

Barriers to Nutritional Practices and Dietary Education in Patients with Type 1 Diabetes Mellitus in India

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Abstract

Type 1 diabetes mellitus (T1DM) affects a significant proportion of young adults Indians with Diabetes mellitus. Appropriate nutrition therapy is essential to sustain good glycaemic control and avoid hypoglycaemia. Preliminary study amongst these patients indicated a poor nutrient intake with a deficit in macronutrients and micronutrients. Hence the main objective of this study was to assess the major barriers to good nutrition in this group of patients. This cross-sectional study was conducted amongst 110 young adults with Type 1 diabetes mellitus (18-45 years of age) followed up at the Young Adults Type 1 Diabetes mellitus clinic of Christian Medical College & Hospital, Vellore. The major barriers to good nutrition practices were classified based on our previous study on eating disorders in T1DM into (i) Barriers to compliance to diabetes care education imparted at the clinic (ii) Barriers to following the appropriate principles of medical nutrition therapy (iii) Barriers to complying with the 3 meal/ 3 snack pattern. The responses were elicited using open ended and closed ended questions and their food diaries were used to validate their responses. The data was collected from the patient by the dietitian during one of their routine hospital visits over a period of 6 months. Time constraints related to work and study responsibilities were the major hindrance to dietary compliance in this young adult population. Lack of proper awareness about the importance of nutritional principles in diabetes was also a significant hindrance to the treatment process. Other issues faced by a minority of patients include a lack of support from the family, work colleagues and peers, while affordability was an issue in a small number of these patients. Lack of confidence and a low self-esteem was a barrier in following the general dietary advice imparted at the clinic in a proportion of the study population. The study throws light on the need to coordinate meal pattern and timings with the work schedule of Type 1 Diabetes mellitus patients. There is a need to enhance the availability of cost effective, easy to prepare and nutrient rich foods especially when dining out. The importance of meal dependant insulin dose adjustments should be reinforced at every hospital visit. Our study is the first of its kind to highlight specific barriers to nutritional practices and dietary education in T1DM patients from India.

Keywords: Type 1 Diabetes mellitus, Nutrition, Barriers, Time

Introduction

Type 1 diabetes mellitus (T1DM) accounts for 5% to 10% of all diagnosed diabetes worldwide [1]. Diabetes mellitus (DM) is one of the commonest metabolic disorders of childhood and it occurs due to the autoimmune destruction of insulin producing islet beta cells predisposed by genetic and precipitated by environmental determinants [2].

Data collected in 2013 found that the South-East Asia Region (SEAR) have 77,900 children affected with T1DM with the largest incidence found in the Indian continent [3]. The Karnal district of Haryana in Northern India (2008) , reported a prevalence of 18.3/100,000 in the 0 to 14 years age group [4]; with a lower incidence seen in South India (10.5/100,000/year) amongst children below 15 years of age in the four year period from 1991 to 1994 [5].

Appropriate medical nutrition therapy is essential to ensure that patients attain their maximum potential in terms of academic and quality of life. Avoidance of hypoglycaemia with sustained optimum growth is of paramount importance to this growing population. The American Diabetes Association has defined the goals of medical nutrition therapy as achieving a healthful eating pattern to improve overall health, attainment of individualized glycaemic control, blood pressure, lipid and weight goals with delay or prevention of diabetes complications [6].

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The pivotal components of diet are the provision of suitable quality and proportions of macronutrients (carbohydrate, proteins and fat) and micronutrients (vitamins and minerals) at each meal. Appropriate food choices have a positive effect as it lowers the post prandial glycaemic peak. Substituting refined cereals and flours with whole cereal grains and millets [7], inclusion of low glycaemic index foods [8] and the consumption of 4 to 5 servings of fruits and vegetables [9] daily are beneficial in attaining glycaemic control. A regularised meal pattern with intermediate protein rich snacks is mandatory to prevent hypoglycaemia. Regular recording of the food intake, physical activity and self-monitoring of blood sugars two to three times a week provides a continual picture of their glycaemia thus enabling better coping strategies [9]. It is crucial that the T1DM patients comprehend their condition so that they are in control of their lives. Numerous elements like socio-economic conditions, educational status and faulty understanding of the diabetes care can upset the glycemic control. Adolescents and the youth are particularly prone to put themselves at risk [9].

A preliminary study in our centre amongst these T1DM patients indicated a poor nutrient intake with a deficit in macronutrients and micronutrients [10]. The meal composition was inappropriate; there was a deficit in calories and proteins with a proportionally high carbohydrate intake. Nearly one-fourth of the patients did not have a satisfactory eating pattern and did not take snacks in between meals to avoid hypoglycaemias. The fibre intake of the patients was inadequate. This was due to the low vegetable intake, inadequate intake of whole gram pulses and high intake of refined cereals. Similar findings have been reported among Northern Indian T1DM patients, where Knowledge, Attitude and Practices with respect to Diabetes management were found to be unsatisfactory [11].

Hence the main objective of this study were to evaluate the major barriers faced by the patients in practising the good nutrition practices that are imparted at the T1DM clinic and to study its association with glycaemic control and hypoglycaemic attacks.

Methods

This cross-sectional study of T1DM patients was conducted in the Department of Endocrinology, Diabetes & Metabolism (Dept. of EDM) of Christian Medical College and Hospital (CMC&H), Vellore, Tamil Nadu, India. This is a 2600 bedded tertiary care teaching hospital catering to the medical needs of patients from all over India and its neighbouring countries.

Data was obtained (over a six month period) from patients aged between 18-45 years who had T1DM for duration of at least one year and were managed at the Young Adults Diabetes Clinic of the Department of EDM of CMC&H, Vellore, India. Patients with chronic conditions that interfere with food intake, known psychiatric illnesses, pregnant or lactating mothers, patient with malignancies, congenital diseases and prevailing syndromes were excluded from the study. The study protocol conformed to the ethical guidelines of the Declaration of Helsinki (2013) [12] and approval was obtained by the Institutional Review Board of Christian Medical College & Hospital, Vellore, India (IRB Min. No. 9547 dated 22.07.2015).

The baseline demographic details of the patients were

obtained from the updated medical records maintained for each patient individually at our clinic. During their visit to the clinic, the patients partook in group education and individual counselling sessions conducted by the diabetes care team consisting of two trained diabetes nurse educators, one dietician and two doctors. The sessions disseminated the principles of diabetes care management and proper nutrition practices using power point presentations, models, pictures and standardized tools. The patients were encouraged to self-monitor their blood sugars using glucometers and record the fasting and post prandial levels (4 times a day) for at least two days a week in their food diary books. The corresponding insulin dose and regime, food intake (including quantity) and physical activity are also recorded in the same page. Thus the food diary recordings give a vivid picture of their diabetes status and provide the diabetes team a platform to plan the future treatment action.

Those T1DM patients who had participated in at least 3 individual and 3 group sessions were selected to participate in this study. Thus 110 patients who met the inclusion criteria and provided informed consent constituted the study sample. The data for this study was collected from the patient by the dietitian during one of their routine hospital visits. Based on our previous study we identified three major nutritional areas where patient compliance was poor. The major barriers to good nutrition practices were studied under the following headings (i) Barriers to compliance to diabetes care education imparted at the clinic. The questions in this section included-compliance with recording of their food diary, dietary compliance and insulin adjustment (ii) Barriers to following the appropriate principles of medical nutrition therapy- were related to inclusion of adequate vegetable and proteins in each meal, inclusion of millets and avoidance of simple sugars (iii) Barriers to complying with the 3 meal/3snack pattern comprised of questions checking for regularity of meals and snacks intake. The patients were given the schedule to complete and assistance was given to those who were unable to read and understand the same. The responses were elicited using open ended and closed ended questions. Their food diaries were used to validate their responses and assess their insulin dose adjustment.

Statistical Analysis

The data was statistically analysed using PASW Statistics 19. Percentage analysis was done to represent the data. Chi-square analysis was done to assess the association between the barriers to good nutrition practices and glycaemic control. Student 'T' test was done to assess significant difference in the HbA1C levels and hypoglycaemia episodes between patients who followed the appropriate medical nutrition therapy against those who did not.

Results

The baseline characteristics of 110 Type 1 diabetes patients who met the inclusion criteria are presented in Table 1. This study included 53% males (n=58) and 47% females (n=52) with a mean age of 26.7 ± 7.3 years respectively. More than one-third of them had completed 10th grade schooling and half of them had a Bachelor's degree. An equal number of the population was employed or unemployed. One-third of the population did not have any hypoglycemic attacks in the previous 3 months. Nearly 47% (n=53) of them had at least 1 to 3 hypoglycemic attacks in

Variables	Frequency (n)	Percentages (%)
Gender		
Male	58	53
Female	52	47
Mean Age in years ^a		
Male	26.3±7.2	-
Female	26.9±7.5	-
Educational Status		
Illiterate	4	4
School up to 10 th	32	28
Higher secondary	16	15
College/professional	55	50
Not available	3	3
Occupational status		
Employed	46	42
Unemployed	45	41
Studying	18	16
NA	1	1
No. of episodes of hypoglycaemia in previous month		
None	33	30
1-3	53	47
4-6	8	8
≥7	5	5
Not available	11	10
Mean HbA1C %^a		
Male	8.5±2.6	-
Female	8.1±1.7	-
^a Mean ± Standard deviation		

Table 1. Baseline characteristics of patients with T1DM (n=110).

the last one month. However a small proportion of them (13%, n=13) experienced more than 4 hypoglycemic attacks in the last one month. The mean HbA_{1C} values (determined by High Performance Liquid Chromatography) for the T1DM patients was 8.3 ± 2.3%. The median duration of diabetes was 8 years in the population. Independent Sample t test revealed no significant difference in the age and HbA_{1C} of the male and female patients.

Barriers to good nutrition practices

The barriers to good nutrition practices were classified into three broad areas (i) Barriers to compliance to diabetes care education imparted at the clinic (ii) Barriers to following the appropriate principles of medical nutrition therapy (iii) Barriers to complying with the 3 meal/ 3snack pattern.

Barriers to compliance to diabetes education imparted at the clinic

Patients were advised to record their blood sugars, medications, the corresponding food intake and physical activity details in the food diary at least twice a week. They were taught and encouraged to adjust their insulin dose according to their blood sugar levels. The major factors that hampered them from practising these principles were recorded. Out of the total population (n=110), 83% (n=91) of them recorded food intake accurately and the remaining 17% patients (n=19) did not do so. Amongst those who did not comply, 9 patients (47%) considered it cumbersome (due to time constraints), another 4 (21%) were unable to write down the details in the food diary accurately owing to lack of literacy, a small number 3 (16%) appeared unaware of the importance of complying with the food diary. Low self-esteem and lack of family support were the other impediments in 3 (16%) of the patient.

With regard to the dietary compliance, 67% (n=74) were compliant and 33% (n=36) were non-compliant. In the latter group, time constraints was the major hindrance faced by 19 (53%) of the patients, 5 (15%) did not have family support in this regard and 7 (17%) appeared unaware of the role of diet in diabetes management. A small number 5, (15%) had a low self-esteem which impeded them from following the correct dietary principles. The major hindering factors are illustrated in (Figure 1).

With regard to insulin adjustment, more than three-fourth of the patients (85%, n=93) was confident with adjusting insulin dosages to maintain euglycaemia and the remaining 15% (n=17) did not adjust the insulin dosages. In these patients, the major hindering factor was unawareness of the significance of adjusting insulin (n=8; 46%), not recognising which meals may require adjustments in dose of insulin (n=6; 36%) and unfamiliarity with accurate dose adjustment (n=3; 18%).

Barriers to following the appropriate principles of medical nutrition therapy

The nutrient composition and choice of foods at each meal is vital to maintain acceptable post prandial blood sugars. The patients were questioned about the major difficulties they encountered in practicing these recommendations. The analysis found that although more than half (62%, n=68) of them consumed vegetables adequately, 38% (n=42) had inadequate vegetable intake. Time constraints were the major barrier in 22 (52%) subjects. Dicing and cooking vegetables were considered time consuming, indicating that these foods are considered as extras and not normally part of the family meal. However one fourth of them did not consume it due to the taste (n=10) and the cost (n=10) factor. This is represented in Figure 2.

Protein foods are to be included at each meal to attain acceptable macronutrient composition in the diet. More than half the patient population (58%, n=64) included protein foods and 42% (n=46) did not have adequate protein in the diet. Amongst the latter, 20 (44%) of the patients were unaware of the protein rich foods, 16 (35%) did not consume it because they did not have family support and 10 (21%) considered it to be expensive.

The fibre rich millets were not very popular in this group of patients although it has been traditionally considered as a staple food. Wheat was taken once a day in 76% (n=84) of the population and 24% (n=26) consumed refined cereals more than once a day.

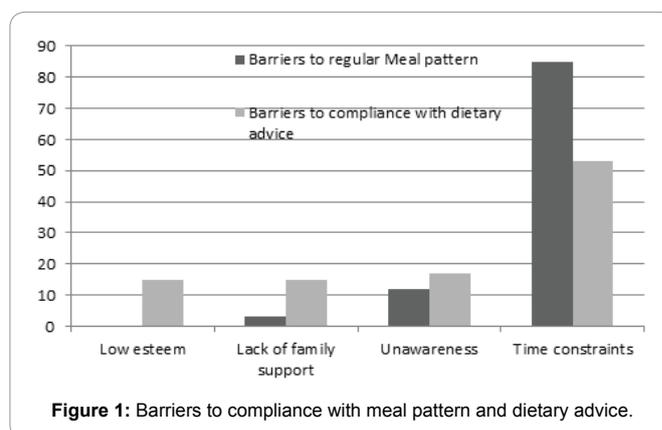


Figure 1: Barriers to compliance with meal pattern and dietary advice.

Polished rice constituted the other two meals since it was cheaply available in the public distribution system. Amongst those who consumed refined cereals for two meals, 14 (53%) consumed it since it was easy to prepare and 5 (23%) found it affordable. A small proportion 5 (23%) of them refused to include millets due to the taste factor and a lack of awareness of this nutrient rich grain (n=2; 1%).

Simple sugars were consumed occasionally by 25% (n=28) of the patients and 75% (n=82) did not consume it. Amongst those who consumed it 15, (53%) tried to manage the postprandial excursions by exercising or increasing their insulin doses, 3 (11%) of them were unaware of its high glycaemic index. Peer pressure was the reason in 5 (18%) of those consuming these simple sugars foods and 5 (18%) confessed that they found it hard to resist the high glycaemic index foods.

Barriers to complying with the 3 meal/ 3 snack pattern

Results showed that 70% (n=77) of our patients followed the appropriate 3 meal/ 3 snack meal pattern and 30% (n=33) did not follow it. Amongst the latter group, 28, (85%) kept irregular eating times due to late night working shifts and 4 (12%) of them

lacked awareness about the importance of meal timings. One patient (3%) did not have family support in this regard. This is illustrated in Figure 1.

It was seen that 68% (n=75) of the patients consumed snacks regularly and 32% (n=35) did not consume snacks regularly. However 14, (40%) of the patients did not regularly take snacks due to time constraints and the taste factor (n=14; 40%). Cost was an issue in 5 patients (14%) and 2 of them (6%) were unaware of its importance. This is illustrated in Figures 2 and 3.

A nocturnal snack was consumed regularly by 76% of these patients (n=84) and 24% (n=26) skipped the night snack. The main reasons in the latter group were late working hours in 20 of them (78%). In a minority of patients affordability (n=3; 11%) and unawareness (n=3; 11%) were the hindering factors.

One-third (n=31; 28%) of the patients consumed nutritious snacks like peanuts, roasted/sprouted whole gram pulses, fruits and salads and 72% (n=79) continued to take biscuits. Biscuits at snack time have been discouraged because of their poor nutrient content. Amongst those who consumed biscuits, 33, (43%) of them did so owing to convenience, low cost (n=13; 16%), satiety value (n=13; 16%) while 20 (25%) were unsure of any other nutritious snack options.

Forty two percent (n=46) of the patients faced problems when eating food from other than home particularly during special functions and festivals, but 58% (n=64) did not face any issues. The major issues were lack of healthy food options (n=24; 52%) and peer pressure (n=22; 48%).

Influence of nutritional practices on glycaemic control and hypoglycaemic attacks

A chi-square test was conducted to study the association between the glycosylated haemoglobin levels (HbA1C) and their dietary compliance. Out of the different factors affecting good nutritional practices, recording in the food diary and insulin adjustment in relation to meals showed a significant association

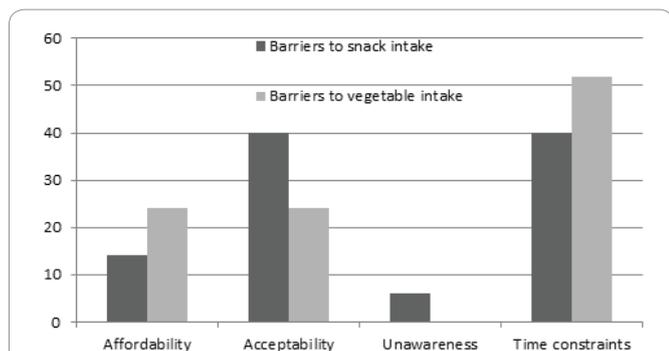


Figure 2: Barriers to adequate intake of snacks and vegetable in the daily meal.

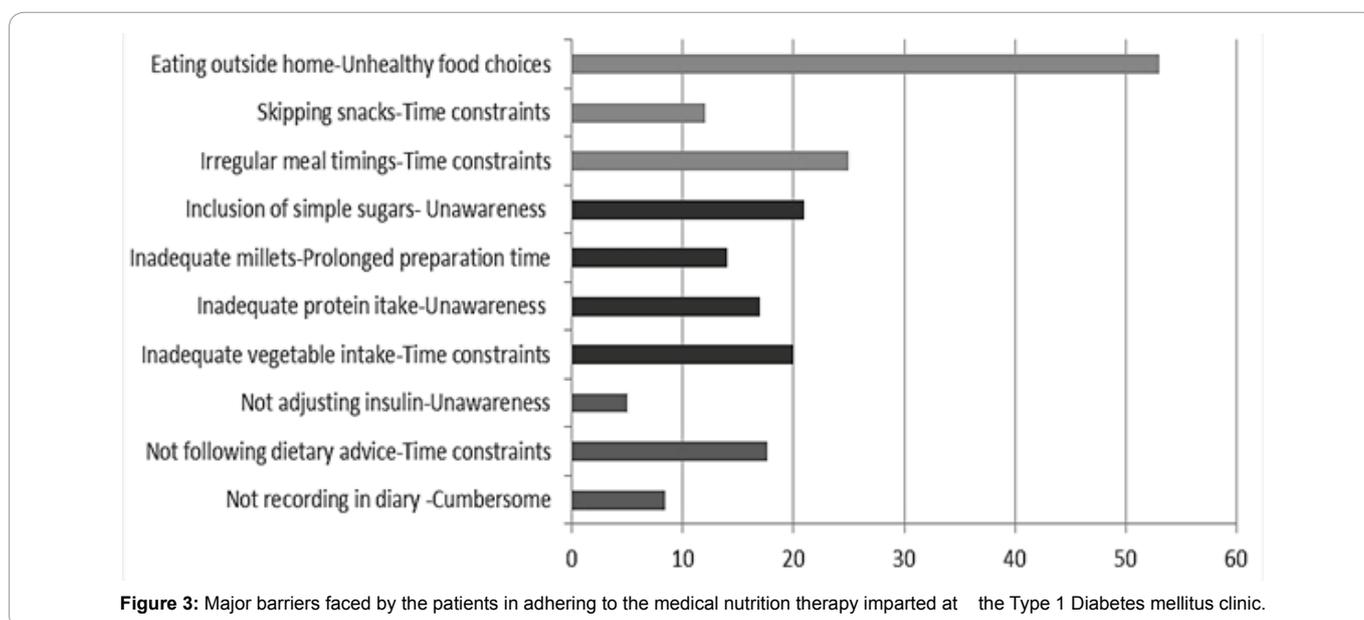


Figure 3: Major barriers faced by the patients in adhering to the medical nutrition therapy imparted at the Type 1 Diabetes mellitus clinic.

with HbA1C levels ($p=0.015$; $p=0.024$). When analysing the influence of these factors on the frequency of hypoglycaemic attacks in the previous six months, poor compliance with insulin dosage adjustment in relation to meals had a significant association ($p=0.009$).

Discussion

Our study has looked at three major barriers to good nutrition practices in Type 1 Diabetes mellitus patients from a developing country. In Barrier 1 (barriers to compliances to diabetes education), the most important impediment was a lack of dietary compliance due to time constraints. In Barrier 2 (barriers to following appropriate principles of Medical Nutrition Therapy), lack of adequate protein intake due to a paucity in their awareness of their importance was the hindering factor. In Barrier 3, (barriers to complying with the meal pattern) lack of compliance with a regular snack intake due to time constraints were the major hindrances.

In order to realize an individual's maximum potential in terms of academic and work performance, glycaemic control is crucial. Dietary compliance is an important arm in the management of diabetes [13]. While individual and group education is key to inculcating appropriate dietary practices, there may be difficulties experienced by the patients' despite a focussed diabetes education program. Our study aims to identify the major barriers in the implementation and compliance with good nutritional practices in a group of patients of Type 1 Diabetes mellitus receiving individual and group education imparted at the clinic. It was encouraging to note that majority of the patients (more than 50%,) complied with the advice imparted at the Type 1 Diabetes clinic and adhered to appropriate medical nutrition therapy, and the major issues that confront the non-compliant patients are discussed below.

Time constraints related to work and study responsibilities were the major hindrance to dietary compliance in this young adult population. The working schedules and academic pressures often regulated their eating patterns and meal timings. Majority of the working class resorted to easy to cook refined cereals, skipped snacks and vegetables and selected less nutritious snacks (biscuits) due to time constraints. Recording of the food diary was found to be a protective behaviour in achieving acceptable glycosylated haemoglobin levels. Thus time management skills, setting priorities, quick and healthier food options will better equip the patients to get the best out of their circumstances.

Lack of proper knowledge about the principles of proper dietary management of diabetes can hinder the treatment process. The basic principles about nutrition, composition of each meal, regular eating pattern, avoiding long delays between meals with frequent snack consumption, inclusion of fibre rich and low glycaemic foods at each meal were not understood in a small handful of the patient population. A small number of patients found learning and practising the principles of diabetes management cumbersome. These patients require continued counselling in their mother tongue during each visit to reinforce the principles of basic medical nutrition therapy. An American study reported that one of the most frequently reported barriers was a lack of knowledge of a specific dietary plan and the helplessness and frustration from lack of glycaemic control and continued disease progression despite adherence [14]. However a North Indian

study on the knowledge, attitude and practices of patients with Type 2 Diabetes, found they had acceptable KAP scores [11]. Illiteracy interfered with the recording of data in their food diary in a small number of patients; however this did not hinder their understanding of the information disseminated at the clinics.

Other issues faced by a minority of patients include a lack of moral support from the family, work colleagues and peers. The intricate Indian societies we live in have a significant impact on our social behaviours. An Austrian study found that the positive influence can be a cost-effective model in the treatment of Type 2 Diabetes [15]. In our study population we found that a few patients did not get positive support from their family, workplace or their peers and on the contrary were often ostracised by them. The family was unsupportive of their dietary requirements and no consideration was extended to them for their meal planning. Peer pressure influenced their choice of foods when eating outside the domestic environment. In this young population, a negative peer pressure can influence their food choice and this can have an adverse effect on their glycaemic control. There is an urgent need to sensitise our community regarding the non-communicable disease condition. Adolescence and young adults with Type 1 Diabetes mellitus requires a positive family support to make a smooth transition from adolescence to adulthood [16]. A study amongst native Hawaiians and Pacific islanders indicated that self-support groups improved glycaemic control, lipid profile, blood pressures, diabetes knowledge and self-management skills when compared to those patients without support in a 3 month period of the study. This effect, however, waned towards the end of 6 months [17].

Affordability was an issue in a small minority of these patients. Majority of our patients came from the lower socio-economic group and cost of food interfered with their food choices. Although glucometers and strips were supported by the International Diabetes Federation- Life for a Child program (IDF-LFAC) and Marjorie's fund, food costs had to be borne by the patients themselves. The subsidised polished rice disseminated by the government through the public distribution system was more widely consumed than nutrient rich millets. Coarse small grains were traditionally consumed by the earlier generations; however the green revolution of the 1980s diminished their production making them less widespread and relatively more expensive. Similarly the intake of vegetables and protein rich foods in daily diet was inadequate, owing to their high cost. Patients were advised to include locally grown seasonal vegetables and encouraged to initiate kitchen gardens to overcome these price issues. Including protein rich foods at each meal and as snacks (instead of biscuits) will on the long run ease the cost of diabetes care by preventing and delaying the onset of complications. Cost-related studies from South India by Shobhana et al. revealed that those from the lower socio-economic groups spent more than half of their income (59%) on overall diabetes care [18]. A Northern Indian study revealed that the direct costs of T1DM were high and more in lower socio-economic groups. The largest expenditure was on home blood glucose monitoring and insulin [19]. Studies from South African countries have shown that poverty was the major hurdle to attaining good glycaemic control [20]. A systematic review on the possible barriers that affect diabetes management found that besides the patients and clinicians attitudes, beliefs and knowledge, patients finance resources is important barrier in good diabetes management [21].

Lack of confidence and a low self-esteem was a barrier in following the general dietary advice imparted at the clinic in a small proportion of the population. In the initial days of diagnosis, there is often a period of denial by patients and relatives which may hinder efficient diabetes care. The professional input by a mental health professional in the routine diabetes care management will deliver the much needed moral support to initiate behavioural changes especially during the early stages. Similar findings were stressed by Hillard, et al. who reported that psychological and behavioural interventions can promote adherence to the complex and demanding diabetes care regimen, promote high quality of life, achieve optimal glycaemic control and ultimately prevent disease-related complications [22]. The DAWN study (Diabetes Attitudes, Wishes and Needs Study) reported that psychosocial problems appear to be common to Diabetes patients worldwide and the providers often face problems addressing these issues [23].

Conclusion

The study throws light on the need to coordinate a meal pattern and timings with the work schedule of Type 1 Diabetes mellitus patients from low to middle income countries. There is a need to enhance the availability of cost effective, easy to prepare, and nutrient rich foods especially when dining out. The importance of meal dependant insulin adjustments should be reinforced at every hospital visit. Our study highlights the need for intense and continuous nutritional education to increase awareness about the individual nutrients in the diet of Type 1 diabetes mellitus patients.

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Compliance with ethical standards

The study protocol conformed to the ethical guidelines of the Declaration of Helsinki (2013) and approval was obtained from the Institutional Review Board of Christian Medical College, Vellore India (IRB Min. No. 9547 dated 22.07.2015)

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Conflict of Interest

The authors declare that they have no conflicts of interest.

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