

Nutritional assessment of Type 1 Diabetes Mellitus patients

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Abstract

The study was conducted to access the impact of nutrition on type 1 diabetes at Mahatma Gandhi hospital Jaipur. If this type of diabetes is not treated for a long time, then many related diseases may occur. In some patients who had been suffering from diabetes for a long time, some other problems such as chronic kidney disease, decompensated cardiomyopathy and retinopathy may also occur. It was found from this study that this type of diabetes occurs mostly in people of young age (17- 25) although it is also observed in children. The study also found that it occurs more in men than in women. In this study it was found that most of the patients had similar types of clinical sign and symptoms like weakness. Majority of patient were underweight as they lost their weight 5-10 kg. Higher occurrence may be attributed to less physical activity by some patients during the covid-19 lockdown. The blood sugar was found to grow as even after being diagnosed for the disease and after proper diet counseling also, a proper diet and lifestyle pattern was not followed by them.

Keywords

Nutritional status, diabetes, T1DM, Assessment, dietary intake

Introduction

What is diabetes?

Diabetes is a degenerative disease that brings some metabolic changes in the body due to insufficient action of insulin or it can be said that body's ability to convert food into energy is hampered in diabetes. Uncontrolled diabetes may have negative impact on blood vessels of our eyes, peripheral nerves, kidneys and heart.

Whatever food we eat, is converted into glucose after metabolism. Pancreas receives signals to release insulin as glucose in blood reaches to a certain level. Insulin helps entering this blood sugar into body's cells but in case of diabetes, as insulin is not sufficient due to whole or partial production or insulin resistance of body, the blood sugar is not able to enter into the cells. Therefore, blood glucose level rises and body feels weak and lethargic due to lack of energy (Khanna et al. 1998).

1.Type 1 diabetes mellitus (Insulin dependent diabetes)

In Type 1 diabetes, β cells of the island of langerhans of the pancreas are destroyed by the immune system. The consequence include symptoms of hyperglycaemia and ketosis seen due to lack of insulin. If uncontrolled for long duration, then it may damage different body organs including kidney, nerves, heart, blood vessels and eyes (Mobasseri et al., 2020; Chimen et al., 2022).

2. Type 2 diabetes mellitus (non-Insulin dependent diabetes)

Condition of insulin resistance is known as Type 2 diabetes mellitus (T2DM) that accounts to approximately 90% cases of diabetes all over the world. In T2DM, functioning of cell's insulin receptors is impaired therefore, cells cannot utilize blood glucose as fuel. Generally T2DM is seen in adults but now a days, it is increasingly observed in younger age group also due to decreased physical inactivity and junk diets (Goyal and Jialal, 2022)

3. Gestational diabetes

Gestational diabetes mellitus (GDM) is recognized during pregnancy with signs of glucose intolerance and increased blood glucose levels. It can be classified as A1 GDM and A2 GDM. Remarkable insulin resistance is seen in GDM that is secondary to secretion of placental hormone - lactogen (Bryan et al., 2022; Alfadhli, 2015)

Some related terminology used in T1DM

Latent Autoimmune Diabetes of Aging (LADA)

LADA is very often misinterpreted as T2DM, but it is different in the sense as it is a slowly progressive autoimmune disorder. In initial stages, although it can be controlled with dietary modification but in later stages medication and insulin intervention is required (Diabetic mellitus T1; Khardori, 2012).

Brittle T1DM

Another names for this are labile or unstable diabetes. It is very tough to manage as there are abrupt swings in the levels of blood glucoses levels that may lead to frequent episodes of hypo or hyperglycaemia (Lucier and Weinstock, 2021; Cleveland Clinic.org)

Cause: Celiac disease, eating disorder, gastro paresis, adrenal Insufficiency, hypothyroidism, stress, anxiety, depression.

Symptoms: There may be sudden episodes of hypoglycaemia or hyperglycaemia. Symptoms of hypoglycaemia include dizziness, weakness or tremors, increased heart beat, irritability, pale skin, restlessness, improper sleep, sweating, sudden cravings etc. Symptoms of hyperglycaemia include blurred vision, fatigue, polyuria, headache, skin infections and slow-healing cuts, polyphagia and polydipsia.

DKA (diabetic ketoacidosis)

Uncontrolled blood glucose levels in T1DM may lead to a very critical state of diabetic ketoacidosis (DKA). Acidic ketone bodies rise to a dangerously high level in the body in state of DKA.

Proliferative Diabetic Retinopathy (PDR)

PDR is found in uncontrolled diabetes for long duration. Type 1 diabetics are at more risk of PDR.

Diabetic Foot

In uncontrolled high blood sugar levels, peripheral nerves are damaged that may simultaneously damage blood vessels in the feet. Symptoms of numbness, tingling and pain in feet can be noted in this condition. In absence of sensation, person is unaware of any cut, blister or ulcer on foot, that can get infected. The healing process of that infection is also very slow due to hampered blood supply in the feet. This may lead to a very serious condition named as gangrene. Muscle, skin, and other tissues become dead of the infected area and If gangrene is not cured, it may need a foot amputation to save patient's life.

Etiology of Type 1 diabetes

There are two main types of diabetes - primary or idiopathic and secondary diabetes.

1. Primary or Idiopathic Diabetes

Hereditary is the main aetiological factor for this. There is a familial tendency to develop diabetes but the specific biochemical defect and the mode of inheritance has not been identified. The tendency of diabetes is believed to be inherited as a Mendelian recessive characteristic. If both parents are diabetic, all their children would be diabetic if they live long enough and if one parent is a diabetic and the other a diabetic carrier, half of their children would be potential diabetics. If one parent is a diabetic and the other a non-diabetic and also a non-carrier, none of their children would be diabetic, but they would all be carriers. If these children and their children marry consistently non-diabetics, the carrier tends eventually disappears. However, environmental and other factors play a role in unmasking an underlying diabetic genotype and determine whether a person with a genetic predisposition actually develops the disease or not.

Age: The disease may occur at any age but about 80 percent of the cases occur after the age of 20 years. Diabetes is thus mainly a disease of the young age.

Gender: In the younger age groups, diabetes is more commonly seen in males than in females. In middle age, women are more affected and the chances increase with pregnancy and increasing parity. obesity. There is a strong association between diabetes and obesity but it is uncertain whether obesity is the result or the cause of diabetes.

Dietary factors: A high intake of sugar has been related to obesity and may predispose to diabetes as seen in Indians in South Africa. A low intake of fibre due to consumption of refined foods associated with high prevalence of diabetes in prosperous communities. The specific effect of fibre in reducing the risk of diabetes is, however, not clearly defined.

Infections: Infections, particularly staphylococcal, may unmask latent diabetes due to production of hormones that are antagonist to insulin. There is increasing evidence of Type 1 diabetes following viral infections, which brings about autoimmune reactions that destroy the B - cells of pancreas and impair insulin secretion .

Stress: Physical injury or emotional stress may be a cause of unmasking latent diabetes by eliciting adrenocortical response, Surgical operations and severe infections may therefore be contributing factors in precipitating the disorder .

2. Secondary Diabetes

A minority of cases of diabetes occur as secondary to some other disorders These are due to diseases which destroy the pancreas and lead to impaired secretion and release of insulin, e.g. pancreatitis, haemochromatosis, carcinoma of the pancreas and pancreatectomy.

Abnormal concentration of certain hormones in the circulation which are insulin antagonist. These include:

- **Growth Hormone :** About 30 percent of patients with increased concentration of growth hormone have been found to develop diabetes.
- **Adrenocortical Hormones:** Cortisol and other corticosteroids lead to increased protein breakdown and inhibit utilisation of glucose by peripheral tissues, thus increasing the glucose levels of blood. Patients with Cushing's syndrome show impaired carbohydrate tolerance and those suffering from Addison's disease (decreased secretion of corticosteroids) and hypopituitarism show increased . sensitivity to insulin . Various forms of therapy like administration of corticosteroids and certain diuretics may precipitate diabetes in those who are genetically susceptible.
- **Adrenaline:** This raises the blood glucose by increasing glycogenolysis (breakdown of liver glycogen) and by suppressing the secretion of insulin.

Symptoms of Type 1 diabetes mellitus

- Polyuria.
- Polydipsia
- Polyphagia
- Hyperglycaemia .
- Electrolytes distribution.
- Dehydration.
- Ketoacidosis.
- Weight loss.

- Delayed wound healing.
- Dry and Itchy skin.
- Losing the feeling in feet or tingling.
- Blurry Eyesight

This is also known as juvenile diabetes as it is mostly seen in younger age group. Although it is usually observed in younger generation, yet it can occur at any age (Lucier and Weinstock, 2021)

Diagnosis

The diagnosis of type 1 diabetes is done with a history of symptoms of polyuria, excessive thirst, hunger and excess weight loss, with uncontrolled high blood sugar levels, glycosuria, ketonemia, and ketonuria.

The following diagnostics can be done to rule out condition of T1DM -

- Fasting blood glucose test: It is done on empty stomach generally in early morning after an overnight fasting (Normal value = 70-100)
- Random plasma glucose test: This test can be done at any time randomly (Normal values = 70-140)
- Post prandial normal values : This test can be done after eating food (Normal values = less than 140)
- HbA1c test: HbA1C or glycolyted haemoglobin test gives an average values of blood glucose for three months
- Oral glucose tolerance test: In this test, fasting blood glucose level is measured and then measured amount of glucose is given to patient. Then blood glucose is again measured after one, two and three hours of administration

Metabolic Changes in diabetes

Insulin secreted by the pancreas is either insufficient or ineffective . This may be due to a primary disorder of insulin secretion or due to insulin resistance because of a receptor defect in the target tissues . As a result , glucose cannot be oxidized properly through the main glycolytic pathway in the cells to furnish energy and its level in the blood rises, leading to **hyperglycemia**. When kidney threshold crosses to absorb blood sugar due to excess blood glucose levels (180 mg / 100 ml), condition of **glycosuria** develops. Increased glucose concentration increases the osmolarity of the glomerular filtrate that

prevents water reabsorption by kidneys and leads to **polyuria and nocturia**, water and electrolytes loss and consequently **polydypsia**. Metabolic changes can be seen in terms of increased glycogenolysis and gluconeogenesis. Glycogen and protein are present in cells associated with water and intracellular electrolytes as they are catabolised glucose, water and electrolytes (Herbert, Waxman clinical study centre).

Nutritional Management

Diet modification is a very effective tool in the management of diabetes. Diet and regular physical activity may be useful alone to manage blood sugar levels or if still it is not controlled then diet can be used as a tool in combination with insulin or oral Hypoglycemic agents (Sandhya Rani and Bhadada, 2017) .

Energy distribution in carbohydrate, fat, protein:

At least 55-60% of complex carbohydrates are advisable of total calories. Less than 100g carbohydrate per day may cause ketosis. Type and distribution of carbohydrate is equally important as the quantity.

The protein requirements are similar to normal healthy individuals.

Total fat intake usually accounts for 20-24% of total calories but it can be reduced in case of obesity. It is advisable to take restricted amount of fat only as diabetics are prone to heart diseases also. Fats in the form of polyunsaturated fats should be preferred. Daily cholesterol intake should be < 300 mg. Omega-3 fatty acids are beneficial and so 2-3 servings of fish per week are recommended.

Calculation of Energy Requirements in Type 1 diabetes Patients

Age	Energy requirements (Boys)
1 st year	1000 kcal = A
Up to 12 years	$A + (125 \text{ kcal} \times \text{per year till 12 year}) = B$
13 – 15 year	$B + (200 \text{ kcal / year over the age of 12 year UP to 15 year of age})$

Table 1: Calculation of energy requirements of T1DM boys

Age	Energy requirements (Girls)
1 st year	1000 kcal = A
Up to 12 years	$A + (100 \text{ kcal} \times \text{per year till 12 year}) = B$
13 – 15 year	$B + (100 \text{ kcal / year UP to 15 year of age})$

(Clinical Dietetics Manual, 2018)

Table 2: Calculation of energy requirements of T1DM girls

Add 20 % additional Kcal for activity and add up to 20 % for pubertal needs .

Minimum caloric prescription for Adults recommended by ADA (2018) is

1,200-1,500 Kcal / day for women

1,500-1,800 Kcal / day for men

Type of carbohydrates

Monitoring both the type and amount of carbohydrate in meals is important. The carbohydrate content of the diet can be estimated by use of exchange lists and carbohydrate counting. In carbohydrate counting, food portions containing 15g of carbohydrate are taken as one carbohydrate serving. Complex carbohydrates should be preferred as it increases intestinal transmit time and releases glucose more slowly. Forty gram of dietary fibre intake per day is beneficial. Fibre content can be obtained from whole cereals, leafy vegetable, beans and pulses.

Glycemic Index

Glycemic index shows the level of blood sugar increases after ingestion of a food. GI Area under the glucose response curve of test food (50g) / Area under the equivalent carbohydrate amounts.

The glycemic index of any food depends on composition and size of starch molecule, digestibility and cooking method.

Glycemic Index of Certain Foods <60%

Peas	51
Rajmah	29
Lentils	29
Apple	39
Orange	40

Methi	34
Curd	34
Barely	36
Oats	49
Buck wheat (Kootu)	51
Corn	51

Table 3: Glycemic Index of Certain Foods <60%

Glycemic Load

$GI \times \text{Available Carbohydrate (g)} / 100$

* Available Carbohydrate = Total Carbohydrate - Dietary Fibre

Classification of GL High ≥ 20 Medium 11 to 19 Low ≤ 10

Foods having a GI less than 55 are considered low GI foods, those with 55 to 70 as moderate and more than 70 as high GI foods.

The glycemic load (GL) is calculated by multiplying the GI by the amount of carbohydrate in each food and totalling the values for all foods in a meal / diet. Diet and Feeding Pattern In all diabetes, the amount and time of food intake particularly the carbohydrates, should be controlled to prevent fluctuations of blood glucose beyond the normal range. Intake of refined sugar should be low as blood levels rise sharply shortly after consumption. Patients should avoid feasting 'or' fasting: adjustment should be made for exercise and appetite and they should not miss a meal or overeat. Use of exchange lists helps to provide variety in the menus and break monotony while complying and adhering to a strict regime. As the carbohydrate, fat and protein of each exchange is given, diet can be planned using different foods from the given amount of particular exchanges. Mineral and vitamin requirements of patients with well controlled diabetes do not differ much from those of normal subjects. Neuritis frequent complication in diabetic patient is prevented by liberal intakes of B - group vitamins, especially Thiamine.

Some research have been carried out in this direction but still no work was done on the assessment of nutritional status of type 1 diabetic mellitus (T1DM) Rajasthani population, therefore present research work was planned with the aim to assess nutritional status of type 1 diabetic mellitus patients of Rajasthani population.

Objectives

- Collection of demographic details of the subjects
- Assessment of Nutritional status of T1DM patients
 - To collect information on anthropometry
 - To collect information of biochemical profile
 - To examine clinical signs and symptoms
 - To collect data on dietary intake
- Interpretation of data as Nutritional Diagnosis

Research Methodology

A prospective baseline study was conducted on T1DM patients admitted in Mahatma Gandhi Medical College & Hospital, Jaipur. Purposive sampling technique was used for sample selection until the sample size of 20 was not completed.

Inclusion criteria

- Patient from childhood and adult age group
- Patient willing to participate
- Patient suffering from T1DM

Exclusion criteria

- Patient under infancy and elderly age group
- Patient who were not willing to participate or non-cooperative patients
- Patients who do not have T1DM
- Critically ill patients on ventilator

Data Collection

- **Demographic information of the patients:** In this general information of patients was collected by interview of patients or attendant. Some information was obtained from patient's IPD or OPD file such as name, age, place, education, work status, type of activity, economic status and marital status.

Format for data collection for general information is as below

Part 1: General Information

Name:

Age/ Sex

Address:

Place:

Education:

Working status of the Respondent:

Type of activity:

Economic Status:

Marital Status:

Admission date:

Mobile no.:

Assessment of nutritional status

2.1 Collection of anthropometric data: The patient's anthropometric measurements were carried out in which weight, height, waist circumference, hip circumference, mid upper arm circumference (MUAC), body mass index (BMI) and waist hip ratio were measured.

- Height was measured using an heightometer.
- Weight was noted by digital weight balance.
- BMI was calculated by the formula $Wt (kg) / Height (m^2)$
- MUAC & waist circumference and hip circumference were measured using non stretchable measuring tape.
- Waist to hip ratio was calculated using the formula (Waist circumference/ Hip circumference)

Format for the same is as below -

Anthropometric Measurement

- Weight :
- Height :
- Waist circumference :
- Hip circumference :
- MUAC :

- Head circumference : (KIDS)
- Chest circumference :(KIDS)
- BMI Z Score/ percentile : (KIDS)
- Growth chart / percentile (WHO/IAP) : (KIDS)
- BMI :
- Waist/ Hip circumference ratio (WHR) :

Collection of biochemical profile: In this part of the study, data was recorded from patient's in patient or out patient records. Majorly, reports were obtained for sugar charting, HbA1C, electrolytes, liver function test, renal function test and urine culture.

Biochemical Data

Date	Parameters	Result values	References

Data collection on clinical signs & symptoms: In this part, clinical sign and symptoms of patients were observed or interview. In this, data was recorded for the presence or absence of weakness, anorexia, wasting, anemia, loss of appetite, taste change, vomiting, frequent urination, excessive hunger and excessive thirst.

Clinical Sign And Symptoms

- Weakness
- Anorexia
- Wasting
- Anaemia
- Loss of appetite and taste changes
- Fatigue
- Nausea / Vomiting
- Frequent Urination
- Excessive thirst
- Excessive Hunger
- Weight gain

Collection of data on dietary intake: In this part of study, the patient's 24 hour dietary intake was noted by dietary recall method. Besides this, patient's empty calories intake was also recorded using food frequency tables. Then calculation of nutrient intake was done using Indian Food Composition Tables (2017) and the intake of nutrients was compared to the requirements as per RDA (2020).

Time	Menu	Household Measures	Calorie	Protein	CHO	Fat	Fibre

Table 4: Format for 24 Hour – Home diet recall

Food Item	Daily	Weekly	Fortnight	Monthly	Total Empty calories Intake
Oil					
Sugar					
Cold drink/ Sharbat					
Juice					
Pickles/ fried foods/ Junk foods					
Alcohol					
Total					

Table 5: Format for empty calories intake using food frequency table

Nutritional diagnosis: In the last, Nutritional diagnosis was interpreted using above data, in which the patient is classified on the basis of BMI, history of weight loss, clinical signs & symptoms and food intake in the category of “Obese”, “Overweight”, “Underweight”, “Malnourished” and “Normal healthy”.

Diet counseling: Patients were finally given diet charts as per their nutritional diagnosis

Sample menu	
8:30 – 9 am:	½ glass milk (without sugar) + 1 chapati/ dalia/ rabadi/ 1.5 idli + 2 egg white / 1 bowl sprouts ½ गिलास दूध (बिना चीनी) + 1 चपाती/दलिया/राबड़ी/ 1.5 इडली + 2 अण्डे की सफेदी/1कटोरी अंकुरित दाल
11 am:	Fruit 100 g (Guava/ orange/ apple/ pears/ jamun/ musambi/ pomegranate/ papaya) फल 100 ग्राम(अमरुद /संतरा /सेब /मौसमी/नाशपाती/जामुन/अनार/पपीता)
1 – 2 pm:	Salad ½ plate + 2.5 chapati + dal (1 bowl) + vegetables (1 bowl) + chhachh (1 glass) सलाद (1/2 प्लेट) + 2.5 चपाती + दाल 1कटोरी+सब्जी 1कटोरी+ छाछ 1गिलास
5 pm:	1/2 glass milk (without sugar) + 1 bowl roasted chana ½ गिलास दूध(बिना चीनी) + 1 कटोरी गुना चना
8 – 9 pm:	Salad ½ plate + 2 chapati + dal (1 bowl) + vegetables (1 bowl) सलाद (1/2 प्लेट) + 2 चपाती + दाल 1 कटोरी+ सब्जी 1 कटोरी
Instructions (निर्देश):	
☐ Eat bejad chapati (wheat 3 kg + barley 1 kg + black chana 1/2 kg) - without ghee (बेजड की रोटी- गेहूँ 3 किलो + जौ 1 किलो + काला चना 1/2 किलो)	
☐ Oil 2 tsp (10 ml) (तेल 2 चम्मच)	
☐ Eat only in suggested quantity & in suggested time (निर्धारित समय व निर्धारित मात्रा में ही खाएं)	
☐ Physical activity: a) Morning walk 30 min. Postdinner walk 15 min. Exercise. (यायाग: 1/2 घंटे सुबह की सैर व रात के खाने के बाद 15 मिनट सैर)	
☐ Eat last meal 2 hrs prior to sleep (रात का खाना सोने से 2 घंटे पहले) खाएं	
☐ Have your meals at fixed times & never skip a meal (खाने बताए समयपर ही लें व कोई मील छोड़ें) नहीं	
2022/9/9 09:50	

Figure 1: Sample menu of diet

Dietary tips to improve glycemic control

- A moderate caloric restriction of 500-750 calories from the usual daily intake and an increase in physical activity by 30 minutes / day may lead to improved insulin sensitivity
- Emphasis should be given on complex carbohydrate foods to reduce hyperglycemia
- Avoid whole milk and prefer skimmed milk for tea, coffee, curds and paneer
- Prefer whole grain cereals (millets, amaranth, oats, barley and quinoa), long grain basmati rice and whole pulses
- Avoid refined carbohydrates like sugar, juices, jams, jellies, sugar candies, honey, jaggery, sharbat, lassi, sweets, chocolates, etc.
- Limit roots and tubers like potato, colocasia, yam, sweet potato and beetroot
- Sago, arrowroot and refined flour preparations like white bread, biscuits, noodles and pasta should be avoided / restricted
- Reduce the intake or eliminate fried and creamed foods. Encourage the intake of foods rich in omega - 3 fatty acids
- As per ADA (2017), foods like nuts, berries, yogurt, etc. are beneficial in diabetes

- Fenugreek intake was also encouraged in patients as it has hypoglycemic and hypocholesterolemic properties
- Active ingredients found in cinnamon to lower blood glucose levels are Procyanidin Type - A Polymers. Individuals on secretagogue should be cautious while using cinnamon, since it might decrease blood glucose levels further. Prolonged use large amounts may result in hepatotoxicity in individuals susceptible to or with pre-existing liver disease
- Read the nutrition label carefully. It's not necessary always that food packings labelled as sugar-free, fat-free or high fibre can be true to these claims and their consumption is greater in assumption of one is taking low calorie food. In this way high amount ultimately may cause increase in sugar level
- Eat bejad Chapati (wheat 3 kg + barley 1 kg + black chana ½ kg)

Eat in suggested quantity (निर्धारित मात्रा में खाएँ)	Avoid (नहीं खाएँ)
Whole grain cereals (wheat with choker, bejad, bajra, corn, sattu, rabadi, dalia, oats, barley) (साबुत व छिलके वाला अनाज, चोकर, बेजड़, बाजरा, मक्का, सत्तू, राबडी, दलिया, ओट्स, जौ)	Poha & refined wheat flour foods, biscuit, toast, fan (पोहा, बिस्किट, टोस्ट, फेन व मैदे से बनी चीजें)
Raw vegetables, salad (कच्ची सब्जियाँ, सलाद)	Potato, arbi, sweet potato, yam (आलू, अरबी, शकरकंद, जिमीकंद)
Fruits guava, orange, mausambi, apple, pears, jamun, pomegranate, papaya (अमरुद, संतरा, मौसमी, सेब, नाशपाती, जामुन, अनार, पपीता)	Mango, banana, cheeku, grapes, litchi, dates, melons (आम, केला, चीकू, अंगूर, लीची, खजूर, तरबूज, खरबूज)
Doubletoned milk, curd (without cream), chhachh (डबलटोण्ड दूध, दही – बिना मलाई, छाछ)	Full cream milk, cream, mawa, icecream (चिकनाइयुक्त दूध, मलाई, मावा, आइसक्रीम)
Egg white, fish, chicken (अण्डे की सफेदी, मछली, चिकन)	Red meat, egg yolk (लाल मांस, अण्डे का पीला भाग)
Chhachh, lemon water, coconut water, vegetable soups (छाछ, नींबू पानी, नारियल पानी, सब्जियों का सूप)	Sweets: sugar, gur, honey, sharbet, shikanji, lassi, fruit juices, cold drinks, sweets, chocolates, icecream (मीठा: चीनी, गुड़, शहद, शरबत, शिकंजी, लस्सी, फलों का रस, कोल्ड ड्रिंक्स, मिठाइयाँ, चॉकलेट, आइसक्रीम, टॉफी)
Danamethi, jamun, karela (दानामैथी, जामुन, करेला)	Fried foods: Puri, parantha, samosa, kachori, chips, namkeen, kurkure (तली हुई चीजें : चिप्स, कुरकुरे, समोसा, कचौरी, पकोड़े, नमकीन)
Whole & husked pulses, roasted chana, sprouts (साबुत व छिलके वाली दालें, भुना चना, बीगी दालें)	

Figure 2: Dietary tips

Statistical Analysis

It was done for all values. Values were documented as Mean & percentage of the total numbers.

Results & Discussion

The data was collected for 20 patients and presented under following sub headings:

• **Demographic profile of the patients**

Parameters		Total no. of patients=20	Percentage (%)
Age	0-10 year	4	20
	11-16 year	3	15
	17-25 year	10	50
	>25 year	3	30
Sex	Male	13	65
	Female	7	35
Activity	Sedentary	14	70
	Moderate	6	30
	Heavy	0	0
Education	Primary	6	30
	Secondary	1	5
	Sr. Sec	6	30
	Graduate	6	30
	Illiterate	1	5
Income group	LIG	4	20
	MIG	12	60
	HIG	4	20
Working status	Working	6	30
	Non working	14	70
Place	Jaipur	6	30
	Alwar	3	15
	Ajmer	2	10
	Bhilwara	2	10
	Bharatpur	1	5
	Jhunjhunu	1	5
	Tonk	1	5
	Churu	1	5
	Bikaner	1	5
	Sikar	1	5
	Dausa	1	5

Table 6: Interpretation of demographic data

It was concluded from the Table 6 that type 1 diabetes was observed in individuals under the age group of 17 to 25 years. It accounts for 50% of the total type 1 diabetes patients.

Apart from this, this diabetes was also found in children, which is 40% of the total type one diabetes patients.

Type 1 diabetes was found mostly in males, 65% of the total patients were found to be male and only 35% females were found to be diabetic.

It was also concluded that 70% of the patients were involved in sedentary activity. Only 30% were moderate workers and nobody was doing heavy activity.

30% of diabetic patients were driver, farmer or shopkeeper by occupation, while 70% of the patients were involved in education.

30% of the patients were local residents of Jaipur. Apart from this, 15% of the patients had come from Alwar, 10% were from Ajmer and 10% were patients from Bhilwara.

- **Nutritional Status Assessment**

- Anthropometric Measurement

Parameters		Total no. of patients = 20	Percentage (%)
Height (cm)	110 -130	3	15
	131 – 160	9	45
	161 – 190	8	40
Average Height (cm)	156.31		
Weight (kg)	10 -30	5	25
	31 - 50	10	50
	51 - 70	3	15
	70 - 80	1	5
Average weight (kg)	44.43		
Average MUAC (inches)	9.007		
Average Waist circumference	27.85		
Average Hip circumference	29.58		
Average Waist/Hip	0.94		

Table 7: Anthropometric measurements of the patients

It is concluded from Table 7 that out of the total 20 patients, the height of 45% of the patients was found to be 131- 160 cm and 40% of the patients was found to be 161 to 190 cm in height. The average height was found to be 156.31 cm.

The weight of 50% of the patients in total was found to be between 31 to 50 kg and the average weight was found to be 44.43 kg. It also concludes that out of the total patients, the average MUAC of all patients was found to be 9.007 inches, average Waist Circumferences was 27.85 cm, Average hip Circumferences was 29.58 cm and average Waist/ hip ratio was 0.94.

- **Biochemical Reports**

Parameters		Total no. of patients = 20	percentage (%)
HbA1C	5.5 – 10 %	9	45
	10.1 – 15 %	10	50
	> 15.1	1	5
TSH	0.465 – 4.68	20	100
Hb Male	13 - 18	5	38.46
	< 13	8	61.53
Hb Female	11.5 – 16.5	3	42.85
	< 11.5	4	57.14
SGOT	15.0 – 46.0	20	100
SGPT	13.0 -69.0	20	100

Table 8: Interpretation of biochemical profile of T1DM patients

It can be concluded from Table 8 that 50% of patients had HbA1c in the range of 10.1- 15%, which is much higher than the normal levels and 5% of patients had HbA1c 15.1 percent. Forty five percent patients showed HbA1c in the range of 5.5-10%. Thyroid stimulating hormone was found to be normal in all patients. Out of the total males, 61.53 % of the men were found to be anaemic and out of the total women 57.14% of the women were found to be anaemic. Liver Function Test showed that all patients were in the normal range.

BBF	ABF	BL	AL	AD
260.75	224.7	210.9	237.15	229.65

Table 9: Average RBS

Table 9 is presenting average blood sugar levels of patients before and after meals (BBF = before breakfast, ABF = 2 hours after breakfast, BL =before lunch and AL =2 hours after lunch).

• Clinical Sign And Symptoms

Parameters		Total no = 20	percentage (%)
Weakness	Yes	20	100
	No	0	0
Anorexic	Yes	5	25
	No	15	75
Wasting	Yes	16	80
	No	4	20
Anaemia	Yes	12	60
	No	8	40
Loss of Appetite	Yes	8	40
	No	12	60
Taste change	Yes	6	30
	No	14	70
Fatigue	Yes	20	100
	No	0	0
Nausea/ Vomiting	Yes	15	75
	No	5	25
Frequent Urination	Yes	19	95
	No	1	5
Excessive thirst	Yes	19	95
	No	1	5
Excessive Hunger	Yes	12	60
	No	8	40

Table 10: Clinical sings & symptoms of T1DM patients

It is concluded from Table 10 that problems of weakness and fatigue were found in all patients. Weight loss was found in 80% of the total patients. They had lost 5 - 10% of their weight and 60% of the patients were found to be anaemic. Frequent urination and excessive thirst were found in 95 % patients, while excessive hunger was found in only 60% of patients.

• **Nutrient intake in comparison to RDAs**

Parameter		Total no. of patients = 20	Percentage (%)
Energy	30 – 60 %	2	10
	51– 80 %	8	40
	81 – 100 %	5	25
	101 – 136 %	5	25
Protein	40 – 80 %	5	25
	81 -100	6	30
	101 – 130	5	25
	131 – 150	4	20
Carbohydrates	69 – 100 %	9	45
	101 – 150 %	5	25
	151 – 210 %	6	30
Fat	45 – 70 %	5	25
	71 – 100 %	8	40
Fibre	30 – 90 %	7	35
	91 – 120 %	9	45
	121 – 150 %	4	20

Table 11: Nutritional Intake Compared To RDA

Parameters	Average
Empty calories	267.51

Table 12: Empty calorie intake

Table 11 and table 12 are depicting the data related to nutrient intake in comparison to RDAs and patients empty calorie intake. It was observed that 40% patients had calorie intake 51 – 80% of RDAs, while 50% patients showed calorie intake equal or in excess to the RDAs. Protein intake was found normal in 30% patients while it was on a higher side in approximately 45% patients. Intake of carbohydrate was normal in 45% patients while 55% patients showed higher carbohydrate intake in comparison to RDAs. Forty percent patients showed fat content near normal, while 35% patients consumed fat higher than their requirements. Forty five percent patients showed fibre intake near normal but 35% patients had poor fibre intake. On an average, empty calories intake was found 267.51 Kcal per day.

- **Nutritional Diagnosis**

Parameters	Total no. of patients = 20	Percentage (%)
Malnourished	1	5
Underweight	8	40
Normal	9	45
Overweight	1	5
Obese	1	5

Table 13: Interpretation of Nutritional diagnosis

Table 13 is revealing the results of the present study. 45% percent patients were found normal, while 40% patients were underweight. It may be due to uncontrolled blood sugar levels. Only 5% patients were overweight and 5% were obese in type 1 diabetic patients. It may be attributed to the less physical activity and higher calorie intake by these subjects.

Conclusion

Prevalence of T1DM is growing at a faster rate. All age groups are becoming equally affected by this problem. Therefore it becomes very important to assess nutritional status of these type of patients and to plan a suitable diet plan as per their requirements that will not only control blood sugar level but also improve weight and growth of the patients. Therefore present work was planned in which it was evident that 45 percent patients had normal nutritional status but 40% patients were found underweight. A little fraction (5% each) of patients were diagnosed as overweight and obese also, that is a very alarming condition as patients were from 17 – 25 years of age. Majority of them were males. Therefore there is a need to diagnose nutritional status of patients timely. It will not only help in control of disease but also many future complications can be prevented by following a proper diet, lifestyle and medication. For this expert advise matters a lot.

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