DIETARY INTAKE AND CLINICAL PROFILE OF THE CHILDREN WITH DIABETES MELLITUS

1. INTRODUCTION

“He who takes medicine and neglects diet wastes the skill of his doctors” ~ Chinese Proverb.

Diabetes was first described more than 3,500 years ago in ancient Egypt as ‘very abundant urine’. Later in the nineteenth century, the French man Bouchardat published a work on ‘the hygienic treatment of Diabetes Mellitus’ linking the condition with over eating. Nevertheless, after several thousand years of observation, diabetes remained a disease for which neither the cause nor the mechanism was known until the 20th century. In 20th century Minkowski from Strasbourg University showed that the islets of Langerhans are involved in the pathogenesis of Diabetes Mellitus by inducing Diabetes Mellitus in the dog by removal of the pancreas. Later research conducted in Toronto by Banting, Best, Macleod and Collip (1921) successfully treated diabetic dogs with pancreatic extract. The first human to be treated with pancreatic extract was Leonard Thompson in 1922. His spectacular recovery resulted in the Nobel Prize for Banting and Macleod in 1923 which they shared with their co-researchers (Brink et al., 2011).

Diabetes Mellitus (usually known just as diabetes) is the name given to group of disorders characterized by chronically high blood glucose levels and glucose in the blood comes from food and from stores in the body, including the liver, muscle and fat. Blood glucose is the main source of energy for the cells, tissues and organs of the body. The hormone insulin produced by the beta cells (β-cells) in the pancreas is required for glucose to move into the cells. Diabetes is a metabolic disorder that occurs when the beta cells of the pancreas are unable to produce an adequate amount of insulin to prevent hyperglycemia. Other than Type 1 and Type 2 Diabetes there are specific types of Diabetes Mellitus due to genetic defects of cell function,
genetic defects in insulin action, diseases of the pancreas, endocrinopathies, drug or chemical induced, infections, uncommon forms of immune-mediated Diabetes, other genetic syndromes sometimes associated with Diabetes and gestational Diabetes.

The prevalence of Diabetes is increasing globally at an alarming rate. Diabetes is now not a disease of the elderly as it was 30 years ago. More and more of children are getting Diabetes at a very young age. Approximately 90 per cent of young people with Diabetes suffer from Type 1 Diabetes however, the number of children and young adults affected by Type 2 Diabetes is also on rise. The International Diabetes Federation (IDF) estimated that the total number of people in India with Diabetes will be around 50.8 million in 2010, rising to 87.0 million by 2030. In fact, India has been designated as the "Global Capital of Diabetes" having as much as 35 million diabetic patients. It is estimated that annually approximately 76,000 children aged under 15 years develop Type 1 Diabetes worldwide. The South-East Asia region also has one of the highest estimates of prevalence of Type 1 Diabetes in children. In the year 2011, it was estimated that 18,000 children under the age of 15 had developed Type 1 Diabetes. India will face one of the toughest struggles against Diabetes in the region further, due to its large childhood population most of the 112,000 children in the region will be affected with Type 1 Diabetes. The epidemiological study conducted in south Indian population for a period of four years, indicated that the prevalence of Type 1 Diabetes in India is 10.1 – 10.6 per hundred thousand. However, in view of lack of effective monitoring mechanism, it is not possible to estimate the exact number of sufferers (Pushpa Krishna et al., 2005).

Type 2 Diabetes, which was marked only in adults earlier, is now increasing at dismaying rates in children and teenagers. Type 2 Diabetes is a tissue-wide insulin resistance that occurs due to a combination of defective insulin secretion and insulin resistance. Initially Type-2 Diabetes was treated with lifestyle modification namely diet, physical activity and behavior modification as these measures were considered to restore insulin sensitivity, allowing Type 2 Diabetics to regain satisfactory glucose control for years. Over the last decade, there has been a disturbing trend of increase in cases of Type 2 Diabetes in children due to higher
incidence of obesity and sedentary lifestyle. The risk factors for pediatric Type 2 Diabetes are obesity with increased body mass index, family history of Type 2 Diabetes, membership of ethnic minority, puberty, female gender and syndrome X. The common link among these risk factors is insulin resistance which plays a pivotal role in the patho-physiology of Type 2 Diabetes (Arslanian, 2002). The epidemics of obesity and the low level of physical activity among young people, as well as exposure to diabetes in-utero, may be the major contributors to the increase in Type 2 Diabetes during childhood and adolescence (Piyush Diwan, 2007). However, Type 2 Diabetes can often be treated with lifestyle modifications and medication.

The role of the early life environment in programming diabetes risk has been the focus of numerous human and animal studies. Historical studies highlighted an association between low birth weight, a proxy for suboptimal in-utero growth, and diabetes risk in adulthood. Over more recent years it has become apparent that a variety of expositions, including maternal obesity and/or maternal diabetes, can have a significant effect on offspring health outcomes. Further, paternal and transgenerational transmission of T2D can occur thus mediating a perpetuating cycle of disease risk between generations. It may be possible to prevent, delay or reverse a pre-programmed risk for T2D induced by pre- and/or postnatal environmental factors to improve health outcomes and curb premature metabolic decline (Berends and Ozanne, 2012).

A study by Karnataka Institute of Diabetology (KID) Bangalore in the year 2010 which had among 4,500 subjects with Type 2 Diabetes. As per the results of the study, 138 were found to be in the age group of 10 – 30 yrs and 11 were in the age group of 10 years. The trend is alarming and the reasons reported in the study were the type of diet, obesity, lack of exercise and other lifestyle factors. Type 2 Diabetes is becoming increasingly common in the preteen and teen years with hospitals reporting sharp rise in such cases in the last 3 – 4 years.

There is no known preventive measure for Type 1 Diabetes as most of the people affected are otherwise healthy when onset occurs. Diet and exercise cannot reverse or prevent Type 1 Diabetes which can affect both children and adults. Nickname for
Type 1 Diabetes is "juvenile diabetes" among children. There are several types of Type-1 Diabetes such as Type-1A or Autoimmune Diabetes where the T lymphocytes (T Cells) does not recognize the beta cells of the pancreas as part of the body instead attack them as if they were antigens. Latent Autoimmune Diabetes of Adulthood (LADA) is a sub category of Type1A diabetes where slower and longer process of β cell destruction than those with type-1A diabetes and type-1B is referred as idiopathic diabetes with unknown origin.

It is predicted that the cases of Type 1 Diabetes in kids could double in the next decade. Apart from genetics, the possible reasons for the dramatic rise include too big too fast, too little sun, too clean, too much cow’s milk and too much pollution (Mercola, 2009). The age of the mother > 35 years, preeclampsia during pregnancy, physiological jaundice, age at which supplementary foods are included to the infant are also found to be the potential risk factors (Scott R Votey, 2010).

Type 1 Diabetes is the most common type of Diabetes among children and adolescence which occurs when the body stops producing insulin a hormone which is essential for carbohydrate metabolism. The β-cells are destroyed at a variable rate and clinical symptoms of Type 1 Diabetes occur when 90 per cent of cells have been destroyed. Prevalence of Type 1 Diabetes in children under 5 years are expected to double by 2020 and cases among children younger than 15 years are expected to rise by 70 per cent during this time according to Mercola (2003). In India approximately 70,000 children under the age of 15 years get Type 1 Diabetes every year that means around 200 children/ day (The International Diabetes Federation (IDF), 2010). The incidence of Type 1 Diabetes is increasing in many parts of Asia, where resources may not enable targets for glycemic control to be achieved. The last 30 years has seen a three-fold increase in the number of cases of childhood Diabetes (John A. Seibel, 2009). In Karnataka particularly Type 1 Diabetes registry based on 13 years of data collection reported an incidence of 3.7/100,000 in boys and 4.0/100,000 in girls.
While the underlying patho-physiology and management of both forms of Diabetes are different, a common feature is the development of long-term micro and macro-vascular complications such as retinopathy, nephropathy, peripheral and autonomic neuropathy, macro-vascular disease. These complications are associated with increased morbidity and mortality. Duration of Diabetes and poor metabolic control are predictors of the development of both micro and macro-vascular complications and keeping the blood sugar level close to normal most of the time can dramatically reduce the risk of many complications. Long-term complications of Type 1 Diabetes develop gradually, over years. The earlier development of Diabetes and the less controlled blood sugar results in higher risk of complications. Eventually, Diabetes complications may be disabling or even life-threatening. Delaying or managing of these complications in case with children is a challenging task for both the parents and the physicians. The diagnostic criteria for a diabetic child is similar to that of a diabetic adult, where fasting blood glucose (FBS), oral glucose tolerance test (OGTT) and glycated haemoglobin (HbA1c) are used to confirm Diabetes.

An increasing number of children with Diabetes require intensive treatment programs to reduce their development of complications. These programs can cause an extra burden on the routines and relationships of children and their families. Off late researchers say it is important to conduct research on how Diabetes and its treatments impact the quality of life of the patient and family. Diabetes influences the lifestyle, personality, emotional and physical well-being of the child. Psychological factors are important influences affecting the care and management of Diabetes. Diagnosis of Diabetes poses considerable challenges and stress for children and families. Depression is often mentioned as a correlate of diabetes as also certain other psychological disturbances. Psycho-educational intervention helps prevent the impact of diabetes on different dimensions of quality of life. Diabetes education and counseling may go a long way in promoting emotional integration to diabetes adjusted quality of life (Ramachandran, 2003).
Diabetes management requires nutritional knowledge along with insulin therapy which includes the knowledge pertaining to types and dosage of insulin, injection site, insulin pump etc along with the regular physical activity plays a pivotal role in the treatment and management of a diabetic child. Thus, education of the patient and caretakers form an integral and important component in the management of Diabetes.

According to Parvez et al., (2007) diabetic children should be aware of the importance of Home Monitoring of Blood Glucose (HMBG) at regular intervals to ensure overall well-being and to know about the measuring of insulin dose and to self inject the insulin apart from dietary management. Diabetes education classes should cover a wide range of issues like the effect of diabetes on physical and emotional health, testing the blood sugars, importance of exercise, signs of a blood sugar emergency, regulating medications and/ or insulin, recognizing and preventing complications and coping with lifestyle issues.

Nutrition education and lifestyle counseling should be adopted to individual needs and delivered in a patient-centered manner. Education can be delivered both to the individual child and family in a small group settings. In case of very young children, new behavioral-based intervention strategies to help parents to improve meal times could be useful in teaching diabetic children to learn to follow a structured eating schedule, desirable for long-lasting efficacy in diabetes care. In adolescents, eating disorders and insulin misuse for weight control purposes are concrete and difficult problems to deal with. Appropriate nutritional education helps children with diabetes to find this balance and enjoy a better quality of life. Nutritional management is most important factor for diabetes care and education (Pastors and Franz, 2013).
In view of this background, the present study has been undertaken with the following aim and objectives.

**AIM OF THE STUDY**

The aim of the study is to assess the nutritional status, clinical and subjective health profile of the children with Diabetes Mellitus and to find the impact of an organized short duration diabetes education at regular intervals.

**OBJECTIVES**

- To study the demographic and socio-economic profile of the subjects with Diabetes Mellitus.
- To study the dietary profile, calculate the nutrient intake and compare with the RDA.
- To measure the somatic status of the subjects by anthropometric measurements, standard growth charts and comparing with the standards.
- To evaluate the glucose control (glycemic control) maintained by the subjects.
- To estimate the glycosylated haemoglobin (HbA1c) values and compare with normal range.
- To find out whether the insulin intake is based on carbohydrate counting and body weight of the subjects.
- To study the effect of diabetic education for the group along with individual nutrition counseling on dietary intake, somatic status, glycemic control, HbA1c values and quality of life.
HYPOTHESIS

H₀₁: The nutrient adequacy of the dietary intake pertaining to energy and macronutrients of the subjects will not be 100%.

H₀₂: The somatic status of all the subjects will not be as per the normal standards.

H₀₃: The insulin intake will not be based on carbohydrate count.

H₀₄: The insulin intake will not be based on body weight.

H₀₅: There will not be any difference between the subjects from government hospital and corporate hospital pertaining to:

H₀₅.₁: Nutrient intake
H₀₅.₂: Somatic status
H₀₅.₃: HbA₁c level
H₀₅.₄: Quality of life

H₀₆: The diabetes education intervention will not have significant effect on the following:

H₀₆.₁: Nutrient intake
H₀₆.₁.₁: Energy
H₀₆.₁.₂: Carbohydrate
H₀₆.₁.₃: Protein
H₀₆.₁.₄: Fat
H₀₆.₂: Somatic status
H₀₆.₂.₁: Height
H₀₆.₂.₂: Weight
H₀₆.₃: Insulin intake based on carbohydrate counting
H₀₆.₃.₁: Morning insulin intake
H₀₆.₃.₂: Evening insulin intake
H₀₆.₄: Glycemic control – Home Monitoring Blood Glucose (HMBG)
H₀₆.₄.₁: Before breakfast
H₀₆.₄.₂: After breakfast
H₀₆.₄.₃: Before dinner
H₀₆.₄.₄: After dinner
H₀₆.₅: HbA₁c level
H₀₆.₆: Quality of life
SCOPE OF THE STUDY

The care of children and adolescents with Diabetes is especially important because these children come under vulnerable population and they require both family and professional support in order to become healthy and productive adults. Management of Diabetes in children is much more difficult when compared to adults. Achieving good glycemic control and prevention of diabetes related complications in the long run are the issues of concern and fact remains that there is a paucity of clear solid data in Indian scenario. Nutrition education through motivational interviewing and/or group and individual counseling adopted to individual needs pertaining to dietary modification, lifestyle pattern, glycemic control and concept of carbohydrate count to fix the require dosage of insulin would be a sustainable approach in management of children with Diabetes to prevent complications.