Dietary Quality and Self-Management Status according to the Glycemic Control in the Elderly with Type 2 Diabetes

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노인 당뇨환자에서 혈당조절에 따른 식사의 질과 당뇨자가관리상태

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Abstract

Evidence for the effects of different health behaviors, including diet, in elderly diabetes is currently limited. The aim of this study was to compare the quality of diet and health behaviors in Korean elderly T2DM patients, using a glycemic control. T2DM elders(>65 yr, n=48) were recruited and categorized by the concentration of glycated-hemoglobin HbA1c; subjects with HbA1c<7% were the good control(GC) group, and subjects with HbA1c≥8% constituted the poor control(PC) group. General characteristics, self-management behavior questionnaires, and 3-d diet records were all collected and assessed. No significant differences in general characteristics between GC and PC were detected, with the exception of a higher level of education in GC($p<0.05$). A twofold longer duration of diabetes was observed in PC as compared to GC($p<0.01$). The GC group did exercise for a longer time($p<0.001$), and had an earlier beginning of diabetes self-management education (DSME) by healthcare practitioners using a team teach as compared with the PC group($p<0.05$). The total dietary quality index($p<0.001$) and individual index for carbohydrate(p<0.001) or vegetables and fruit($p<0.05$) were better in GC than in PC. Therefore, the earlier DSME including intensive exercise and balanced diet selection should be expected to improve glycemic control in diabetic Korean elders.

Key words: elderly, glycemic control, diet quality, diabetes self-management education.

INTRODUCTION

The prevalence of diabetes is about 18.1% for those over 65 years of age in Korea according to the third Korea National Health and Nutrition Examination Survey(KNHANES Ⅲ)[1]. This is similar to the 20% found in the United States, and will increase substantially over the next few years as a result of increased life expectancy[2]. In general, older people are less likely to attend a hospital and are more likely to be missed by surveys than younger people, and the disproportionate burden of ill health that they carry compared with their non-diabetic peers will have increasing socioeconomic consequences. Such considerations thus have begun to focus attention on older people with diabetes as a subpopulation worthy of special consideration[3]. KNHANES III also reported only half of elders with diabetes had the preventive examination rate for diabetes complication, which is half of the Behavioral Risk Factor Survellance System (BRFSS) in the US[1]. Data revealed that elderly people with a

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lower education level and a lower income, living in more remote areas had lower learning experience of self-care for diabetes[1]. The late Chinese study showed that education of elderly people about nutrition is important, and the design of education program should consider the low education levels of the elderly[4]. Since there are limited studies providing the state of Korean elderly diabetes care, the aim of this study is to investigate and compare the health behavior, diet quality and self-care education between good glycemic control group and poor glycemic control group, and to identify factors that affect glycemic control for improving the quality of life in elderly diabetic people.

SUBJECTS AND METHODS

1. Data Collection

The participants of this study were type 2 diabetic mellitus (T2DM) elders visited Kyung Hee University Medical Center in Seoul between July 2005 and October 2005. Eligibility criteria included willingness to participate the study protocol, and understanding and signing of informed consent; diagnosed as T2DM at least three months prior to the beginning of the study; aged over 65 years. We used the criteria for the diagnosis of T2DM that were established by the Korea Diabetes Society[5], which are similar to that of the American Diabetes Association[6]. Exclusion criteria included any serious complicated diseases such as hepatic or renal disease, malignant disease, any recent surgery, eating or hearing disorders; individuals with HbA1c level between 7 and 8%. Forty eight subjects participated in the present study after screening.

The study was designed as a cross-sectional group comparisons of dietary risks, heath related behavior and self-care education between the good glycemic control(GC) group(n=30) and the poor glycemic control(PC) group(n=18). Participants with HbA1c<7% was defined as good glycemic control and with HbA1c≥8% was defined as poor glycemic control, which was modified from the American Diabetes Association definition[6]. Participants with HbA1c level between 7 and 8% had been excluded. Subjects were treated either with diet alone or diet in combination with hypoglycemic agent(sulfonylureas or metformin) and/or insulin. The protocol for this clinical research was reviewed by the Institutional Review Board(IRB) at the Kyung Hee University Medical Center(Seoul, Korea).

2. Measures

HbA1c level was determined by a commercial enzyme immunoassay(primary calibration; DAKO, Ely, Cambrigeshire, UK). Dietary data was collected by trained-interviewer for 3-day 24-hour recall using semi-quantitative method. Intake information was disaggregated to provide dietary intake data for total energy (kcal per day), macro- or micro-nutrients(g or mg per day). The 24-hour recalls were converted to daily nutrient intake using software computer aided nutrition analysis program(CAN pro, version 2.0, 2002). The recalls were averaged to obtain a single daily nutrient report. Overall diet quality was assessed using the Korean Recommended Dietary Allowance(KRDA)[7]. Also, qualitative assessment was scored using the diet quality index(DQI)[8], which are summed from poor diet(0) to excellent diet(16) across the eight recommendations.

3. Statistical Analysis

All analyses were conducted using the SAS software package (Version 9.1, SAS Inc, Cary, NC)[9]. Continuous variables were presented as a mean and standard deviation. Categorical variables were presented as absolute and relative frequencies. The chi-square test was employed to examine the effects of dietary diversity on categorical variables, and continuous variables were compared using the t-test. Statistical significance was accepted within $p<0.05$.

RESULTS

General characteristics of the study participants was compared between the good glycemic control(GC) and the poor glycemic control(PC)(Table 1). The average age of subjects was 71.0 (±6.0) years. There was no significant difference of age, gender, status of employment or living between GC and PC. However, average duration of diabetes of the PC group was approximately twice longer than the GC group($p<0.01$), and more complications were existed in the PC group($p<0.05$). Most people with good glycemic control were treated by hypoglycemic tablets, while most people with poor glycemic control was treated by insulin.

There was no significant differences between the GC group and the PC group against health behavior such as drinking, smoking, exercising, dietary supplement use although subjects in the GC group exercised 2 times longer than the PC group ($p<0.001$)(Table 2).

Half of the elderly people with diabetes had an opportunity of self-management education in the present study(Table 3). Among

Table 1. Characteristics of the study participants

Variables	GC(n=30)	PC(n=18)	P value[2]
Age(y)	70.2±4.4	70.2±5.5	NS
Sex			
Male	13(43)	5(28)	NS
Female	17(57)	13(72)	
Employment status			
Employed	19(63)	10(56)	NS
Unemployed	11(37)	8(44)	
Education			
Middle school or less	18(60)	14(88)	<0.05
High school or more	12(40)	4(22)	
Living alone			
Yes	3(10)	3(17)	NS
No	27(90)	15(83)	
Duration of diabetes(y)	7.9±6.8	15.7±10.1	<0.01
Number of complications	3.7±1.2	4.4± 1.5	<0.05
Treatment of diabetes			
Diet and exercise	2(7)	0(0)	
Oral hypoglycemic agent	25(83)	5(28)	<0.05
Insulin	3(10)	13(72)	

[1] Data were presented as number(%) or mean±standard deviation,
[2] Statistical analysis was determined by students *t*-test(for continuous variables) or by chi-square test(for categorical variables). ns means not significant, GC; Good glycemic control, PC; Poor glycemic control.

difficulties of diabetes self-management, dietary management was the most difficult part in both GC and PC(Table 3). Interestingly, good glycemic control group began earlier education(*p*<0.05) with team teaching consisting of doctors, nurses and dietitians (*p*<0.05) rather than later education with single teaching type (Table 3).

Total diet quality index(DQI) scoring was significantly higher in the GC group than in the PC group(*p*<0.001)(Table 4). Especially, carbohydrate as well as vegetables and fruits consumption was markedly higher in GC group than PC group(*p*<0.05). However, there were no significant differences in other nutrients intake such as fat, saturated fats, cholesterol, protein, calcium and sodium (Table 4).

DISCUSSION

This study demonstrated differences of dietary quality and self-management status in elders with type 2 diabetes mellitus

Table 2. Health behaviors of the study participants according to the glycemic control

Variables	GC(n=30)	PC(n=18)	P value[2]
Drinking alcohol			
None	26(87)[1]	18(100)	NS
Sometimes	4(13)	0	
Smoking			
None	29(97)	18(100)	NS
Sometimes	1(3)	0	
Regularity of exercise			
None	2(7)	3(17)	NS
Always	28(93)	15(83)	
Exercise Time (min)	76.4±35.4	37.3±24.3	0.001
Dietary supplements use			
None	12(40)	11(61)	NS
Intake	18(60)	7(39)	

[1] Data were presented as number(%) or mean±standard deviation,
[2] Statistical analysis was determined by students *t*-test(for continuous variables) or by chi-square test(for categorical variables). ns means not significant, GC; Good glycemic control, PC; Poor glycemic control.

(T2DM) according to their glycemic control. It is well recognized that impaired blood glucose tolerance is a risk factor for cardiovascular disease[10]. Considering the life expectancy of the healthy 65-year-old woman to be 19 years, good glycemic control with resultant decrease in vascular damage thus could be a critical impact on the quality and quantity of the final years of life in diabetic elders[11].

Exercise improves insulin resistance and has beneficial effects on preventing and treating T2DM[12]. In this study, significantly longer period of exercise was performed by the good glycemic control(GC) group, while shorter period of exercise was practiced in the poor glycemic control(PC) group. No significant difference was observed on average of BMI in the GC group(24.6± 3.2 kg/m²) and the PC group(25.3±3.1 kg/m²), whereas significantly higher lean body mass was observed in the GC group(44.9±7.2 kg) than in the PC group(38.5±5.4 kg). Because skeletal muscle is the biggest reservoir for glucose disposal, and visceral fat deposition in elders may be causally related to elevated cortisol secretion in response to stressors and may lead impaired glucose tolerance[12]. It is thus a safe and effective exercise including weight lifting or progressive resistance training(PRT) can offers gaining and maintaining good glycemic control in diabetic elders.

Table 3. Diabetes Self-Management Education(DSME) of the study participants according to the glycemic control

Variables	GC(n=30)	PC(n=18)	P value[2]
Experience of diabetic self-management education			
Yes	15(50)	10(55)	NS
No	15(50)	8(44)	
Onset of diabetic self-care education			
Immediately	8(53)	1(10)	
Within 5 years after diagnosis	4(27)	3(30)	<0.05
In recent 1 years	3(20)	2(20)	
During hospital stay	0	4(40)	
Type of diabetes self-management education			
By team teaching (by doctor, nurse, dietitian)	12(80)	3(30)	<0.05
By one of healthcare practitioner	3(20)	7(70)	
Cause of difficulties in diabetes self-management			
High cost for medicine	3(10)	3(17)	
Hard to go hospital	3(10)	2(11)	
Be forgetful to take medicine	3(10)	1(6)	NS
Dietary treatment	19(63)	8(44)	
Often painful	2(7)	4(22)	

[1] Data were presented as number(%) or mean±standard deviation,

[2] Statistical analysis was determined by students t-test(for continuous variables) or by chi-square test(for categorical variables). ns means not significant, GC; Good glycemic control, PC; Poor glycemic control.

Table 4. Comparative diet quality index(DQI) scores of the study participants according to the glycemic control

Variables[1]	GC(n=30)	PC(n=18)	P value
Energy from fat	2.0±0.0[2]	2.0±0.0	NS
Energy from saturated fatty acids	1.8±0.6	1.8±0.5	NS
Consumption of cholesterol	1.8±0.5	1.9±0.3	NS
Energy from carbohydrate	1.0±0.8	0.1±0.3	<0.001
Relative consumption of protein[3]	1.1±0.9	1.3±0.9	NS
Relative consumption of calcium[3]	1.0±1.0	0.5±0.9	NS
Consumption of vegetables & fruits	0.6±0.6	0.2±0.4	<0.05
Consumption of sodium	0.5±0.7	0.3±0.5	NS
Total DQI score	9.7±1.6	7.7±1.2	<0.001

[1] Dietary quality index(DQI) scores were summed from 0(poor) to 16(excellent) across the eight recommendations,

[2] Values were mean±SD and statistical significance was determined at $p<0.05$ or $p<0.001$ by t-test. ns means not significant,

[3] Relative consumption of either protein or calcium to Korean recommended dietary allowance,

GC; Good glycemic control, PC; Poor glycemic control.

Appropriate dietary modification to improve insulin sensitivity is effective and simultaneously hard in diabetic patients. Results from a prospective cohort study on dietary patterns and risk for T2DM showed that prudent dietary pattern; characterized by higher consumption of vegetables, fruit, fish, poultry and whole grains was associated with a lower risk for T2DM(relative risk, 0.84; CI, 0.70~1.0)[13]. In contrast, the western dietary pattern; red meat, processed meat, French fries, high fat dairy products, refined grains and sweets and desserts with low physical activity was associated with a particularly high risk for T2DM(relative risk, 1.96; CI, 1.35~2.84)[13]. Lee $et\ al.$ showed that appropriate dietary intervention through scoring system in three parts; regularity, balance, and attitude significantly promoted clinical outcome, and revealed that the intensive diabetic education program is more effective than a conventional program, both improving glycemic control and self-control ability of T2DM patient[14].

Our study demonstrated that total dietary quality index(DQI) score was significantly higher in the GC group than in the PC group, specifically, for carbohydrate and vegetables and fruits (Table 4). It is therefore suspected that withdraw of behavior for certain food choices should be derived through inadequate knowledge on nutrition in diabetic elders. Nutrition education for

diabetic elders needs to focus the balanced diet with appropriate consumption of complex carbohydrates, fruits and vegetables.

Diabetes self-management education(DSME), the process of teaching people to manage their diabetes, has been considered an important part of the clinical care of diabetes[15]. The American Diabetes Association[6] recommends assessing self management skills and knowledge of diabetes at least annually and providing or encouraging continuing education; nevertheless, in the US, 50 to 80% of elderly diabetes have not significant knowledge and skill on glycemic control resulting in unacceptably high glycated hemoglobin HbA1c levels both in T1DM and T2DM[16].

In Korea, most diabetic patients do not check-up their blood glucose concentration periodically[17]. The rate of performance of self care following the instruction of doctor was unfortunately lower in Korea than in other developed country[18]. In the present study, only half of the diabetic elderly experienced DSME. It is interesting to note that earlier starting of DSME was found in good glycemic control(GC) group rather than in poor glycemic control(PC) group. This result implies that the earlier knowledgeable the group, the more effectively delayed the glycemic deterioration, although there was no significant difference between GC and PC by an experience of DSME *per se*.

Moreover, the efficacy of DSME can be determined by various factors including educators, types, duration, etc. In the present study, most elders with good glycemic control answered that they've been learned diabetes self-management skills with healthcare educators, doctors, nurses and dietitians together, whereas most elders with poor glycemic control group answered that they've learned them with one of healthcare practitioner. It could be said that DSME might be effective if it is multidisciplinary. On the other hand, DSME has been reviewed to be more effective when it is delivered in a community gathering places[15]. Therefore, DSME could be effective when carried out in collaboration with educators in community gathering places.

In conclusion, targeted-nutrition education including diet quality, duration of exercise and onset of diabetic care education can affect glycemic control for improving the quality of life in elderly diabetic people. Practical and individualized method of intervention needs to be developed for the improvement of healthy glycemic control in elders with T2DM.

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