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DIETARY HABITS AND METABOLIC CONTROL OF TURKISH AND GERMAN CHILDREN WITH TYPE I DIABETES*

*Serpil Uğur MD***, Bruno Weber MD****,
*Süheyla Altay MD*****, Makbule Haktan******

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The regulation of food intake and a fixed time schedule for meals are widely accepted as important factors in the treatment of diabetic children[1]. The diet for diabetic children greatly varies throughout the world[2]. Although customs influence nutrient distribution immensely, education is also an important factor which should be offered by the physician to the patient. In fact, education functions as the key in the treatment of Type I diabetes[3].

Our aim was to establish the problems regarding dietary management and the differences in dietary habits among Turkish and German children. This study was conducted in the Department of Pediatrics of the Free University in West Berlin (Kinderklinik der Freien Universität Berlin-KAVH-) on Turkish and German patients who were chosen from 322 patients with Type I diabetes.

These patients were followed up until the age of 32 in which time some of them became pregnant (Fig. 1).

Material and Methods

The subjects of this study consisted of nine Turkish and nine German children with Type I diabetes who were treated in the Free University Children's Hospital. Their mean ages were 120.3 ± 61.3 months and 122.5 ± 58.2 months (range $3^{7/12}$ to $17^{4/12}$ years) and the duration of diabetes was 34.5 ± 23.3 months and

* From the Department of Pediatrics, İstanbul University Cerrahpaşa Faculty of Medicine, İstanbul and the Diabetes Polyclinic of the Department of Pediatrics, Free University, West Berlin.

** Pediatrician, 7th Mother and Child Care Center, Istanbul, formerly Resident in Pediatrics, Istanbul University Cerrahpaşa Faculty of Medicine.

*** Professor of Pediatrics and Diabetologist, Free University Children's Hospital.

**** Dietitian, Department of Pediatrics, Istanbul University Cerrahpaşa Faculty of Medicine.

***** Associate Professor of Pediatrics, Istanbul University Cerrahpaşa Faculty of Medicine

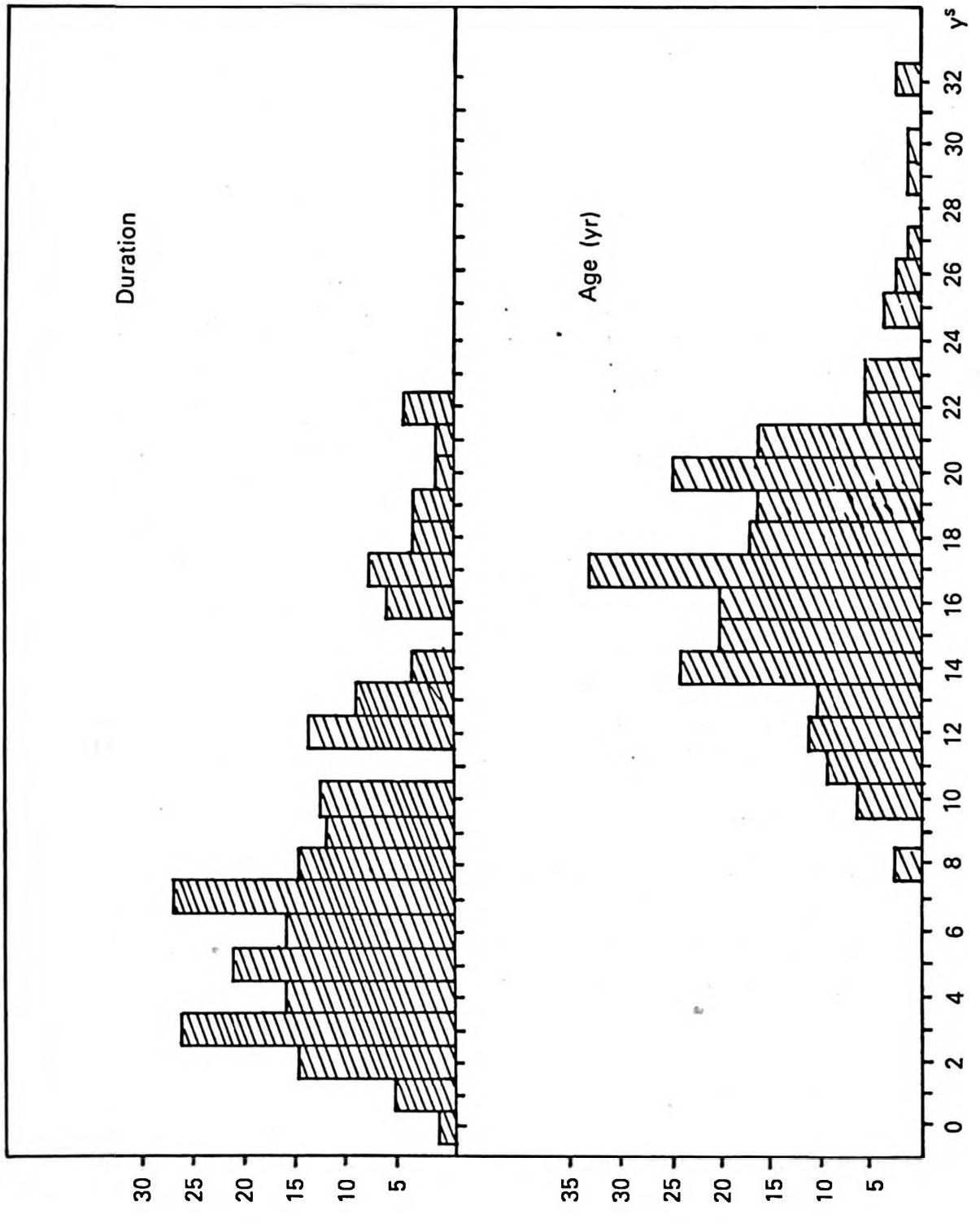

Fig. 1: Distribution by age and duration of diabetes of patients with Type I diabetes in the Department of Pediatrics, Free University, West Berlin[12].

41.5 ± 33.5 months (range 2 months to $8^{11/12}$ years) respectively recorded at the end of October, 1984. Both groups of children, who were matched according to age, sex and duration of diabetes, were in different socio-economic classes. There were three boys and six girls in each series.

A doctor and a dietitian made home visits to the patients and their families and discussed the problems encountered in the application of diet. A questionnaire which had been prepared previously was handed to each family and the main problems responsible for improper dietary habits were then established. Afterwards, the patients were told to come to the diabetes polyclinic for a medical examination and laboratory tests.

The following parameters were periodically documented during out-patient visits in 4 to 8 week intervals.

Results of physical examination, height, body weight, skin-fold thickness, pubertal development, blood pressure, fundus examination by opthalmoscopy and FA (fluorescein angiography) for patients older than 15 years of age and with a duration of the illness of more than five years, postprandial blood glucose, 24-hour glucosuria of the preceding day, albuminuria, urine sediment, serum electrolytes, total lipids, urea, BUN, hemogram, and HLA-A, B, C antigens were recorded. The glycosylated hemoglobin and urinary protein excretion were measured every three months, and the fasting serum cholesterol, triglycerides, serum transaminases and creatinine clearance once annually. In the last out-patient visit, we again documented the results of physical examination, height, body weight, blood pressure skin-fold thickness, (TRI: triceps, SCA: subscapular, SIL: suprailiac), fundus examination by opthalmoscopy, postprandial blood glucose, HbA_1 levels (total), labile and stable washed erythrocytes, hemoglobin-HbA_{1W}-, 24-hour glucosuria and proteinuria. Furthermore, the results of metabolic self-monitoring at home were registered and evaluated together with the patients or their families.

The energy intake was calculated to meet each patients's requirements. A carbohydrate-fixed diet which consisted of 55-45% carbohydrate, 30-40% fat (polyunsaturated/saturated ratio: 1.0) and 12-18% (up to 20% in younger children) protein (Table I) was adapted to the patients.

Insulin (intermediate-acting or mixtures of intermediate and short-acting highly purified preparations) was administered twice daily with mean doses of 0.8 ± 0.3 units/kg/per day.

The adherence of diabetic children to a dietary regimen, appropriate carbohydrate, protein and fat contents in diet and family problems were evaluated according to the information given in the questionnaires. The daily food intake was compared to the mean intake which was required (calculated requirements) by each patient.

The German scores were used to evaluate the physical parameters[4,5].

The adherence of the children to a diabetic diet was evaluated according to their levels of daily carbohydrate, fat and protein intake and their adaptation to diet exchange lists.

Metabolic control was evaluated mainly according to the mean HbA_1 levels during the duration of diabetes as Good (lower than 8.5 mg/dl), Fair (8.5 to 10 mg/dl) and Poor (higher than 10 mg/dl) (Table II).

The glycosylated hemoglobin was measured by using the microcolumn technique[6,7] as both its total and stable component. Triglycerides were calculated by Behring's enzymatic analyses, the blood glucose by the hexokinase method and urine glucose by semi-quantitative methods. The Kolmogorov-Smirnov test[8] was performed on the two groups to compare both the Hb A_1 levels and the adherence of the diabetic child to a diet.

TABLE I: Nutrient Distribution Recommended for Diabetic Children (percentage of energy intake)

	Low	Normal	High
Carbohydrates	< 45	50	> 55
Protein	< 12	15	> 18
Fat	< 30	35	> 40

TABLE II: Evaluation of Metabolic Control According to HbA_1 Level

HbA_1 level (mg/dl)	Metabolic Control
< 8.5	Good
8.5 - 10	Fair
> 10	Poor

Results

	Turkish Group	German Group
1. Educational level	Literate mothers (2) both parents with primary school eduation (1), mothers with a slight knowledge of German (5).	All the mothers had a 8-13 year education
2. Family knowledge of diabetes	Both groups had been instructed by the physician and diabetes nurse. Two Turkish mothers were of the opinion that one recovers from the illness	
3. Type of cuisine	Turkish	Mid-European
4. Type of food specified (Tables III, IV)	High fat, low protein	Normal protein, low carbohydrate
5. Daily frequency of food intake	6-7 times (exception of one)	6-7 times
6. Application of diet exchange lists	7 patients	All patients
7. Use of carbohydrates found in the traditional Turkish cuisine	White and flat bread, olives, Turkish desserts, macaroni, rice and pounded wheat consumption was high in the Turkish group. Five patients brought provisions, from Turkey	Three German patients occasionally ate the Turkish type of bread.
8. Percentage of family income allotted for food	30-40%	20-30%
9. Adherence of the diabetic child to a diet and dietary advice		
Good	3	7
Fair	3	1
Poor	3	1
10. Families that adopted the same diet as the diabetic child (mothers only)	3	7
11. Diabetic children having difficulty in adhering to a diet	5	3
12. Problems encountered by the diabetic child in adhering to a diabetic diet	Extremely good appetite, desire for sweets, timing difficulties, disturbed family patterns, psychological problems in adolescence and difficulty in school	

13. Adherence of the Turkish patient to a diabetic diet with foodstuffs available in Germany used in the Turkish cuisine.	5 patients obtained diet foods in Germany		
14. The number of Turkish families with diabetic children who plan to return to Turkey	8 (time of return uncertain because of their children's education and treatment)		
15. Physical activities excluding school sports	Swimming, football, bicycling, jogging		Swimming, football, bicycling, jogging, ballet, jumping, judo, dancing, fencing
16. Skin-fold thickness (mm) (The sum of TRI SIL and SCA mean values)	35.1 ± 19.5		33.8 + 18.7
17. Annual frequency of hypoglycemia (each patients's mean value)	6		11
18. Mean HbA_1 (stable) value during diabetes duration (mg/dl)	9.48 + 2.18		8.86 ± 1.87
		$p > 0.05$	
19. Metabolic control according to HbA_1 level			
Good	2		5
Fair	6		1
Poor	1		3
		$p > 0.05$	
20. Fluorescein angiography			
Normal	2		2
Pathologic (microaneurysms without bleeding)	-		1

Food consumption patterns of the patients are summarized in Tables III and IV. Physical examination revealed normal findings and pubertal changes. No patient was found to be under the third percentile in physical growth. Mild hepatomegaly was palpated in one Turkish and two German patients.

The cholesterol level was high in one Turkish (7.65 mmol/1) and one German patient (5.9 mmol/1) who were found to be fairly well but had poor metabolic control. The HDL-cholesterol level was high in one Turkish patient (2.44 mmol/1) with fair metabolic control. The AP was high in one German patient (677 U/1). The results of the blood tests and the urinalyses mentioned above and also the blood pressure were within the normal range in all patients. The skin-fold thickness was above 97 percent in only one patient.

TABLE III: Daily Protein (P), Carbohydrate (CH), Fat (F), and Energy Intake of both Turkish (T) and German (C) Children with Type I Diabetes

(IBE: Broteinheit is the German equivalent for 12 grams of carbohydrates)

			Daily intake (g / kg)					
Patients	Age (yrs.)	Sex	P	CH	F	Kcal/kg	Kjoule/kg	BE/day
T	3 6/12	F	3.2	14.8	4.5	115	48	15
G	3 8/12	F	3.2	8.1	2.7	73	308	13
T	3 8/12	F	3.5	10.9	3.8	86	362	17.8
G	4 9/12	F	3.4	9.3	3.1	81	333	11
T	5 8/12	F	2.6	6.9	2.1	60	249	13
G	6 10/12	F	2.8	7.1	2.3	63	263	13.7
T	7 2/12	M	4.1	8.3	3.7	94	397	12.5
G	7 6/12	M	2.6	6.6	2.3	59	247	20.5
T	11 8/12	F	2.0	5.2	1.7	46	194	16
G	11 5/12	F	1.9	4.7	1.7	44	185	17.9
T	12 10/12	M	1.3	4.9	1.9	48	198	17
G	13	M	1.6	4.2	1.4	37	157	20.8
T	13	M	2.3	7.0	3.2	59	246	22
G	13 8/12	M	1.2	3.3	1.1	32	132	13
T	15 4/12	F	1.3	3.3	0.9	39	164	16
G	15	F	2.0	5.9	1.9	51	213	29
T	17 3/12	F	1.6	3.7	1.9	39	164	19.5
G	17	F	1.5	4.4	1.4	38	162	21

TABLE IV: Food Consumption Patterns According to Amount of Carbohydrate, Protein and Fat Content (number of patients)

	Protein			Carbohydrate			Fat		
	Low	Normal	High	Low	Normal	High	Low	Normal	High
Turkish Group (9 patients)	2	7	—	4	5	—	1	5	3
German Group (9 patients)	—	9	—	5	4	—	—	9	—

In one Turkish patient, beta heterozygotic thalassemia was diagnosed by electrophoresis. The HbA_1 levels were relatively low in this patient despite the high blood-glucose levels which were due to a rapid turnover of erythrocytes and insufficient time for glycosylation.

There was statistically no significant difference between the groups regarding HbA_1 levels and the adherence of the diabetic child to diet ($p>0.05$).

Discussion

The purpose of dietary management in Type I diabetes is to provide adequate calories and all the necessary nutritional ingredients for the normal growth and development of the child in addition to assuring a relatively constant daily food intake. Since 1971, American, British and Canadian Diabetes Associations have advised that the carbohydrate content in meals range between 45 to 55 percent of the total caloric intake[3].

The diet composition varies greatly in different countries (Table V). This variation depends on traditional factors, customs, foodstuffs available, and the economic and educational levels of each country. The energy intake of the diabetic child also shows variations from day-to-day.

Weber and co-workers[1] have proven that protein intake is very stable during childhood (16% of total energy) and increases in girls at 15 years of age, due to caloric restriction. Fat consumption increases slightly, and carbohydrate intake consequently decreases with age.

In our study, we observed that the protein intake was low in two Turkish patients (12%), the fat intake high in three Turkish patients (40%), the carbohydrate intake low in one of the Turkish patients, who had consumed low protein, and in three

Turkish patients who had consumed a normal amount of protein. The protein and fat consumptions were normal in all the German patients and the carbohydrate intake was low (45%) in five German patients (Table IV).

A greater consumption of bread, cereals, macaroni, rice, olives, pounded wheat, flour and margarine was observed among the Turkish patients. In another study[9], which was conducted by the Hacettepe and West German Passau Medical Faculties, the dietary habits of both Turkish and German patients with Type II diabetes was compared. The consumption of sweets, soft drinks, cereals and meat was found to be higher in the German group, although the consumption of fruits and legumes was higher in the Turkish patients. Adherence to diet was seen more among German patients. The main reasons suggested for this was that the children in the Turkish group had an extremely good appetite and conditions were inappropriate to apply the diet at home.

Weber and co-workers[1] have estimated the long-term metabolic control of their 322 patients with Type I diabetes using HbA_1 levels and metabolic scores[10,11]. The percentage of these patients estimated to be under Good (G), Fair (F) and Poor (P) control was 20%, 38% and 42%, respectively, using the HbA_1 levels and 15%, 44% and 41%, respectively, using the metabolic scores (Table VI).

In our study, according to the mean HbA_1 value, no statistically significant difference was found in metabolic control between the Turkish and German groups.

The frequency of hypoglycemia was observed to be higher in the German patients. This might have been due to more efficient self-monitoring at home, better adherence to a dietary regimen or more physical activity.

Only one German patient in our study group (13 8/12 years of age) and with a nine year duration of diabetes presented with micro-aneurysms upon FA examination[12].

We observed that the Turkish patients had more problems regarding the management of their illness than the German group. For example, the Turkish children did not use their diet lists, while the German children did.

Stress, anxious, disturbed and uninterested family patterns, lack of education and neglect are the major psychological and family-related complications observed in families with diabetic children. In addition, family-size, and language problems encountered in a foreign country may also affect treatment.

The educational levels of the Turkish and German families differed. The Turkish children attending German schools faced more emotional problems than the German children.

A family's attitude towards food influences eating habits[13]. A good meal plan for a diabetic child is also a good meal plan for the whole family. Families with diabetic

TABLE V: Diet Compositions of Diabetic Children (percentage of energy intake)

			P	F	CH
White	USA	1959	20	40	40
Heik	E.Germany	1964	15	25	60
Lestradet	France	1966	16	24	60
Rosenkranz	Austria	1967	25	25	50
Hungerland	W.Germany	1968	15	40	45
Birkbeck	Great Britain	1976	14	44	42
	Canada	1976	20	32	48
Mozin	Belgium	1977	15	43	43
Berlin[1]		1978	16	34	50

TABLE VI: Parameters of the Metabolic Score[11]

	Degree of Control*			Weight of parameter (multiplication factor)
	G	F	P	
24-h glucosuria (g)	< 20	20 - 39	≥ 40	4
pp BG (mg/dl)**	< 200	200 - 299	≥ 300	2
ketoacidosis (no/yr)	0	1 - 2	≥ 3	2
hypoglyc. comata (no/yr)	0 - 1	2 - 3	≥ 4	2
growth* (percentile)	within	within		
weight change* (percentile)	according to height			1

* No evaluation for first year of diabetes. G - good, F - fair, P - poor control

** ppBG, postprandial blood glucose

children require continued emotional and practical support[14]. Education on this subject should be done by the physician, dietitian and nurse.

The diabetic child appears as a difficult patient when emotional disturbances are effective[15]. It seems to be the most important factor behind poor diabetic control, providing that economic and educational conditions are appropriate.

Turkish patients require more support in the management of their illness. Good contact with patients and their families must be provided in addition to a greater degree of social assistance.

Summary

Nine Turkish and nine German patients with Type I diabetes are compared according to dietary habits, adherence to diet, and metabolic control. In comparing these children, we observed that the Turkish patients had encountered more difficulties in adhering to a diabetic dietary regimen which was probably due to the customs and educational differences existing between the two groups.

Although no significant statistical differences were found between the groups, it should be emphasized that education plays a major role in dietary control.

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