Research Article

Nutritional Status Of Children With Type 1 Diabetes Mellitus And Knowledge Of Their Parents About Managing The Disease In Babylon-Iraq

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Abstract

Background: Type 1 diabetes mellitus (T1D) was an autoimmune condition requiring insulin pump therapy, daily injections, or automated delivery systems. Successful self-management should consider the child's developmental stage and be gradual. The aim of the study to assess nutrition status of children withT1D and to assess their parents' knowledge regarding to dietary management

Methodology: A cross sectional study design was conducted at charitable organization in Babylon, Iraq. A total of 222 children with TID with their parents from Babylon, Iraq both sexes were included.

Results: Most parents had fair to poor knowledge about type 1 diabetes (68.47% and 28.83%, respectively), with only 2.70% showing good knowledge (mean score 40.81% ± 11.56). Boys had higher weight and height than girls, while BMI distribution showed about half normal weight, one third overweight, and higher obesity among girls; HbA1c was similar in both sexes. Girls had higher mean dietary intake, while boys showed higher adequacy for calories and protein. Significant positive correlations were found between parents' knowledge and children's calorie, protein, and fat intake, while correlations with carbohydrate intake, HbA1c, and anthropometric measures were weak and not significant.

Conclusion: Most families had fair to poor knowledge of type 1 diabetes, especially regarding diet and management of critical situations. Children commonly showed unhealthy eating habits and low physical activity, with a notable family history of diabetes. About 30% were overweight and 17% were obese.

Keywords: Nutritional Status, Type 1 Diabetes Mellitus, Knowledge, Parents.

1.Introduction

Diabetes mellitus (DM) was a common, chronic metabolic disorder characterized by prolonged high blood glucose concentrations. High blood glucose (hyperglycemia) was a cardinal biochemical feature of metabolism disturbance involving carbohydrate, protein, and fat which results from the degree of insulin deficiency (absolute or relative) and tissue sensitivity to its actions. The combination of insulin deficiency and sensitivity to its actions bring about distinct clinical phenotypes with varying severity of disturbed metabolism. [1] associated with absolute or relative deficiencies in insulin secretion and/or action. Inadequate insulin secretion and/or diminished tissue responses to insulin in the complex pathways of hormone action result in deficient insulin action on target tissues, which leads to abnormal carbohydrate, fat, and protein metabolism. Impaired insulin secretion and/or action may coexist in the same patient. [2]

An inducing number of cases are coming in at the age of one to two years. The initial peak could potentially align with the period of heightened infectious agent exposure that occurs concurrently with the start of the academic years. However, the subsequent peak could be associated with the pubertal growth spurt that was stimulated by gonadal steroids & a higher release of pubertal growth hormone, an analogue of insulin. Boys and girls are impacted virtually equally. The incidence rate for young women declines substantially following the pubertal years, whereas it remains comparatively high for young adult males until they reach the age of 29-35. The occurrence of a peak in winter had been documented in numerous studies as a seasonal onset characteristic, which was typically observed in cases of all ages and genders. [3]

Worldwide, type 1 DM was among the most prevalent metabolic diseases affecting children and adolescents. Emerging research indicates that early-stage disease in adolescents at risk of progressing T1D was an ongoing

process that advances through distinct stages before clinical symptoms manifest. [4, 5] Two age groups experience peak pations: those among the ages of five and seven & those during puberty. Global prevalence estimates place the number of children aged under fifteen with diabetes classified as type 1 at approximately five hundred thousand [3]. The incidence rate in Middle Eastern nations was 2.5 per 100,000 individuals [6]. Recent estimates place the spread of type 1 DM in Iraq at eighty-seven per 100,000 individuals [7] .According to information derived from extensive epidemiological research conducted globally, the annual incidence of type 1 DM increases nearly three percent, with approximately 78,000 children under the age of fifteen developing the condition. Regarding to the World Health Organization (WHO), the incidence of DM was projected to increase globally by 300 million individuals by 2025 [6].

The study aimed to assess the nutritional status of children with type 1 diabetes mellitus and their parents' knowledge regarding disease management in Babylon, Iraq. Specifically, it evaluated the children's anthropometric measurements and dietary intake, determined the level of parental knowledge about the disease, and examined the association between children's dietary intake, anthropometric status, and parental knowledge.

2.Subjects and Methods

This cross sectional study was conducted on 222 type 1 diabetes children aged between 5-18 years and their parents at charitable organization in Babylon, Iraq.

2.1. Sample size:

The total number of children registered in the charitable organization was 222. Assuming
the effect size of knowledge of type 1 DM children's parents about managing the disease and children nutritional status was 0.2. Using alpha error of 0.05 and sample size of 220, this achieved power of 85.4%. Power analysis was calculated using G-power.

Type of sample and method of selection: It was a convenient sample of all patients registered in the charitable organization (222) with their caregivers who agreed to participate

2.2. Inclusion criteria: Type 1 diabetes children between 5-18 years of both sexes with their parents were enrolled in the current study

2.3. Exclusion criteria: Children with other endocrinal disease

2.4.Data collection methods and tools

Data were collected using a structured,

1-Interviewing: pre-designed interviewing questionnaire (Appendix 1) completed by children and their parents. It included socio-demographic data (child age and sex; parental age, education, occupation, and marital status), child medical history (age at diagnosis, disease duration, family history, diabetic coma episodes, diagnosis and treatment history, and information sources), dietary habits (meal patterns, snack intake, eating outside home, sugar and artificial sweetener consumption), and 24-hour dietary recalls over 3 days to assess nutrient intake and adequacy using ESHA food processor and standard food composition tables. The tool also assessed diabetes management practices (diet adherence, training, glucose monitoring, insulin use, exercise-related practices, illness management, and follow-up behaviors) and parental knowledge of diabetes, complications, hypo/hyperglycemia, diet, exercise, and illness care, scored as 1 for correct and 0 for incorrect/unknown responses, with total scores categorized into poor (<33.3%), fair (33.3–66.6%), and good (>66.6%).

2- Anthropometric data of the child: Weight and height were measured following standardized procedures described by Gibson, and body mass index (BMI) was calculated using the formula weight (kg)/height (m^2). Anthropometric indicators, including weight-for-age (W/A), height-for-age (H/A), and BMI-for-age, were assessed using CDC reference standards, with short stature defined as a height-for-age Z-score below −2 SD. BMI was classified according to percentile cut-offs as underweight (<5th percentile), normal weight (5th to <85th percentile), overweight (85th to <95th percentile), obese (95th to <99th percentile), and severely obese (≥99th percentile). [8]

3-Laboratory test: HbA1c was obtained for each child as an indicator of glycemic control. HbA1c levels ≤ 7% are regarded as good metabolic control. **[9]**

2.5. Ethical considerations

Ethical approval was obtained from the Ethics Committee of the High Institute of Public Health and the Iraq Ministry of Health, and the study followed international research ethics guidelines. Written informed consent was obtained

from caregivers after explaining the study purpose. Participant anonymity and confidentiality were strictly maintained, and no conflicts of interest were declared.

2.6. Statistical analysis

Data were analyzed using IBM SPSS software version 20.0 (IBM Corp., Armonk, New York). Categorical variables were presented as numbers and percentages, while quantitative data were expressed as mean, standard deviation, median, range (minimum–maximum). Normality was assessed using the Kolmogorov–Smirnov test. At a 5% level of significance, the chi-square test was used for comparisons of categorical variables, with Monte Carlo correction applied when more than 20% of expected cell counts were less than 5. Student's t-test and one-way ANOVA (F-test) were used to compare normally distributed quantitative variables between groups, while Pearson's correlation coefficient was applied to assess relationships between normally distributed quantitative variables.

3.Results

Table (1): Distribution of the studied sample according to their personal and socio-demographic characteristics

Personal and socio-demographic characteristics	Total (n = 222)	
	No.	%
Child age (yrs.)		
5-	88	39.64
10-	88	39.64
15+	46	20.72
Min-Max	5 - 18	
Mean ± SD	10.88 ± 3.750	
Child sex		
Boys	116	52.25
Girls	106	47.75
Mother's age (yrs.)		
18-	28	12.61
30-	138	62.16
40-	51	22.97
50+	5	2.25
Min-Max	19 - 55	
Mean ± SD	35.54 ± 6.047	
Mother's marital status		
Married	214	96.40
Widowed	5	2.25
Divorced	3	1.35
Mother's level of education		
Elementary certificate	28	12.61
Preparatory certificate	63	28.38
High school	102	45.95
University degree	29	13.06
Mother's working status		
Working	27	12.16
Not working	195	87.84
Father's age		
20-	11	4.95

30-	136	61.26
40-	67	30.18
50+	8	3.60
Min-Max	23-87	
Mean ± SD	38.25± 7.42	
Father's level of education		
Elementary certificate	11	4.95
Preparatory certificate	41	18.47
High school	94	42.34
University degree	76	34.23
Father's working status		
Working	214	96.40
Not working	8	3.60

The studied sample had a mean age of 10.88 ± 3.75 years, with the smallest proportion aged ≥15 years (20.72%), and slightly more than half (52.25%) were boys. The mean age of mothers was 35.54 ± 6.05 years, with most mothers (62.16%) aged between 30 and <40 years, while fathers had a mean age of 38.25 ± 7.42 years, and 61.26% were in the same age category. The majority of mothers (96.40%) were married. Regarding educational level, nearly half of both mothers (45.95%) and fathers (42.34%) had a high school education. Most mothers (87.84%) were not employed, whereas almost all fathers (96.40%) were employed. (Table 1)

Table (2): Distribution of the studied sample according to dietary habits of the child

Dietary habits of the child	Total (n = 222)	
	No.	%
Number of basic meals		
One	**2**	**0.90**
Two	**11**	**4.95**
Three	**158**	**71.17**
More Three	**51**	**22.97**
Skipped meal (n=69)		
Breakfast	**57**	**82.61**
Lunch	**12**	**17.39**
Snacking between meals		
Always	**67**	**30.18**
Sometime	**147**	**66.22**
Never	**8**	**3.60**
Kind of foods or drinks snacks* (n=214)		
Sandwiches	**24**	**11.21**
Sweets and biscuits	**178**	**83.18**
Fruit	**24**	**11.21**
Tea or coffee	**4**	**1.87**
Soft drinks	**37**	**17.29**
Eating outside home		
Always	**19**	**8.56**
Sometime	**168**	**75.68**
Never	**35**	**15.77**

Kind of meals does eat outside home(n=187)		
Fast food	**182**	**97.24**
Regular food	**5**	**2.76**
Amount of daily sugar intake (teaspoon/day)		
less than 3	**92**	**41.44**
3+	**130**	**58.56**
Min-Max	**1-9**	
Mean ± SD	**2.53± 0.822**	
Kind of artificial sweeteners consumed		
Stevia	**42**	**18.92**
Saccharin	**1**	**0.45**
Aspartame	**2**	**0.90**
Do not use	**177**	**79.73**

*Responses are not mutually exclusive

This table shows that 71.17% of the children consumed three main meals daily, while 31.08% skipped meals, with breakfast being the most commonly skipped meal (82.6%). About 66.22% of the children sometimes consumed food or drinks between meals, mainly sweets and biscuits (80.18%). Additionally, 75.68% sometimes ate meals outside the home, and fast food was the most frequently consumed type (97.24%). More than half (58.56%) consumed more than three teaspoons of sugar daily, while the majority (79.73%) did not use artificial sweeteners, and 18.92% reported using stevia. (Table 2)

Table (3): Distribution of the studied sample according to the medical history of the child

Medical history of the child	**Total (n = 222)**	
	No.	**%**
Family history of diabetes*		
Parents	32	14.41
Siblings	13	5.86
Grandparents	39	17.57
Uncle	17	7.66
Cousins	39	17.57
None	99	44.59
Age of the child at disease diagnosis (yrs.)		
1-	47	21.17
5-	112	50.45
10-	58	26.13
15+	5	2.25
Min-Max	1-15	
Mean ± SD	7.34± .3.50	
Disease duration		
1-	133	59.91
3-	84	37.84
5+	5	2.25
Min-Max	1-14	
Mean ± SD	2.60± .1.62	
Ways that discovered type 1 diabetes*		

Clinical examination	80	36.04
Symptoms	204	91.9
Source of information about type1 diabetes*		
Doctor	222	100.00
Internet	81	36.49
Child had been exposed to a diabetic coma during the past six months		
Sometime	54	24.32
Never	168	75.68

This Table illustrates the medical history of the studied children. Nearly half (44.59%) had no family history of diabetes, while the remainder reported having one or more affected relatives. About half (50.45%) were diagnosed with type 1 diabetes between 5 and <10 years of age, and 59.91% had been living with the disease for more than one year. The vast majority (91.9%) were diagnosed following the appearance of symptoms. Doctors were the primary source of information about type 1 diabetes for all parents, while 36.49% also obtained information from the internet. Furthermore, 75.68% of the children had not experienced a diabetic coma during the previous six months. (Table 3)

Table (4): Distribution of the studied sample according to the parents' knowledge (at least one of parents) regarding the disease and its management

Knowledge items	Total (n = 222)			
	Correct		Incorrect	
	No.	%	No.	%
Diabetes was an infectious disease. (No)	170	76.58	52	23.42
Diabetes was a chronic disease that "cannot be cured". (Yes)	166	74.77	56	25.23
Heredity was the cause of type 1 DM. (Yes)	162	72.97	60	27.03
Children can get diabetes and stay healthy. (Yes)	89	40.09	133	59.91
A diabetic patient can fast. (Yes)	82	36.94	140	63.06
The normal fasting blood sugar in a patient with diabetes was …. (130-150)	196	88.29	26	11.71
Is the cause of diabetes in children different from adults? (Yes)	155	69.82	67	30.18
Eating sugar was the main cause of diabetes. (No)	26	11.71	196	88.29
Diabetes leads to other diseases such as damage to organs. (Yes)	181	81.53	41	18.47
Diabetes affects the child's development or growth. (Yes)	78	35.14	144	64.86
Feeling pain not occurred during injured of feet was evidence of ……. (Nerve damage)	122	54.95	100	45.05
What insulin was your child taking? (Hormone)	52	23.42	170	76.58
Insulin can be taken orally. (No)	88	39.64	134	60.36
Diabetes can only be controlled through medication. (No)	58	26.13	164	73.87
Diabetes can be controlled through proper nutrition. (Yes)	156	70.27	66	29.73
Non calories sweeteners are better for the diabetic child. (Yes)	176	79.28	46	20.72
Eating meals should be at fixed times. (Yes)	208	93.69	14	6.31
Having diabetes means that the child should eliminate sweets. (No)	41	18.47	181	81.53
High blood sugar level reduces the feeling of hunger of diabetic patients (No)	46	20.72	176	79.28
Diabetic patients eat brown bread because …. (it contains high fiber)	4	1.8	218	98.2
Which of the following foods contains the highest amount of energy …? (fats)	34	15.32	188	84.68
A lot of vegetables in the meal help reduce high blood sugar. (Yes)	59	26.58	163	73.42
Eating fruits of any kind does not affect the rise in blood sugar. (No)	128	57.66	94	42.34

Eating white rice or white bread reduces the level of blood sugar. (No)	62	27.93	160	72.07
Unlike white bread, whole grain bread can be consumed at any amount. (No)	19	8.56	203	91.44
"Carbohydrate counting " was a certain type of diet specifically for type 1 diabetes. (Yes)	30	13.51	192	86.49
Bread, rice, sweets, and fruits are all considered as carbohydrates source. (Yes)	72	32.43	150	67.57
Potatoes, milk and its derivatives, cereals and legumes, fruits, sweets are considered as alternatives to starches or carbohydrates. (Yes)	33	14.86	189	85.14
Carbohydrate alternatives must be taken according to a specific quantity and quality. (Yes)	162	72.97	60	27.03
The amount of carbohydrates that the child takes should be measured. (Yes)	173	77.93	49	22.07
It was carbohydrates that raise blood sugar. (Yes)	80	36.04	142	63.96
The quality of carbohydrates affects the rise in blood sugar. (Yes)	54	24.32	168	75.68
Diabetic patients who take diabetes medications do not need to organize meals. (No)	45	20.27	177	79.73
The glycemic index concerns starches and fruits more than salad vegetables. (Yes)	6	2.7	216	97.3
The glycemic index varies from one fruit to another. (Yes)	10	4.5	212	95.5
Food with a high glycemic index was a good choice for the diabetic child. (No)	11	4.95	211	95.05
A child with diabetes cannot practice sports. (No)	90	40.54	132	59.46
Regular exercise helps lower blood sugar. (Yes)	92	41.44	130	58.56
Diet and physical activity may prevent complications and the child will grow properly. (Yes)	160	72.07	62	27.93
The diabetic child who practices sports was injected with insulin according to the duration of the exercise (long or short). (Yes)	69	31.08	153	68.92
If the exercise time (less than half an hour) does not require the child to inject insulin, it was sufficient to give the child one carbohydrate serving (i.e., three dates). (Yes)	19	8.56	203	91.44
After the exercise was over, the ratio of insulin to carbohydrate servings should be reduced. (Yes)	36	16.22	186	83.78
Dose of insulin must be increased when the diabetic child suffers from certain illness (i.e., flu).(Yes)	196	88.29	26	11.71

Table shows that parents had limited knowledge about diabetes management, with the majority answering 28 of 43 questions incorrectly, particularly those related to carbohydrate counting, glycemic index, and blood glucose management during exercise. However, parents demonstrated better knowledge regarding the nature of diabetes, blood glucose control, nutrition, carbohydrate measurement, prevention of complications, and insulin adjustment during illness, with correct response rates ranging from 54.95% to 93.69%. (Table 4)

Table (5): Distribution of the diabetic children according to the anthropometric data and HbA1c by child sex

Anthropometric data	**Boys (n=116)**		**Girls (n=106)**		**Total (n=222)**		**t**	**P**
	No.	**%**	**No.**	**%**	**No.**	**%**		
Weight (kg)							2.785	0.006*
Min-Max	15 – 78		16 - 85		15 - 85			

Mean±SD	41.96± 15.22		36.58± 13.34		39.39±14.57			
Height (cm)							3.864	0.000*
Min-Max	110-171		95-160		95-171			
Mean±SD	140.28± 15.31		132.14± 16.08		136.40±16.17			
Z-score height							-0.501	0.617
Min-Max	-3.94-3.26		-5.11-12.15		-5.11-12.15			
Mean±SD	-0.88±1.58		-0.76±1.84		-0.82±1.70			
Z-score weight							-0.419	0.676
Min-Max	-3.10-2.95		-2.47-2.07		-3.10-2.95			
Mean±SD	0.17±1.24		0.23±1.06		0.20±1.15			
Height/age interpretation								
Normal	69	59.48	76	71.70	145	65.32	5.23	0.073
Short	37	31.90	27	25.47	64	28.83		
Tall	10	8.62	3	2.83	13	5.86		
Body mass index (kg/m²)								
Mean±SD	20.53± 3.42		20.22± 3.64		20.38±3.52		0.646	0.516
Body mass index classification								
Underweight (<5th percentile)	1	0.86	1	0.94	2	0.90	3.778	0.286
Healthy (5th percentile to <85th percentile)	56	48.28	58	54.72	114	51.35		
Overweight (≥85th percentile to <95th percentile)	42	36.21	26	24.53	68	30.63		
Obesity (≥95th percentile)	17	14.66	21	19.81	38	17.12		
Mean± SD	75.19± 21.95		75.21± 23.80		75.20±22.80		0.007	0.994
Laboratory test (HbA1c)							-1.186	0.237
Min-Max	7.20 – 16		7.50 - 15		7.20 - 16			
Mean±SD	10.02 ± 1.70		10.30 ± 1.87		10.15 ±1.78			

This table demonstrate that boys had significantly higher mean weight and height than girls (41.96±15.22 vs. 36.58±13.34 kg and 140.28±15.31 vs. 132.14±16.08 cm, respectively; p=0.006 and p<0.001). Most children (65.32%) had normal height-for-age, while 28.83% were stunted, with no significant sex difference. Mean BMI was similar in boys and girls (20.53±3.42 vs. 20.22±3.64 kg/m²; p=0.516), and approximately half (51.35%) had normal BMI-for-age, whereas 30.63% were overweight and 17.12% were obese, with no significant differences between sexes (p=0.286). The mean HbA1c level was 10.15±1.78%, showing no significant variation between boys and girls (p=0.237). (Table 5)

Table (6): Correlation between parents' knowledge score and dietary intake and HbA1c of the children

	Parents' knowledge score	
	Pearson correlation	**Sig.(2-tailed)**
Calorie intake (kcal)	0.127	0.059
Protein intake(g)	0.135*	0.045
Fat intake(g)	0.157*	0.020
Carbohydrate intake(g)	0.076	0.257
Protein adequacy (%)	0.019	0.777
Calorie adequacy (%)	-0.075	0.263
Carbohydrates adequacy %	0.028	0.679
Fat adequacy%	0.061	0.366
HbA1c	-0.092	0.174

*. Correlation was significant at the 0.05 level (2-tailed).

This table indicates a weak to moderate positive correlation between total parents' knowledge score and children's dietary intake, which was statistically significant for calorie (r=0.127, p=0.045), protein (r=0.135, p=0.045), and fat intake (r=0.157, p=0.020), while the correlation with carbohydrate intake was weak and not significant (r=0.076). In contrast, a weak negative, non-significant correlation was observed between parents' knowledge score and children's HbA1c levels (r = -0.092). (Table 6)

4. Discussion

Concerning the dietary habits of the children. The findings of the current research revealed that near three quarters of them take three main meals, one third of children skip or neglect a meal which was mostly breakfast. Two thirds of children sometime eat food or drink between meals and the uppermost kind of foods or drinks were sweets and biscuits in of the children. Moreover, Al Duraywish in Saudi Arabia reported that regarding snacks and school lunches for diabetic children, (88.2%) mentioned no snacks or special school lunches ped to diabetic children. [10] Seckold, stated in the same line that with regard to the dietary intake of kids with TIDM, ice cream & sweet biscuits were the most frequently ingested discretionary foods. Aside from that, it was reported that every child consumed a minimum of three main meals (breakfast, lunch, & dinner) daily, with eighty-one percent also consuming morning and afternoon munchies. [11]

The current study revealed regarding the medical history of the children; that nearly half of the children had no family history of diabetes while the other half reported more than one relative. Doctors were the source of information about type 1 diabetes for all parents of the study sample, however, more than one third of parents also gain their information from the internet. In the same line Aldossary and Snelgrove, in Saudi Arabia reported that there were 43.75% of the studied children with no family history of diabetes. [12] Also Al Duraywish reported that regarding their sources of information, there were 35.5% reported that they had this information as a part of their general knowledge [10]. Also Cho, in South Korea reported that regarding source of information about T1DM, there were 78 (55.3%) had their personal and there were 15 (28.8%) from expert [13].

Regarding the parents' knowledge about diabetes and its management, the current research revealed that more than half of the parents' answers were incorrect, mostly questions about carbohydrate counting, glycemic index of foods and managing blood sugar during exercise, while just 15 questions were answered correctly namely the questions that asked about, whether diabetes was an infectious disease, diabetes was a chronic disease that can't be cured, heredity was the cause of type 1 DM the normal fasting blood sugar of a diabetic child, there was difference in causes of diabetes in children than in adults , diabetes leads to other diseases, nerve damage was an evidence of feeling pain in feet. However, the percentage of mothers who provided accurate responses regarding general diabetes-related knowledge (25.0%) & symptoms of complications associated with uncontrolled diabetes 15 %was disappointingly low. [14]

The precent study results are in contrast with Ndahura in Uganda reported that there wasn't statistically significant distinction among parents' knowledge score and their children' dietary intake (energy intake, fat intake and protein

intake). [15] As well, the p results disagree with Nabeel who reported that there was a statistically significant association was found between maternal diabetes-specific knowledge and HbA1c levels of their children. [16] Regarding anthropometric measurements of the diabetic children by sex, the current study revealed that the means of weight and height were higher among boys than girls, with statistically significant differences. This came in accordance with Shaikh in Pakstan reported that there was statistically significant difference between girls and boys regarding weight at last visit which significantly higher in boys compared to girls. Otherwise, there was no statistically significant difference between girls and boys regarding height. [17] In contrast, Brener in Israel reported that there wasn't statistically significant distinction among TIDM boys and girls regarding height z-score. [18] Also Maffeis reported that there wasn't statistically significant distinction among boys and girls <10 years and 10 - 13.9 years regarding height and weight. [19]

5. Conclusions

The study revealed that most participating families had fair to poor knowledge regarding type 1 diabetes, particularly in relation to special diets and management of critical situations. Unhealthy dietary habits were common among children, including skipping breakfast, frequent fast-food consumption, high intake of soft drinks, and excessive sugar use, alongside a generally sedentary lifestyle with limited physical activity. A notable proportion of children also had a family history of type 1 diabetes, especially among first-degree relatives. In addition, around 30% were overweight and 17% were obese. Regarding dietary adequacy, carbohydrate intake was nearly normal, while protein and fat intake were above normal for both sexes, and overall calorie intake was approximately normal.

6. References

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