



Behavioral changes in patients with diabetes during the COVID-19 pandemic

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Abstract

Aims/Introduction Amid the coronavirus disease (COVID-19) pandemic, the Japanese government declared a state of emergency and urged people to stay at home to prevent disease transmission. Herein, we investigated this emergency situation's effect on diabetes patients' lifestyle and glycemic control

Materials and methods Diabetes patients who visited our hospital between April 1 and June 13, 2020, for a regular consultation were asked about changes in their physical activities and dietary habits during the state of emergency period.

Results Among 168 patients, 26 (15.5%) gained > 2 kg; HbA1c levels were elevated or decreased by > 0.2% compared to that at the last visit in 57 and 51 patients (Groups D and I), respectively. Group D patients were affected to a larger extent by changes in commuting (transition to teleworking) and closures of sport gyms than Group I patients. Increased snacks, sweets, total diet, and alcohol intake could have contributed to worsening of glucose control in Group D, whereas a healthy diet and less alcohol intake could have led to better glucose control in Group I.

Conclusion During the state of emergency period, decreased physical activity levels negatively affected glycemic control. However, despite changes in physical activity level, maintaining or improving dietary habits could lead to better glycemic control in diabetes patients. During this COVID-19 pandemic, more diabetes patients are likely to shift to teleworking and stay home for longer periods. Therefore, we should develop effective and feasible measures to promote exercise and dietary therapy, especially for those who engage in teleworking.

Keywords COVID-19 · Stay-at-home · Physical activity · Diet · Teleworking

Introduction

The coronavirus disease (COVID-19) is an infectious disease caused by a recently discovered coronavirus which was hitherto unknown before the outbreak began in Wuhan, China, in December 2019 [1]. The World Health Organization (WHO) declared COVID-19 to be a public health emergency on January 30, 2020, and subsequently graded it as a pandemic that affected many countries worldwide. As of September 9, 2020, there were 27,486,960 confirmed

cases of COVID-19, including 894,983 deaths that have been reported to the WHO [1].

In Japan, since early March, the government asked all school to close and encouraged companies to introduce remote-working systems to prevent COVID-19 spread. On April 7, the Prime Minister declared a state of emergency for Tokyo, Osaka, and five other prefectures, and since April 16, the declaration was applied nationwide. On the basis of the declaration, citizens were instructed to stay at home and asked to refrain from nonessential outings. The Japanese government lifted the nationwide state of emergency on May 25, and the economy was gradually reopened. This unprecedented situation affected all Japanese people, including patients with diabetes, to various levels.

To understand how this declaration affects the lifestyle and glycemic control of patients with diabetes, we investigated changes in individual behavior, body weight, and glycosylated hemoglobin (HbA1c) levels of patients with

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diabetes during the period of the declaration of a state of emergency.

Materials and methods

Subjects

Study participants were patients with diabetes who visited the Sanno Hospital between April 1 and June 13, 2020 for a regular consultation and whose treatment of diabetes remained unchanged since February 2020. The individualized information of the patients, such as sex, age, occupation, height, body weight at the previous visit, body weight at the study visit, the body mass index (BMI) at the study visit, of the previous visit, that of the study visit, duration of diabetes, family history of diabetes, complications, and treatments was acquired from the chart records. Doctors in charge of the patients asked them the following questions during the outpatient clinic visit. (1) During the nationwide state of emergency and stay-at-home period, did you find any change in physical activity (PA)? (2) Is there anything that you have changed or started about PA to compensate for the negative impact of this period? (3) Did you find any change in dietary habit during this period? (4) Is there anything that you have changed or started about dietary habit to compensate for the negative impact of this period? (5) What is your comprehensive assessment of your PA and diet situation during this period? The answers for these questions were aggregated, and substantially similar answers were grouped and categorized.

Statistical analyses

The relationship between the changes in glycemic control (deterioration or improvement in HbA1c levels) and changes in PA levels or dietary habit were assessed via multiple logistic analysis with the use of SPSS Statistics version 27 (IBM, Armonk, NY, USA). A *P* value of <0.05 was considered statistically significant.

The protocol for this research project was approved by a suitably constituted Ethics Committee of the Sanno Hospital (approval no. 20-S-5, Approval Date; June 29, 2020), and informed consent was obtained from all patients for study participation.

Results

In total, 168 patients (161, type 2 diabetes; 7, type 1 diabetes) participated in this study. The characteristics of these patients are shown in Table 1. The HbA1c levels were elevated by more than 0.2% or decreased by more than 0.2%

from that at their last visit in 57 and 51 patients (patients whose glycemic control deteriorated [Group D] and the group of the patients whose glycemic control improved [Group I]), respectively. The remaining 60 patients showed no remarkable changes in glycemic control (changes in HbA1c levels were not more than $\pm 0.2\%$) and are categorized as Group N. Among all participants, compared to their last visit, 26 patients (15.5%) gained more than 2 kg, whereas 12 patients (7.1%) lost more than 2 kg during the period. Regarding individual groups, Group I lost 0.06 ± 1.60 kg; however, patients in Group D and Group N gained 0.84 ± 1.60 kg and 0.33 ± 1.40 kg, respectively.

The representative answers for Questions 1, 3, and 5 are categorized in Tables 2, 3, 4, respectively. Regarding Question 2, the most cited answer (multiple answers were allowed) in all groups was “walking or jogging.” Specifically, 19 patients (37.3%) in Group I and 23 patients (38.3%) in Group N went walking or jogging, whereas only ten patients (17.5%) in Group D did so. The second most cited answer in all groups was “Muscle training such as push-ups, sit-ups, stretching, or squatting.” Seven patients (13.7%) in Group I, ten patients (16.7%) in Group N, and eight patients (14.0%) in Group D cited this answer. Regarding Question 4, the most cited answer (multiple answers were allowed) in all groups was “I try to eat a lot of vegetables.” Ten patients (19.6%) in Group I and 11 patients (18.3%) in Group N tried to increase vegetable intake, whereas only 5 patients (8.8%) in Group D cited this answer. The second most cited answer in all groups was “I tried to reduce the total amount of the diet (especially carbohydrate intake).” Nine patients (17.6%) in Group I, seven patients (11.7%) in Group N, and only three patients (5.3%) in Group D cited this answer.

For the multiple logistic regression analyses, we coded PA levels as 0 = increased, 1 = no change, and 2 = decreased and diet habit as 0 = improved, 1 = no change, and 2 = deteriorated. The results revealed that changes in PA level and dietary habits were significant determinants of group categorization (Group D or I) with the odds ratios of 5.03 (95% CI: 2.20–11.54; *P* < 0.05) and 6.92 (95% CI: 3.23–14.85; *P* < 0.05), respectively.

Discussion

The COVID-19 pandemic has affected the global population including patients with diabetes. Behavioral management, including PA and dietary habits, is fundamental to achieving treatment goals for people with diabetes [2–7]. However, many patients with diabetes were unable to maintain their previous lifestyle during the nationwide state of emergency and stay-at-home period. Based on the results of our study, as shown in Table 2, the patients in Group D were affected more by the changes in commuting (transition to

Table 1 Characteristics of the study participants

Variables	Mean \pm SD or <i>N</i> (%)
Age (years)	62.1 \pm 12.3
Sex (males/females)	116/52
Height (cm)	166.5 \pm 8.08
Body weight (kg)	71.57 \pm 14.33
BMI (kg/m ²)	25.6 \pm 4.0
HbA1c (%)	7.26 \pm 0.95
Duration of diabetes (years)	8.3 \pm 7.4
Family history of diabetes (-/+)	62/106
Diabetic retinopathy	21 (12.5)
Diabetic nephropathy	50 (29.8)
Diabetic neuropathy	51 (30.4)
Treatment	
Diet and exercise only	23 (13.7)
DPP4-I	79 (47.0)
Metformin	88 (52.4)
Sulfonylurea	21 (12.5)
SGLT2-I	42 (25.0)
α -GI	9 (5.4)
Glinide	4 (2.4)
Insulin	23 (13.7)
GLP-1 RA	11 (6.5)
Working style	
Employed and still commuting as before	32 (19.0)
Employed and now completely shifted to telework	53 (31.5)
Employed and sometimes commuting and sometimes teleworking	19 (11.3)
Self-employed	8 (4.8)
Formerly employed, but now unemployed or absent from work	16 (9.5)
Originally unemployed	40 (23.8)

Data are expressed as mean \pm standard deviation or number (%)

BMI body mass index, *HbA1c* glycosylated hemoglobin, *DPP4-I* dipeptidyl peptidase-4 inhibitor, *α -GI* α -glucosidase inhibitor, *SGLT2-I* sodium-glucose cotransporter-2 inhibitor, *GLP-1 RA* glucagon-like peptide-1 receptor agonist

Table 2 Representative answers to Question 1 “During the nationwide state of emergency and stay-at-home period, did you find any change in physical activity?”

Answers	Group D	Group N	Group I
PA level in commutation was decreased due to a transition to teleworking	29 (50.9)	24 (40.0)	18 (35.3)
Already working at home or unemployed. Therefore, no change in commutation but less PA due to stay-at-home	8 (14.0)	10 (16.7)	8 (15.7)
Already working at home or unemployed. Therefore, no change in commutation and no change in PA level in daily life	5 (8.8)	5 (8.3)	11 (21.6)
Commuting as usual. Therefore, no change in the PA level in commutation	3 (5.3)	9 (15.0)	5 (9.8)
Working every day but less PA due to less work load	3 (5.3)	5 (8.3)	1 (2.0)
PA level was decreased due to discontinuance of business	2 (3.5)	6 (10.0)	6 (11.8)
PA level was decreased due to closure of sports gym or swimming pool	14 (24.6)	11 (18.3)	2 (3.9)
PA level was decreased due to lack of leisure activities	3 (5.3)	1 (1.7)	4 (7.8)
PA level was increased due to increased housework	0 (0.0)	0 (0.0)	1 (2.0)

The numbers in the right column indicate the numbers and percentages of the individual answers. Multiple answers were allowed
PA physical activity

Table 3 Representative answers to Question 3 “Did you find any change in dietary habits during this period?”

Answers	Group D	Group N	Group I
The amount of snacks or sweets increased	28 (49.1)	11 (18.3)	3 (5.9)
The restaurants were closed and mostly I ate at home. Home-cooked meals were healthier	5 (8.8)	17 (28.3)	16 (31.4)
No remarkable change in the portion or content of diet	16 (28.1)	26 (43.3)	19 (37.3)
Meal times became irregular	2 (3.5)	2 (3.3)	1 (2.0)
The total amount of diet was increased (including the cases where 2 meals changed to 3 meals per day)	14 (24.6)	6 (10.0)	2 (3.9)
The total amount of carbohydrate intake was increased	5 (8.8)	1 (1.7)	2 (3.9)
Frequency of using delivery food, takeout food, or lunch box at the convenience store was increased	6 (10.5)	4 (6.7)	2 (3.9)
The amount of vegetable intake was decreased	1 (1.8)	2 (3.3)	2 (3.9)
I lost appetite due to less PA or constipation. Therefore, the amount of food intake was decreased	0 (0)	3 (5.0)	3 (5.9)
Less opportunity to drink outside, but more at home. Therefore, the total amount of alcohol intake was increased	9 (15.8)	6 (10.0)	6 (11.8)
Less opportunity to drink outside due to the cancelation of business trip or party. Therefore, the total amount of alcohol intake was decreased	9 (15.8)	13 (21.7)	13 (25.5)

The numbers in the right column indicate the numbers and percentages of the individual answers. Multiple answers were allowed
PA physical activity

Table 4 Representative answers to Question 5 “What is your comprehensive assessment of your PA and diet situation during this period?”

Answers	Group D	Group N	Group I
PA decreased, and the diet deteriorated	29 (50.9)	9 (15.0)	3 (5.9)
PA decreased, and no change in the diet	13 (22.8)	9 (15.0)	4 (7.8)
PA decreased, and the diet improved	6 (10.5)	18 (30.0)	13 (25.5)
No change in PA, and the diet deteriorated	4 (7.0)	1 (1.7)	0 (0.0)
No change in PA and the diet	3 (5.3)	16 (26.7)	8 (15.7)
No change in PA, and the diet improved	1 (1.8)	5 (8.3)	7 (13.7)
PA increased, and the diet deteriorated	1 (1.8)	0 (0.0)	3 (5.9)
PA increased, and no change in the diet	0 (0.0)	1 (1.7)	4 (7.8)
PA increased, and the diet improved	0 (0.0)	1 (1.7)	9 (17.6)

The numbers in the right column indicate the numbers and percentages of the individual answers

PA physical activity

teleworking) and closures of sports gym than those in Group I. To compensate for the negative impact of this period in PA, more patients in Group I started walking or jogging than those in Group D. To identify the reasons that contributed to the worsening of glycemic control, we asked questions on the changes in dietary habits during the period. As shown in Table 3, increased amount of snacks, sweets, total diet, and alcohol intake could likely have contributed in worsening glycemic control in Group D, whereas a healthy diet at home and less alcohol intake seem to have led to better glycemic control in Group I. Compared to Group D, a greater

proportion of the patients in Group I tried to eat sufficient amount of vegetables. The answers of self-estimation for Question 5, categorized in Table 4, indicates that nearly half of the patients in Group D assessed that their PA levels had decreased and that the quality of diet had deteriorated. In contrast, regardless of PA levels, patients who tried to maintain or even improve their diet were more likely to be included in Group I.

With regard to teleworking, a survey conducted by the Tokyo Metropolitan Government showed that the ratio of teleworking companies in the capital surged from 24.0% in March to 62.7% in April 2020 as the spread of COVID-19 expanded. Furthermore, many firms continue to push teleworking due to a reduced risk of infection, even after the state of emergency was called off. Therefore, more patients with diabetes are expected to shift to teleworking and are likely to stay home longer than they did before. To minimize the risk of reducing PA levels and aggravating dietary habits, we should educate individual patients by providing appropriate and feasible measures for exercise and dietary therapy during teleworking. There is plenty of useful information available to us, some of which comes from the International Diabetes Federation that recommends healthy nutrition tips and home-based exercise on their official website [8].

Our study had some limitations. First, the self-reported patients' comments about changes in PA and dietary habits were, subjective and not scientifically evaluated. Second, because this survey was carried out at a single medical institute, the sample size was small, and the participant selection was limited to the patients of our hospital who may have special characteristics, such as living or working in urban cities close to the hospital, in a developed area of Tokyo. Therefore, the results of the survey may not be generalized.

In conclusion, we investigated changes in individual behavior and the HbA1c levels of patients with diabetes during the state of emergency and found out that decreased PA levels negatively affected glycemic control. However, regardless of changes in the PA level, efforts to maintain or improve dietary habit can lead to better glycemic control. It is important to understand the behavioral changes of patients with diabetes in the real-world setting, especially during this unprecedented situation, to adequately support them to maintain appropriate glycemic control. Not only during the COVID-19 pandemic, but also in the future, more patients with diabetes are expected to shift to teleworking and likely to stay home for extended periods. Therefore, we should develop effective and feasible measures to promote exercise and dietary therapy, especially for this population who engage more than ever in teleworking.

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Compliance with ethical standards

Conflict of interest All authors declare no conflict of interest.

Human rights statement All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and/or with the Declaration of Helsinki of 1964 and its later amendments.

Informed consent Informed consent or substitutes for it was obtained from all patients for the study participation.

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