

Original Research

A study on the effect of intensive health education on the biochemical profile of the Diabetics living in the selected rural areas of Tirunelveli District in Tamil Nadu.

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ABSTRACT:

Background: Non-communicable disease diabetes mellitus is on the rise globally and developing countries are also witnessing the burden. Once diabetes is diagnosed, adequate treatment requires a significant amount of resources for patients of low economic standing. Being a chronic disease, there is great scope for cost effective strategies like motivation and health awareness in controlling this lifelong disease. The objective of this study was to determine the effect of intensive health education on the control of this chronic life long disease.

Methods: Nine villages were screened for diabetes among subjects aged above 20 years. Among the identified cases, data on blood pressure, anthropometric and biochemical profile were assessed. Their knowledge on the disease was also assessed. Based on their level of knowledge an education programme was planned. Fifty volunteers (25 males and 25 females) were chosen from the cases and were given an intensive personalized health education with the aim of motivating them to have effective control over the disease. The blood parameters such as HbA1c, Fasting blood glucose, HDL, LDL, urea, creatinine, microalbuminuria, along with Body Mass Index (BMI) and Blood Pressure (BP) were assessed both before and after three months of intervention through health education. The results were statistically analyzed for interpretation using t-test.

Results: Through the study 68 new cases and 163 old cases of diabetes were identified. Among the new cases 60.3% were pre-diabetics, 62.6% did not have control over the disease, 48.9% had varied grades of hypertension and 21.6% were pre-hypertensive. More than 90% of the cases had no idea on the complications of uncontrolled diabetes mellitus (DM) and hypertension (HT). The effect of intervention showed significant difference in BP, HbA1c, LDL, urea, creatinine and microalbuminuria but HDL, Waist Hip Ratio (WHR) and BMI did not have any significant difference.

Conclusion: Personalized diet counseling and health awareness on DM and HT had been found to be an effective means for achieving good control over this chronic lifelong disease and in preventing the dreaded complications of the disease among the rural population with low socioeconomic background.

Keywords:

Diabetes mellitus, pre-diabetes, hypertension.

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INTRODUCTION

Diabetes is increasing faster in the developing countries. India ranks first in diabetes followed by China and U.S. Diabetes Mellitus is a silent disease and it continues to be one of the most costly and burdensome chronic disease. Each year another 6 million people develop diabetes and India leads the world with large number of diabetic subjects and termed as "DIABETES CAPITAL OF THE WORLD"(Mohan *et al.*, 2007). A national survey of diabetes conducted in six major cities in India in the year 2000 has shown that the prevalence of diabetes in urban Indian adults was 12.1% (Ramachandran *et al.*, 2001). The onset of diabetes among Indians is about a decade earlier than their western counterparts and this has been noted in Asian Indians in several studies (Ramaiya *et al.*, 1990).

Diabetes Mellitus is a metabolic disorder and lifelong disease marked by high levels of glucose in blood. It is due to the consequences of abnormalities of beta cells of pancreas that convert blood glucose into energy (Kathleen Mahan and Sylvia Escott-Stump. 2004). Diabetes mellitus basically produces changes in the blood vessels and hence can affect almost every part of the body. Long standing diabetes mellitus is associated with an increased prevalence of micro-vascular and macrovascular diseases. The onset of Type-2 diabetes is usually insidious and the patient may remain asymptomatic until late stages of the disease (Gen *et al.*, 2009). The insidious onset of the disease and long duration of asymptomatic disease before the symptoms develop makes the prevalence of complications quite high even at the time of diagnosis of Type-2 diabetes. Persistent elevations in blood sugar (and, therefore, HbA1c) increase the risk for the long-term vascular complications of diabetes such as coronary disease, heart attack, stroke, heart failure, kidney failure, blindness, erectile dysfunction, neuropathy (loss of sensation, especially in the feet), gangrene, and gastroparesis (slowed emptying of the

stomach). Poor blood glucose control also increases the risk of short-term complications of surgery such as poor wound healing.

Once diabetes is diagnosed, adequate treatment requires a significant amount of resources for patients i.e. access to glucocheck instrument, medications, regular access to health care and referral to specialists for management of complications. For a person of low economic standing in India, diabetes care can account for 25% or more of their family income for each person with diabetes (Gen *et al.*, 2009). The management of long-term complications of diabetes is costly and also leads to enormous productivity loss with significant social burden to the patient and family. Lifestyle changes/interventions and drugs are the current strategies that exist to prevent or reduce the onset of diabetes.

A country like India with its large burden of diabetes and vulnerability to chronic complications, must evolve strategies for primary prevention of diabetes and its complications. Early screening and therapeutic interventions are the primary steps towards achieving this goal. Being a chronic disease, quality diabetes care involves more than just the primary provider. There is great scope for motivation and health awareness in controlling this lifelong disease. No longer it is satisfactory to provide patients who have diabetes with brief instructions and a few pamphlets and expect them to manage their disease adequately. Instead, education of these patients should be an active and concerted effort involving the physician, nutritionist, diabetes educator, and other health professionals. Moreover, diabetes education needs to be a lifetime exercise.

Hence a study was under taken with the objective of identifying the diabetic cases in selected rural areas of Tirunelveli district, to know the level of awareness about the disease and its control and to assess the effect of health education on their health status.

Table 1 Characteristics of Cases under study

S.no	Particulars		Male	Percentage %	Female	%	Total	Percentage %
1	Diabetes	Old cases	60 (63.8%)	10.3	103 (75.2%)	9.3	231	9.7
		New case	34 (36.2%)		34 (24.8%)			
2	Non-diabetic		821	89.7	1337	90.7	2158	90.3
3	Total screened		915	100	1474	100	2389	100

MATERIALS AND METHODS

Locale of the study

To carry out this study, nine village panchayats namely Seevalaperi, Naduvakurichi, Maruthur, Udaiyarkulam, Kansapuram, Keelapaatam, Melapattam, Notchikulam and Thirumalaikozhundurpuram were selected along with nine hamlets, from Palayamkottai union in Tirunelveli district based on the findings in a voluntary medical camp conducted by the National Social Service Scheme (NSS) of Sadakathulah Appa College unit No:151.

Selection of the Respondents

Door-to-door survey of the houses in these villages was carried out based on the willingness and availability of the subjects for the study. After obtaining oral consent, all available individuals of age 20 years and above were screened by testing the urine glucose (Benedict’s method) and measuring the blood pressure with sphygmomanometer. The blood pressure of participants was measured in the supine position after five minutes of rest. Hypertension was defined as either systolic blood pressure above 139 mmHg and/or diastolic blood pressure above 89 mmHg and/or treatment with

anti-hypertensive medications (WHO, 2010). Positive cases in the urine glucose test were confirmed with gluco check strips. With this pre-test, the positive cases were selected for the assessment of fasting blood glucose level. The fasting glucose test is greatly preferred because of the ease of administration, convenience, acceptability to patients, and low cost. Fasting is defined as no caloric intake for at least eight hours (ADA, 2000). Five milliliter of blood was drawn from each selected case under fasting condition. The level of blood glucose was ascertained using glucose kit and semi auto analyzer and were classified as per the American diabetes association guideline for diabetes, normoglycemia is Fasting Plasma Glucose (FPG) <100 mg/dl (<5.6 mmol/L), Impaired Fasting Glucose (IFG) is FPG 100-125mg/dl (5.6-7 mmol/L) and for diabetes it is >125mg/dl (>7 mmol/L) (Mahan and Escott- Stump, 2008 and Diabetes care, 2007).

On the test day the diabetic cases were administered a set of 10 questions to assess their knowledge on both diabetes mellitus and hypertension because hypertension coexisted with diabetes in most of the cases. A set of possible right answers were recorded

Table 2 Classification of Fasting Blood Glucose

Fasting Blood glucose	New DM cases						Old DM cases					
	Male		Female		Total		Male		Female		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
Normal <100mg/dl	-	-	-	-	-	-	8	13.3	9	8.7	17	10.4
Pre-diabetics 100–125mg/dl	23	67.6	18	52.9	41	60.3	17	28.3	27	26.2	44	27.0
Diabetics >125mg/dl	11	32.4	16	47.1	27	39.7	35	58.3	67	65.1	102	62.6
Total	34	100	34	100	68	100	60	100	103	100	163	100

Pearson’s Chi-Square: 29.530; df=2; p= 0.000 which is <.05(0 cells (0%) have expected count less than 5.

Table 3 Sex wise classification of hypertension among diabetes mellitus

DBP* in mm/Hg	Male		Female		Total	
	No	%	No	%	No	%
Normal < 81	29	30.8	39	28.5	68	29.4
Pre Hyper tension 81-89	29	30.8	21	15.3	50	21.6
Mild Hyper tension 90-99	27	28.7	47	34.3	74	32.0
Moderate Hyper tension 100-109	3	3.2	19	13.9	22	9.5
Severe Hyper tension ≥ 110	6	6.4	11	8.0	17	7.4
Total	94	100	137	100	231	100

Chi square=14.499; p<.05 *DBP-Diastolic Blood Pressure

in a scoring sheet for all the questions and the field investigator was trained to score three options such as correct answer, wrong answer and No idea based on the answers given by the subjects.

Among the subjects 25 male and 25 female cases who had no control over blood glucose were chosen for the study. After getting oral permission anthropometric measurements, BP and initial fasting blood parameters such as HbA1c, HDL LDL, urea, creatinine and urine microalbumin were recorded using standard kits and semi autoanalyzer (CPC-Stat fax 3000).

The subjects were given intensive health education on the importance and the methods of management of diabetes and hypertension with special emphasis on diet, regular medication and exercise, with the help of power point slides using a laptop for individualized counseling and LCD projectors for a

group. They were also given live cooking demonstrations on the preparation of high fiber diet, low sodium diet and low carbohydrate and low cholesterol diet. Each subject was given a handout printed in the vernacular language containing the instructions for effective control of diabetes and hypertension. After three months of personal follow up, counseling and motivation, the same biochemical and anthropometric parameters were tested. The results were analyzed using SPSS soft ware for significance using pared sample t test.

RESULTS AND DISCUSSIONS

The results of the study are as follows. The number of the participants in the diabetic and non diabetic group are shown in Table 1.

Total sample of the study population who volunteered for the study was 2389. Out of which 90.3%

Table 4 deals with the results of the pre test administered on the knowledge of diabetes mellitus and hypertension. Level of awareness of diabetics

S.No	Questions	Correct	%	Wrong	%	No idea	%
1	What is DM?	84	36.4	64	27.7	83	35.9
2	What foods Should be avoided / included for DM?	17	7.4	183	79.2	31	13.4
3	What are the methods of controlling DM?	12	5.2	4	1.7	215	93.1
4	How often should the blood be tested to keep DM under control?	9	3.9	23	10.0	199	86.1
5	What are the complications of DM?	11	4.8	10	4.3	210	90.9
6	What is Hypertension?	32	13.9	36	15.6	163	70.6
7	What foods Should be avoided / included for HT?	13	5.6	94	40.7	124	53.7
8	What are the methods of controlling HT?	6	2.6	16	6.9	209	90.5
9	How often should BP be checked to control HT?	13	5.6	34	14.7	184	79.7
10	What are the complications of HT?	4	1.7	5	2.2	222	96.1

Table 5 Biochemical profile of DM cases Before and after intervention

Particulars	Before		After		Difference		Std.error	df	T value	Significance
	Mean ± SD		Mean ± SD		Mean ± SD					
BMI	23.612 ± 4.288		23.510 ± 3.905		0.102 ± 0.620		0.0878	49	1.162	0.251**
WHR	0.844 ± 0.054		0.844 ± 0.060		0.0 ± 0.0237		0.0033	49	0.000	1.000**
Systolic Pressure mm/hg	131.04 ± 13.544		128.88 ± 11.239		2.16 ± 4.419		0.625	49	3.457	0.001*
Diastolic pressure mm/hg	84.90 ± 7.203		83.70 ± 5.874		1.20 ± 2.416		0.342	49	3.512	0.001*
FBG mg/dl	287.86 ± 52.04		258.12 ± 47.374		29.74 ± 16.888		2.388	49	12.452	0.000*
HBA1C	6.338 ± 1.332		5.898 ± 1.2343		0.440 ± 0.3949		0.0558	49	7.879	0.000*
HDL mg/dl	40.0 ± 5.704		40.38 ± 5.458		-0.38 ± 2.398		0.339	49	-1.120	0.268**
LDL mg/dl	136.98 ± 16.481		134.14 ± 15.957		2.84 ± 1.963		0.278	49	10.233	0.000*
Urea mg/dl	41.04 ± 14.263		38.28 ± 14.068		2.76 ± 1.996		0.282	49	9.780	0.000*
Creatinine mg/dl	1.480 ± 0.4794		1.376 ± 0.4293		0.104 ± 0.1009		0.0143	49	7.286	0.000*
UMA mg/dl	16.296 ± 5.470		15.918 ± 5.003		0.378 ± 0.819		0.1158	49	3.264	0.002*

*p value < 0.05 – significant at Five percent level

**not significant at Five percent level

were non diabetics and the rest 9.7% were diabetics.

Among the diabetics 63.8% of the males and 75.2% of the females were old cases and 36.2% of the males and 24.8% of the females were newly identified as diabetics. There are many studies to support the increasing trend of diabetes in rural areas also. A study conducted by Deo *et al.*, (2006) reported a high prevalence (9.3%) in rural Maharashtra. In another study, the prevalence of known diabetes was 6.1% in individuals aged above 40 years which was unexpectedly high at that time for a rural area with low socio-economic status and decreased health awareness (Rao *et al.*, 1989).

Table-2 deals with the level of fasting glucose among the new and the old cases of diabetics.

Of the newly identified cases, 60.3% were pre-diabetics and the rest were diabetics. If not intervened at this point pre-diabetes will be heading towards irreversible stage of diabetes. The occurrence of pre-diabetes in the rural area is much higher than the findings of Viswanathan *et al.*, (1996) which state that the prevalence of pre-diabetes in the rural population is at 7-8%, which indicates the presence of a genetic basis for Type-2 diabetes in ethnic Indian population (Viswanathan *et al.*, 1996) Among the diabetics 10.4% had very good control and 62.6% did not have control over their blood glucose level, indicating the need for health education on diabetic control. It was found that there was significant association between the cases and the fasting blood glucose level with Pearson's chi-square value 29.530 and p-value <0.05.

From table-3 it is evident that 39% of the total cases were identified as pre-hypertensive cases. About 7.4% of the diabetic cases were found to have severe hypertension. Only 29.4% of the diabetics had normal blood pressure. The Pearson chi-square value is 14.499 with a significance of 0.013 (P value <0.05). Hence it is concluded that there is association between hypertension and sex among DM cases.

More specifically, it has been reported that individuals with blood pressure values of 130-139/85-89 mmHg were significantly in higher risk of developing cardiovascular diseases compared to subjects with lower blood pressure values (Vasan *et al.*, 2001).

It is clear from the table-4 that more than ninety percent of the cases did not have any idea on methods of controlling HT and DM and the complications of uncontrolled HT and DM. Nearly 79.2% did not have clear knowledge on diet restrictions for DM and 40.7% did not have knowledge on food restriction for HT. Based on the findings of the awareness study, health education was given with audio visual aids and personal diet counsel with special emphasis on positive motivation in adhering to diet to prevent or delay the complications

The biochemical profile of diabetics study group, both before and after health education intervention is given in Table-5. It indicates that there was significant difference in the biochemical profile with regard to systolic, diastolic pressure, fasting blood glucose, HbA1c, LDL, serum urea and creatinine and urine microalbumin among diabetic patients before and after intervention. The current goal of LDL < 100 mg/dl or the optional goal of < 70 mg/dl is recommended for high-risk patients and to address other components of diabetic dyslipidemia. Intensive treatment of LDL cholesterol in patients with diabetes can substantially affect long-term health outcome. (Richard and Nesto, 2008). A low level of high-density lipoprotein cholesterol (HDL-C) is a key feature of the metabolic syndrome and Type-2 diabetes. HDL particles exert an anti-atherogenic effect and hence low HDL-C levels are associated with increased cardiovascular disease risk. (Rosenson, 2000). Serum creatinine and urea concentrations change inversely with changes in *Glomerular Filtration Rate* (GFR) and are therefore useful in gauging the degree of renal dysfunction. Microalbuminuria is the earliest manifestation of diabetic nephropathy which leads to

irreversible kidney damage. Control over these parameters reflect good control of diabetes and prevention of complications such as diabetic nephropathy. The three months of intervention did not have any significant difference on BMI, Waist Hip Ratio and HDL, probably because these anthropometric indices may require longer time for any significant changes. Emphasis on proper diet control, regular medication and exercise to avoid or postpone complications through intensive health education has had a positive impact in the control and maintenance of diabetic cases. HbA1c is primarily a treatment-tracking test reflecting average blood glucose levels over the preceding 90 days (approximately). The mean HbA1c level after the intervention was 5.898 (SD±1.2343). The current recommended goal for HbA1c in patients with diabetes is < 7.0%, as defined as "good glycemic control". glycated hemoglobin (hemoglobin A1c, HbA1c, A1C, or Hb1c; sometimes also HbA1c) is a form of hemoglobin that is measured primarily to identify the average plasma glucose concentration over prolonged periods of time. The 2010 American diabetes association standards of medical care in diabetes added the A1c ≥ 48 mmol/mol ($\geq 6.5\%$) as another criterion for the diagnosis of diabetes (Standards of medical care in diabetes, 2010)

People with diabetes that have HbA1c levels within this goal have a significantly lower incidence of complications from diabetes, including retinopathy and diabetic nephropathy. This study has shown that an intensive personalized health education can help in controlling and preventing the complications of diabetes mellitus. Similar findings have been recorded in a study conducted by (Mohan *et al.*, 2005) which has shown that increasing awareness and empowerment of community can possibly help in the prevention of diabetes and other non communicable disorders.

CONCLUSION

A focused individualized awareness creation along with motivation brought in significant changes in the biochemical status of type-2 diabetics. Patients with type-2 diabetes who had a baseline hemoglobin A1c (HbA1c) of greater than 8% may achieve better glycemic control when given individual education rather than usual care. Hence the study concludes that the quality diabetic care involves more than just the primary medical care. Education can empower patients to take on greater responsibility for the management of their disease. This forms the basis for integration of medical and social sciences into professional education so that partnerships with patients can be realized. Within this frame work, responsibility for management of the disease resides with patients and the primary role of the health care professional becomes one of supporter and educator.

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