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Plasma lipid levels and nutritional intake in childhood- and adolescence-onset young type 1 diabetic patients in Japan

Mieko Saito [a], Hiromi Kuratsune [b], Hayami Nitta [b], Kazue Kawahara [b], Masahiro Hamano [c], Masafumi Matsuda [d], Kohei Kaku [d], Masaaki Eto [a,*]

[a] *School of Pharmaceutical Sciences, Ohu University and Department of Medicine, Ohu University Hospital, Tomita-Misumido 31-1, Koriyama 963-8611, Japan*
[b] *Department of Clinical Nutrition, Kawasaki Medical School Hospital, Japan*
[c] *Clinical Laboratory, Kawasaki Medical School Hospital, Japan*
[d] *Diabetes & Endocrine Division, Department of Medicine, Kawasaki Medical School, Japan*

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Abstract

In recent years, the diet of the young Japanese has changed to westernized diet with high fat content. Childhood-onset type 1 diabetic patients have had good diet training since onset of the disease, but adolescence-onset type 1 diabetic patients have already established westernized diet habit at onset of the disease, which may not be easily improved. We hypothesized that a difference of the age at onset of the disease may affect nutritional status and plasma lipid levels in Japanese type 1 diabetic patients. Plasma lipid levels and nutritional intake were compared between childhood- and adolescence-onset young type 1 diabetic patients. Our research involved 9 childhood-onset type 1 diabetic patients (childhood group), 11 adolescence-onset type 1 diabetic patients (adolescent group), and 24 age-matched non-diabetic control subjects. There were no significant differences in age and body mass index (BMI), daily energy intake among the childhood group, the adolescent group, and the non-diabetic control group. There was no significant difference in HbA1c level between the childhood group and the adolescent group. The adolescent group had significantly higher plasma levels of total cholesterol, triglyceride, and low-density lipoprotein (LDL)-cholesterol than the childhood group ($p < 0.01$, <0.05, and <0.001, respectively) or the control group ($p < 0.001$, <0.001, and <00.001, respectively). The adolescent group had significantly lower plasma level of high-density lipoprotein (HDL)-cholesterol than the childhood group ($p < 0.05$). The adolescent group had significantly higher percentage energy intake from fat (31.7%, $p < 0.001$), higher saturated fatty acids intake (19.0 g/day, $p < 0.01$), and higher cholesterol intake (428 mg/day, $p < 0.05$), and significantly lower polyunsaturated fatty acids intake (13.4 g/day, $p < 0.05$) and lower fiber intake (9.5 g/day, $p < 0.01$) than the childhood group. It is concluded that young Japanese type 1 diabetic patients with onset of adolescence have lipid abnormalities, which may be mainly caused by westernized dietary habits.
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Keywords: Type 1 diabetes mellitus; Lipid abnormalities; Nutrition; Plasma lipids; Age at onset of diabetes

1. Introduction

Mortality from coronary artery disease is lower in Japan than in western countries. It is generally thought that the Japanese low fat diet is an important contributor to this observation. However, national surveys conducted in Japan indicate that although the mean total

* Corresponding author. Tel.: +81 24 932 8931; fax: +81 24 933 7372.
E-mail address: m-etou@pha.ohu-u.ac.jp (M. Eto).

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Table 1
Characteristics of type 1 diabetic patients and non-diabetic control subjects

	Type 1 diabetic patients		Non-diabetic control
	Childhood-onset	Adolescence-onset	
Number	9	11	24
Sex (M/F)	2/7	3/8	6/18
Age at onset (years)	6.4 ± 1.5	17.8 ± 1.0	
Age (years)	18.9 ± 1.0	20.3 ± 0.6	20.8 ± 0.2
Body length (cm)	156 ± 3	156 ± 2	159 ± 1
Body weight (kg)	54.4 ± 3.0	55.0 ± 2.3	53.9 ± 1.7
BMI (kg/m^2)	22.3 ± 0.5	22.6 ± 0.5	21.3 ± 0.5
HbA1c (%)	8.2 ± 0.4	7.9 ± 0.2	4.8 ± 0.2*
Insulin dose (units/day)	44.6 ± 5.7	37.4 ± 3.3	

Values are mean ± S.E.; BMI, body mass index.
* $p < 0.001$ vs. childhood- and adolescence-onset diabetic patients.

energy intake in adults has remained steady, the carbohydrate intake has decreased gradually every year, whereas fat intake had increased to 26.5% of total energy intake in the year 2000 [1]. It has been reported that in the adolescent population, fat intake has increased to approximately 30% of total energy [1]. In type 1 diabetic patients, dietary therapy as well as insulin therapy is essential to improve hyperglycemia and lipid abnormalities and to prevent complications. However, it remains unclear how the change from Japanese diet to western diet has affected the nutritional intake and plasma lipid levels in young type 1 diabetic patients.

Recently, it has been reported that type 1 diabetic patients whose diabetes was diagnosed at age ≥12 years had higher mortality than those diagnosed at age <12 years in Japan [2]. The reason for this difference remains unclear [2]. In type 1 diabetic patients with onset of childhood, nutritional counselling begins at the time of onset of the disease, and is centered on the patient's mother, and there are many opportunities to learn dietary therapy. By contrast, in type 1 diabetic patients with onset of adolescence, there already may exist long-standing westernized dietary habits of a high fat intake at the time of onset of the disease. This dietary habit may not be easily improved by nutritional counselling, and then may contribute to lipid abnormalities. Thus, we hypothesized that a difference of the age at onset of the disease may affect nutritional intake and plasma lipid levels in Japanese type 1 diabetic patients, and that this may, at least in part, explain a higher mortality in type 1 diabetic patients diagnosed at age ≥12 years in Japan [2].

In the present study, young (mean age 19.7 years) type 1 diabetic patients were grouped according to the age at onset of the disease, namely childhood group and adolescent group, and plasma lipid levels and nutritional intake were compared between the two groups.

2. Research design and methods

Twenty patients with type 1 diabetes mellitus receiving outpatient nutritional counselling were recruited from our hospital. Nine patients had childhood-onset type 1 diabetes mellitus (childhood group), and 11 patients had adolescence-onset type 1 diabetes mellitus (adolescent group). The mean ages at onset for the two groups were 6.4 years (0–11 years) and 17.8 years (15–21 years), respectively, and their current mean ages were 18.9 years and 20.3 years, respectively (Table 1). All patients were taking intensive insulin therapy with four daily subcutaneous injections of regular- or rapid-acting insulin and intermediate-type insulin at time of sleep. The patients were taking no medications other than insulin. The patients were defined as type 1 diabetes according to a continuous need for insulin therapy and laboratory data. None of the patients had overt nephropathy, abnormal liver or endocrine function. There were 24 age- and sex-matched non-diabetic control subjects (mean age 20.8 years) recruited from our school. Non-diabetes was defined as HbA1c level <5.5%. All diabetic patients and non-diabetic control subjects were Japanese, and had no evidence of genetic hyperlipidemia such as familial hypercholesterolemia or type III hyperlipoproteinemia [3]. The present study was undertaken according to the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants before the study.

Blood after an overnight fast was obtained to determine the plasma total cholesterol, triglyceride (TG), and high-density lipoprotein (HDL)-cholesterol by the enzymatic method, and HbA1c by the HPLC method. Low-density lipoprotein (LDL)-cholesterol was calculated by the formula of Friedewald et al. [4]. In addition, blood after an overnight fast was also obtained from 24 non-diabetic control subjects, and the plasma lipid levels and HbA1c level were measured.

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