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RESEARCH: COMPLICATIONS

Sexual dysfunction in women with type 1 diabetes in Norway: A cross-sectional study on the prevalence and associations with physical and psychosocial complications

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Abstract

Aim: To estimate the prevalence of sexual dysfunction in women with type 1 diabetes (T1D) compared with women without diabetes and to analyse associations between sexual dysfunction and the presence of chronic physical diabetes complications, diabetes distress and depression in women with T1D.

Methods: This cross-sectional study was conducted in Norway, and 171 women with T1D and 60 controls completed the Female Sexual Function Index (FSFI) and the Hospital Anxiety and Depression Scale (HADS). Diabetes distress was assessed with the Problem Areas in Diabetes (PAID) scale. Data on diabetes complications were retrieved from medical records. We performed logistic regression to estimate differences in the prevalence of sexual dysfunction (defined as FSFI ≤26.55) between women with T1D and women without diabetes and to examine associations of sexual dysfunction with chronic diabetes complications, diabetes distress and depression in women with T1D.

Results: The prevalence of sexual dysfunction was higher in women with T1D (50.3%) compared with the controls (35.0%; unadjusted odds ratio [OR] 1.89 [95% confidence interval (CI) 1.06–3.37]; adjusted OR 1.93 [1.05–3.56]). In women with T1D, sexual dysfunction was associated with both diabetes distress (adjusted OR 1.03 [1.01–1.05]) and depression (adjusted OR 1.28 [1.12–1.46]), but there were no clear associations with chronic diabetes complications (adjusted OR 1.46 [0.67–3.19]).

Conclusions: This study suggests that sexual dysfunction is more prevalent in women with T1D compared with women without diabetes. The study findings emphasize the importance of including sexual health in relation to diabetes distress and psychological aspects in diabetes care and future research.

KEYWORDS

female sexual dysfunction, type 1 diabetes

1 | INTRODUCTION

Type 1 diabetes (T1D) poses major physical and psychosocial challenges related to treatment implementation and self care throughout the lifespan. Given that T1D incidence rates peak during childhood and adolescence,[1] most people with T1D live with the disease for many years and through various phases of life. As there is no cure for T1D, the treatment goals are to optimize glucose control to prevent or minimize chronic physical complications (nephropathy, neuropathy, retinopathy, cardiovascular disease) and prevent negative psychosocial impacts of the disease.[2] The psychosocial or emotional challenges related to diabetes are referred to as diabetes distress. Diabetes distress is defined as the worries, fears and threats that are associated with the demanding diabetes self-management tasks, and does not necessarily imply psychopathology.[3] However, research has shown that there is an association between diabetes distress and depression and that depression occurs more frequently in people with diabetes than in people without diabetes, but the exact prevalence differs between studies.[4]

The physical and psychosocial challenges related to T1D pose potential negative effects on several parts of life, including sexual health. Previous studies reported that urogenital complications and sexual problems are prevalent in both men and women with T1D. Among women with T1D, several studies have indicated a significantly higher prevalence of sexual dysfunction compared with healthy controls,[5–11] although the prevalence rates varied substantially across these studies. A study of Flotynska et al.[9] indicated a prevalence rate of sexual dysfunction of 29% among the 118 sexually active women with T1D included in the study compared to 13% among 62 younger and healthy women in a control group. The study included in total 160 women with T1D, 42 (17.5%) of them reported no sexual activity. A study of Zamponi et al,[10] reported sexual dysfunction in 12 (36.4%) of 33 women with T1D and in 2 (5.2%) of 29 control women. The larger observational follow-up study of participants in the Diabetes Control and Complications Trial (DCCT), the Epidemiology of Diabetes Interventions and Complications (EDIC), which included about 1200 men and women with T1D, reported sexual dysfunction prevalence rates as high as 45% for men and 43% for women.[8] The study found an association between urological morbidities, including sexual dysfunction, and the physical metabolic effects on genitourinary tissues and the neural, vascular and hormonal input to these organs. An additional study in the same cohort identified an association between sexual dysfunction and cardiovascular autonomic neuropathy among the female participants.[11] However, another DCCT/EDIC publication indicated that sexual dysfunction is more strongly related to psychological and psychosocial aspects in women than in men,[5] and the study showed a significant association between female sexual dysfunction and depression.

What's new?

- In this cohort, 50.3% of women with type 1 diabetes (T1D) reported sexual dysfunction compared with 35.0% of the matched women without diabetes in the control group.
- Women with T1D had nearly twofold higher odds for sexual dysfunction compared with the control group.
- In women with T1D, sexual dysfunction was associated with diabetes distress and symptoms of depression, indicating a need to address psychological and psychosocial aspects related to sexual health as part of the overall diabetes care.
- In this cohort, we did not identify any clear associations between sexual dysfunction and chronic physical diabetes complications.

It is obvious that the knowledge on sexual dysfunction in women is considerably more limited and unclear than the knowledge and research on sexual dysfunction in men.[12,13] The existing studies on sexual dysfunction in women are few and mostly small.[6] Given that data on the prevalence of sexual dysfunction in women with T1D are highly divergent, we aimed to (1) estimate the prevalence of sexual dysfunction in women with T1D compared with women without diabetes and (2) analyse associations between sexual dysfunction and the presence of chronic physical diabetes complications, diabetes distress and depression in women with T1D.

2 | PARTICIPANTS AND METHODS

2.1 | Study design and setting

This was a cross-sectional study conducted at the diabetes outpatient clinic at Haukeland University Hospital in Norway. In total, 835 women aged 18–70 years with T1D had visited the clinic during the past 3 years.

2.2 | Sample and data collection

In the study, we targeted all the 835 women between 18 and 70 years who had visited the clinic during the past

3 years. We excluded women with temporary conditions that may have an impact on sexual function (pregnant women, women with genital diseases and women with critical or very serious mental or somatic diseases) and women who were unable to answer the study questionnaire (women with impaired cognitive function and women unable to answer a questionnaire in Norwegian; $n = 85$). A total of 750 women met the inclusion criteria. Nine women were excluded due to relocation and/or missing addresses, leaving a total of 741 participants for study invitation.

Data collection was based on paper-based survey questionnaires. Two sets of information letters, consent forms, questionnaires and pre-stamped envelopes for returning were sent by regular mail to the eligible women, one set for themselves and one set for a possible control woman. To obtain a relevant control group, the women were asked to deliver one set of the material to a female friend of similar age without T1D or other types of diabetes. Due to a low response rate after the first invitation, we received approval from the ethics committee to send a reminder to the women who had not responded.

2.3 | Measures and variables

Sexual dysfunction was assessed with the Female Sexual Function Index (FSFI). All participants also completed the Hospital Anxiety and Depression Scale (HADS), and the women with T1D completed the 20 item Problem Areas in Diabetes (PAID) scale assessing diabetes distress.

The FSFI is a 19-item multidimensional measure of sexual function over the past 4 weeks.[14,15] The scale is divided into six key domains of sexual function in women measuring sexual desire, arousal, lubrication, orgasm, satisfaction and pain. The item scores are on a Likert scale from 1 to 5 for the desire domain (2 items) and 0 to 5 for the arousal (4 items), lubrication (4 items), orgasm (3 items), satisfaction (3 items) and pain (3 items) domains. Within the items with scores 0 to 5 (17 of the 19 items), a score of zero indicates no sexual activity (14 items) or intercourse (3 items) during the past 4 weeks. A full-scale score ranging from 1.2 to 36.0 is calculated by summing the domain scores. Domain scores are obtained by summing item scores and multiplying by a domain factor related to the number of items in the domain.[14] Higher scores indicate better sexual functioning. The cross-validation study by Wiegel et al.[15] indicated an FSFI full-scale score of 26.55 as the optimal cut-off score for differentiating women with sexual dysfunction (score ≤26.55) and women without sexual dysfunction (score >26.55).

The HADS was designed for clinicians as a screening test for anxiety and depression in non-psychiatric hospital departments.[16] It consists of two subscales, HADS-A (anxiety) and HADS-D (depression), each with seven questions. In this study, we included only HADS-D. HADS-D item scores are on a Likert scale from 0 to 3, yielding a total score from 0 to 21, where a higher score indicates a worse depression state.[17,18] The psychometric properties of the Norwegian version of the HADS subscales are shown to be satisfactory.[19]

The PAID is a validated and widely used instrument developed to gain insight into the breadth of emotional responses to living with diabetes and consists of 20 statements (e.g. 'feeling overwhelmed by your diabetes', 'worrying about low blood sugar reactions').[20,21] The scores are on a 5-point Likert scale from 0 (not a problem) to 4 (serious problem). An item score of 3 (somewhat serious problem) or 4 (serious problem) indicates moderate to serious diabetes distress related to the specific item. Scale scores are transformed to a 0 to 100 scale, with higher scores indicating greater distress.[22]

The variable related to the presence of chronic physical diabetes complications was obtained from the medical records of the women with T1D. This variable is in the diabetes-specific medical record in Norway. If a person has one or more chronic complications (nephropathy, neuropathy, retinopathy or cardiovascular disease), the answer for this variable is 'yes'. If a person does not have any complications the answer is 'no'.

The following additional variables were obtained from the medical records of the women with T1D: age, diabetes duration, HbA1c and insulin regimen. Finally, the following self-reported variables were included in the survey questionnaires and collected from both women with T1D and those without diabetes: age, educational level, work status, marital status, having children, menopausal symptoms, self-reported menopause and genital urinary infections in the last year.

2.4 | Data analysis

For the statistical analyses, we used SPSS version 26 (IBM SPSS) and STATA IC version 16 (StataCorp). We performed descriptive statistics (counts, proportions, means and standard deviation [SD]) to quantify sample characteristics, whereas differences in sample characteristics between women with T1D and women without diabetes and between women with T1D with and without sexual dysfunction, were analysed with the *t*-tests for continuous variables and Pearson's chi-squared or Fisher's exact tests for categorical variables.

We defined sexual dysfunction as an FSFI score ≤26.55 in accordance with the previously reported cut-off score for differentiating women with and without sexual dysfunction.[15] Furthermore, symptoms of depression and diabetes distress assessed by HADS-D and PAID, respectively, were analysed as continuous variables where higher scores indicate more symptoms of depression or more diabetes distress. There were overall few missing data in the study. However, missing substitution by the persons mean were performed for missing items in persons with answers on at least half of the items in the scale. The presence of chronic diabetes complications was assessed by the dichotomous variable described earlier with the answer categories yes or no.

To examine differences in the prevalence of sexual dysfunction (FSFI ≤26.55) between women with T1D and women without diabetes, we used logistic regression with robust standard error estimation due to the inclusion of matched control women. We adjusted for the variables 'postmenopausal' (yes/no) and 'genital or urinary infection the last year' (yes/no) due to an indicated difference between women with T1D and women without diabetes on these variables (Table 1). We did not adjust for other background variables (e.g. age, education and marital status) as these were similar in distribution across the compared groups. We presented difference in prevalence of sexual dysfunction using odds ratio (OR) with 95% confidence interval (CI).

TABLE 1 Demographic characteristics of 171women with type 1 diabetes and 60 women without diabetes

	Women with type 1 diabetes	Women without diabetes	Unadjusted *p* value[a]
Age (years), mean (SD)	39.4 (14.3)	38.6 (13.6)	0.796
Missing, *n* (%)	0 (0)	37 (61.6)[b]	
Education, *n* (%)			0.177
Elementary or advanced school	75 (43.9)	20 (33.3)	
Higher education	93 (54.4)	38 (63.3)	
Missing	3 (1.8)	2 (3.3)	
Work status, *n* (%)			0.072
Working	101 (59.1)	40 (66.7)	
Unemployed	31 (18.1)	3 (5.0)	
During education	26 (15.2)	12 (20.0)	
Other/home staying	11 (6.4)	4 (6.7)	
Missing	2 (1.2)	1 (1.7)	
Marital status, *n* (%)			0.444
Single	38 (22.2)	16 (26.7)	
Living in cohabitation	133 (77.8)	43 (71.7)	
Missing	0 (0)	1 (1.7)	
Children (yes), *n* (%)	102 (59.6)	33 (55.0)	0.617
Missing	0 (0)	1 (1.7)	
Genital or urinary infection the last year (yes), *n* (%)	77 (45.0)	15 (25.0)	0.007
Missing	0 (0)	1 (1.7)	
Menopause symptoms (yes), *n* (%)	24 (14.0)	11 (18.3)	0.425
Missing	2 (1.2)	1 (1.7)	
Postmenopausal (yes), *n* (%)	29 (17.0)	4 (6.7)	0.056
Missing	0 (0)	1 (1.7)	
HADS-D (score 0–21), mean (SD)	4.4 (3.8)	4.3 (3.8)	0.745
Missing	0 (0)	2 (3.4)	

Abbreviation: HADS-D, Hospital Anxiety and Depression Scale - Depression subscale.

[a]Independent sample *t*-test for continuous variables and Pearson's chi-squared test for categorical variables were applied to test differences between groups. Due to <5 participants in cells, Fisher's exact tests were applied for the variables 'work status' and 'postmenopausal'. Units with missing values were not included in the statistical analyses.

[b]An error in the questionnaire in the first dispatch resulted in a high degree of data missing for age in the control group.

Finally, we performed logistic regression to examine associations between sexual dysfunction (FSFI ≤26.55) and the presence of chronic physical diabetes complications, diabetes distress and symptoms of depression in women with T1D. Each of these variables was examined, separately, unadjusted and adjusted for age, marital status, the presence of menopause symptoms and being postmenopausal. The inclusion of adjustment variables was based on indicated differences in these variables between women with T1D with and without sexual dysfunction. In the analysis of diabetes distress, we made additional adjustment for chronic diabetes complications, and in the analysis of depression, we also included diabetes distress as an adjustment variable. Diabetes distress (PAID-20) and symptoms of depression (HADS-D) were included as linear terms, whereas age was included as a quadratic linear term due to a non-linear relationship between age and sexual dysfunction.

2.5 | Ethics

The Norwegian Regional Committee for Medical and Health Research Ethics approved the study (2018/1416/REK Vest), which also included sending a reminder to women who did not respond to the first dispatch. The women consented to participate by completing the study questionnaires. Responses from participants were made anonymous in accordance with the applicable privacy regulations and kept strictly confidential. As filling out such questionnaires may produce negative emotions, a phone number and an email address were available in case of emotional challenges or just a need to discuss issues related to the study. Only a few participants (<5) approached the study team, and they had only practical questions about the study.

3 | RESULTS

3.1 | Sample characteristics

In total, 171 women with T1D (response rate, 23%) and 60 women without diabetes responded and were included in the study. Demographic characteristics of the participants are shown in Table 1. There were no apparent differences between the women with T1D and those without diabetes regarding age, education level, work status, marital status, having children, menopausal symptoms and HADS-D scores (symptoms of depression). However, more women with T1D were postmenopausal and had a history of a genital or urinary infection in the last year (Table 1).

3.2 | Prevalence of FSFI full-scale scores indicating sexual dysfunction

On the FSFI scale from 1.2 to 36.0, the mean score (SD) was 23.07 (10.48) in the women with T1D and 24.04 (10.29) in the women without diabetes. The corresponding median (25th–75th percentile) was 26.0 (17.6–31.6) in women with T1D and 28.5 (18.9–31.3) in women without diabetes. Figure 1 indicates a skewed and somewhat unequal distribution of scores between the two groups and more women

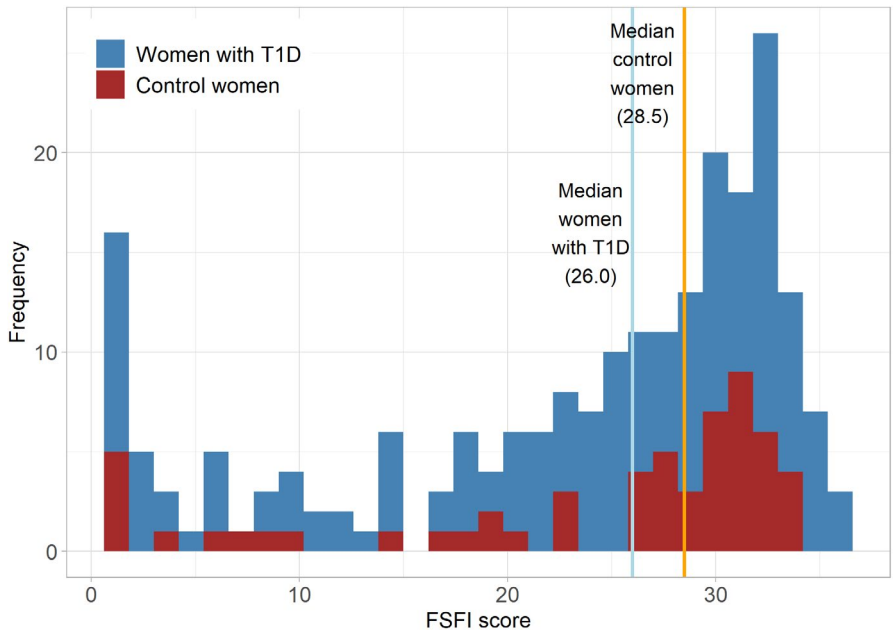

FIGURE 1 Distribution of FSFI scores in women with type 1 diabetes ($n = 171$) and women without diabetes ($n = 60$)

TABLE 2 Prevalence of sexual dysfunction (FSFI score ≤26.55) in women with type 1 diabetes (n = 171) compared with women without diabetes (n = 60).

FSFI full-scale score	Women with type 1 diabetes (*n* = 171), *n* (%)	Women without diabetes (*n* = 59), *n* (%)	Unadjusted OR (95% CI) [*p* value]	Adjusted 1[a] OR (95% CI) [*p* value]	Adjusted 2[b] OR (95% CI) [*p* value]	Adjusted 3[c] OR (95% CI) [*p* value]
>26.55	78 (45.6)	36 (60.0)	Reference	Reference	Reference	Reference
≤26.55	86 (50.3)	21 (35.0)	1.89 (1.06–3.37) [0.031]	1.78 (0.99–3.20) [0.052]	1.81 (1.02–3.23) [0.044]	1.93 (1.05–3.56) [0.035]
Missing	7 (4.1)	3 (5.0)				

Abbreviations: CI, confidence interval; FSFI, Female Sexual Function Index; OR, odds ratio.

[a]Adjustment for the variable 'postmenopausal' (yes/no) was performed for all the three adjusted analyses.

[b]Additional adjustment for the variable 'genital or urinary infection the last year' (yes/no).

[c]Additional adjustment for the variables, 'genital or urinary infection the last year' (yes/no) and symptoms of depression (HADS-D mean score).

with T1D had lower FSFI scores than women without diabetes. Among the women with T1D, 50.3% scored ≤26.55, indicating sexual dysfunction, compared with 35.0% of the women without diabetes (Table 2). In the unadjusted logistic regression analysis, the women with T1D had 1.89 (95% CI 1.06–3.37) times higher odds for sexual dysfunction compared with the women without diabetes. The OR after adjusting for the variables 'postmenopausal' and 'genital or urinary infection the last year' was 1.81 (95% CI 1.02–3.23). Additional adjustment for symptoms of depression did not alter the results significantly (OR 1.93 [1.05–3.56]; Table 2).

3.3 | Associations between sexual dysfunction and chronic physical diabetes complications, diabetes distress and depression

The descriptive characteristics of the women with T1D with and without sexual dysfunction (FSFI full-scale scores ≤26.55 or >26.55) are shown in Table 3. Between-group analysis showed that those with scores indicating sexual dysfunction (FSFI full-scale scores ≤26.55) reported more diabetes distress and symptoms of depression than those without sexual dysfunction (Table 3). In addition, they were older, more likely to be single, reported more often menopausal symptoms, and were more often postmenopausal. There were no clear differences in the prevalence of chronic physical diabetes complications between the groups.

Both the unadjusted and the adjusted logistic regression analyses indicated associations between sexual dysfunction (FSFI full-scale scores ≤26.55) and both diabetes distress (adjusted OR 1.03 [95% CI 1.01–1.05]) and symptoms of depression (adjusted OR 1.28 [95% CI 1.12–1.46]; Table 4). However, the association of sexual dysfunction with the presence of one or more chronic physical diabetes complications was uncertain with a large CI (adjusted OR 1.46 [95% CI 0.67–3.19].

4 | DISCUSSION

This study from Norway found a higher prevalence of sexual dysfunction among women with T1D (50.3%) compared with women without diabetes (35.0%), thus supporting results reported in other cohorts with T1D. The women with T1D had nearly twofold higher odds for sexual dysfunction compared with the women without diabetes. In the women with T1D, we also identified positive associations between sexual dysfunction and both diabetes distress and symptoms of depression. This supports the hypothesis that psychological and psychosocial

TABLE 3 Characteristics of 171women with type 1 diabetes with and without sexual dysfunction (FSFI score ≤26.55 or >26.55)

	Women with FSFI ≤26.55	Women with FSFI >26.55	Unadjusted *p* value[a]
Age (years), mean (SD) (*n* = 164)	41.7 (15.4)	36.6 (11.9)	0.019
Education, *n* (%) (*n* = 162)			0.489
Elementary or advanced school	39 (46.4)	32 (41.0)	
Higher education	45 (53.6)	46 (59.0)	
Work status, *n* (%) (*n* = 162)			0.705
Working	50 (58.8)	51 (66.2)	
Unemployed	17 (20.0)	12 (15.6)	
During education	12 (14.1)	11(14.3)	
Other/home staying	6 (7.1)	3 (3.9)	
Marital status, *n* (%) (*n* = 164)			0.001
Single	28 (32.6)	8 (10.3)	
Living in cohabitation	58 (67.4)	70 (89.7)	
Children (yes), *n* (%) (*n* = 164)	51 (59.3)	47 (60.3)	0.901
Genital or urinary infection the last year (yes), *n* (%) (*n* = 164)	40 (46.5)	33 (42.3)	0.589
Menopause symptoms (yes), *n* (%) (*n* = 161)	17 (20.2)	6 (7.8)	0.041
Postmenopausal (yes), *n* (%) (*n* = 164)	19 (22.1)	8 (10.3)	0.057
Diabetes duration (years), mean (SD) (*n* = 161)	20.1 (13.3)	19.9 (11.1)	0.928
HbA1c level (*n* = 163)			
IFCC units (mmol/mol), mean (SD)	62 (10.8)	60 (12.7)	0.509
NGSP units (%), mean (SD)	7.8 (3.1)	7.7 (3.3)	
Using insulin pump (yes), *n* (%) (*n* = 163)	37 (43.5)	43 (55.1)	0.139
One or more chronic physical diabetes complications (yes), *n* (%) (*n* = 159)	35 (41.7)	23 (30.7)	0.150
PAID (score 0–100), mean (SD) (*n* = 162)	37.3 (21.0)	29.2 (18.6)	0.009
HADS-D (score 0–21), mean (SD)	5.7 (4.0)	3.0 (2.8)	<0.001

Abbreviations: FSFI, Female Sexual Function Index; HADS-D, Hospital Anxiety and Depression Scale - Depression subscale; PAID, Problem Areas in Diabetes scale.

[a]Independent sample t-test for continuous variables and Pearson's chi-squared test for categorical variables were applied to test differences between groups. Due to <5 participants in cells, Fisher's exact tests were applied for the variable 'work status'.

aspects might play an important role in the sexual health among women with T1D. There was no clear association between sexual dysfunction and the presence of chronic physical diabetes complications in this study.

The prevalence of female sexual dysfunction found in our study is comparable with previous research that has indicated prevalence rates between 29% and 51% in women with diabetes.[5,7–11] The large variation in prevalence rates between studies might among others be related to the variation in the proportion of postmenopausal women or women with menopausal symptoms included in the study sample. Symptoms such as vaginal dryness and pain can be related to low oestrogen levels and not necessarily related to diabetes-related factors such as high blood glucose levels. Another factor that can influence the prevalence rates is the variation in the instruments used to assess sexual dysfunction and the lack of a standardized definition of the construct.[23] In addition, the women's subjective understanding and definition of what it means to be sexually active or inactive, and the understanding of each item in a scale, might play a role. The latter is supported by the findings in our study. Unlike most of the previous studies, but in line with the manual for calculating full-scale and sub-domain scores in the 19-item FSFI scale, we did not exclude women who answered 'no sexual activity

TABLE 4 Associations between sexual dysfunction (FSFI score ≤26.55) and the presence of chronic physical diabetes complications, diabetes distress and depression in women with type 1 diabetes

	Sexual dysfunction (FSFI ≤26.55)	
	Unadjusted OR (95% CI) [*p* value]	**Adjusted OR (95% CI) [*p* value]**
The presence of one or more chronic physical diabetes complications (yes)	1.62 (0.84–3.11) [0.152]	1.46 (0.67–3.19) [0.342][a]
PAID (score 0–100)	1.02 (1.01–1.04) [0.011]	1.03 (1.01–1.05) [0.005][b]
HADS-D (score 0–21)	1.26 (1.13–1.39) [<0.001]	1.28 (1.12–1.46) [< 0.001][c]

Abbreviations: CI, confidence interval; FSFI, Female Sexual Function Index; HADS-D, Hospital Anxiety and Depression Scale - Depression subscale; OR, odds ratio; PAID, Problem Areas in Diabetes scale - 20 item.

[a]Adjustments for age, marital status, menopause symptoms and being postmenopausal were performed for all the adjusted analyses.

[b]Additional adjustment for physical diabetes complications.

[c]Additional adjustment for physical diabetes complications and diabetes distress.

during the last four weeks' or 'did not attempt intercourse during the last 4 weeks' on one or more of the 17 items in the scale that have these answer options. The reason for including all women in the analysis was that we identified that the women did not answer unambiguously on these 17 questions. The ambiguous answers suggest the complexity of female sexual functioning and the challenges related to how the individual woman defines her sexuality and how she rates herself on a self-report instrument like the FSFI.

Sexual inactivity might be a result of sexual problems or dysfunction, and the problems or dysfunction could be caused by either physical aspects, psychological or psychosocial aspects or a combination of these.[23] From a clinical perspective, it is important to be aware that those who report 'no sexual activity' or 'did not attempt intercourse' might have sexual-related problems that need attention in clinical consultations. However, the reason for answering 'no sexual activity' or 'did not attempt intercourse' on a scale like FSFI could be a result of a desired abstinence from sexual activity and not related to sexual dysfunction. Thus, we could not conclude decidedly about the prevalence of sexual dysfunction in the women in our study. Accordingly, in their validation of FSFI, Wiegel et al.[15] highlight the importance of not using FSFI scores as the sole basis for diagnostic classification of female sexual dysfunction in clinical practice. Thus, a score of zero ('no sexual activity' or 'did not attempt intercouse') on one or more of the 17 items with zero as a scoring alternative, may not definitely indicate sexual dysfunction although it could.

The results of our study supports the hypothesis of Enzlin et al.[5] about a relationship between sexual dysfunction and psychological and psychosocial aspects in women with T1D. To our knowledge, our study is the first to explore the association between female sexual dysfunction and diabetes distress measured by the PAID. The PAID is the most commonly used instrument to measure diabetes distress and is also used as a dialogue tool in clinical interventions to enhance the focus on diabetes distress in consultations.[24–27] In Norway, the PAID is available in the national diabetes medical record and could therefore be used as a dialogue tool in clinical consultations to promote putting diabetes distress on the agenda in consultations, also in relation to patient-provider conversations about sexual problems and dysfunction. For example, an item in the PAID scale asks about fear of hypoglycaemia, and fear of hypoglycaemia is one factor that could affect sexual functioning, and which should be addressed in diabetes consultations. However, health care providers may need training to discuss the various aspects of diabetes distress in relation to sexual health.

The interaction between psychiatric disorders such as depression and sexual health has been shown in several previous publications over the years. The symptoms of depression identified in the women with T1D in our study could, however, be unrelated to diabetes or they could be a result of severe diabetes distress over many years. Nevertheless, the prevalence and complexity of diabetes distress, symptoms of depression and sexual problems among women with T1D suggest that all these aspects and the relationship between them should be approached in diabetes consultations. Furthermore, more studies are needed to increase the knowledge on the relationship between diabetes distress, depression and female sexual dysfunction, including qualitative studies to explore the women's experiences about the impact of diabetes on psychosocial and psychological aspects and sexual health.

We did not identify a clear association between sexual dysfunction and the presence of chronic physical diabetes complications in women with T1D. However, the group with 'yes' for the variable 'presence of chronic diabetes complications' includes both women with serious diabetes complications and women with, for example, harmless non-proliferative diabetic retinopathy. Thus, we cannot exclude that this non-specific variable retrieved from the women's medical record might be a reason for the absence of association. In consequence, we cannot exclude an association between specific complications (i.e. neuropathy) or severity of complications and sexual dysfunction based on this study.

This study suggests that a significant proportion of women with T1D experience sexual problems or dysfunction that should be addressed in diabetes follow-up consultations. However, more research is needed. In addition to quantitative and qualitative studies to increase the knowledge on the relationship between diabetes distress, depression and female sexual dysfunction, future studies should consider alternative methods of capturing data (e.g. electronically) to achieve higher response rates. In addition, prospective studies are needed in addition to functional studies looking at the interaction between sexual dysfunction and autonomic neuropathy. Future research should also differentiate better between sexual inactive women due to sexual problems and sexual inactivity due to a desired abstinence. Finally, future studies should consider including data on hypoglycaemic events as a diabetes-related variable that may affect sexual functioning.

4.1 | Strengths and limitations

One important limitation revealed in this study was the methodological challenges related to the 19-item version of the FSFI. The 14 possibilities to report 'no sexual activity' and the three possibilities to report 'did not attempt intercourse', introduced challenges related to the division of the women into groups of either sexually active or inactive women. In addition, the estimation of the actual prevalence of sexual dysfunction could be blurred because the participants answered ambiguously on these items. Due to a mistake during data collection, the question about age was not included in the first dispatch. Therefore, there is a high degree of missing data on this variable among the women without diabetes. Furthermore, lack of power might be an issue in our study. However, both the absolute difference (50.3% vs. 35.0%) and odds ratio (adjusted OR 1.93) for sexual dysfunction between groups are strong and agree with previous studies that sexual dysfunction is more frequent among women with T1D compared with women without diabetes. The fact that the FSFI mean scores did not differ substantially between the women with T1D and the women without diabetes in this study may be a result of an asymmetric and unequal distribution of the FSFI scores in the two groups.

In this study, the sample size limited the possibility for inclusion of additional possible relevant variables (e.g. body weight, medications, more specific variables on chronic complications) in the analysis. Also the low response rate in the study is a limitation in line with other studies on this topic. Applying to a questionnaire about sexual dysfunction might for some be off-putting or emotionally uncomfortable, and for them it also might have been difficult to ask a friend to complete the questionnaire. This could partly explain the low response rate among the women with T1D and the even lower response rate among the control women. However, we do not know how many of the women with T1D who delivered the questionnaire to a friend or how many friends who just did not respond. Recruiting a representative control group is always a concern in controlled studies. We chose to ask the women with T1D to aid in the procurement of non-diabetic controls, resembling themselves. Although this has some clear advantages in terms of matching age, marital status and education, there is a possible risk of selection bias, which may have an impact on our results. However, the responders with T1D in the study matched well with the background population, as derived from the Norwegian Diabetes Registry's annual report from 2018.[28]

5 | CONCLUSIONS

This study suggests that sexual dysfunction is more prevalent in women with T1D compared with women without diabetes, and that sexual dysfunction in women with T1D is associated with diabetes distress and symptoms of depression. The study findings emphasize the importance of including sexual health in relation to diabetes distress and psychological aspects in diabetes care and future research.

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CONFLICT OF INTEREST

None declared.

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