奈医誌. (J. Nara Med. Ass.) 48, 82～88, 1997

LIFESTYLE OF PATIENTS WITH DIABETES MELLITUS

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Received February 18, 1997

Abstract: We evaluated the lifestyle of 214 patients with diabetes mellitus to determine which aspects were affected by their disease and diabetic complications. Information concerning lifestyle was obtained from 15-item questionnaires, and a total lifestyle score (TLS) was calculated. Clinical characteristics including duration of diabetes, glycemic control, current treatment, obesity, hypertension, hyperlipidemia, and macro- and microvascular complications were evaluated. Patients in their 40s had the lowest TLS, and lifestyle factors were strongly associated with glycemic control, ischemic heart disease, and with autonomic neuropathy. Subjects were also divided into two subgroups of equal size based on the median rate of TLS: an adequate lifestyle group and an inadequate lifestyle group. Although degree of excess in caloric intake was similar in these two groups, sodium intake was significantly higher in the inadequate lifestyle group than in the adequate lifestyle group.

Index Terms

diabetes mellitus, lifestyle, obesity, physical activity, risk factor, salt consumption, smoking

INTRODUCTION

Prevention of diabetes and its complications is a major public health problem[1]. There are great prospects of significant improvement in prognosis with the implementation of effective preventive strategies[2]. A high rate of prevalence of diabetes has been documented in populations with a modern lifestyle[3]. Therefore, further research is needed to determine the lifestyle of diabetic patients. The purpose of this study is to provide information about the lifestyle of diabetic patients, and to determine the relationship between lifestyle and diabetic complications.

PATIENTS AND METHODS

Patients

A total of 214 patients with diabetes mellitus who had sought medical attention by physicians in First Department of Internal Medicine at Nara Medical University Hospital or in six associated institutions were enrolled in this study. The subjects included 93 male patients and 121 female patients, aged 40 to 89 years (mean, 64.9 years). Clinical background factors for these subjects are given in Table 1.

Assessment of lifestyle

Lifestyle was assessed using a 15-item questionnaire (Table 2) modified from the questionnaire of Hygiene and Preventive Medicine of Osaka University Medical School[4,5]. Each item was a multiple choice question with 3 possible answers; 2, good or adequate; 1, fair or occasionally present; 0, poor or inadequate. A total lifestyle score (TLS) was calculated as the sum of the responses to the 15-item questionnaire. For analysis, the subjects were ranked by TLS, and divided into two subgroups of equal size based on the median TLS: an adequate lifestyle group and an inadequate lifestyle group.

Table 1. Background of subjects

Items		Number	(%)
Gender	Male	93	(43.5)
	Female	121	(56.5)
Age	40-49	19	(8.9)
	50-59	35	(16.4)
	60-69	80	(37.4)
	70-79	69	(32.2)
	>80	11	(5.1)
Type	NIDDM	211	(98.6)
	IDDM	3	(1.4)
Therapy	Diet alone	44	(20.6)
	Oral agent	115	(53.7)
	Insulin	55	(25.7)
Environment	Urban life	121	(56.5)
	Rural town	80	(37.4)
	Mountain village	13	(6.1)

Table 2. Questionnaire for lifestyle assessment

Questionnaire	Point		
	2	1	0
1. Regularity of daily life?	regular	intermediate	irregular
2. Regularity of eating?	regular	intermediate	irregular
3. Eating breakfast?	every morning	sometimes	never
4. Snacking?	never	sometimes	everyday
5. Eating out?	never	sometimes	every day
6. Alcohol consumption?	never	sometimes	every day
7. Smoking habits?	never	1-20 ps daily	>20 ps daily
8. Total hours of walking	>120 min	30-120 min	<30 min
9. Regular exercise (sports)?	every day	twice a week	never
10. Job burden?	adequate	intermediate	overwork
11. Work pattern?	active	intermediate	sedentary
12. Mental stress?	none	a little	strong
13. Enjoying hobbies?	yes	somewhat	no
14. Rest on holidays	every week	twice a month	rarely
15. Sleep	good	moderate	poor

Dietary calorie and salt consumption

Patients recorded their own prospective 5-day food-intake diaries, from which estimates of the average dietary caloric intake were determined. Excess energy intake was expressed as a percentage of optimum caloric intake. Twenty-four-hour urine samples were collected at the outpatient clinic, and total urinary excretion of sodium was determined.

Clinical data

Information concerning the duration of diabetes, glycemic control, current treatment, obesity, hypertension, hypercholesterolemia, hypertriglycerolemia, cerebrovascular disease (CVD), ischemic heart disease (IHD), peripheral vessel disease (PVD), diabetic retinopathy, diabetic nephropathy and diabetic neuropathy was obtained from medical records. Using the criteria given in Table 3, subjects were divided into two or three categories. Obesity was defined as a body mass index (BMI) of 26.5 % or higher[6]. Hypertension was defined according to WHO guidelines[7]. Patients being treated with antihypertensive drugs were also classified into the hypertensive group. Hyperlipidemia was defined as a serum cholesterol concentration of 220 mg/dl or higher and/or a serum triglyceride concentration of 150 mg/dl higher. CVD was defined as documented history of transient ischemic attack or stroke due to cerebral infarction or cerebral hemorrhage. IHD was identified by classical symptoms of angina pectoris or documented myocardial infarction. PVD was identified by responses to a standard questionnaire for lower-limb claudication or gangrene. The grade of diabetic retinopathy as determined by ophthalmoscopy and classified as no diabetic retinopathy (NDR), non-proliferative diabetic retinopathy (NPDR), or proliferative diabetic retinopathy (PDR). Diabetic nephropathy was divided into three clinical stages : normoalbuminuria (NA), microalbuminuria (MA), and overt proteinuria (OP). Diabetic neuropathy was divided into three categories : no neuropathy, peripheral neuropathy, and autonomic neuropathy.

Table 3. Categorical grades for variables

Variables	Category		
	I	II	III
Duration of diabetes (years)	<10	10-19	≧20
Glycemic control (HbA_{1c} value ; %)	<7.0	7.0-8.9	≧9.0
Therapy	diet only	oral agent	insulin
Obesity	absent	present	
Hypertension	absent	present	
Hyperlipidemia	absent	present	
CVD	absent	present	
IHD	absent	present	
PVD	absent	present	
Retinopathy	NDR	NPDR	PDR
Nephropathy	NA	MA	OP
Neuropathy	absent	peripheral	autonomic

Abbreviations are: CVD, cerebrovascular disease; IHD, ischemic heart disease; PVD, peripheral vascular disease; NDR, no diabetic retinopathy; NPDR, non-proliferative diabetic retinopathy; PDR, proliferative diabetic retinopathy; NA, normoalbuminuria ; MA, microalbuminuria ; OP, overt proteinuria.

Statistical analysis

Values are expressed as means±SD. The means of groups were compared by analysis of variance (ANOVA), and differences between groups were tested using Fisher's exact test. Statistical significance was assumed at $p<0.05$.

RESULTS

Total lifestyle score (TLS)

TLS results are shown in Fig. 1 and 2. TLS was significantly lower for patients in their 40s than for those in their 50s, 60s and 70s. No significant difference in TLS was observed between genders (Fig. 1). No significant difference in TLS was observed among the groups with different duration of diabetes. TLS was significantly lower in the group with the poorest glycemic control than in the groups with better control. No significant difference in TLS was observed among the different modalities of treatment, and no significant difference in TLS was observed between the groups with obesity, hypertension, hyperlipidemia, CVD, and PVD. However, TLS was significantly higher in the group with IHD than in the group without it. TLS was significanthly lower in those with autonomic neuropathy than in the other groups. However, no significant difference in TLS was found among groups classified by degree of severity of diabetic retinopathy or nephropathy (Fig. 2).

Dietary calorie and salt consumption

There was no significant difference in age, duration of diabetes, BMI, HbA_1c or serum creatinine concentration between the groups with adequate and inadequate lifestyle. Degree of excess in caloric intake was also similar between these groups. Sodium intake was significantly higher in the inadequate lifestyle group than in the adequate lifestyle group (Table 4).

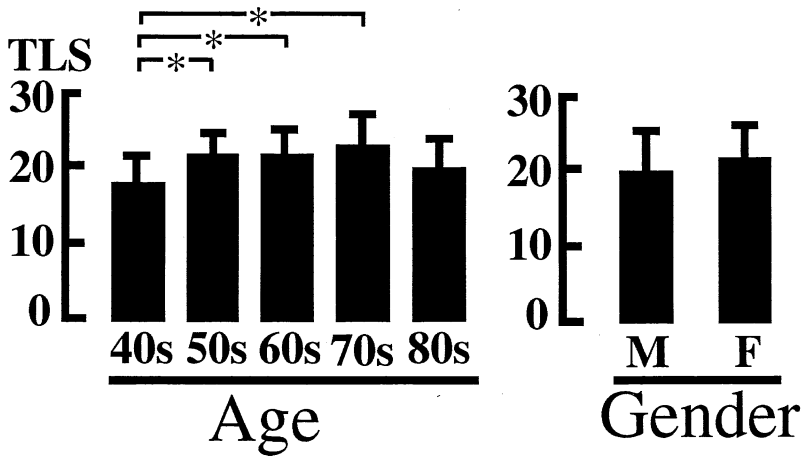

Fig. 1. Total lifestyle score by age and gender.
*p<0.05

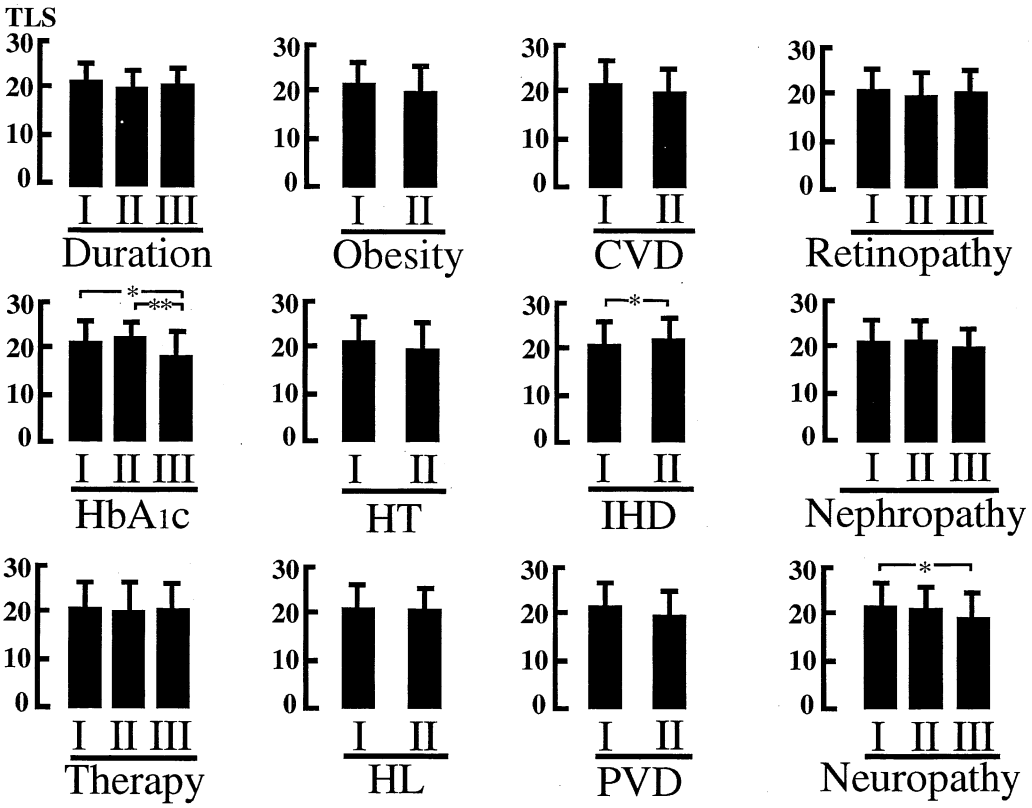

Fig. 2. Total lifestyle score and clinical conditions.
Abbreviations are : HT, hypertension ; HL, hyperlipidemia ; CVD, cerebrovascular disease ; IHD, ischemic heart disease ; PVD, peripheral vascular disease.
Categorical grades of I , II and III as in Table 3.
*p<0.05 **p<0.01

Table 4. Comparison of groups with adequate and inadequate lifestyles

Item	Adequate lifestyle	Inadequate lifestyle
Number of subjects	103	111
Age (yo)	65.8±8.1	64.1±10.8
Duration of diabetes (yrs)	11.0±8.7	10.6±8.0
BMI (%)	23.1±3.2	23.3±3.2
HbA_{1c} (%)	7.02±1.36	7.27±1.56
Serum creatinine (mg/dl)	0.99±0.82	0.96±0.53
Excess caloric intake (%)	14.0±20.3	14.3±18.5
Sodium intake (g/day)	8.76±3.32	9.94±3.65*

Abbreviations are : BMI, body mass index ; HbA_{1c}, hemoglobin A_{1c}.
*p<0.05 vs adequate lifestyle group

DISCUSSION

Interventional strategies to prevent diabetes and its complications are useful for high-risk individuals including those changing to Westernized lifestyles, lifestyle in urban societies or sedentary living. Obesity and certain lifestyle behavior, for example, ingestion of alcohol,

smoking, and lack of physical activity, have been found to be related to general health status. Mental health conditions resulting from stressful life events have also been found to influence glycemic control in diabetics. However, it is currently unknown whether lifestyle factors are associated with an increased risk of diabetic complications or not.

In the present study, we demonstrated that results of self-assessment of lifestyle factors are strongly associated with age, glycemic control, presence or absence of IHD, and diabetic autonomic neuropathy. Some investigators have shown that poor health practices are more common among younger people than among older subjects[8]. The elderly tend to be cautious regarding their health status and tend to maintain a more healthy lifestyle. We have demonstrated that some diabetic complications are associated with an unfavorable quality of life (QOL)[9]. In particular, foot complication and stroke limit physical activity and enforce a sedentary way of life. However, in the present study presence or absence of PVD and CVD was not correlated with total lifestyle score. On the other hand, patients with IHD were more likely to have a good lifestyle than patients without it. We speculate that these conflicting findings indicate that many patients with IHD also tend to be cautious concerning their health condition and to maintain a more healthy lifestyle. Among microvascular complications, only autonomic neuropathy was associated with inadequate lifestyle. On the other hand, presence or absence of diabetic retinopathy and nephropathy were not correlated with TLS. The lack of relationship between these complications and TLS should be further exmained from another viewpoint.

Our second approach was to evaluate nutritional condition by determining excess dietary calorie and salt consumption. The long-term adverse health effects of excess consumption of energy-dense foods have recently become apparent. Decrease in daily food energy intake has been shown to decrease fasting plasma insulin concentrations and atherogenic lipoproteins. For example, Australian Aborigines who switched from a Westernized diet to a traditional diet exhibited a dramatic improvement in glucose tolerance[10]. However, we did not find a close relationship between excess of caloric intake and TLS. This may have been the case because the subjects in this study were relatively advanced in age, and the caloric intake of such subjects is usually limited. On the other hand, salt consumption may contribute to the development of hypertension and diabetic nephropathy. Most patients with essential hypertension exhibit high blood pressure due to high dietary salt intake. Salt sensitivity is more common among those patients with diabetes mellitus who are more likely to develop renal failure. Our study demonstrated that diabetic patients with an inadequate lifestyle have a higher salt intake. In summary, our findings suggest that lifestyle mondification may be a useful strategy for prevention or delay of development of the complications of diabetes.

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