Title: **Sex Differences in the Association of Psychological Status with Measures of Physical Activity and Sedentary Behaviour in Adults with Type 2 Diabetes**

Short title: Psychological Status and Physical Activity in Type 2 Diabetes

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ABSTRACT

Aim – To assess the association of psychological variables on leisure time physical activity and sedentary time in men and women with type 2 diabetes mellitus (T2D).

Methods – In this cross-sectional study, we evaluated 163 patients with T2D, consecutively recruited at the Diabetes Centre of the Verona General Hospital. Scores on depression and anxiety symptoms, psychosocial factors (including self-efficacy, perceived interference, perceived severity, social support, misguided support behaviour, spouse's positive behaviour), physical activity and time spent sitting were ascertained using questionnaires responses to the Beck Depression Inventory-II, Beck Anxiety Inventory, Multidimensional Diabetes Questionnaire, International Physical Activity Questionnaire.

Results – Physical activity was significantly associated with higher social support in women, and with increased self-efficacy in men. Sedentary time was significantly associated with higher perceived interference, anxiety and depressive symptoms, and with reduced diabetes self-efficacy in women, while it was associated solely with anxiety in men. Depressive symptoms and self-efficacy in women and anxiety symptoms in men were independent predictors of sedentary time when entered in a multivariable regression model also including age, BMI, hemoglobin A1c, diabetes duration, perceived interference and self-efficacy as covariates.

Conclusions – Lower self-efficacy and higher symptoms of depression were closely associated with increased sedentary time in women, but not in men, with T2D. It is possible that individualized behavioral interventions designed to reduce depressive symptoms and to improve diabetes self-efficacy would ultimately reduce sedentary behaviours, particularly in women with T2D.

Keywords (5): *Diabetes; Depression; Anxiety; Physical Activity; Sedentary Behaviour*

INTRODUCTION

Depression is diagnosed in about 15-20% of adults with type 2 diabetes (T2D), with women twice as likely to be affected as men [1]. Depression interferes with diabetes self-management and metabolic control [2-4] and may increase the risk of complications [5], cognitive decline [6] and mortality[7]. According to Mezuk *et al.* [8], diabetes and depression appear to share a bi-directional relationship, with depression increasing the risk of incident diabetes and diabetes increasing the risk of depression. However, according to recent meta-analyses [9, 10], the prevalence of depression appears to be higher in individuals with known diabetes, than in those with impaired glucose regulation or newly diagnosed diabetes, an observation also confirmed by a recent report from a large cross-sectional study in Chinese individuals [11]. Moreover, a study from the English Longitudinal Study of Aging (ELSA) database, found higher incident depressive symptoms in younger older adults with diabetes than their non-diabetic counterparts (<65 years) but not in those 65 years and older [12]. These studies suggest that the presence of T2D alone is not sufficient to increase the prevalence or incidence of depression. Rather, they suggest that psychological factors are likely to play a role in developing depression among people with diabetes but that it is the burden of living with and having to care for diabetes especially in the presence of diabetes complications and the stresses of a working life that increases the risk of developing depression [13].

Several studies have shown that increased physical activity levels are associated with lower symptoms of depression, stress and anxiety [14]. The evidence provided by the Diabetes Prevention Program and other landmark trials [15, 16] strongly support the benefits of physical activity to prevent T2D and relent its progression. Indeed, a general increase in daily physical activity is included among the first-line intervention of current structured programs for diabetes prevention and care [17, 18].

However, the achievement of recommended exercise goals is challenging, due to a number of limiting factors, such as individual motivation and accompanying comorbidities [19]. Therefore, despite the clear benefits of physical activity on metabolic control and mental health, many people

77 remain physically inactive [19, 20].

78

79 These observations have recently prompted research efforts to identify the psychological factors
80 associated with leisure physical activity in individuals with T2D [21]. A number of psychological
81 models have been developed to explore the reciprocal interaction of personal and environmental
82 factors as determinants of exercise behaviour change. For instance, the Social Learning Theory (SLT)
83 provides a theoretical framework to isolate the psychosocial variables specifically relevant to chronic
84 diseases, such as T2D, by emphasizing the reciprocal interactions occurring at the level of social
85 support, patients' idiosyncratic beliefs and social incentives related to self-care activities [22]. Self-
86 efficacy, defined as a person's belief in his or her own ability to execute a specific behaviour [23],
87 candidates among the psychological variables as a major determinant of behaviour change. Indeed,
88 low self-efficacy percepts may underlie the difficulties experienced by T2D patients to start and
89 maintain a regular physical activity. In this context, the SLT provides a perspective that emphasizes
90 the role of self-efficacy in driving successful behaviour change [23].

91

92 Whereas some studies have investigated associations between psychological variables and leisure
93 physical activity [24], the relationships of the former with sedentary behaviour have received much
94 less attention, particularly among people suffering from chronic diseases such as T2D. Notably,
95 sedentary behaviour is not the opposite of physical activity, rather it refers to behaviours that do not
96 increase energy expenditure above resting levels [25]. Specifically, sedentary behaviour is defined as
97 the time spent in non-exercising or reclining pursuits, including screen-time behaviours such as
98 watching television or computer use [26].
99 Recent evidence revealed a direct association of daily sitting time and other sedentary habits with
100 all-cause mortality and cardiovascular diseases [27]. Other studies have shown that sedentary
101 behaviour *per se* adversely affects individual health, independent of the amount of physical activity
102 in the general population [28] and in individuals with T2D [29, 30]. These evidences suggest that

sedentary behaviour recognizes specific biological pathways distinct from those elicited by physical activity [31]. Of note, the psychosocial mechanisms leading to sedentary behaviour differ from those leading to physical activity, thus supporting the rationale for testing the hypothesis that sedentary behaviours may recognize specific psychological determinants also in patients with T2D. Moreover, Hamer *et al.* [32] have observed that sedentary behaviour is actually associated with depression and that this relationship remains significant after controlling for physical activity, thus providing compelling evidence that physical activity and sedentary behaviour have distinct and independent associations with depressive symptoms. The direct relationship existing between depressive symptoms and sedentary behaviour has been highlighted by a recent review [33], thus corroborating previous findings by Vallance *et al.* [34] that depressive symptoms are twice as high in adults spending more time in sedentary behaviours.

In the light of this evidence, novel approaches to reduce sedentary behaviours are urgently needed, as well as updated public health recommendations increasing awareness of the risk associated with these behaviours. This is particularly relevant for individuals with T2D, as they are exposed to an increased demand of self-care and, simultaneously, they typically display an increased vulnerability to psychological distress [2, 35, 36], which, in turn, is associated with poorer clinical outcomes and a higher occurrence of un-healthy behaviours.

The research efforts hitherto conducted to unravel the motivational determinants of physical activity engagement in adults have shown that behavioral and cognitive factors (particularly self-efficacy) are crucial for the initiation and long-term maintenance of physical activity. However, it is currently unknown whether the same factors also act on sedentary behaviour. Furthermore, there are no studies that have examined the association between physical activity measures (including time spent sitting and leisure physical activity), psychological distress (depression and anxiety) and psychological factors (e.g. self-efficacy) in individuals with T2D.

Hence, the present study aimed at investigating the associations of anxiety, depression and other

psychosocial variables with leisure physical activity and sedentary behaviour in individuals with T2D. Since the relationship of the psychological variables with the individual sedentary behaviour or the attitude at exerting physical activity may vary by sex in the general population [37] and in patients with T2D [38], a secondary objective of the study was to examine these relationships in men and women, separately. We therefore examined associations first in the entire cohort, then for men and women separately.

METHODS

Participants

In this cross-sectional study, we report baseline data of 163 individuals with T2D, recruited among the outpatients included in the larger research project "glycemic *CO*ntrol, *P*sychological distr*E*ss and *S*elf-efficacy in *T*ype 2 diabetes" (COPEST), conducted at the Diabetes Centre of Verona City Hospital. As specified elsewhere[2], the COPEST study tested the effect of a self-efficacy oriented psychological intervention on glycaemic control in T2D patients with baseline suboptimal glucose control. The study protocol was approved by the Ethics Committee of the Hospital Trust of Verona. All participants gave written informed consent upon recruitment. Further details on the study design and enrollment criteria are provided as online Supplementary Material.

Assessment of depressive and anxiety symptoms

Depressive symptoms were assessed by the validated Italian version of the Beck Depression Inventory-II (BDI-II) [39]. The BDI-II is a 21-item questionnaire assessing the intensity of depressive symptoms as defined by the Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition (DSM-IV). Internal consistency (Cronbach's alpha) was $\alpha = 0.80$.

Anxiety symptoms were assessed by the validated Italian version of the Beck Anxiety Inventory (BAI) [40]. The BAI consist of 21-items developed to assess the severity of anxiety symptoms ($\alpha = 0.89$).

Assessment of diabetes psychological adjustments

Diabetes-related cognitive and social factors were assessed by the validated Italian version of the Multidimensional Diabetes Questionnaire (MDQ), which includes three sections [41]. The first section is designed to assess the general perception of diabetes and related social support. Cronbach's alphas for the subscales ranged from 0.81 to 0.92. The second section measures social incentives in relation to self-care activities. Cronbach's alpha for positive and misguided reinforcement behaviours was 0.88 and 0.83, respectively. The third section measures self-efficacy and outcome expectancies (α = 0.84 and 0.90, respectively). In particular, the self-efficacy measure stands on a 7-item scale assessing the patients' confidence in their ability to perform behaviours specific to diabetes self-care activities including diet, exercise, medication, self blood glucose monitoring and general diabetes management. Sample items include "How confident are you/your ability to: (1) follow your diet, (2) test your blood sugar at the recommended frequency, (3) to exercise regularly?".

Physical activity and sedentary behaviour measurements

Assessment of leisure physical activity and time spent sitting were assessed using the Italian shortened version of the International Physical Activity Questionnaire (IPAQ) [42]. This version provides information on time spent walking or on sedentary pursuits or being engaged in vigorous-to-moderate intensity over the last 7 days. The IPAQ questionnaire estimates the total weekly physical activity by weighting the reported minutes-per-week within each activity category by an energy expenditure estimate (dubbed as MET, metabolic equivalent, according to Jetté *et al.* [43]) assigned to each category of activity (3.3 METs for moderate walking, 4.0 METs for moderate physical activity and 8.0 METs for vigorous physical activity). The weighted MET-min per week ($MET \cdot min \cdot wk^{-1}$) were calculated as duration·frequency·MET intensity, which were summed across activity domains to produce a weighted estimate of total physical activity from all reported activities per week. In terms of sedentary behaviour, sitting questions were developed as separate indicators

and not as part of physical activity score. Participants were instructed to consider the time spent sitting (hours and minutes per day) at work, at home, while doing course work and during leisure time. Both the leisure physical activity and sedentary behaviour measures assessed by IPAQ are supported by validated data [44, 45].

Statistical analysis

Data are presented as mean and standard deviation (SD) or median and interquartile range [IQR], unless otherwise indicated. Standard normal distribution of the variables was assessed by the Kolmogorov-Smirnov test. Variables deviating from the Gaussian distribution (leisure physical activity, anxiety, depressive symptoms, perceived interference) were naturally log-transformed to improve normality before analysis. Data analysis was conducted firstly in the overall cohort and thereafter separately for men and women. The comparisons of clinical, socio-psychological and physical activity parameters between women and men were conducted by Student's *t*-test. Simple correlations (expressed as Pearson's *r*) were calculated to explore the relationship of sedentary behaviour and physical activity with depressive and anxiety symptoms, diabetes-specific self-efficacy and other psychological variables. Partial correlations controlling for age, BMI, diabetes duration and HbA1c were also calculated. We then explored whether symptoms of depression and anxiety, self-efficacy and perceived interference were independent predictors, alone or in combination, of sedentary behaviour and physical activity by entering these variables in linear regression models with age, BMI, diabetes duration, HbA1c and sex (coded as female=1; male=0) as covariates. The latter was then excluded in the analyses by sex subgroups. All covariates were selected for inclusion in the partial correlations and regression models if significant in univariate analysis or according to their biological plausibility. All statistics were carried out with IBM SPSS 22.0® software. Statistical significance was declared at two-tailed *P*-value <0.05 for all comparisons.

RESULTS

Table 1 summarizes the clinical, socio-demographic and psychological characteristics of the study cohort (*N* = 163). The study participants included marginally more men (59.5%); age (mean ±SD) was 62.7±7.6 years, while diabetes duration and HbA1c were 11.1±8.6 years and 7.6±1.3 %, respectively. The majority of patients was on oral hypoglycemic agents (OHA, 70.3%), while a smaller number of them were prescribed a combination therapy (OHA + insulin, 18.8%) or insulin alone (10.9%). No sex-differences were found for any of the clinical study variables, with the only exception of BMI, which was significantly higher in men than in women (32.0±4.3 *vs.* 30.6±3.6 Kg/m^2, p<0.05).

Compared to men, women reported higher levels of anxiety but lower social support, spouse's misguided support behaviour and spouse's positive reinforcing behaviour. However, these differences reached statistically significance only after adjustment for BMI. Both men and women reported similar physical activity rates, but men spent more time in sedentary behaviours than women.

We considered physical activity and sedentary time as health behaviour variables and we calculated their simple correlations (reported as Pearson's *r*) with the psychological variables. As shown in **Table 2**, higher degrees of physical activity showed a significant relationship with increasing self-efficacy, while no significant figure was apparent in relation to other psychological variables. In contrast, sedentary behaviour exhibited an inverse association with self-efficacy and it was related to more severe symptoms of anxiety and depression and with an increased occurrence of misguided support behaviours. Hence, in contrast to what observed for physical activity, sedentary behaviour appeared to be significantly related to negative emotions.

When the same analyses were conducted separately in men and women, we observed that physical activity was associated with social support in women and with diabetes self-efficacy in men. For women, sedentary behaviour showed a negative and significant association with diabetes self-efficacy and a positive association with symptoms of depression and anxiety and with perceived

interference. In contrast, sedentary time in men was only associated with anxiety symptoms. Thus, in contrast to what observed in men, sedentary behaviour in women appeared to be linked with negative emotions and with the impact of diabetes in their lives.

In order to further investigate the association of these psychological variables with sedentary behaviour in light of accompanying confounding variables, we calculated partial correlations by controlling for age, BMI, diabetes duration and HbA1c in the whole sample and separately for men and women. As reported in **Table S1**, the relationship of sedentary behaviour with depressive symptoms and self-efficacy in women held statistical significance and effect direction. The same applied to the association of sedentary behaviour with anxiety symptoms in men. However, anxiety symptoms and perceived interference in women did not retain statistical significance for the association with sedentary behaviour after adjustment for confounders.

We then explored, in the whole sample, whether symptoms of depression and anxiety, self-efficacy and perceived interference were independent predictors, alone or in combination, of sedentary behaviour by entering these variables in a linear regression model with age, BMI, diabetes duration, HbA1c and sex as covariates (**Table 3**). Results showed that lower self-efficacy and increased anxiety symptoms were independent predictors of sedentary behaviour. Among the other variables included in the analysis, a clear contribution of sex to the variance of sedentary behaviour prompted a stratified analysis separately for men and women. Depressive symptoms ($ß_{std}$ = 0.30, p = 0.023) and diabetes-specific self-efficacy ($ß_{std}$ = -0.27, p = 0.041) were independent predictors of sedentary behaviour in women only (adjusted model-R^2= 0.21). Conversely, only anxiety symptoms were found to be independent predictors of sedentary time, when the same model was applied to men ($ß_{std}$ = 0.24, p = 0.023), despite a negligible overall explained variance (adjusted model-R^2= 0.05).

The association of physical activity with social support in women and with self-efficacy in men was

investigated by applying distinct linear regression models also including age, BMI, diabetes duration and HbA1c as covariates. Social support was found to be the unique predictor of physical activity in women (β_{std} = 0.27, p = 0.027), with an overall explained variance of 6.1%. The model did not retain self-efficacy, but only BMI (β_{std} = -0.33, p = 0.001), as a predictor of physical activity in men (adjusted model-R^2= 0.10).

DISCUSSION

In this study we have examined the relationship of sedentary behaviour and physical activity with symptoms of depression and anxiety and with diabetes-specific psychosocial variables in adults with T2D admitted to the outpatient clinic of a major diabetes referral centre.

The observation that sedentary behaviour and physical activity show distinct associations with the psychosocial variables herein evaluated stands as a key finding of our study. While physical activity showed a significant relationship with increasing diabetes self-efficacy only, the opposite was observed in relation to sedentary behaviour, which also appeared to be significantly related with a more articulated combination of psychosocial variables, namely more severe symptoms of anxiety and depression and an increased occurrence of misguided support behaviours. More specifically, we observed that women, in contrast to men, were less sedentary and were characterized by a closer relationship of sedentary behaviour with negative emotions and with the impact of diabetes in their lives.

To date, research has mainly focused on the determinants of physical activity, whereas sedentary behaviour has received much less attention. Our study evaluated both of these aspects and provided supporting evidence that, similarly to recent observations in the general population [33], sedentary behaviour and physical activity recognize differential psychosocial variables as underlying factors also in individuals with T2D.

Some studies have previously reported that sedentary behaviour is associated with depression

independently of extant physical activity levels [32]. On the other hand, a recent study by Breland *et al.* [46] showed that daily sitting time, but not physical activity, increases the risk of depressive symptoms. Accordingly, in our study, we found no evidence of association between physical activity and symptoms of depression and anxiety. One possible explanation for the lack of association is that, on average, the individuals included in our study did not engage in high intensity exercise and they were not formally enrolled in a structured physical activity program. Therefore, although physical activity and depression are closely linked [47],), it could be reasonably assumed that low levels of unstructured physical activity may have no major effect on mental health.

Alernatively, the lack of association between physical activity and symptoms of depression and anxiety results might be inherent to the instrument employed to evaluate physical activity. Indeed, the IPAQ score does not allow to clearly discriminate among different classes of physical activity or to clarify whether physical activity is conducted alone or in concert with significant others. For example, Teychenne *et al.* [48] observed that only leisure-time physical activity was associated with a lower risk of depression.

Our results also confirm previous findings [38, 49], in that we observed differential patterns between men and women regarding the associations of psychological variables with sedentary behaviour and physical activity. Indeed, diabetes-specific self-efficacy and depressive symptoms in women and anxiety symptoms in men resulted as independent predictors of sedentary time, while social support retained statistically significant association with physical activity in women only. These data may provide rationale for further intervention studies targeting negative mood (anxiety in men; depression in women) and diabetes self-efficacy in women in order to reduce sedentary behaviours and, ultimately, to improve the individual cardiovascular risk profile.

In contrast with previous studies in T2D individuals [37, 38], we have observed that men and women reported comparable physical activity levels. The potential causes of disparities in physical activity levels between men and women are likely to be multiple. However, most studies (including the

311 present one) investigating this issue have not assessed all sex-specific activities, in particular,
312 activities of lower intensity or more relevant to women's lives. In this regard, Hallal *et al.* [50]
313 showed that, when specific domains of activity practice are considered, no sex differences are
314 observed.
315 Conversely, as compared to men, women showed significantly lower propensity to spend time in
316 sedentary pursuits, an observation that may be amenable to a number of possible explanations.
317 First, it is well known that men and women hold distinct social roles in society. Women are more
318 likely to assume greater domestic responsibilities than men, thus reducing the time spent sitting at
319 home. Second, there is evidence that sex differences in the daily time spent in sedentary activities
320 are more accentuate among people ≥60 years of age. Martin *et al.* [51] have demonstrated that
321 older men replace higher-intensity activity with sedentary behaviour compared to women, which
322 maintained relatively constant levels of light intensity activities in each age group.
323
324 As for the novelty of our study, we believe that it fills important gaps in the existing literature, as to
325 date no study has specifically and thoroughly explored the association of psychological factors with
326 physical activity and sedentary behaviours in men and women with T2D. Indeed, our findings extend
327 previous observations and suggest that the relationship of psychological variables with health
328 outcomes depends on sex-related factors, although the underlying mechanisms yet remain to be
329 completely understood. Taken together, our results and the evidence from other studies suggest
330 that the identification of predictors of healthy behaviours by sex is warranted to develop
331 intervention programs suitable for the different needs of women and men with T2D.
332 Nonetheless, we should acknowledge some limitations. First, the generalizability of the study
333 findings is limited, as it was conducted in a single Diabetes Centre and the study participants were
334 relatively homogeneous in terms of age, health and educational status. Second, physical activity and
335 sedentary behaviour were evaluated by self-assessment measures, which imply inherent
336 inaccuracies in the reported estimates. Third, the relatively limited sample size and the gender

imbalance towards male participants may have lead to imperfect estimates of the association findings. Finally, the cross-sectional study design precludes any inference of causation: although sedentary behaviour may induce negative emotions, the causal arrow could indeed point the other way, i.e. negative emotions may be responsible for un-healthy behaviour. Therefore, the interpretation of our data should be made with caution and prospective longitudinal and experimental studies are advocated to confirm and expand our results.

CONCLUSIONS

In conclusion, we have shown that, at variance to what observed for physical activity, sedentary behaviour is closely linked to a more articulated pattern of psychological variables, largely influenced by sex-related differences in the individual psychological characteristics. Diabetes is a chronic progressive condition that calls for a profound change in the perception of the individual's health status and demands a pro-active involvement in several self-care activities. While it is possible that interventions to increase physical activity and decrease sedentary time could in turn improve emotional health, our results may indicate depressive symptoms and self-efficacy in women and anxiety symptoms in men as potential targets for tailored interventions that may ultimately benefit the individual health status by reducing the time spent sitting. Further studies are needed to verify whether this approach would ultimately soften the negative effects of sedentary behaviours on glycemic control and other relevant cardiovascular risk factors.

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Author Contributions

L.I., M.D. and El.B., and researched and analyzed data and wrote the manuscript. L.S. analyzed data. C.N. and V.C. provided care for study patients. A.N., E.B. and PM edited the manuscript and provided substantial contribution to the overall discussion. L.I., M.D. and El.B are the guarantors of this work and, as such, had full access to all the data in the study and take responsibility for the integrity and the accuracy of the data analysis.

Conflict of interest

None to disclose.

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Table 1 – Descriptive characteristics of the study population

Variables	All	Females	Males	P^*	P_{adj}
N	163	66	97	-	-
Age (years)	62.7±7.6	63.5±6.5	62.1±8.1	0.24	-
Diabetes duration (years)	11.1±8.6	10.7±9.9	11.2±7.6	0.71	-
BMI ($Kg \cdot m^{-2}$)	31.5±4.1	30.6±3.6	32.0±4.3	**0.02**	-
HbA1c$_{DCCT}$ (%)	7.6±1.3	7.6±1.1	7.5±1.3	0.52	-
HbA1c$_{IFCC}$ (mmol/mol)	59.1±14.5	59.9±12.9	58.5±14.8		
Diabetes medication (%)					
OHA	63.4	70.8	69.8	0.79	-
Insulin	11.2	9.2	12.5		
OHA+insulin	18.6	17.7	20.0		
Education (%)					
Primary school	27.7	35.9	22.1	0.11	-
Junior high school	31.4	31.3	31.6		
Senior high school	33.3	29.7	35.8		
University	7.5	3.1	10.5		
Work status (%)					
Employed	28.4	22.7	32.3	0.40	-
Unemployed	3.1	3.0	3.1		
Retired	68.5	74.2	64.6		
Marital status (%)					
Single	8.0	4.5	10.3	**<0.001**	-
Widower	11.7	21.2	5.2		
Divorced/separated	4.9	10.7	1.0		
Married	75.5	63.6	83.5		
Leisure Physical Activity ($MET \cdot min \cdot wk^{-1}$)	245 [0-525]	332.5 [70-630]	210.0 [0-476]	**0.02**	0.23
Sedentary Behaviour (hours/day)	6.0 [5-9]	6.0 [4.5-8]	7.0 [5-10]	**0.01**	**0.03**
Depression (BDI-II score)	5.0 [1-10]	4.0 [1-10]	5.0 [1-9]	0.22	0.39
Anxiety (BAI-score)	4.0 [1-8]	5.0 [1.8-13.5]	3.0 [1-7]	**0.002**	**0.007**
Psychosocial variables (MDQ score)					
Self-efficacy	58.7 [44.2-71.4]	56.4 [43.5-70.4]	60.0 [44.2-72.8]	0.46	0.18
Perceived interference	1.1 [0.2-2.1]	1.1 [0.2-2.4]	1.1 [0.3-2.0]	0.17	0.28
Perceived severity	4.0 [3.0-5.3]	4.3 [2.9-5.6]	3.6 [3.0-5.0]	0.26	0.22
Social support	4.0 [2.5-5.2]	3.5 [2.1-4.6]	4.0 [3.0-5.2]	**0.04**	**0.02**
Misguided support behaviour	1.6 [0.2-3.2]	0.5 [0.0-2.5]	2.2 [0.7-3.6]	**0.05**	**0.008**
Spouse's positive behaviour	2.7 [1.4-4.2]	2.1 [0.5-3.4]	3.2 [1.7-4.3]	**0.05**	**0.005**

Abbreviations: BMI, Body Mass Index; OHA, oral hypoglycemic agents; HbA1c$_{DCCT}$, Diabetes Control and Complication Trial-Aligned Hemoglobin A1c; HbA1c$_{IFCC}$, International Federation of Clinical Chemistry-Aligned Hemoglobin A1c; BDI-II, Beck Depression Inventory II; BAI, Beck Anxiety Inventory; MDQ, Multidimensional Diabetes Questionnaire. Data expressed as mean ±SD, median [IQR] or percentage; * Pearson's *P* value for sex-comparison. P_{adj}, BMI-adjusted Pearson's *P* value. Statistically significant figures are provided in boldface type.

Table 2 – Simple correlations (Pearson's *r*) between physical activity, sedentary behaviour and psychological variables in the overall cohort and separately in men and women.

	All		Females		Males	
	Physical Activity	**Sedentary Behaviour**	**Physical Activity**	**Sedentary Behaviour**	**Physical Activity**	**Sedentary Behaviour**
Depressive symptoms (BDI-II score)	0.02	**0.22****	-0.15	**0.49****	0.12	0.10
Anxiety symptoms (BAI score)	-0.05	**0.20***	-0.11	**0.30***	-0.05	**0.27***
Self-efficacy (MDQ score)	**0.21****	**-0.25****	0.20	**-0.44****	**0.23***	-0.13
Perceived Interference (MDQ score)	-0.08	0.16	-0.11	**0.25***	-0.04	0.11
Perceived severity (MDQ score)	-0.06	0.10	-0.03	0.13	-0.05	0.09
Social support (MDQ score)	0.11	-0.03	**0.27***	-0.19	0.05	-0.01
Misguided support behaviour (MDQ score)	-0.03	**0.23****	0.14	0.19	-0.07	0.14
Spouse's positive behaviour (MDQ score)	-0.04	0.14	0.11	0.20	-0.11	0.01

*Significance at two-tailed $P < 0.05$; **$P < 0.001$. Statically significant figures are reported in boldface type

Table 3 - Association of sedentary behaviour with symptoms of depression and anxiety, diabetes self-efficacy and perceived interference by liner regression analyses in the overall cohort and separately for men and women.

	All		Females		Males	
	β_{std}	*P*	β_{std}	*P*	β_{std}	*P*
Depressive symptoms	0.06	0.61	**0.30**	**0.02**	-0.15	0.31
Anxiety symptoms	**0.18**	**0.03**	-0.13	0.44	**0.24**	**0.02**
Self-efficacy	**-0.20**	**0.01**	**-0.27**	**0.04**	-0.09	0.39
Perceived interference	0.05	0.57	0.06	0.66	0.01	0.91
Age	-0.001	0.99	0.01	0.96	0.04	0.74
BMI	0.09	0.25	0.18	0.14	0.04	0.68
Diabetes duration	-0.007	0.93	0.15	0.19	-0.09	0.41
HbA1c	0.006	0.94	0.12	0.32	0.002	0.41
Sex	**-0.22**	**0.006**	-		-	
Adjusted model-R^2	R^2=10.6%		R^2=21.2%		R^2=4.6%	

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