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## Self-reported sitting time and prevalence of erectile dysfunction in Japanese patients with type 2 diabetes mellitus: The Dogo Study

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### ABSTRACT

**Aims:** No evidence exists regarding the association between sitting time and erectile dysfunction (ED) among patients with type 2 diabetes mellitus. The aim of this study was to evaluate the association between self-reported sitting time and ED among patients with type 2 diabetes mellitus.

**Methods:** Study subjects were 430 male Japanese patients with type 2 diabetes mellitus (mean age, 60.5 years). A self-administered questionnaire was used to collect information on the variables under study. The study subjects were asked about time spent sitting during typical 24-hour periods over the past 12 months. Subjects were divided into four groups according to self-reported sitting time: 1) <5 hours, 2) 5–7 hours, 3) 7–9 hours, and 4) ≥9 hours. ED was defined as present when a subject had a Sexual Health Inventory for Men score <8. Adjustment was made for age, body mass index, duration of type 2 diabetes, current smoking, current drinking, hypertension, coronary artery disease, stroke, glycated hemoglobin, walking habit, and diabetic neuropathy.

**Results:** The prevalence values of moderate to severe ED and severe ED were 36.1% and 49.8%. At least 9 hours sitting was independently positively associated with severe ED but not moderate to severe ED; the adjusted OR was 1.84 (95% CI: 1.06–3.33). In the multivariate model, there was a statistically significant inverse exposure–response relationship between the self-reported sitting time and severe ED ( $p$  for trend = 0.029).

**Conclusions:** Self-reported sitting time may be positively associated with ED in Japanese patients with type 2 diabetes mellitus.

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### 1. Introduction

The opportunities for participating in sedentary lifestyle activities in modern society, such as watching television (TV), sitting in a car, or using the computer, are ubiquitous. In the general population, sitting time is significantly positively associated with all-cause death, type 2

diabetes mellitus, and cardiovascular diseases, regardless of presence of physical activity (Thorp, Owen, Nauhaus, & Dunstan, 2011; van Uffelen et al., 2010; Wilmot et al., 2012). Limited evidence exists regarding the association between a sedentary lifestyle and erectile dysfunction. In a US study of 31,742 men aged 50 years, TV viewing time was significantly positively associated with ED (Bacon et al., 2003). In a US study of 2126 men aged 20 years or older, sedentary time (TV, video, and computer use) was significantly positively associated with ED (Selvin, Burnett, & Platz, 2007). Similarly, in a Brazilian study of 1942 men, a sedentary lifestyle was positively associated with ED (Martins & Abdo, 2010). On the other hand, TV viewing hours per week was not associated with self-reported erectile

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function in a cross-sectional US study of 933 men (Eaton et al., 2007). In a Brazilian study of 192 men, the percentages of subjects living a sedentary lifestyle were similar for those with ED and without ED (Kupelian, Link, Rosen, & Mckinlay, 2008). No evidence exists regarding the association between sitting time and ED among patients with type 2 diabetes mellitus, although the prevalence of ED among patients with type 2 diabetes mellitus was higher than without. We aim to evaluate the association between self-reported sitting time and ED among Japanese patients with type 2 diabetes mellitus.

## 2. Subjects

This study is a multicenter prospective cohort study that recruited 1051 Japanese patients with previously diagnosed type 2 diabetes mellitus from September 2009 to September 2014 (median age at recruitment, 61.6 years; range, 19–88 years; 60.9% men). Collaborating physicians from 10 hospitals who specialize in diabetes mellitus was responsible for the diagnoses of type 2 diabetes mellitus, according to the Japan Diabetes Society criteria (Seino et al., 2010). Excluded from our current analysis were 621 patients because of female sex or incomplete data on the variables under study. Thus the final analysis sample consisted of 430 patients. The present study protocol received ethical approval from the institutional review board of Ehime University Graduate School of Medicine. Written informed consent was obtained from all patients enrolled in the Dogo Study.

## 3. Material and method

### 3.1. Clinical examination and measurements

Each participant completed a self-administered questionnaire, which collected data on diabetes duration, current smoking habits, current drinking habits, walking habits, use of antihypertensive medication, use of anti-hyperlipidemic medication, height, and weight. Each patient's body mass index (BMI) was calculated as their weight (kg) divided by the square of their height (m<sup>2</sup>). Current smoking was defined as positive if a study subject reported smoking at least one cigarette per day. Current drinking was defined as positive if a study subject reported drinking, regardless of frequency or amount. Walking habit was defined as positive if a study subject reported walking or participating in an equivalent physical activity for at least one hour per day. Blood pressure was measured with a cuff in the sitting position after a rest period of greater than 5 min. Hypertension was defined as positive if systolic blood pressure was >140 mmHg, diastolic blood pressure was >90 mmHg, or both, or if the patient had received anti-hypertensive medication. Dyslipidemia was defined as positive if serum low-density lipoprotein cholesterol concentration was  $\geq 140$  mg/dL, triglyceride concentration was  $\geq 150$  mg/dL, or high-density lipoprotein cholesterol concentration was <40 mg/dL, or if the patients were already being treated with lipid-lowering agents (Teramoto et al., 2007). Stroke and ischemic heart disease were assessed based on the self-administered questionnaires, medical records, and/or admission data. Information on the use of insulin and oral anti-hyperglycemic agents was based on medical records.

### 3.2. Assessment of self-reported sitting time

Study subjects were asked about time spent sitting during typical 24-hour periods over the past 12 months. Subjects were divided into four groups according to self-reported sitting hours: 1) <5 hours, 2) 5–7 hours, 3) 7–9 hours, and 4)  $\geq 9$  hours.

### 3.3. Assessment of ED

The Sexual Health Inventory for Men (SHIM) is a validated abridged five-item version of the 15-item International Index of Erectile Function

questionnaire (Rosen, Cappelleri, Smith, Lipsky, & Peña, 1999). In the present study, we used two outcomes: 1) moderate to severe ED was defined as present when a subject had a SHIM score <12, and 2) severe ED was defined as present when a subject had a SHIM score <8.

### 3.4. Assessing the complications of type 2 diabetes mellitus

Retinopathy was diagnosed based on the presence of hemorrhage, microaneurysm, soft and hard exudates, areas of neovascularization, or laser coagulation scars in at least one eye. Several ophthalmology specialists were responsible for evaluating the participants' funduses, and all ophthalmologists were blinded to the diagnoses of ED and self-reported sitting time. Estimated glomerular filtration rate (eGFR) was calculated using serum creatinine (Cr):  $194 \times \text{serum Cr}^{-1.094} \times \text{age}^{-0.287}$  (Matsuo et al., 2009). Diabetic nephropathy was defined as positive when the urine albumin-to-creatinine ratio was  $\geq 300$  mg/g creatinine and/or eGFR was <30 ml/min per 1.73 m<sup>2</sup> (Haneda et al., 2015). Diabetic neuropathy was diagnosed if the patients showed two or more of the following three characteristics: neuropathic symptoms, the absence of the Achilles reflex, or abnormal vibration perception threshold scores assessed with a 128-Hz tuning fork (Yasuda et al., 2007).

### 3.5. Statistical analysis

Estimations of crude odds ratios (ORs) and their 95% confidence intervals (CIs) were generated using logistical regression analyses for ED in relation to self-reported sitting time. Age, body mass index, duration of type 2 diabetes, current smoking, current drinking, hypertension, dyslipidemia, coronary artery disease, glycated hemoglobin, walking habit, and diabetic neuropathy were selected a priori as potential confounding factors. Multiple regression logistic analyses were used to adjust for potential confounding factors. Trend of an association was assessed using a logistic regression model assigning consecutive integers to the categories of the sitting hours variables. All statistical analyses were performed using SAS software package version 9.4 (SAS Institute Inc., Cary, NC, USA). All probability values for statistical tests were two-tailed, and  $p < 0.05$  was considered statistically significant, using an alpha value of 0.05.

## 4. Results

Among the 430 patients with type 2 diabetes mellitus, the median SHIM score was 8.0 and the prevalence values of moderate to severe ED and severe ED were 36.1% and 49.8%. The percentage of <5 hours sitting, 5–7 hours sitting, 7–9 hours sitting, and  $\geq 9$  hours sitting were 49.1%, 19.5%, 10.7%, and 20.7%, respectively. Table 2 shows diabetic parameters according to self-reported sitting time. There were increasing trends in BMI and a decreasing trend in walking habit. Table 3 shows crude and adjusted ORs and 95% CIs for the prevalence of ED in relation to self-reported sitting time. In crude analysis, self-reported sitting time was not associated with ED. However, among 179 patients aged 65 years or older, self-reported sitting time was positively associated with moderate to severe ED and severe ED, respectively. After adjustment for age, BMI, duration of type 2 diabetes, current smoking, current drinking, hypertension, dyslipidemia, coronary artery disease, glycated hemoglobin, walking habit, and diabetic neuropathy,  $\geq 9$  hours sitting was independently positively associated with severe ED but not moderate to severe ED: the adjusted OR was 1.87 (95% CI 1.06–3.33). In the multivariate model, there was a statistically significant positive exposure–response relationship between the self-reported sitting time and ED ( $p$  for trend = 0.029). Among patients aged 65 years or older,  $\geq 9$  hours sitting was independently positively associated with moderate to severe ED and severe ED: the adjusted ORs were 5.66 (95% CI 1.34–40.81) and 4.57 (95% CI 1.46–18.03), respectively. Among 251 patients aged less than 65 years, self-reported sitting time was not

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