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BRIEF REPORT

The Influence of Sitagliptin on Treatment-Related Quality of Life in Patients with Type 2 Diabetes Mellitus Receiving Insulin Treatment: A Prespecified Sub-Analysis

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ABSTRACT

Introduction: Treatment-related quality of life (QOL) is an important aspect of diabetes management. Here, we investigated the influence of sitagliptin, a dipeptidyl peptidase-4 inhibitor, on treatment-related QOL in patients with type 2 diabetes mellitus treated with insulin.

Methods: This was a prespecified sub-analysis of the Sitagliptin Preventive Study of Intima-Media Thickness Evaluation (SPIKE). The study population consisted of 71 subjects in the sitagliptin group, and 62 subjects in the conventional group who were treated with insulin. Patients of the sitagliptin group were started on sitagliptin in addition to ongoing insulin therapy. In the conventional group, either increasing the dose of current insulin therapy or the addition of oral hypoglycemic agents other than dipeptidyl peptidase-4 inhibitors was allowed to achieve glycemic control. Treatment-related QOL was evaluated before and 104 weeks after the initiation of the study using the Diabetes Therapy-Related QOL Questionnaire 7 (DTR-QOL7).

Results: Forty-five out of 71 subjects in the sitagliptin group and 41 out of 62 subjects in

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the conventional group filled out the QOL questionnaire at week 104. The DTR-QOL7 score at week 104 was significantly increased from baseline in the sitagliptin group, while that in the conventional group was not changed. However, the changes in score did not differ between the two groups. Change in HbA1c was negatively associated with change in score.

Conclusions: Our data suggest that sitagliptin added to insulin treatment was comparable to other treatments in terms of its impact on treatment-related QOL.

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Keywords: Sitagliptin; Treatment-related quality of life; Type 2 diabetes mellitus

INTRODUCTION

One of the main goals in the management of type 2 diabetes (T2DM) is to maintain quality of life (QOL). Effective treatment needs to achieve these goals by taking into account many factors, including age, disease duration, glycemic control status, physical status, and diabetic complications. In terms of choosing oral hypoglycemic agents, consideration of treatment-related QOL is important because it has been recognized as an important factor associated with patient motivation and adherence [1]. This is crucial since poor adherence to T2DM treatment has been shown to be associated with poor glycemic control and increased risk of mortality [2]. The American Diabetes Association therefore emphasized the importance of considering patient preference in addition to efficacy, hypoglycemic risk, impact on weight, potential side effects, and cost [3].

Hypoglycemia and weight gain are common side effects of treatment for T2DM [4] and the major barrier to achieving optimal glycemic control, especially with insulin therapy. In this regard, treatment with insulin plus metformin [5] and α-glucosidase inhibitors [6], but not pioglitazone [7] or sulfonylurea [8], were advantageous in avoiding both weight gain and hypoglycemia. However, there are treatment-limiting side effects with α-glucosidase inhibitors or metformin such as gastrointestinal symptoms [6, 9]. These treatment-limiting side effects may be associated with reduction in treatment-related QOL in patients. Dipeptidyl peptidase-4 (DPP-4) inhibitors reduced blood glucose levels through increasing insulin secretion and suppressing glucagon release and are generally safe and well tolerated without increasing body weight [10, 11]. As a result of these characteristics, DPP-4 inhibitors are widely prescribed in Japan. In addition, sitagliptin was shown to improve QOL in patients treated with oral hypoglycemic agents in a single-arm study [12].

In addition, DPP-4 inhibitors are sometimes administered to patients receiving insulin; however, treatment-related QOL in this population has not yet been elucidated. Recently, we conducted the Sitagliptin Preventive Study of Intima-Media Thickness Evaluation (SPIKE) study to investigate the effect of sitagliptin, a DPP-4 inhibitor, on carotid atherosclerosis and reported that sitagliptin slowed the progression of carotid intima-media thickness in insulin-treated T2DM patients [13]. However, there are few studies that investigate the effect of DPP-4 inhibitors on QOL in patients treated with insulin while recent studies demonstrated that the addition of DPP-4 inhibitors to insulin therapy improved blood glucose levels without increased risk for hypoglycemia and increasing body weight [13, 14]. The present study was originally planned as a sub-analysis of the SPIKE study to investigate the effect of sitagliptin on treatment-related QOL in patients treated with insulin.

METHODS

Study Population

We performed a sub-analysis of the SPIKE study, whose methods were described in detail previously [15]. Briefly, a total of 282 insulin-treated Japanese T2DM patients free of a past history of apparent cardiovascular disease were randomly

allocated to either the sitagliptin group ($n = 142$) or the conventional treatment group (using oral hypoglycemic agents other than the DPP-4 inhibitor) ($n = 140$). Patients were included regardless of the number of insulin injections or type of insulin. Randomization is performed using a dynamic allocation method based on the number of insulin injections, with/without pioglitazone, age, and gender. In the conventional treatment group, either increasing the dose of current therapy (e.g., insulin) or the addition of sulfonylurea, glinide, and α-glucosidase inhibitors is allowed with the goal of achieving the target value specified in the Treatment Guide for Diabetes (usually HbA1c level less than 6.9% and/or fasting blood glucose less than 130 mg/dl and/or 2 h postprandial blood glucose less than 180 mg/dl) [16] at each medical provider's discretion. The addition of other DPP-4 inhibitors and glucagon-like peptide-1 analogues is banned in the control group. The dose adjustment and addition of metformin and pioglitazone are banned in both groups during the study. In case of hypoglycemia, the dose of insulin and/or oral hypoglycemic agents is titrated. All patients who agreed to participate were entered into the study and signed written informed consent. The SPIKE study was registered with the University Hospital Medical Information Network Clinical Trials Registry (UMIN000007396) and meets the requirements of the International Committee of Medical Journal Editors.

Compliance with Ethics Guidelines

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1964, as revised in 2013. Informed consent was obtained from all patients for being included in the study.

Diabetes Therapy-Related QOL Questionnaire (DTR-QOL) 7

The DTR-QOL is a reliable and valid questionnaire developed by Ishii; it is a 29-item, self-administered assessment with four primary factors [17]. As a result of practical constraints we created a short version, the DTR-QOL7. This involved selecting six questions from the original 29 items by considering relationships among items based on the results of the original study. Of the 23 excluded items, we chose to include one (Q2) that asked about weight gain with treatment because this factor is likely to have a major impact on QOL based on clinical experience. Unfortunately, the way of selecting seven questions from the original 29 items was not based on technical or statistical rationales. However, we confirmed that all six items other than Q2 seemed to be included in the same domain, suggesting that the structure of the DTR-QOL7 was relatively consistent in the original study. The total scores of DTR-QOL7 except Q2 had high internal consistency based on Cronbach's alpha coefficients (data not shown) and were highly associated with the total scores of the original 29 items. The items included are shown in Table 1. The response to each question consisted of a 7-point Likert-type scale that ranged from 1 (strongly agree) to 7 (strongly disagree). The scales of Q5, Q6, and Q7 were reversed so that 7 represented the highest QOL score. The total score, after simple addition of each item score, was converted to a range from 0 to 100 (best-case response = 100; worst-case response = 0). The score of Q2 was evaluated separately. We treated missing values according to the original DTR-QOL [17]. We measured the DTR-QOL7 at baseline and at 104 weeks.

Statistical Analysis

Results are presented as mean ± SD, median (quantile 1 and quantile 3), or number (proportion) of patients. Factor analysis was performed on the seven items to investigate whether the structure of the DTR-QOL7 was consistent. Variables with factor loading of at least 0.30 were considered for interpretation. The internal consistency of the total score and each domain of the DTR-QOL7 was assessed using Cronbach's alpha coefficient. An alpha of at least 0.70 is considered acceptable for the

Table 1 DTR-QOL7 questionnaire

Q1. I am constantly concerned about time to manage my current diabetes treatment
Q2. I am bothered by weight gain with my current diabetes treatment
Q3. I am sometimes bothered by low blood glucose
Q4. I am worried about high blood glucose
Q5. Overall, I am satisfied with my current blood sugar control
Q6. With my current diabetes treatment, I am confident that I can maintain good blood glucose control
Q7. With regards to diabetes treatment, I am satisfied with current treatment methods

Table 2 Clinical characteristics of patients in the sitagliptin and conventional treatment groups

Parameters	Sitagliptin treatment group ($n = 71$)	Conventional treatment group ($n = 62$)	*P* value
Age (years)	62.6 ± 11.7	63.6 ± 9.5	0.59
Gender (male) (%)	40 (56.3)	31 (50)	0.49
Duration of diabetes (years)	16.8 ± 8.3	17.2 ± 8.3	0.77
eGFR (mL/min/1.73 m^2)	77.8 ± 20.8	79.5 ± 22.3	0.65
Body mass index (kg/m^2)	25.7 ± 4.4	25.3 ± 4.0	0.57
HbA1c (%)	8.3 ± 1.2	8.0 ± 1.1	0.15
Total daily insulin dosage (IU/day)	32.3 ± 22.8	29.4 ± 22.3	0.46
Time of insulin injections (times/day)	3.0 ± 1.1	3.1 ± 1.0	0.77
Type of insulin			
Prandial insulin (yes)	41 (57.7)	39 (62.9)	0.60
Premixed insulin (yes)	35 (49.3)	18 (29)	0.02
Basal insulin (yes)	31 (43.7)	33 (53.2)	0.30
Use of oral glucose-lowering agents			
Metformin (yes)	31 (43.7)	25 (35.5)	0.38
Sulfonylurea (yes)	11 (15.5)	8 (12.9)	0.81
Glinides (yes)	0 (0)	0 (0)	–
Thiazolidinediones (yes)	9 (12.7)	4 (6.5)	0.26
α-Glucosidase inhibitor (yes)	31 (43)	24 (38.7)	0.60

Data are number (%) of patients or mean ± SD
HbA1c glycated hemoglobin A1c, *eGFR* estimated glomerular filtration rate

purpose of group comparisons [18]. Baseline and follow-up group comparisons were assessed with the Student's *t* test or Wilcoxon's rank sum test for continuous variables and Fisher's exact test for categorical variables. Changes from baseline to treatment visits were assessed with one-sample *t* test or Wilcoxon's signed rank test for continuous variables and McNemar's test for

binary variables within the group. Differences in delta change in score of QOL from baseline to 104 weeks between groups were analyzed with analysis of covariance adjusted for score at baseline. All statistical tests were two-sided with a 5% significance level. All analyses were performed using the SAS software version 9.4 (SAS Institute, Cary, NC).

RESULTS

Baseline Characteristics

Among patients in the original study, 71 in the sitagliptin group and 62 in the conventional group completed the DTR-QOL questionnaire at baseline. Baseline clinical characteristics were comparable between the two groups (Table 2). At week 104, 45 in the sitagliptin group and 41 in the conventional group completed the DTR-QOL questionnaire. Consequently, 47 subjects did not complete the DTR-QOL questionnaire. In the comparison of clinical characteristics at baseline between subjects who completed the DTR-QOL questionnaire and those who did not, there were statistical significant differences in total daily insulin dosage, the use of prandial insulin, and the use of metformin and α-glucosidase inhibitors between subjects who completed the DTR-QOL questionnaire and those who did not (Table 3). On the other hand, there were no significant differences in clinical parameters at baseline between patients who completed the

Table 3 Baseline clinical characteristics of patients who completed questionnaire and who did not complete questionnaire

Parameters	Completion of questionnaire at week 104 ($n = 86$)	No completion of questionnaire at week 104 ($n = 47$)	P value
Age (years)	63.9 ± 10.0	61.5 ± 11.8	0.22
Gender (male) (%)	44 (51.2)	27 (57.4)	0.59
Body mass index (kg/m^2)	25.7 ± 4.1	25.1 ± 4.5	0.37
Duration of diabetes (years)	17.7 ± 8.6	15.6 ± 7.7	0.16
HbA1c (%)	8.2 ± 1.2	8.1 ± 1.2	0.50
eGFR (mL/min/1.73 m^2)	77.4 ± 20.6	80.7 ± 22.9	0.39
Total daily insulin dosage (IU/day)	33.0 ± 24.1	27.3 ± 18.8	0.046
Time of insulin injections (times/day)	3.2 ± 1.0	2.8 ± 1.1	0.16
Type of insulin			
Prandial insulin (yes)	58 (67.4)	22 (46.8)	0.026
Premixed insulin (yes)	35 (49.3)	21 (44.7)	0.46
Basal insulin (yes)	42 (48.8)	22 (46.8)	0.86
Use of oral glucose-lowering agents			
Metformin (yes)	25 (25.9)	28 (59.6)	<0.001
Sulfonylurea (yes)	14 (16.3)	5 (10.6)	0.45
Glinides (yes)	0 (0)	0 (0)	–
Thiazolidinediones (yes)	10 (11.6)	3 (6.4)	0.38
α-Glucosidase inhibitors (yes)	21 (24.4)	34 (72.3)	<0.001

Data are number (%) of patients or mean ± SD
HbA1c glycated hemoglobin A1c, *eGFR* estimated glomerular filtration rate

Table 4 Comparison of clinical parameters at baseline and week 104

Parameters	Sitagliptin treatment group ($n = 45$)		Conventional treatment group ($n = 41$)		P value (intergroup)	
	Baseline	Week 104	Baseline	Week 104	Baseline	Week 104
Age (years)	62.6 ± 11.9	–	65.4 ± 7.2	–	0.19	–
Gender (male) (%)	25 (55.6)	–	19 (46.3)	–	0.52	–
Body mass index (kg/m^2)	26.1 ± 4.4	25.8 ± 4.5	25.3 ± 3.7	25.6 ± 4.7	0.37	0.82
Duration of diabetes (years)	17.1 ± 8.7	–	18.4 ± 8.4	–	0.50	
HbA1c (%)	8.4 ± 1.2	7.7 ± 1.7**	8.0 ± 1.1	7.7 ± 1.3	0.21	0.51
eGFR (mL/min/1.73 m^2)	78.3 ± 21.3	73.6 ± 25.8**	76.4 ± 20.0	73.5 ± 21.2	0.67	0.98
Total daily insulin dosage (IU/day)	3.2 ± 1.1	2.9 ± 1.3	3.2 ± 0.9	3.2 ± 1.0	0.77	0.35
Time of insulin injections (times/day)	34.5 ± 24.6	30.2 ± 22.7*	31.4 ± 23.8	29.0 ± 19.7	0.56	0.79
Type of insulin						
Prandial insulin (yes)	30 (66.7)	28 (65.1)	28 (68.7)	28 (68.7)	1.00	0.82
Premixed insulin (yes)	18 (40.0)	15 (34.9)	14 (34.1)	11 (26.8)	0.66	0.48
Basal insulin (yes)	24 (53.3)	25 (58.1)	18 (43.9)	23 (56.1)	0.40	1.00
Use of oral glucose-lowering agents						
Metformin (yes)	15 (33.3)	15 (33.3)	10 (24.4)	9 (22.0)	0.48	0.34
Sulfonylurea (yes)	8 (17.8)	8 (17.8)	6 (14.6)	7 (17.1)	0.79	1.00
Glinides (yes)	0 (0)	1 (2.2)	0 (0)	1 (2.4)	–	1.00
Thiazolidinediones (yes)	8 (17.8)	8 (17.8)	2 (4.9)	2 (4.9)	0.09	0.09
α-Glucosidase inhibitor (yes)	12 (26.7)	12 (24.4)	9 (22)	9 (22)	0.63	0.80

Data are number (%) of patients or mean ± SD values

Changes from baseline to week 104 were assessed with by one-sample t test or Wilcoxon's signed rank test for continuous variables and McNemar's test for binary variables within the group: * $P < 0.05$, ** $P < 0.01$

HbA1c glycated hemoglobin A1c, *eGFR* estimated glomerular filtration rate

DTR-QOL questionnaire in the sitagliptin group and those who did in the conventional group (Table 4). The addition of sitagliptin to insulin therapy significantly reduced HbA1c level from baseline to week 104 (Table 4). The change in HbA1c level from baseline to week 104 was numerically greater in subjects who completed the DTR-QOL questionnaire of the sitagliptin group than in subjects who completed it in the conventional group; however, there was no significant difference between the two groups (−0.6 ± 1.4 vs. −0.3 ± 1.0%, $P = 0.23$). On the other hand, there were no differences between the two groups in change in body mass index (−0.3 ± 2.1 vs. 0.3 ± 2.5 kg) or in the average number of hypoglycemic episodes [0.0 (0.0, 0.4) vs. 0.0 (0.0, 0.3) times/month/person] over 104 weeks (data not shown).

Factor Analysis and Internal Consistency

Factor analysis with promax rotation was performed to investigate the structure of the DTR-QOL7 (Table 5). As expected, all six items other than Q2 seemed to be included in the

Table 5 Seven items on the DTR-QOL7 and factor analysis with promax rotation ($n = 131$)

Question number	Factor 1
Q1	**0.36**
Q2	−0.02
Q3	**0.43**
Q4	**0.46**
Q5	**0.68**
Q6	**0.76**
Q7	**0.58**

Individual question items with a factor loading of >|0.3| are shown in bold

same domain, suggesting that the structure of the DTR-QOL7 was relatively consistent. According to internal consistency analysis of the DTR-QOL7, all six items except for Q2 showed moderate internal consistency, with a Cronbach's alpha coefficient of 0.71. The result of the factor analysis at 104 weeks was almost similar to that at baseline (data not shown).

Temporal Change in DTR-QOL7 Scores

Both at baseline and at 104 weeks, there were no differences between the two groups in the total DTR-QOL7 score (excluding Q2) or in the score of each individual question (Q1–Q7), as shown in Table 6. The total DTR-QOL7 score and the scores of Q5 and Q6 were significantly increased at 104 weeks compared to baseline in the sitagliptin group. In the conventional group there were no significant score changes over time. There were no significant differences between the two groups in changes from baseline to week 104 of the total DTR-QOL7 score or the score of any individual question (Q1–Q7).

We investigated the relationship between changes in total DTR-QOL7 score and changes in various parameters. The change in HbA1c at week 104 was negatively associated with change in total DTR-QOL7 score (Spearman's correlation coefficient, $r = -0.35$, $P < 0.001$); age at baseline, gender, body mass index at baseline, duration of T2DM, and type of treatment showed no association (data not shown). Also, the occurrence of hypoglycemia showed negative, non-significant association with change in total DTR-QOL7 score ($r = -0.21$, $P = 0.05$).

DISCUSSION

In this study, sitagliptin treatment increased the score of DTR-QOL7 from baseline while conventional treatment resulted in no change. On the other hand, there were no significant differences in the use of oral glucose-lowering agents other than DPP-4 inhibitors between two groups. Thus, increase in the score of DTR-QOL7 may be associated with sitagliptin used as an add-on therapy to insulin itself. However, the change in DTR-QOL7 score did not differ between the two groups. Taken together, these results may suggest that sitagliptin added to insulin treatment was comparable to other treatments in terms of its impact on treatment-related QOL.

A previous report demonstrated that glycemic control was associated with higher treatment-related QOL [17]. In this study, change in HbA1c level was negatively associated with change in the total DTR-QOL7 score. Thus, it is reasonable to hypothesize that sitagliptin treatment improved QOL by increasing patient satisfaction with aspects of treatment related to glycemic control (Q5 and Q6). On the other hand, adverse effects and patient acceptance of treatment may worsen treatment-related QOL. In particular, more frequent hypoglycemic episodes have a harmful effect on QOL [19, 20]. In addition, weight gain caused by diabetes treatment may be an undesired feature and negatively affects QOL. With respect to these issues, sitagliptin treatment did not worsen QOL as shown by constant scores on Q2 and Q3. These findings are reasonable considering that sitagliptin treatment did not increase body weight or risk of hypoglycemia compared to conventional treatment.

The present study has certain limitations. First, the study was a sub-analysis that included a relatively small sample from the original study because the questionnaire was completed on a voluntary basis. This may have caused selection

Table 6 Effect of each treatment on DTR-QOL7 scores

Variables		Sitagliptin treatment group	Conventional treatment group	*P* value (intergroup)
Total score of DTR-QOL7 (excluding Q2)	Baseline	50.0 (38.9, 58.3) ($n = 71$)	52.8 (41.7, 66.7) ($n = 62$)	0.28
	Week 104	63.9 (44.4, 77.8) ($n = 49$)	52.8 (44.4, 66.7) ($n = 45$)	0.25
	Change from baseline	8.3 (−5.6, 22.2)** ($n = 45$)	2.8 (−8.3, 13.9) ($n = 41$)	0.24
	Treatment effect	4.7 (−3.0, 12.4)		0.23
Score of Q1	Baseline	4.0 (3.0, 6.0) ($n = 71$)	4.5 (3.0, 6.0) ($n = 62$)	0.69
	Week 104	4.0 (3.0, 7.0) ($n = 49$)	5.0 (4.0, 6.0) ($n = 45$)	0.87
	Change from baseline	0.0 (0.0, 2.0) ($n = 45$)	0.0 (1.0, 1.0) ($n = 41$)	0.85
	Treatment effect	0.1 (−0.7, 0.8)		0.86
Score of Q3	Baseline	5.0 (3.0, 7.0) ($n = 71$)	6.0 (4.0, 7.0) ($n = 62$)	0.47
	Week 104	6.0 (4.0, 7.0) ($n = 49$)	5.0 (3.0, 6.0) ($n = 45$)	0.21
	Change from baseline	0.0 (−1.0, 1.0) ($n = 45$)	0.0 (1.0, 1.0) ($n = 41$)	0.52
	Treatment effect	0.4 (−0.3, 1.2)		0.25
Score of Q4	Baseline	3.0 (2.0, 4.0) ($n = 70$)	3.0 (2.0, 4.0) ($n = 62$)	0.83
	Week 104	4.0 (2.0, 6.0) ($n = 49$)	4.0 (2.0, 6.0) ($n = 44$)	0.60
	Change from baseline	0.0 (−1.0, 2.0) ($n = 45$)	0.0 (−0.5, 1.0) ($n = 40$)	0.80
	Treatment effect	0.2 (−0.6, 1.0)		0.57
Score of Q5	Baseline	4.0 (2.0, 4.0) ($n = 71$)	4.0 (2.0, 5.0) ($n = 62$)	0.66
	Week 104	4.0 (4.0, 6.0) ($n = 49$)	4.0 (3.0, 6.0) ($n = 45$)	0.16
	Change from baseline	0.0 (0.0, 2.0)** ($n = 45$)	0.0 (−1.0, 2.0) ($n = 41$)	0.29
	Treatment effect	0.5 (−0.3, 1.3)		0.23
Score of Q6	Baseline	4.0 (3.0, 5.0) ($n = 71$)	4.0 (3.0, 5.0) ($n = 62$)	0.58
	Week 104	4.0 (4.0, 6.0) ($n = 49$)	4.0 (4.0, 5.0) ($n = 45$)	0.22
	Change from baseline	0.0 (0.0, 1.0)* ($n = 45$)	0.0 (−1.0, 2.0) ($n = 41$)	0.73
	Treatment effect	0.3 (−0.4, 0.9)		0.42

Table 6 continued

Variables		Sitagliptin treatment group	Conventional treatment group	*P* value (intergroup)
Score of Q7	Baseline	4.0 (3.0, 6.0) ($n = 71$)	4.0 (4.0, 6.0) ($n = 62$)	0.30
	Week 104	5.0 (4.0, 6.0) ($n = 49$)	4.0 (4.0, 6.0) ($n = 45$)	0.32
	Change from baseline	1.0 (0.0, 2.0) ($n = 45$)	0.0 (0.0, 1.0) ($n = 41$)	0.25
	Treatment effect	0.2 (−0.5, 0.9)		0.62
Score of Q2	Baseline	4.0 (3.0, 7.0) ($n = 70$)	5.0 (4.0, 7.0) ($n = 62$)	0.23
	Week 104	5.5 (4.0, 7.0) ($n = 48$)	5.0 (4.0, 7.0) ($n = 45$)	0.59
	Change from baseline	0.0 (0.0, 1.5) ($n = 44$)	0.0 (−1.0, 1.0) ($n = 41$)	0.49
	Treatment effect	0.1 (−0.6, 0.9)		0.68

Data are expressed as median (range: 25–75%)

Change from baseline is shown as the change in actual value between baseline and week 104

Changes from baseline to week 104 were assessed with Wilcoxon's signed-rank test within the group: * $P < 0.05$, ** $P < 0.01$

Differences in delta change in score of QOL from baseline to 104 weeks between the two groups (treatment effect) were analyzed with analysis of covariance adjusted for score at baseline. Data are expressed as adjusted mean difference (range: 95% confidence interval)

bias. In addition, there were statistically significant differences in total daily insulin dosage, the use of prandial insulin, and the use of metformin and α-glucosidase inhibitors between subjects who completed the DTR-QOL questionnaire and those who did not. Although we could not rule out the possibility that obtained data did not reflect the characteristics of the original population, there were no significant differences in clinical parameters at baseline between subjects who completed the DTR-QOL questionnaire in the two groups. Second, we evaluated treatment-related QOL using only the DTR-QOL7. Its small number of questions is a weakness in terms of evaluating the many ways that diabetes treatment can influence QOL. However, we confirmed that the structure of the DTR-QOL7 was consistent and that it had moderate internal consistency. Further studies are required to confirm our findings.

CONCLUSIONS

Our data suggest that sitagliptin treatment did not worsen treatment-related QOL compared to conventional treatment, at least when used as an add-on therapy to insulin.

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Data Availability. The analyzed datasets are available from the corresponding author on reasonable request.

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