Research Article

Outcome of a Structured Diabetes Self-Management Education Program at a Tertiary Care Hospital

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Abstract: The purpose of this study was to identify the deficiencies in Diabetes Self-Management (DSM) by a modified Diabetes self-care activities (SDSCA) questionnaire, Implementation of a structured DSME program and study its impact on self-care behaviors, diabetes control, lipids and physical parameters. In this prospective cohort study, 102 patients of Type 1 and Type 2 DM were given a modified SDSCA questionnaire and their baseline physical and biochemical parameters were recorded. A structured DSME program including individual and group therapy was implemented by our team. 3 months later they were reassessed for effect on self-care behaviors, physical and biochemical parameters in the Pre Intervention and Post Intervention period. The SDSCA parameters before intervention revealed a low score for all items i.e. diet, exercise, glucose monitoring and foot care. The SDSCA scores for diet, exercise and foot care improved significantly after the DSME program (p<0.001). Majority had uncontrolled diabetes. 89.2% had HbA1C > 7%. Dyslipidemia was present in 60% of patients. 37.3% had total cholesterol > 200 mg/dl, 45.1% had Triglycerides > 150, 56.8% had LDL > 100 mg/dl and 43.1% patients had HDL < 40. Except for weight and BMI, all these parameters improved significantly after DSME program. A structured DSME program suited to the needs of the patients helps in improvement of DSM and achievement of better diabetes and lipid control. The study also emphasizes the role of diabetes educators.

Keywords: Structured DSME, Improved diabetes and lipid control

INTRODUCTION

Diabetes has emerged as one of the major health care problems in India. The prevalence of diabetes is predicted to double globally from 171 million in 2000 to 366 million in 2030 with a maximum increase in India. It is predicted that by 2030 diabetes mellitus may afflict up to 79.4 million individuals in India, while China (42.3 million) and the United States (30.3 million) will also see significant increases in those affected by the disease [1]. Diabetes self-management education(DSME), the process of teaching individuals to manage their diabetes, has been considered the cornerstone of the clinical management of individuals with diabetes since the work of the Joslin Diabetes Center. The goals of diabetes self-management (DSM) education are to optimize metabolic control, prevent acute and chronic complications, and optimize quality of life. The keystone to successful management is to involve the patient in his treatment [2].

The better the patient understands of the essential nature of diabetes and of the therapeutic goal, the more likely he is to be motivated to accept the regime and to persevere in its long-term implementation [3]. Thus, an effective educational program is an essential part of a diabetes clinic.

Diabetes Self-Care Activities (SDSCA): The SDSCA was created by researchers at the Oregon Research Institute to address a need for a reliable, non-judgmental measure of patients' self-care behaviors. Research on the measure indicates that the questionnaire is generalizable to various groups of patients with diabetes across gender, age, number of comorbid medical illnesses and duration of diabetes [4]. We used this questionnaire after modification to identify the deficiencies in Diabetes Self-Management (DSM) in our subset of patients. After that we prepared a structured Diabetes self-management education (DSME) program and implemented it on our patients.

Aims and Objectives
Primary Objective

To study the impact of a structured Diabetes self-management education program prepared after identifying deficiencies in DSM by patients attending

our Diabetes Clinic, on health outcomes i.e. BMI, Glycemic control, lipid profile at 3 months follow up.

Secondary Objective

To formulate effective methods to facilitate and empower patients for DSM.

MATERIAL AND METHOD

This Prospective cohort study was carried out in the Diabetes Clinic of Govt. Medical College, a tertiary care center in Central India. 120 patients having Type 1 or Type 2 Diabetes Mellitus according to WHO criteria were included in the study after obtaining an informed consent. Detailed history and clinical examination was done. Baseline investigations of hemoglobin, complete blood count, urine examination, Serum creatinine, Lipid profile, Electrocardiogram, Fundoscopy were done. For Glycemic control, fasting and postprandial blood glucose, HbA1C were done. Screening for complications of Diabetes was done by appropriate investigations. Patients were given a modified Diabetes Self-care activities assessment (SDSCA) questionnaire. The questionnaire was modified taking into consideration the regional characteristics like diet, traditions and cultural habits of our patients. The SDSCA assesses 5 important regimen in diabetes care; Diet, Exercise, Self-monitoring of blood glucose (SMBG), Foot care and smoking status. Additional item of medications; both oral ant diabetic agents and insulin was included and scoring was made for individual item. The scores were calculated and deficiencies were identified.

Intervention

A comprehensive diabetes education program was prepared in vernacular language to cover all the aspects of diabetes self-care and to remove the deficiencies identified by SDSCA questionnaire. A program was prepared and conducted to train the nurses and resident doctors as Diabetes educators, as we do not have separate diabetes educators. Patients were divided in groups of 25 each. They were required to attend a) 2 sessions of 40 min. duration on diabetes 1 month apart in group, b) An individual counseling session with diabetes educator : nurse or resident doctor in medicine or the consultant himself, c) A special session on ' How to take Insulin', d) An individual monthly session with the dietician, e) An individual monthly session with the physiotherapist, f) A short session of individual counseling of 15 minutes with the consultant for individual fears and problems. The patients underwent this program for 3 months.

Follow Up

Patients were followed up for 3 months. At the end of 3 months, patients again filled up the SDSCA questionnaire and were again evaluated for BMI, Glycemic control as assessed by fasting and post prandial blood glucose, HbA1C and lipid profile.

Out of these 120 patients 18 patients did not complete the program and hence 102 patients were included in final analysis. Patients were recruited in the study for a period of 3 months and then each patient was followed up for 3 months.

All the data was entered in Microsoft excel program for baseline analysis. Data was categorized into following groups for comparison; Part 1 - Identification of deficiencies using SDSCA – Percentages, mean and standard deviation, Part 2 - Comparison of SDSCA scores of 2 groups i.e. Group I – Pre intervention and Group II – Post intervention, Part 3 - Comparison of BMI, glycaemic control, Lipid profile in Group I and II.

The data on demographic variables, physical, biochemical parameters and DSME parameters for pre- and post-intervention scenarios were obtained on 102 subjects. Descriptive statistics like mean, standard deviation, range and percentage were obtained for demographic variables according to the scales of variables. The effect of intervention on physical & biochemical parameters was evaluated using *paired t-test*. The effect of intervention on DSME parameters was evaluated using *Wilcoxon signed rank test*. The statistical significance of post-interventional effect on various parameters was also studied across the categories of each demographic variable. For demographic variables with more than two categories, the significance of difference in the mean 'change in level' of physical and bio-chemical parameters was evaluated using one-way analysis of variance(ANOVA). While for DSME parameters, the significance was tested using Kruskal Wallis non-parametric test. A significance level of 0.05 was considered throughout the analysis.

RESULTS

Total No. of patients enrolled in the study were 120. Of these 18 patients dropped out or were not able to complete the sessions of the educational program. Hence final analysis included 102 patients.

It was observed that majority of patients in the study were in the age group of 51-70 years and the number of males and females were equal, M: F =1:1. Uneducated patients were 7% and 16% were educated up to primary level. There was no statistically significant difference in self-carebehaviors when compared with educated patients. 68.6% patients were asymptomatic and 15% had comorbidities. Family history was positive in 33.33%. Hypertension was seen in 60 (58.8%) patients. The mean duration of Diabetes was 8.43 ± 5.68 yrs. About 25% patients were irregular in their visit to Diabetes clinic. The number of smokers and alcoholics was 16.6% and 8.8% respectively. Majority of the patients were on OAD (Table No.1).

Patients were asked to fill up SDSCA questionnaire which is a 22 item questionnaire to test for self-care abilities of patients. Based on the evaluation of questionnaire following deficiencies in diabetes self-management were identified: 16.6 % were smokers and 8.8 % were alcoholics. They were never given advice to stop smoking or alcohol consumption. Patients never had an individual diet consult at detection of diabetes. Only 19.6% patients had a diet consult and that to on their own initiative for better control of their diabetes. Many patients had myths about diabetes diet and only 28.3 % patients were compliant with diet prescribed by dietician. Most of the patients were totally lacking in adherence to exercise schedule. Most of them did not exercise because of unawareness of importance of exercise, joint pains, osteoarthritis, weakness and busy schedule. However some elderly patients did strengthening exercises like Yoga and Pranayama. Only 4 patients were aware about foot care in diabetes. They were never advised about footcare or footwear. Only 2 patients were using Micro-cellular rubber(MCR) Footwear and that too after they had developed diabetic foot. There was a severe deficiency in self-blood glucose monitoring by patients. Only 13.7 % had a glucometer. They were not aware about how frequently they should test blood sugar, nor were they aware about correct method and time of testing fasting and post meal blood sugar. Only 10.7 % had tested blood glucose in the week prior to assessment.63.7 % patients were aware about diabetes, 28.4 % were aware about diet in diabetes, 21.5 % were aware about exercise,

29.4 % were aware about complications and their prevention. Maximum patients i.e. 68.6 % were aware about medications and 81.3 % were compliant for medications.

After DSME program they were asked to fill up the SDSCA questionnaire again and change in self-carebehavior was noted.

The SDSCA parameters before intervention revealed a low score for all items i.e. diet, exercise, Glucose monitoring and foot care. Patients fared well on medication item and there was no change in median score after intervention. Those who were on Insulin learned effectively to self-administer insulin. The SDSCA scores for diet, exercise and SMBG improved significantly after the DSME program (p=0.001) and improved highly significantly (p<0.0001) for foot care (Table No.2 & Figure 1).

Most of the patients, especially females were obese, having BMI >25. Most of the patients had uncontrolled diabetes before entering the program. 89.2% had HbA1C > 7%. Dyslipidemia was present in about 60%

patients. 37.3% had Total cholesterol > 200 mg/dl, 45.1% had Triglycerides > 150,56.8% had LDL > 100 mg/dl and 43.1% patients had HDL < 40. All these parameters improved after intervention i.e. DSME program. The mean fasting blood glucose was controlled from a mean of 141.44 mg/dl to a mean of 128.35 mg/dl and post meal glucose improved from a mean of 207.33 mg/dl to 172.69 mg/dl. HbA1C also declined from 8.44 to 7.99. This difference however failed to reach statistical level of significance.

Improvement was also noted in Lipid Profile; Total Cholesterol from 188.38 mg/dl to 172.69 mg/dl, Triglycerides from 147.42mg/dl to 130.13 mg/dl, LDL from 107.53 mg/dl to 96.55 mg/dl. But improvement in HDL from 42.34 mg/dl to 44.91 mg/dl was not statistically significant.

Except for weight and BMI all the biochemical parameters showed highly significant improvement (p<0.001). (Table No.3). These might improve over a longer time period and follow up.

Table-1: Demographic characteristics of patients

Demographic variables	Mean + SD [range]/ No. Of Patients (%)
Age (yrs)	56 ± 11.32 [24 - 78]
Gender Males Females M: F	51 (50%) 51 (50%) 1:1
Education level	
Uneducated	7 (7%)
Primary	16 (16%)
SSC	1 (1%)
HSC	28 (27%)
Graduation	36 (35%)
Post-graduate	14 (14%)
Duration of diabetes (years)	8.43 ± 5.68 [1- 25]
Visiting frequency to diabetes Clinic	
Once in 15 days	26 (26%)
Once in a month	21 (20%)
Once in 3 months	30 (29%)
Irregular	25 (25%)
Personal Habits	
Smoking	17 (16.6%)
Alcoholism	9 (8.8%)
Medications	
Oral Antidiabetic drugs(OAD)	82 (80.4%)
OAD + Insulin	20 (19.6%)

**Table-2: Self-care behavior parameters before and after DSME intervention**

SDSCA Parameters	Pre Intervention Median (IQR)	Post Intervention Median (IQR)	p-value
Diet	12 (6)	17 (3)	0.0000 **
Exercise	0 (4.75)	6 (4)	0.0001**
Glucose Monitoring	3 (1)	4 (2)	0.0001**
Foot Care	7 (6.5)	14 (3)	0.0001**
Medications	8 (0)	8 (0)	0.0852[+]

** P< 0.001, + p < 0.05

Table No.3: Comparison of physical and Bio-chemical parameters before and after DSME intervention

Parameters	Pre Intervention Mean + SD (Range)	Post Intervention Mean + SD (Range)	p-value
Physical			
BMI	25.39 ± 4.52 [16.85 - 39.5]	25.32 ± 4.25 [16.8 - 37.4]	0.9125 (NS)
Bio-chemical			
FBG	141.44 ± 31.98 [78 - 230]	128.35 ± 21.15 [95 - 192]	0.0007**
PMBG	207.33 ± 46.60 [104 - 329]	172.69 ± 29.68 [128 - 285]	0.0000**
TC	188.38 ± 31.73 [114 - 256]	170.45 ± 24.29 [124 - 230]	0.0000**
TG	147.42 ± 43.81 [67 - 260]	130.13 ± 21.64 [78 - 188]	0.0005**
LDL	107.53 ± 25.81 [50 - 177]	96.55 ± 14.98 [60 - 141]	0.0003**
HDL	42.34 ± 8.23 [28 -63]	44.91 ± 5.78 [33 - 58]	0.0106*
Hb1Ac	8.41 ± 1.42 [6.2 - 12.4]	7.99 ± 1.15 [6.4 - 11.4]	0.0237*

*p < 0.05; **p < 0.001; NS: Not significant
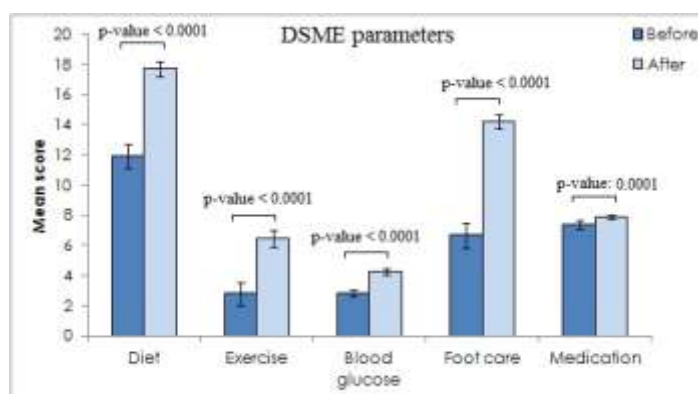
Fig-1: Showing comparison between DSM parameters before and after DSME Intervention

DISCUSSION

Inspite of enumerable recent advances in treatment of Diabetes, we have failed to achieve the desired goals. Mostly it is due to lack of awareness and improper management by the patient himself. Hence it is important to promote DSM by proper DSME program. Many workers in the past have endorsed this approach [5].

Beggan MP, *et al.* were the first to observe that the management of Diabetes mellitus, whilst under the overall control of the physician, demands the active participation of the patient, the degree of this participative role being determined by the willingness and the capacity of the patient to co-operate [6]. In our study patients scored low on all items i.e. diet, exercise, SMBG and Foot care. Only positive finding was that patients were fairly compliant with medications. Many researchers observed that barriers exist regarding diet-related knowledge and skills, access to structured DSM

education, hyperglycemia control, and environmental support for physical activity [7, 8, 9]. Negin Masoudi Alavi *et al.* examined the self-treatment behaviors in patients with diabetes mellitus and identified 7 factors that explained the 43% of variation in the self-treatment. These seven factors were categorized as knowledge, deficiencies of formal treatments, available self-treatment methods, physician related factors, the tendency to use herbal remedies, underlying factors such as gender and factors related to diabetes [8]. Al-Khawaldeh OA, *et al.* also found that the majority of subjects did not have their diabetes controlled; their self-efficacy was low, and they had suboptimal self-management behaviors[9].

As per the guidelines given by NHS, Team UK, A structured DSME needs to 1) be person centred incorporating the assessment of individual learning needs; 2) be reliable, valid, relevant and comprehensive; 3) be theory driven and evidence based;

4) be flexible and able to cope with diversity; 5) be able to use different teaching media; 6) be resource effective and have supporting materials; 7) be written down [10]. Recently we have The National Standards for Diabetes Self- Management Education and Support which are designed to define quality DSME and support and to assist diabetes educators in providing evidence-based education and self-management support. The Standards are applicable to educators in solo practice as well as those in large multicenter programs and everyone in between [11]. We tried to adhere to these guidelines and also the cultural aspects of the region and carried out our DSME program. Culturally tailored programs are more effective at improving patients' objectively measured clinical outcomes, in particular A1C levels, and psychobehavioral outcomes. Patients are also highly satisfied with such programs [12, 13]. We trained our nurses and residents to be Diabetes Educators. They were trained easily as they had a basic knowledge of diabetes and patients accepted them easily. Only limitation was short duration of study and follow up of only 3 months.

In our study we found that there was a statistically significant improvement in biochemical as well as SDSCA parameters at the end of 3 months. The diet scores improved from a median of 12 to 17. Patients' adherence to diet plan averaged 5 days a week. The exercise scores also improved from 0 to 6. As majority of our patients were elderly having joint problems, they were not doing any form of exercise. The younger patients were not adhering to exercise due to busy work schedule. They were all given an exercise plan according to their individual needs. The glucose monitoring pattern also showed a highly significant improvement. The monitoring scores improved from 3 to 4 and patients were encouraged for SMBG. The most significant improvement was observed for foot care and use of MCR footwear. This improvement would help to prevent the occurrence of Diabetic Foot. There was no significant improvement in medication score. The reason could be that most of the patients were aware about their drugs and were taking them appropriately. However those receiving insulin benefitted by demonstration of 'How to take Insulin'.

Of physical parameters there was no statistically significant improvement in weight or BMI of patients. Probably a time period of 3 months was short to have a significant weight loss and thereby change in BMI.

Our education program had an equal impact on patients' at all educational levels and the improvement in physicobiochemical and DSME parameters did not vary across different educational levels. This is similar to findings of Jahanlou AS *et al* [14] in their study of SE (Self efficacy) and QOL (Quality of life) correlating with literacy in diabetic patients. They reported that there was no significant difference for the level of HbA1C, implying that literacy level does not have any effect on glycemic control. We also did not find significant differences in self-management across various age groups, gender, co-morbidities or duration of Diabetes.

Tan M Y *et al.* in 2011, in the intention-to-treat analysis (n = 164), observed that the intervention group improved their SMBG (P = <0.001), physical activity (P = 0.001), HbA1c (P = 0.03), diabetes knowledge (P = <0.001) and medication adherence [15].

Trento M *et al.* conducted a 5-year randomized controlled clinical trial of continuing systemic education delivered by group versus individual diabetes care in a hospital-based secondary care diabetes unit. Knowledge of diabetes and problem solving ability, quality of life, HbA1c, HDL cholesterol and even BMI improved significantly in group care patients. They concluded that Adults with type 2 diabetes can acquire specific knowledge and conscious behaviors if exposed to educational procedures and settings tailored to their needs. Better cognitive and psychosocial results are associated with more favorable clinical outcomes [16].

As our education program combined individual as well as group therapy, we had a statistically significant improvement in glycemic control and lipid profile. There was improvement in HbA1C and HDL but it just failed to reach statistical significance.

Torres Hde C *et al.* also observed that HbA1C levels dropped down and the educational practices improved self-care and self-management of the disease [17]. Similarly M J Davies *et al.* also evaluated the effectiveness of a structured group education programme in people with newly diagnosed type 2 diabetes and concluded that a structured group education programme for patients with newly diagnosed type 2 diabetes resulted in greater improvements in weight loss and smoking cessation and positive improvements in beliefs about illness but no difference in HbA1C levels up to 12 months after diagnosis [18]. Deakin T *et al.* assessed the effects of group-based, patient-centered training on clinical, lifestyle and psychosocial outcomes in people with type 2 diabetes. They concluded that Group-based training for self-management strategies in people with type 2diabetes is effective by improving fasting blood glucose levels, glycatedhemoglobin and diabetes knowledge and reducing systolic blood pressure levels, body weight and the requirement for diabetes medication [19]. Recent concept of Diabetes management support has been validated by many researchers who observed that it improves the consumption of healthy diet, reduces the consumption of fatty foods and improves the frequency of physical activity [7, 21]. Researchers have also

advocated Peer support i.e. supports by a patient with diabetes to a fellow patient, which helps in improvement of self-carebehaviors and psychosocial aspect of diabetes. A study by SreedeviAswathyet.al. from India has observed Peer support as an important strategy for management of diabetes. WHO has acknowledged peer supportas a low cost, flexible intervention with promise, though further studies are necessary to understand the various ways in which it can be used [21].

Is the effect of DSME is sustainable? Tang T S *et al*. observed that post 6-month DSME, participants demonstrated significant improvements for diastolic BP (p<0.05), serum cholesterol (p<0.001), healthy diet (p<0.01), blood glucose monitoring (p<0.05) and foot exams (p<0.01). Post 24-month intervention, participants sustained the improvements achieved from the 6-month DSME and reported additional improvements for healthy diet (p<0.05), carbohydrate spacing (p<0.01), insulin use (p<0.05), and quality of life (p<0.05) [22].

Our study has definitely proved a beneficial impact of Diabetes self-management Education (DSME) program and established the need for Diabetes educators for empowerment of diabetes patients in self-care. The study has limitations due to small sample size and a short duration. It was not possible to have a control group continuing the standard care, for comparison.

To conclude, it was observed that the deficiencies in Diabetes self-care management by patients exist in knowledge, lack of awareness about lifestyle changes i.e. diet, exercise, complications of diabetes; especially foot care and their prevention. A well-structured Diabetes self-management education program comprising of group education as well as individual counseling is effective in improving self-care.

Diabetes self-management education program significantly improves health outcomes at short term follow up as seen by improvement in Glycemic control and Lipid Profile over 3 months but not in BMI. Diabetes educators play a very important role in implementation of DSME and they should be associated with physicians and diabetologists. Similarly a short counseling session by the consultant himself has a great motivational impact on improvement in Diabetes self-management by the patients.

However long term effect on health outcomes and sustenance of the beneficial effect of the DSME program needs further evaluation.

Recommendation
It is recommended that a well-structured diabetes education program combining individual as well as group therapy implemented by a team of Specialist, Diabetes educator, dietician and physiotherapist would help improve self-care management by diabetic patients, thereby achieving goals of glycemic control and delaying complications.

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