

## Evaluation of Nutrition and Health Status among Children with Diabetes.

Manal A. Hassanein<sup>1</sup>, Intessar Sultan<sup>2</sup>

<sup>1</sup>Department of Food Science, Faculty of Family Science, Taibah University, Saudi Arabia.

<sup>2</sup>Department of Internal Medicine, Faculty of Medicine, Taibah University, Saudi Arabia.

[drmanal.hasanin@yahoo.com](mailto:drmanal.hasanin@yahoo.com)

**Abstract:** Nutrition obviously plays a part in the development of overweight, obesity among children with diabetes. The present study aimed to measure nutritional status, anthropometric measurements, food pattern, fatty acids and increased risk of diabetes children. Aiming to assess the nutritional status, body measurements, food pattern and increased risk among diabetic children, a random sample of forty cases, age ranged between 7-13 years, were chosen from maternity and children hospital at Madina, Saudi Arabia. Results of present study revealed that boys were younger with lower weight and height compared to girls. The most frequent symptoms were polyuria. Mean **macronutrients** intake for boys and girls were higher than 100% of DRI, except for calories, calcium, iron and vitamin A intakes of girls were less than 100%. Mean percent of omega-6 FA (% of RNI) was higher in girls while omega-3 FA (% of RNI) was higher in boys. These results reflect the increased amount of the fiber intake, fruits, vegetables and legumes among these children and increasing milk and milk products in the diet and decreasing snack and fast foods. Increasing nutrition knowledge.

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**Keywords:** Nutrition, children, diabetes, anthropometric measurements, food pattern, fatty acids.

### 1. Introduction

Diet is a cornerstone of type 1 diabetes treatment, and poor diet quality may affect glycemic control and other health outcomes. Yet diet quality in children and adolescents with type 1 diabetes remains understudied (Nansel *et al.*, 2012).

Nutrition recommendations are developed and implemented to meet treatment goals and desired outcomes for children with type 2 diabetes. It is essential that ongoing nutrition self-management education and care be provided for individuals with diabetes (American Diabetes Association, 2000). Nutrition status should be evaluated for children with type 1 Diabetes as they are growing and they are usually underweight with malnutrition probably because of diabetes itself as a debilitation disease or because of associated celiac disease (American diabetes Association, 2000).

One of the first steps in managing type 1 DM is diet control. According to the ADA policy, the diet treatment is based upon nutritional assessment and treatment goals. Diet recommendations should be made in view of the patient's eating habits and lifestyle. Diet management includes education about the timing, size, frequency, or composition of meals to avoid hypoglycemia or postprandial hyperglycemia. In these patients, the caloric distribution is important; a recommended distribution consists of 20% of daily calories for breakfast, 35% for lunch, 30% for dinner, and 15% for late evening snack. The minimum protein requirement for good nutrition is 0.9 g/kg/d (range = 1-1.5 g/kg/d), Fat intake should be limited to 30% or less

of the total calories, and a low-cholesterol diet is recommended. Patients should consume sucrose in moderation and increase their fiber intake. In some cases, mid morning and mid afternoon snacks are important to avoid hypoglycemia. The role of diet in type 1 is to provide adequate nutrition for proper growth, supplement nutrition deficiency secondary to diabetes and to help in metabolic control of diabetes namely hyperglycemia (American Diabetes Association, 2001).

Overweight and obesity in childhood may predispose persons to morbidity in adulthood (St-Onge *et al.*, 2003).

A number of eating patterns have been associated with overweight among preschool-aged children. Recently, 100% fruit juice and sweetened fruit drinks have received considerable attention as potential sources of high-energy beverages that could be related to the prevalence of obesity among young children (O'Connor *et al.*, 2006).

Health coaching may help persons with diabetes become confident self-managers of their diabetes (Howard & Hagen, 2012).

The present study aimed to assess dietary nutritional status in relation to their body measurements, and metabolic control among children with type 1 diabetes.

### 2. Subjects and Method

#### Subjects:

A total number of 40 patients with type 1 diabetes mellitus for more than 3 years who were receiving their

diabetic care at the diabetic unit in the outpatient department of Maternity and children Hospital at Madina, Saudi Arabia were recruited. They were divided into 2 groups: group 1 for boys (n=20) and group 2 for girls (n= 20). The age of children range was 7-13 years. Exclusion criteria included type 2 diabetes, presences of acute illnesses, acute diabetic complications as diabetic ketoacidosis, chronic diabetic complications. Children diagnosed with celiac disease were excluded as well as children who were under special dietary restriction other than for diabetes or receiving any form of dietary supplementations.

#### Methods:

##### Material and equipments:

This is the list of equipments and materials which used in the study:

- 1) Digital electronic scale.
- 2) Height metal tape.
- 3) Nylon tape measure.
- 4) WHO Anthroplus.
- 5) Mother questionnaire.
- 6) Child questionnaire.

##### The study Questionnaire:

**Child questionnaire** contained five major parts: child demographic data, anthropometric data, nutritional data and eating habits and Physical activity data

**Mother questionnaire** contained three major parts: personal data of mother and child, socioeconomic data and health of child, nutritional data of child

- 1- **Demographic data:** age, gender, degree of consanguinity, type of diabetes mellitus, and number of the diabetics in the family, Smoking among fathers.
- 2- **Socioeconomic data:** level of education, occupation of parents, school year, and family income.
- 3- **Biodemographic Status**
  - a. The most frequent symptoms encountered by the children during the course of their illnesses.
  - b. The cause of disease as believed by the child: genetics, food induced, psychological state, viral induced, immunity related or known
  - c. The change of the weight as noticed by the child:
  - d. The history of regular exercise
- 4- **Dietary history:**
  - a. The daily food consumed, using 24 hour recall method.
  - b. Food that they like, or dislike
  - c. Food intake when children feel hungry.

##### Physical examination:

##### 1-Anthropometric measurements and anthropometric data analysis

**1. Weight measurement:** Weight was measured by the help of digital electronic scale. Weight was recorded to the nearest 0.1 kg.

**2. Height measurement:** Height was measured by the help of a metal or nylon tape without shoes. Height Measurement was taken to the nearest 0.1 cm.

**3. Body mass index (BMI)** was calculated by using the formula weight (kg) divided by height (m) squared.

**4. Anthropometric indices:** Body mass index for age (BAZ) was used to define overweight, obesity and wasting

##### The 24hr recall and food analysis by diet power (V.4) software:

Random 50 girls from our sample have been completed food analysis for the 24hr recall that was conducted by diet power software version 4 for all meals over the day prior to the interview.

##### Reference standards:

1. The current study used for Height, weight and BMI and other data the newly recommended NCHS/WHO reference standards (Onis de M *et al.*, 2007; (NHANES11) of 1971-1974.

2. The reference for RDA intake for nutrients in calories, grams or mg from the 24hr recall was used according to AHA (2005) recommendations.

Total fat (g), saturated fatty acid SFA (g), monounsaturated MFA (g) and polyunsaturated PFA (g) were calculated. The adequacy of diets evaluated with regard to references intake (**DRI, 2002**)

##### Statistical package:

SPSS (V.16), 2008) was used to find frequencies and percentage, mean, SD, To find the statistical significant difference for the association of two variables  $X^2$  test was used.

##### WHO Anthroplus software:

The age, weight, height were the basic variables required to derive the most common nutritional status indicators for the children, i.e BMI-for-age (BAZ).

##### Biochemical analysis:

1. Hemoglobin level was determined by method according to **Waterman et al. (1975)**.
2. -Blood sugar level was determined by home blood glucose meter.

### 3.Results and Discussion

**Table (1)** shows the mean age, weight, height and BMI for the studies groups. Means for age, weight and BMI were nearly equal in boys and girls patients, while the height was higher in girls than in boys significantly. This significant difference could be explained by the earlier growth spurt in girls. BMI for both boys and girls are higher than their 95 percentile According to the BMI curves (for boys mean age was  $8.5 \pm 1.83$ , BMI was  $22.03 \pm 15.01$  was obesity, for girls, mean age was  $8.7 \pm 1.91$ , and BMI was  $21.78 \pm 13.75$ ) was overweight. These results agreed with **Nafiu et al.**,

(2007). Also agreed with Economos et al., (2012), who reported that Approximately one-third of children in the USA are either overweight or obese.

**Data of table (2)** show the socio-economic status of patients. It is noticed that all the studied children were in the primary school, boys were clustered in the 3<sup>rd</sup> year (30%) and girls in the 2<sup>nd</sup> year (35%). It can be seen that 40% of fathers of boys children received education to the middle level, while those of girls children were nearly equal in their educational level. For mothers of boys children 25% received middle or secondary education, while, 35% of those of girls received middle education. High income ( $\geq$  6000 SR monthly) is found in 60% among boys and 50% among girls. History of smoking fathers were detected in 45% of boys children and 40% of girls children.

**Table (3)** shows the most frequent presenting symptoms among boys children with type 1 diabetes were polyuria, dry mouth, dizziness, hunger pains, sweating, and less frequently blurring of vision. Among the girls children, symptoms were polyuria, hunger pains, dizziness, blurring, mouth dryness and less frequently sweating. On the other hand, other non diabetes related common symptoms was sneeze (25% of boys and 30% in girls). These findings agreed with *Jasinski et al., (2003)* who finding that prevalence of dryness mouth, polydipsia and polyuria and agreed with *Rosenbaer et al., (2002)* who reported that polyuria was the most common symptom.

**Data of table (4)** show the biodemographic status. 60% & 55% for boys & girls were weight lost respectively. While 55% for boys were exercise but 75% of girls no exercise. These results agreed with *Rosenbauer et al., (2002)* and *Jasinski et al., (2003)*.

**Data of table (5)** show the hemoglobin level and glucose level for studied samples.

It noticed that 60% & 50% of boys and girls patients respectively have moderate hemoglobin level (13-14 gm/dl). Also 75% & 85% for boys and girls patients respectively had uncontrolled fasting blood sugar level ( $>130$  mg/dl), 70% & 60% respectively had uncontrolled post breakfast blood sugar levels ( $\geq 160$  mg/dl) and 65% & 55% respectively had  $> 200$ mg/dl in random blood sugar level.

**Table (6)** show the type of the meal snacks, 85% of boys and 90% of girls consume snacks. Children were found to consume snacks when they felt hungry, not according to the dietary prescription by their dieticians. For boys, 40% chips, 20% chocolate, 15% sweets or jams and 10% ice cream, for girls 25% sweets, 20% chips or ice cream, or jams, and 15% chocolate.

**In table (7)** number of daily meals, results show that 50% of boys and 45% of girls have five meals daily, 75% of boys and 65% of girls eat breakfast, 55% of boys and 60% of girls consume dairy products daily

of them 15% of boys and 25% of girls consume twice daily dairy products. Thirty % of boys and 40% of girls consume legumes, 20% of boys and 35% of girls consume bran bread, 80% of boys and 65% of girls consume white bread, 65% of boys and 55% of girls consume red meat, 100% of boys and 95% of girls consume chicken meat. Twenty % and 65% of boys and 50% and 75% of girls consume fresh vegetables and fruits respectively.

**Data of table (8)** show the mean daily nutrients intake by diabetic children, compared to their RDA and DRI. Mean macronutrients for boys and girls were higher than 100% of RDA and DRI except for carbohydrates for both gender (87% boys and 95% girls) and calories (90%) for girls only. On the other hand, macronutrients intake for boys were higher than girls except for protein-P and fat-P. these results agreed with *Kylberg et al., (1985)* and *Overby et al., (2007)*.

Mineral intake of boys were higher than 100% of DRI except zinc consumed at lower than 100% of DRI. While minerals intake of girls were lower than 100% of DRI except for sodium, potassium and magnesium which consumed at higher than 100% of DRI. Mean vitamins intake of boys were higher than 100% of DRI except vitamin D and B<sub>6</sub>. While mean vitamins intake of girls were lower than 100% of DRI except vitamin C, niacin and folates. These results agreed with *Patton et al., (2007)* who reported that mean vitamin B12 and calcium intake were less than the dietary reference intake for children.

**Table (10)** shows the value of mean daily consumption of saturated, monounsaturated, polyunsaturated and total unsaturated fatty acids, as percent for the different sex groups. For boys C18:0, C14:0 and C10:0 fatty acids had the highest percentage intake among other saturated fatty acids (21.77%, 20.49% and 18.70%) respectively, which were girls C10:0, C18:0 and C16:0 fatty acids had the highest percentage intake among other saturated fatty acids (25.29%, 19.42% and 16.39%) respectively. In the present study C16:1 fatty acid had the highest percentage intake among other monounsaturated fatty acids (50.84% and 35.58%) for boys and girls respectively. Also C18:2 fatty acids had the highest percentage intake among other polyunsaturated fatty acids (69.66% and 83.28%) for boys and girls respectively, while C20:4 fatty acid had the lowest intake among other polyunsaturated fatty acids.

**Table (11)** shows the mean daily intake of fatty acids fractions and their percentage of essential fat daily intake according to different sex groups. It is noticed that mean percentage of omega-6 FA (% of RNI) was 50.26% in girls which was higher than boys (26.58%), but percentages of in boys and girls were less than 100% of RNI. While the percent of omega-3

FA% of RNI in boys was higher than in girls. T.unsat. FA/T.sat. FA and P/S in girls were higher than boys.

*Orton et al., (2007)* studied the comparison between omega-3 and omega-6 polyunsaturated fatty acid intake as assessed by a food frequency in young children at

risk for developing type 1 diabetes. Prevention of diabetic ketoacidosis and reduction of its frequency should be a goal in managing children with diabetes and medical information and general awareness can contribute to this (*Habib, 2005*)

**Table (1): Mean  $\pm$  SD of age, anthropometric measurements for boys and girls patients with type 1 diabetes.**

Sex Parameters	Boys(n=20)	Girls(n=20)
	Mean $\pm$ SD	Mean $\pm$ SD
Age (years)	8.5 $\pm$ 1.83	8.7 $\pm$ 1.91
Weight (Kg)	27.1 $\pm$ 5.68	28.1 $\pm$ 7.22
Height (cm)	111.32 $\pm$ 20.66	<b>114.74<math>\pm</math>15.25*</b>
BMI (Kg/m <sup>2</sup> )	22.03 $\pm$ 15.01	21.78 $\pm$ 13.75

\* $P < 0.05$

**Table (2): Frequency Distribution of Boys And Girls patients According To Socioeconomic Status.**

Sex Social Economic Factor	Boys (n=20)		Girls (n=20)	
	No	%	No	%
<b>School Year</b>				
Second	5	25	7	35
Third	6	30	3	20
Fourth	4	20	3	20
Fifth	2	10	5	25
Sixth	3	15	2	10
<b>Levels of education of fathers</b>				
Primary level	7	35	6	30
Middle level	8	40	7	35
Secondary level	5	25	7	35
<b>Level of education of mothers</b>				
Illiterate	4	20	2	10
Primary level	2	10	2	10
Middle level	5	25	7	35
Secondary level	5	25	4	20
College level	4	20	5	25
<b>Smoking among fathers</b>				
Yes	9	45	8	40
No	11	55	12	60
<b>Family Income (SR)</b>				
< 3000	3	15	3	15
3000 – 6000	5	25	7	35
> 6000	12	60	10	50

**Table (3): The most frequent presenting symptoms among children with type 1 diabetes.**

Sex Symptoms	Boys(n=20)		Girls (n=20)	
	No	%	No	%
Dizziness	2	10	2	10
Blurring Of vision	1	5	2	10
Polyurea	5	25	3	15
Dryness of mouth	3	15	2	10
Hunger Pains	2	10	3	15
Sweating	2	10	2	10
Other symptoms Sneeze	5	25	6	30

**Table (4): Biodemographic Status Of children with type 1 diabetes.**

Sex Variables	Boys (n=20)		Girls (n=20)	
	No	%	No	%
<b>History of Weight change</b>				
Weight gain	6	30	7	35
Weight lost	12	60	11	55
Weight not change	2	10	2	10
<b>Exercise</b>				
Yes	11	55	5	25
No	9	45	15	75

Table (5): Hemoglobin Level (g/d l) And Blood Glucose Level (mg/100 ml) For Studies Samples.

Sex Parameters	Boys		Girls	
	No	%	No	%
<b>Hemoglobin Level</b>				
Low <12	5	25	6	30
Moderate 13-14	12	60	10	50
High > 14	3	15	4	20
<b>Blood Sugar</b>				
<b>Fasting</b>				
<70	3	15	2	10
70-130	2	10	1	5
> 130: uncontrolled	15	75	17	85
<b>Post prandial</b>				
< 160	6	30	8	40
> 160: uncontrolled	14	70	12	60
<b>Random</b>				
< 200	7	35	9	45
> 200	13	65	11	55

Table (6): the type of the meal snakes.

Sex Food	Boys (n=20)		Girls (n=20)	
	No	%	No	%
<b>Snack meal</b>				
Yes	17	85	18	90
No	3	15	2	10
Chips	8	40	4	20
Chocolate	4	20	3	15
Ice Cream	2	10	4	20
Sweets	3	15	5	25
Jams	3	15	4	20

Table (7): Food Behavior For Studies Samples.

Sex Variables	Boys(n=20)		Girls (n=20)	
	No	%	No	%
<b>Number of meals daily</b>				
3	5	25	3	15
4	5	25	8	40
5	10	50	9	45
<b>Breakfast eating</b>				
Yes	15	75	13	65
No	5	25	7	35
<b>Daily milk consumption</b>				
Yes	11	55	12	60
No	9	45	8	40
<b>Frequency of daily milk consumption</b>				
1	8	40	7	35
2	3	15	5	25
<b>Eating legumes</b>				
Yes	6	30	8	40
No	14	70	12	60
<b>Eating egg</b>				

Sex Variables	Boys(n=20)		Girls (n=20)	
	No	%	No	%
Yes	16	80	14	70
No	4	20	6	30
<b>Eating red meat</b>				
Yes	13	65	11	55
No	7	35	9	45
<b>Eating chicken meat</b>				
Yes	20	100	19	95
No	0	0	1	5
<b>Eat fresh vegetables</b>				
Yes	8	40	10	50
No	12	60	10	50
<b>Eat Fresh Fruit</b>				
Yes	13	65	15	75
No	7	35	5	25
<b>Prefer bread</b>				
Bran	4	20	7	35
White	16	80	13	65

**Table (8): Mean ± SD Of Macronutrients Intake Of Children.**

Sex Macro-Nutrients	Boys		Girls		Sig
	Mean ± SD	% of DRI	Mean ± SD	% of DRI	
Calories(K cal)#	2023.49 ± 461.5	101%	1785.95 ± 156.71	90%	***
Protein –A (g)	48.73 ± 25.26		32.44 ± 8.19		***
Protein –P (g)	19.76 ± 10.56		23.58 ± 7.17		***
Total Protein(g)	71.89 ± 22.38	256%	53.44 ± 3.4	151%	***
Fat – A (g)	60.31 ± 33.71		38.20 ± 9.53		***
Fat – P (g)	24.69 ± 13.29		30.78 ± 2.20		***
Total Fat(g)	85.0 ± 27.32		68.10 ± 4.75		***
Carbohydrate (g)	242.80 ± 41.70		241.67 ± 47.61		***
Fiber (g)	6.48 ± 4.74		4.03 ± 0.61		*
Cholesterol(mg)	292.8 ± 61.17		134.51 ± 12.58		Ns

#RDA: Recommended Dietary Allowances(1989). DRI: Daily Reference Intake (2002).

\*  $p < 0.05$ ; \*\*\* $p < 0.001$ **Table (9): Mean ± SD Of Micronutrients Intake Of Children.**

Sex Micro-Nutrients	Boys(n=20)		Girls (n=20)	
	Mean ± SD	% of DRI	Mean ± SD	% of DRI
<b>Minerals</b>				
Calcium (mg)	1075.31 ± 287.93	134%	622.96 ± 105.85***	59%
Phosphorus (mg)	1152.77 ± 174.06	144%	848.32 ± 32.23***	83%
Sodium (mg)	1992.95 ± 1486.5	668%	2196.89 ± 198.7	529%
Potassium (mg)	2120.12 ± 588.96	133%	1874.09 ± 173.17	109%
Magnesium (mg)	298.23 ± 78.21	175%	230.37 ± 23.16***	126%
Iron –A (mg)	5.90 ± 29.81		2.91 ± 0.45	
Iron –P (mg)	6.37 ± 4.14		5.36 ± 0.90	
Total Iron (mg)	11.08 ± 3.48	110%	7.73 ± 0.53***	59%
Zinc (mg)	9.46 ± 2.21	95%	7.14 ± 1.66***	60%
<b>Vitamins</b>				
Vitamin-A (μ g)	1087.46 ± 348.88	155%	399.61 ± 64.79***	58%
Vitamin-D (μ g)	3.85 ± 2.75	39%	2.65 ± 1.26***	28%
Vitamin-E (mg)	11.09 ± 5.70	158.56%	7.55 ± 1.78***	95%
Vitamin-C (mg)	60.67 ± 27.74	134%	96.91 ± 60.64	158%
Vitamin-B <sub>1</sub> (mg)	1.36 ± 0.89	135%	0.79 ± 4.03***	75%
Vitamin-B <sub>2</sub> (mg)	1.83 ± 0.99	152%	0.74 ± 8.74***	59%
Niacin (mg)	20.81 ± 15.14	160%	16.06 ± 0.81	113%
Vitamin-B <sub>6</sub> (mg)	0.88 ± 0.18	63%	1.05 ± 0.24	79%
Vitamin-B <sub>12</sub> (mg)	2.42 ± 1.17	173%	0.60 ± 0.34***	33%
Folate (μ g)	256.58 ± 48.19	256%	148.35 ± 8.04	125%

DRI: Daily Reference Intake (2002).

**Table (10): Mean  $\pm$  SD of Daily Consumption (in g) Of Individual Saturated and Unsaturated Fatty Acids And Their Percentage Of Total FA Group According To Different Sex Groups.**

Sex Fatty Acids	Boys (n=20)		Girls (n=20)	
	Mean $\pm$ SD	% T.sat	Mean $\pm$ SD	% T.sat
<b>Saturated fatty acids</b>				
C <sub>10:0</sub>	11.28 $\pm$ 0.64	18.70%	9.66 $\pm$ 0.45	25.29%
C <sub>12:0</sub>	10.42 $\pm$ 0.21	17.28%	4.26 $\pm$ 0.25	11.15%
C <sub>12:1</sub>	12.36 $\pm$ 1.34	20.49%	5.67 $\pm$ 1.19	14.84%
C <sub>16:0</sub>	10.63 $\pm$ 0.37	17.63%	6.26 $\pm$ 0.13	16.39%
C <sub>18:0</sub>	13.13 $\pm$ 1.46	21.77%	7.42 $\pm$ 0.69	19.42%
C <sub>24:0</sub>	2.49 $\pm$ 0.35	4.13%	4.93 $\pm$ 0.17	12.91%
Total	60.31 $\pm$ 3.13	100%	38.20 $\pm$ 2.01	100%
<b>Monounsaturated fatty acids</b>		<b>% of T. Mono</b>		<b>% of T. Mono</b>
C <sub>16:1</sub>	10.34 $\pm$ 4.75	50.84%	8.19 $\pm$ 4.29	35.58%
C <sub>18:1</sub>	7.43 $\pm$ 3.21	36.53%	7.59 $\pm$ 0.46	32.97%
C <sub>20:1</sub>	0.33 $\pm$ 0.35	1.62%	4.24 $\pm$ 1.34	18.42%
C <sub>22:1</sub>	2.24 $\pm$ 1.23	11.01%	3.00 $\pm$ 0.10	13.03%
Total	20.34 $\pm$ 4.20	100%	23.02 $\pm$ 4.30	100%
<b>Polyunsaturated fatty acids</b>		<b>% of T. Poly</b>		<b>% of T. Poly</b>
C <sub>18:2</sub>	3.03 $\pm$ 3.34	69.66%	5.73 $\pm$ 1.35	83.28%
C <sub>18:3</sub>	1.32 $\pm$ 0.18	30.34%	1.15 $\pm$ 0.83	16.72%
C <sub>20:4</sub>	0.00 $\pm$ 0.00	0.0%	0.00 $\pm$ 0.00	0.0%
Total	4.35 $\pm$ 2.33	100%	6.88 $\pm$ 2.64	100%

**Table (11): Mean & SD of Fatty Acids (g) and Percentage Of Essential FA intake Of (RNI) According to Different Sex Groups.**

Sex Fatty Acids	Boys (n=20)		Girls (n=20)	
	Mean $\pm$ SD	D.I	Mean $\pm$ SD	D.I
Omega-6 FA (RNI=11.43)	3.03 $\pm$ 3.34	26.58%	5.73 $\pm$ 1.35	50.26%
Omega-3 FA (RNI=1.9)	1.32 $\pm$ 0.18	69.47%	1.15 $\pm$ 0.83	60.53%
T.unsat FA/T.sat.	0.41		0.78	
P/S	0.072		0.180	

P/S: T. Ployunsat. FA/T. sat. FA.

DI: Daily Intake; RNI: Recommended Nutrient Intake

**Recommendations:**

This study suggest that increasing the fiber intake, legumes, fruits and vegetables And increasing milk and milk and milk products in diet and decreasing snack meals. Increasing nutritional knowledge and awareness and medical for parents and children and care be provided for individuals with diabetes.

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