

The impact of a child being diagnosed with T1DM on their family's dietary habits

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Summary. Despite the well-known effects of Type 1 Diabetes Mellitus (T1DM) diagnosis on a child's alimentation and their family's relationship and psychology, its impact on the whole family's dietary habits has not been adequately investigated. This study's objective is to delve into this less explored subject. Our study's sample consisted of fifty families with a child diagnosed with T1DM, who were evaluated via two questionnaires, the widely used FEAH questionnaire and a second one that we developed for the purposes of this study. Mothers and especially those with children diagnosed with T1DM at an early age changed their dietary habits in a higher proportion. Our study found no correlation between changing one's eating pattern and their educational or socio-economic status. A significant number of families retained their unhealthy nutritional habits after the diagnosis of T1DM and in conjunction with the reported low level of physical activity indicate areas for intervention.

Key words: type 1 diabetes mellitus, children, families, dietary habits, questionnaire

Introduction

Type 1 Diabetes Mellitus (T1DM) is a chronic illness requiring continuing medical care and self-management education in order for the patient to achieve proper glycemic control and prevent both acute and long-term complications. Apart from pharmaceutical medication, maintenance of a healthy body weight, physical exercise and nutrition accordant to physicians' recommendations, are all considered necessary parameters of a diabetic child's treatment (1). Concerning alimentation in particular, medical nutrition therapy in Diabetes Mellitus (DM) management has proved to be effective and is positively correlated with lower glycosylated Hemoglobin (HbA1c) values (2). Therefore, patients should be strongly advised to abide by guidelines provided by their doctors and di-

eticians. Those instructions cover every aspect of one's dietary habits, including the intake of each macronutrient, serving the purpose of instilling a healthier lifestyle in diabetic children (3).

However, the diagnosis of T1DM does not induce life changes for the child alone, since this illness constitutes a predicament in which all family members are actively involved, as they should be (4). Protection, communication and emotional support coming from the patients' parents and/or siblings improve their quality of life (QoL) (5). Besides, family functioning and adherence are strongly associated with better metabolic control (6). Despite the family's willingness to participate in the child's treatment, a chronic illness can often be perceived as a burden, negatively affecting the family's QoL in many aspects (7), causing tension and stress, which may lead to diabetes mismanagement

(8). Parents may feel overwhelmed by the role of the caregiver they assume and siblings may feel neglected and jealous due to unequal distribution of their parents' time and resources (9). Nonetheless, it has been noted that sometimes a family member being inflicted with a chronic illness can actually cause family bonds to strengthen (7).

Except for its impact on family's relationships and psychology, T1DM diagnosis in a child could affect the alimentation of the other family members. Existing literature regarding this subject is limited, yet it suggests that parents are willing to alter their eating habits so as to conform to physicians' recommendations (10), thus adopting a healthier lifestyle and benefiting from supporting their child. The majority of them are considered to be aware and/or conscious about their weight and food choices. In 50% of the families at least one parent is preoccupied with weight – related concerns, usually engaging in weight – loss behavior (11). Following a unanimous dietary regime is presented with multiple advantages. Regarding the diabetic child, this behavior is considered as highly supportive from their parents' side, alleviating the sentiment of solitude they might be experiencing (10). Promoting healthful eating meal structure and cohesiveness seems to constitute a protective factor from eating disorders in youth with T1DM (11,12). Besides, role – modeling healthy eating patterns potentially shapes long-term youth dietary trajectories, urging young patients to adopt qualitative habits for life (11,12). Except from the patients themselves, families of youth with T1DM are encouraged to follow the same overall healthy diet (12). Last but not least, the whole family can benefit from this practice, since purchase and preparation of the food is an easier task when everyone conforms to the same alimentation plans

This study's objective is to further delve into the impact of diagnosing a child with T1DM on their family's nutrition. Comparing our results to existent literature, we also searched for similarities or differences between previous studies and the Greek population, so as to create a data base of reference for Greek families with diabetic children. Moreover, we examined whether the parents' educational and socio-economic status play a role in this impact.

Patients and Methods

This study's sample consisted of families, each of them including one child diagnosed with T1DM and regularly monitored in the Pediatric Diabetes Outpatient clinic of the First Pediatric Clinic of Aristotle University – Hippokration Hospital of Thessaloniki. The inclusion criteria were: *i*) willingness to participate in the study, *ii*) absence of a disease that would affect the dietary intake in either the parents or the siblings of children with T1DM and *iii*) a time interval of more than 6 months since the diagnosis of T1DM was made. The study sought to engage all children who met the above criteria and visited our clinic during the period of March to August of 2014. Local institutional review board approved the study design. Written informed consents were obtained from caregivers of all participants.

The investigation tools employed for this study were two questionnaires. The first one was a commonly used and widely accepted means in research, the Family Eating and Activity Habits (FEAH) questionnaire (13), whose 21 questions are divided into four categories: the first one (questions 1-4) examines one's physical activity level, the second one (questions 5-12) examines their exposure to alimentary stimulus, the third one (questions 13-16) examines one's eating habits related to hunger and the fourth one (questions 17-21) examines their "eating style", meaning their habits when consuming food. After all questions had been answered, the scores of each response were added so as to obtain a result for each category and in total. The higher the score in one category was, the worse this person's habits regarding the respective matter were. Furthermore, a high total score suggested that this person follows unhealthy alimentation habits. The questionnaire's internal consistency was ensured using Cronbach's alpha (α) which was equal to 0.81, while its values for the original test ranged between 0.78 and 0.88. Furthermore, the interrelations between its categories render this questionnaire a valid indicator of a family's dietary intake and physical exercise level. The reliability was also verified using Guttman's model, an alternative split-half methodology, due to inability to perform the test – retest method. As for the questionnaire's validity, meaning its capacity to detect altera-

tions in the sample's dietary habits, it was ensured by comparing the scores between families which modified their alimentation and those which did not, both in total and for each category in separate. Pearson's r was also used as a measure of validity, establishing the linear correlation between each of the categories themselves and between the score in each category and in total. Other check points in the questionnaire's validity were the fact that both parents answered separately each question while their answers' correlation was examined using Pearson's r and, finally, the one-way multivariate analysis of covariance. The proportion of missing data was low (0,41%) in comparison to literature and they were replaced by the sample's median values.

The second questionnaire was developed as part of this study and consisted of two parts. The first one included demographic information, such as parents' age, nationality, profession, educational level, familial annual income and additional facts such as the number of children in each family, the patient's age at the time of the study, the time since their diagnosis and a brief medical case history. In the second part we recorded anthropometric measurements in both the patient and their family's healthy members, as well as contingent changes in the family's diet after the diagnosis of T1DM had been made.

The questionnaires were answered by the patients' parents with the assistance of a dietician. The parents' anthropometric measurements at the time of the study were taken in our clinic, whereas their anthropometric measurements at the time of T1DM diagnosis were provided by them from memory. The children's measurements were collected from their medical booklet.

The statistical analysis of the questionnaires employed the software program IBM® SPSS Statistics 22. It involved the use of descriptive statistics in the presentation of data such as frequency and relative frequency distribution or measures of location and dispersion, as well as in the process of statistical tests in the context of statistical conclusion validity, for the verification of our results. Levene's test was used to assess homoscedasticity, whereas the Kolmogorov – Smirnov test was used to assess the normality of the distribution. The parametric t -test was employed for comparing the averages of two related or independent groups, while the non-parametric Mann – Whit-

ney U-test and Wilcoxon test were used for comparing non-normal distribution parameters and two related samples, respectively.

Results

Fifty families were finally included in the analysis. The patients' mean age at the time of the study was 11.06 ± 4.15 years (ranging from 2 to 17 years), while their mean age at the time of diagnosis was 6.43 ± 3.48 years (ranging from 0.5 to 13 years) and the time since their diagnosis was 4.69 ± 3.73 years (ranging from 0.5 to 16 years). Regarding the parents, the mothers' mean age at the time of the study was 41.3 ± 7.1 years (ranging from 26 to 58 years) and their proportion of second-grade or lower education graduates was 59.2%, while 40.8% of them were graduates of higher educational level institutions. The fathers' mean age at the time of the study was 45.3 ± 6.4 years (ranging from 33 to 60 years) and their respective percentages concerning their educational level were 59.6% and 40.4%. In regard to their annual income, 59.1% of the families declared earnings exceeding 15.000€ as compared to 40.9% of them whose earnings were less than 15.000€. As for their nationality, the vast majority of the parents (83.7% of the mothers and 91.7% of the fathers) were Greek, while the nationality of the rest varied.

As far as their weight is concerned, the mean measurement for the mothers was 66.09 ± 14.89 kilograms at the time of diagnosis and 68.58 ± 15.69 kilograms at the time the study was conducted, while the respective values for the fathers were 88.78 ± 14.48 kilograms and 90.43 ± 14.36 kilograms. Using t -test and non-parametric Wilcoxon test, we found that the weight difference between the time of diagnosis and the time of the study was not of statistical significance neither for the mothers ($p=0.293$), nor for the fathers ($p=0.371$), which suggests that the diagnosis of T1DM did not result into weight loss or other weight change for the parents.

Regarding the most crucial question of whether or not the parents had altered their nutrition habits, 73% (39 out of 50) of the mothers and 53.5% (23 out of 43) of the fathers responded positively. This difference between mothers and fathers has proved to

be of statistical significance with the use of Fisher's exact test ($p=0.016$). Besides, using McNemar's non-parametric test to check on marginal homogeneity, we detected statistically significant differences ($p=0.001$) between spouses as well (Table 1). Thus, in more than half of the families (23 out of 43), both parents replied that they had changed their alimentation, whereas in approximately 1 out of 4 (9 out of 43) families neither parent had adopted a healthier eating pattern. Another worth-mentioning result is the fact that, while in 11 out of 43 families the patient's mother alone reported having made changes in her diet, there was no family in which the father alone responded positively. The reported alterations seem to mostly affect the quantity of some aliments: decrease in sugar, fried food, junk food and soft drinks consumption along with increase in fruit, vegetables, whole grain and lower fat food consumption being the most usual among them. As for the nutrition of the healthy children in each family, some interesting data were collected from the questionnaire that we developed. Although the great majority of the parents (92.9%) do not get so excessive as to apply carbohydrate counting on their healthy children, a large proportion of them enforce the same nutrition regime for the whole family (85.7%) and strictly monitors the quality of their healthy children's snacks (69%), the quantity of the food (66.7%) and the time of the day (51.5%) that they consume it.

Regarding the external factors affecting the parents' alimentation, we investigated the correlation between the patient's age at the time of diagnosis and the changes in their parents' dietary habits separately for each parent, since there seemed to exist a significant differentiation between their answers. According to mothers' responses, those two variants have a statistically significant correlation: younger age (mean patients' age: 5.5 years) at the time of diagnosis is associated with diet

Table 1. Parents' responses to whether they have changed their dietary habits or not in the same family (intra-family comparisons).

Mothers	Fathers			P
	Yes	No	Sum	
Yes	23	11	34	0.001
No	0	9	9	
Sum	23	20	43	

modifications, whereas older age (mean patients' age: 9 years) is associated with maintenance of the family's previous alimentation habits. On the contrary, according to fathers' replies, the patient's age at the time of diagnosis did not affect the parents' choice on whether to modify their dietary habits (Table 2). However, we have to mention that even according to fathers' responses, the mean age of the patient at the time of diagnosis was younger in families that altered their eating patterns compared to those who did not, yet this difference was not of statistical significance ($p=0.546$).

Another factor that we examined was the parental educational level. Dividing parents into two groups - those who were second-grade or lower educational level graduates and those of a higher one - and using McNemar's test, we detected no statistically significant difference ($p=1.000$) between spouses' educational level. Thus, we categorized each family in either group, using the parents' same educational level or the higher one in case of a difference. Employing Fisher's test separately for each parent, we found that there was no statistically significant difference in the educational level of the families who had changed their diet and those who had not, neither according to mothers ($p=0.732$) nor according to fathers ($p=0.355$). In order to assess the role of the annual family income in the family's diet, we formed two groups, the first one consisting of families with an annual income exceeding 15.000€ and the second one composed of families earning less than 15.000€ annually. Using Fisher's test

Table 2. Mean age at T1DM diagnosis in children with T1DM when groups were formed regarding parents' responses to whether they have changed their dietary habits.

Mother	Change dietary habits	
	Yes	No
n	38	11
Age at diagnosis (mean \pm SD)	5.71 \pm 3.33	8.91 \pm 2.88
p	0.004	
Father	Change dietary habits	
	Yes	No
n	23	20
Age at diagnosis (mean \pm SD)	5.74 \pm 3.22	6.45 \pm 3.87
p	0.546	

separately for each parent, we detected no statistically significant difference in families' annual income between those reporting having altered their alimentation and those who did not, neither according to mothers ($p=0.733$) nor according to fathers ($p=0.818$). Additionally, examining the impact of their child being diagnosed with T1DM on the parents' body mass index (BMI), we used the non-parametric Mann-Whitney test separately for each parent and detected no statistically significant difference between the parents' BMI in families who reported having altered their diet and those who did not, neither according to mothers nor according to fathers.

As far as the FEAH questionnaire is concerned, the mean score for each category and in total are documented in Table 3. The data distribution seems to be tending to normal, as verified by Kolmogorov – Smirnov test (Figure 1). As for the FEAH questionnaire evaluation, using t-test separately for each parent, we detected no statistically significant difference in FEAH scores between families who had changed

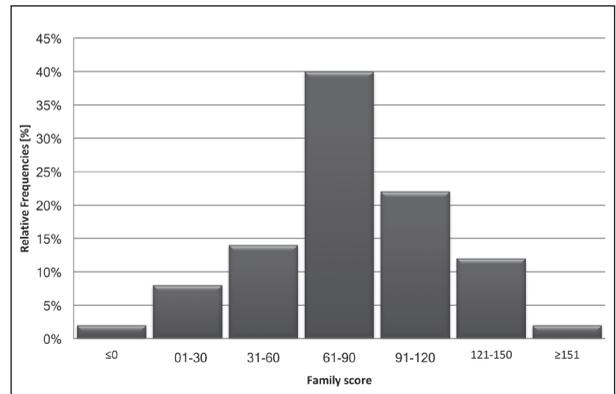


Figure 1. Histogram depicting the relative frequencies of the families' mean score in the FEAH questionnaire.

their nutrition and those who had not, neither according to mothers ($p=0.834$) nor according to fathers ($p=0.638$) (Table 4). No statistically significant difference was either noted when subcategories of the questionnaire was compared between mothers and fathers who changed their nutrition and those who had not,

Table 3. FEAH scores in each category and in total.

Category	Sample size	Mothers		Fathers		Children		Families	
		Mean value	Standard deviation						
A	50	4.6	11.3	6.0	15.8	3.8	12.0	14.4	28.7
B	50	6.7	2.3	6.7	2.3	9.2	3.4	22.6	7.7
C	50	0.9	0.9	1.1	1.0	2.7	1.5	4.7	3.0
D	50	11.8	5.2	12.0	6.3	15.7	8.0	39.5	15.2
Total score	50	24.0	14.0	25.8	19.2	31.5	14.6	81.3	37.2

Letters A, B, C and D correspond to each of the 4 categories of the questionnaire.

Table 4. Mean and SD of FEAH score in total and in subcategories between mothers and fathers who change or not their dietary habits.

Mother	Change in Dietary Habits			Father	Change in Dietary Habits		
	Yes	No	p		Yes	No	p
n	39	11		n	23	29	
Total FEAH	80.67 ± 39.45	83.36 ± 29.17	0.834	Total FEAH	86.59 ± 43.35	81.18 ± 28.98	0.638
Cat. A	4.92 ± 10.94	3.36 ± 0.96	0.691	Cat. A	4.70 ± 21.11	7.60 ± 8.99	0.571
Cat. B	6.56 ± 2.28	7.27 ± 2.53	0.379	Cat. B	6.87 ± 2.24	6.50 ± 2.26	0.594
Cat. C	0.92 ± 0.96	0.81 ± 0.40	0.726	Cat. C	1.48 ± 1.08	0.70 ± 0.80	0.011
Cat. D	12.23 ± 5.00	10.18 ± 5.78	0.251	Cat. D	13.56 ± 5.98	12.20 ± 5.71	0.451

Cat A. refers to questions examining one's physical activity level, Cat B. refers to questions examining exposure to alimentary stimulus, Cat. C refers to questions examining eating habits related to hunger and Cat. D refers to questions examining "eating style", meaning habits while consuming food.

with the exception of fathers who's FEAH score in the subgroup regarding questions examining eating habits related to hunger was significantly higher in those having changed their habits ($p=0.011$, Table 4). Additionally, using t-test we found no statistically significant difference between the FEAH scores of families with low and those with high educational level ($p=0.664$).

Discussion

This study's main objective was to investigate whether a child's diagnosis of T1DM affects their family's alimentation. Dietary recommendations for children with T1DM are based on healthy eating patterns suitable for all children and adults and, therefore, the whole family (3). In most families, both parents report changes in their diet, yet we detected a sex – dependent difference, since a greater proportion of mothers declared having altered their nutrition in comparison to fathers' percentage. The sex – dependent difference regarding our study's main subject as well as the other matters that were investigated supports a fact already established in literature, that of the mother being the main caregiver of a child with a chronic illness, bearing a significantly greater burden related to medical treatment and more emotional distress than the father (14). The child's father rarely assumes this role, despite his otherwise active participation. The father is usually involved in his child's physical exercise, but the one attending to their food preparation and monitoring, as well as their weight management is their mother (15,16).

The alterations that are reported to occur according to the questionnaire that we developed demonstrate the parents' effort to abide by physicians' guidance (1,2) and WHO's recommendations (17). Additionally, parents tend to apply the same dietary regime to their healthy children as well, by monitoring the quantity and quality of their meals and snacks, as well as the time of the day that they consume them. This attitude is considered to be positive rather than judgmental, promoting family's healthy lifestyle (18). The disease burden entails the danger of disrupting the family functioning, leading parents to use rigid and coercive management of their child's illness and express negative comments (19). This attitude jeopardizes the

child's dietary adherence and reflects on their psychology (11,20).

Analyzing the responses to the FEAH questionnaire, we discovered that the mean score was higher compared to the original questionnaire's mean score applied to obese children, concerning the first (14.4 compared to 3), the second (22.6 compared to 18) and the fourth (39.5 compared to 32) category. This finding suggests that the model of physical exercise in Greek families is inadequate, characterized by lack in physical activity and increased rate of sedentary life, that parents have a rather loose attitude when it comes to exposure to alimentary stimulus and that they maintain negative diet habits after their child is diagnosed with T1DM. Those results are consistent with existent Greek literature, according to which parental unhealthy behavior has led to low adherence rate to the Mediterranean diet, abstinence from physical activity and prevalence of overweight and abdominal obesity in Greek children (21-24). On the contrary, the mean score in the third category is relatively low and comparable to the original questionnaire's, displaying lack of parental intervention on the subject of their children hunger – satiation mechanism.

Another observation that we made was the correlation between the child's age at the time of diagnosis and the modification of the family's diet. The latter seems to happen when a child is diagnosed at a younger age, whereas it is rarer in families whose child was diagnosed at an older age. This can be explained if we consider the fact that the management of the dietary regime is a parental exclusivity and foremost a maternal affair in prepubertal children, which positively affects the family's nutrition towards improvement. On the contrary, adopting healthier alimentation habits is more difficult during adolescence both for the children who react negatively to their parents' effort to control their nutrition (25,26) as well as for the parents, since those domestic confrontations lead to T1DM mismanagement (27).

As for the influence of external factors on the alteration of the domestic nutrition, we did not detect any statistically significant correlation between dietary changes and the parental educational level, their annual income or their score in the FEAH questionnaire. Moreover, the reported changes in alimentation are

not positively associated with a decrease in the parents' weight or BMI, which would constitute objective means of verifying the alleged improvement in lifestyle.

At this point, we should stress that findings should be interpreted in the light of study limitations. Our observations constitute subject to parents' self-reported estimations and responses, which can be biased by social desirability. As a matter of fact, there is no palpable evidence for these alleged alterations in diet, such as statistically significant decrease in parents' weight or BMI. Future research could strengthen those findings by employing objective means, such as recording family meals. We should also note that our sample's size and the fact that it was drawn from a single clinic do not allow us to lower our study's confidence interval so as to increase its confidence level. Therefore, generalizing our findings to the whole population entails the possibility of statistical type 1 or 2 errors.

Conclusions

The dietary intake in families of diabetic youth should be further investigated due to its importance for every member. Physicians dealing with those families need to emphasize on the benefits the healthy parents and siblings of the patient can derive individually and as a family. The necessity of averting diabetic youth from unhealthy eating patterns and sedentary attitude that characterizes the contemporary Greek people is much more imperative compared to healthy teenagers, because of the potential complications. In this effort, the active participation of the parents through support and appropriate role – modeling is essential.

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