. After 4 months of intervention also there was no change in the frequency of monitoring blood glucose by the subjects.
- However 20% of the subjects reported that they got their glycated hemoglobin done after intervention as compared to 3% before intervention. Almost all the subjects could recollect GHb and were able to say its significance.
- In the experimental group everyone was well conversant with the term BMI and knew that it is an indicator to assess overweight and obesity (90%). However none of them could remember the cut off values of BMI.
- There was increase in the percentage of subjects monitoring BP after 2 months of intervention which was sustained at 4 months also. Around 47%
and 27% of the subjects monitored once in fortnight and once in a month respectively.

- In this study, after intervention 83% of the subjects started monitoring blood lipids either once in a month or once in 2 months. Further 57% of the subjects used to get their entire lipid profile monitored

- The response for food to be eaten liberally and avoided showed mixed trends. Sugar and sweet foods was well perceived before intervention and it continued after intervention in both the groups. However after intervention it was observed that there was a decrease in the response for fruit and fat intake. Cold drinks, red meat and milk were avoided by 20-27% of diabetics

There was a marked change in the knowledge scores of the experimental subjects in all aspects after 2 and 4 months of intervention. There was also a significant rise in the knowledge scores of the subjects after 4 months of intervention (10.1 Vs 24.8) than 2 months of intervention (10.1 Vs 19.9). Though a significant improvement in the knowledge scores were seen, it was not up to the target. This calls for continuous reinforcement sessions. This can be achieved by starting diabetic rehabilitation centres where in education can be imparted on a continuous long term basis.

**Phase IV: Impact of interpersonal counselling on the physiological indicators (blood sugar, glycated haemoglobin and lipid profile) of T2DM patients**

**Nutrient Intake**

- The mean energy intake prior to the intervention was 1796 and 1854 Kcal in the control and the experimental group respectively

- The protein intake was comparable to the RDA (2004) and as recommended by ADA (2008) in the control group but it was lower than the recommended values in the experimental group before the intervention. After NHE the protein intake increased in the experimental group and were comparable.
• The carbohydrate intake of both the groups was comparable to the RDA suggested by ICMR (2004) and ADA (2008) both before and after intervention.

• The fat consumption was higher than the 20 g recommended for normal adults (ICMR, 2004) and diabetics (ADA, 2008). The percent calories coming from fat ranged from 32% to 34%, which is more than the recommended allowance of ≤ 20%. However, a 4 percent reduction in fat as % calories was seen after the intervention.

• Crude fibre intake was much lower than the recommended that is 20 g/day (ICMR, 2004) and it ranged from 6.8 g to 7.2 g/day and there was no improvement in it after intervention also.

• Wide variations in the β-carotene intake were seen in both the groups.

• Vitamin C intake was higher than the RDA in both the groups before and after intervention.

• Iron intake was lower than the RDA (2004) and remained unaltered throughout the study period.

Effect of interpersonal counselling on the glycaemic status of T2DM subjects

• After intervention period of two months, a 6.4% decrease in the FBS was noted in the experimental group. Four months of intervention led to a significant reduction in the FBS (14.2%) in the experimental group. This was accompanied by a significant fall in the HbA1c levels indicating a physiological fall with good metabolic control.

• At the end of four months intervention the fall was more pronounced in male diabetic subjects (16.2%) than female diabetic subjects (10.8%).

• After two months of counselling, there was a significant decrease in the FBS levels (193 mg/dl vs. 158 mg/dl, p< 0.05) and a non-significant decrease in the HbA1c levels (12.5%) in the experimental group individuals who had initial FBS > 150 mg/dl.

• When the impact of four months nutrition health education was looked into in relation to the initial FBS levels in the type 2 diabetics, it was encouraging to note a 20.9% (p<0.05) reduction in the FBS.
levels. This decline in the FBS levels was accompanied by a significant lowering of the HbA1c levels (p<0.01).

- A significant favourable change (p<0.05) was also observed in the FBS and GHb values when the values were compared between two months and four months of intervention

**Effect of interpersonal counselling on the lipids and lipoproteins of T2DM subjects**

- At the end of 2 months interpersonal counselling a highly significant lowering of TC (229 vs. 191 mg/dl, p< 0.001), LDL-C (157 mg/dl vs. 119 mg/dl, p<0.001) and Non HDL-C (187 mg/dl vs. 147 mg/dl) was noted in the experimental group. There was a 4.6% reduction in the TG levels as a result of which a 3.3% reduction in the VLDL-C was also observed. The intervention also brought a 7.3% increase in the HDL-C levels.

- Four months of intervention also brought a significant reduction in the TC (229 Vs 193 mg/dl, p<0.001), LDL-C (157 Vs 123 mg/dl, p<0.001), and Non HDL-C (187 Vs 149 mg/dl, p<0.001) levels. This was accompanied by a significant rise in the HDL-C levels (41 Vs 44 mg/dl, p< 0.01). In the control group at the end of the intervention, a rise in TG, LDL-C and Non HDL-C was seen.

- After 2 months of intervention there was a 21.2 % decrease (p<0.001) in the TC levels and 29.8% decrease in the LDL-C levels of the male subjects. Surprisingly there was an increase in the HDL-C levels in the male subjects though it was non-significant. In the female subjects there was a slight reduction in the TC, LDL-C and Non HDL-C levels of the subjects. It was heartening to note an 11.6% rise in the HDL-C levels in the female experimental subjects after 2 months of NHE.

- The trends were similar at the end of four months of intervention and the changes in the lipid profile were more significantly marked in the males in comparison to the females.

- The fall in TC and atherogenic lipoprotein (LDL-C, VLDL-C and non HDL-C) was significant in diabetics having TC>200 mg/dl than those diabetics having TC < 200 mg/dl. In diabetics with TC values < 200 mg/dl, the mean values remained unaltered over a period of four months.
In the experimental group the response was better in diabetic subjects with TG>150mg/dl but was not significant

Effect of interpersonal counselling on the atherogenic indices of T2DM subjects

- Though TG/H did not reduce significantly, the mean values reflected a stepwise reduction signifying the role of lifestyle modification in lipid metabolism
- There was a significant decline in the TC/H levels and L/H levels after 2 and 4 months of intervention in the individuals who had initial TC levels > 200 mg/dl whereas in the individuals with initial TC levels < 200 mg/dl a reduction in these parameters were observed but they were not significant. Irrespective of the initial TC levels an improvement was seen in the TG/H values
- Favourable change in the atherogenic indices was observed in the individuals having TG <150mg/dl as well as the ones having TG >150 mg/dl. In the individuals having TG> 150 mg/dl a prominent reduction in the TG/H values was observed at p<0.05

Effect of interpersonal counselling on the FBS, GHb, lipid profile and atherogenic indices of T2DM subjects in relation to their initial BMI and in T2DM subjects with hypertension as a complication

- At the end of four months of counselling a significant reduction in the FBS levels were seen irrespective of BMI. However the GHb levels remained unaltered
- With regard to the lipid profile and it's indices it was seen that the impact was more pronounced in individuals having BMI>23 than BMI<23
- In T2DM subjects (with and without hypertension) a significant reduction in the FBS levels (p<0.05) was noticed. However after four months of intervention period, HbA1c levels were lowered but were not significant
- The intervention brought about a significant decease in the TC, LDL-C and Non HDL-C levels of T2DM subjects with hypertension with a slight increase in the HDL-C levels
There was a significant lowering of the TC/H and L/H ratios (p<0.001) in the subjects having hypertension as a complication. The trends observed with respect to atherogenic indices after 4 months were similar to what was observed after 2 months of intervention and there was a significant lowering of the TC/H and L/H ratios (p<0.001) in the subjects having hypertension as a complication with no change in TG/ HDL-C.

Thus from the study it is clear that nutrition health education is highly instrumental in attaining a better glycaemic and lipemic control in T2DM subjects.

Empowering diabetic subjects is an effective strategy and reinforcement is equally important. The interpersonal counselling can be strengthened in the existing hospital set up by building the capacities of the dieticians and the other supporting staff. Reinforcements of the key messages by the diabetologists in subsequent follow up visits may help in sustainability. Lastly, diabetes education centres/ rehabilitation centres in various clinics should help to facilitate and monitor the progress of diabetic patients by broadening the range of strategies. Each diabetic patient should have his/ her diabetic index card which should give an overview of various risk factors along with physiological indicators.

The overall results have been summarised in Table 5.1

**CONCLUSIONS**

From the studies it is clear that

1) There is a need to improve the fruit and green leafy vegetables intake of the general population
2) Amla supplementation (1 amla/day) during the season can be used as a supportive therapy to reduce the risk of CVD
3) Advocacy measures need to be developed and adopted to sensitize and build capacities of diabetic subjects
4) Development of information, education, communication materials at national level and its dissemination to T2 DM may be a good strategy to control and manage DM
### Table 5.1: Overview of the Results

<table>
<thead>
<tr>
<th>Result</th>
<th>Recommendation</th>
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<tr>
<td><strong>Phase I: Fruit and vegetable consumption pattern</strong></td>
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<td><strong>MEAN INTAKE</strong></td>
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<tr>
<td><strong>Fruits</strong></td>
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<tr>
<td>Adults -100/week</td>
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<tr>
<td>Children - 135 g/week</td>
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<tr>
<td><strong>Green leafy vegetable</strong></td>
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<td>Adults -80 g/day</td>
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<td>Children - 88 g/day</td>
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<tr>
<td><strong>Roots and tubers</strong></td>
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<td>Adults -126 g/day</td>
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<tr>
<td>Children - 98 g/day</td>
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<tr>
<td><strong>Other vegetables</strong></td>
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<tr>
<td>Adults -208 g/day</td>
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<tr>
<td>Children - 331 g/day</td>
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<tr>
<td><strong>Phase II: Amla supplementation trial</strong></td>
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<tr>
<td>1 Amla/day, 60 days</td>
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<tr>
<td>• No significant change in the glycaemic status</td>
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<tr>
<td>• Significant improvement in the lipid levels</td>
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<tr>
<td>• Amla can be used as a supportive therapy to reduce the risk of CVD</td>
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<td><strong>Phase III: Impact of NHE on the knowledge of T2DM subjects regarding their disease</strong></td>
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<tr>
<td>Significant improvement in the knowledge scores (10.1 Vs 24.8) but not satisfactory</td>
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<tr>
<td>• Reinforcements required</td>
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<td>• Adopt other communication strategy to bring the desired effects</td>
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### Phase IV: Impact of NHE on the physiological indicators of T2DM subjects

<table>
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<th>Four months of intervention led to</th>
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<tr>
<td>- A significant reduction in the FBS and HbA1c.</td>
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<tr>
<td>- Significant reduction in the lipid parameters.</td>
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<tr>
<th>Efforts should also be made to carry out patient education programmes at a community/hospital level so that it can reach a large number of patients</th>
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<tr>
<td>Frequent reinforcements</td>
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<tr>
<td>Each diabetic patient should have his/her index card which should give an overview of various risk factors along with physiological indicators</td>
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<td>NHE material should be available at the diabetic centres</td>
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</table>
RECOMMENDATIONS

Looking at the encouraging results of the present study further research can be aimed at

**Fruit and Vegetable Consumption**

1) Developing strategies to increase the intake of fruits and green leafy vegetables by the population to optimize health of the community
2) Database should be prepared of the phytochemical content of the commonly consumed fruits and vegetables
3) Intervention should be given to the population regarding the beneficial effects of fruits and vegetables
4) Population should be encouraged to consume a variety of seasonally available fruits and vegetables and their products
5) Encourage kitchen gardening/community gardening
6) Develop seasonal fruit and vegetable atlas of India
7) Strategies to prevent post harvest losses

**Amla Supplementation Trial**

1) Supplementation of amla and other ascorbic acid fruits for longer duration (3 months) on the lipid profile and antioxidant status so as to arrive at meaningful recommendations for T2DM subjects
2) To evolve techniques to preserve amla and to study the intervention trials with the preserved fruit
3) To incorporate amla into health juices and to study its impact on carbohydrate and lipid metabolism

**Nutrition Health Education Intervention**

1) Long term nutrition health education interventions (6 months to 2 years) with reinforcements at a frequent intervals for improving the knowledge of diabetics
2) Along with the patient, the care taker/family member should also be imparted education and education material that is developed should be
available at the OPD/diabetic clinics. Efforts should also be made to carry out patient education programmes at a community level so that it can reach a large number of patients.

3) Other methods of communication (e.g. video shows at clinics/community gatherings, key messages in TV, radio etc.) should be tried out to enhance knowledge scores of not only diabetics but general public also.

4) Each diabetic should have a diabetic index card which would help him/her to monitor his/her condition.