The validity of the Menopause-specific Quality of Life questionnaire in women with type 2 diabetes

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ABSTRACT

Objectives   To examine the validity and reliability of the Menopause-specific Quality of Life (MENQOL) questionnaire in a sample of women with diabetes in Malaysia, with the secondary aim of determining whether MENQOL domain scores were associated with depression and diabetes.

Methods   A total of 337 postmenopausal women (241 with diabetes, 96 controls) were evaluated. Construct validity was evaluated using principal components analysis (PCA) and comparing scale items against the mental component score of the Short Form-12 (SF-12 MCS), and against the Center for Epidemiologic Studies Depression Scale 10 (CES-D 10). Consistency assessment was conducted using Cronbach's α.

Results   The internal consistencies for the physical (PHS), psychosocial (PS), sexual (VSS) and vasomotor domains were 0.86, 0.79, 0.79 and 0.70, and 0.90 for the full scale of MENQOL. PCA revealed a four-factorial model. Diabetes and non-diabetes subjects experienced their first period (13.25 vs. 13.10 years, $p = 0.680$) and achieved menopause around the same age (49.35 vs. 48.87 years, $p = 0.426$). We found significant variations in the MENQOL's PHS and PS domain scores that could be explained by SF-12 PCS (25%) and SF-12 MCS (20%) sub-scales. The validity of the MENQOL domains was demonstrated through significant associations with the equivalent SF-12 MCS and PCS subscales. The PS domain of the MENQOL also predicted the likelihood of symptoms of depression (1.42, 95% confidence interval 1.01–2.02).

Conclusions   This study confirms the validity and internal consistency of the MENQOL questionnaire for measuring quality of life in postmenopausal women with diabetes, suggesting that the instrument can be used to screen people for menopausal symptoms.

INTRODUCTION

Being one of the leading causes of death globally, type 2 diabetes mellitus prevails across both genders; however, its prevalence and complications increase among women aged 65 years and older[1,2]. In Malaysia, up to 1.2 million individuals are experiencing diabetes, out of which more than half are undiagnosed[3]. Moreover, with an alarming and colossal increase, within a decade, the prevalence of diabetes has drastically risen from 8.3% in 1996 to 14.9% in 2006[3,4]. In 2010, of the Malaysians diagnosed with diabetes, 11.6% were women and this figure is speculated to reach a height of 13.8% in the year 2030[5]. Furthermore, a higher prevalence

of type 2 diabetes has been reported among women with a history of menstrual irregularity[6], particularly in those with long and highly irregular menstrual cycles[7].

Diabetes has detrimental effects on health outcomes[8] and its personal and social predicaments are well studied[9,10]. For instance, studies have shown significant negative associations between quality of life and progression of disease in different populations, for example, elderly women[9,10]. Clearly, it is important to be able to examine quality of life accurately in postmenopausal women with diabetes. In general, women in the transition phase, i.e. perimenopausal phase or those who have already achieved menopause, experience more menopausal symptoms compared to premenopausal women

in terms of frequency and severity. Specifically, women in the perimenopausal and postmenopausal years experience significantly more vasomotor, sexual and psychosocial symptoms compared to women in the premenopausal years[11–13].

Menopausal symptoms as measured by the Menopause-specific Quality of Life (MENQOL) questionnaire in postmenopausal women have a negative impact on health-related quality of life[14]. The 29-item MENQOL questionnaire[15] has been widely used in different populations[11,16–20]. This tool captures the health-related quality of life in four domains, i.e. vasomotor, physical, psychosocial, and sexual functioning[15]. Additionally, the psychometric properties, detailed factorial analysis and validation of the MENQOL instrument in older women (>60 years) have been reported using a Western non-diabetes population[21,22].

Interestingly, there is a commonality among some of the postmenopausal symptoms and those reported by individuals diagnosed with diabetes. The MENQOL questionnaire contains some items that could be confounded with the symptoms of poorly controlled diabetes. These symptoms are, and not limited to, depression, anxiety, and sleep problems[23–26]. Questions relating to symptoms such as frequent urination and lack of energy (which may also be related to symptoms of diabetes) are also included in the MENQOL scale[23–26].

It seems that there is dearth of data on the validity of measuring these symptoms in a menopausal population with diabetes. Moreover, variations in reported symptoms between Asian and Caucasian women have been well established, where Asian women suffer less vasomotor and psychological symptoms than Western women[11,18–20]. However, little is known about symptoms experienced by menopausal women with diabetes, particularly those living in the Asia-Pacific region.

Although the MENQOL questionnaire has been administered in women with type 2 diabetes mellitus in Nigeria[27], and those at risk of metabolic syndrome in Ecuador[17], this is the first study to validate the MENQOL questionnaire using postmenopausal women, with and without diabetes in Malaysia. We are interested to determine whether MENQOL could be used to examine quality of life in postmenopausal women with diabetes. We explored both the validity of the MENQOL domains and their association with symptoms of depression in a sample of women with diabetes in Malaysia.

MATERIALS AND METHODS

Study design and population

In this case–control study, we recruited women aged 35–75 years with type 2 diabetes mellitus (case) and matched them with women without type 2 diabetes (control) in the same age range. Each case was a woman with a known diagnosis of diabetes; and subsequently the control was a woman with no known diagnosis of diabetes. The diagnosis of diabetes or absence of diabetes was confirmed by medical records. Menopausal status was identified as premenopausal (no irregular periods in the previous 12 months), perimenopausal (irregular periods for less than 12 months), or postmenopausal (cessation of menses for 12 months or longer). Since MENQOL is validated only in a postmenopausal population, MENQOL assessment was restricted to postmenopausal women only.

Women with diabetes were recruited from outpatient clinics at PutraJaya Hospital in PutraJaya, Tuanku Jaa'far Hospital and Seremban Health Clinic, both in Negeri Sembilan, one of the states of Peninsular Malaysia. The control subjects were healthy friends or unrelated family members with no blood relationship, for example, inlaws of people with diabetes.

The study was conducted according to the principles expressed in the Declaration of Helsinki and was approved by the School of Pharmacy Ethics Committee at the International Medical University Research and Ethics Committee (Project ID No: B01/09-Res (04) 2012). The study was also registered with the National Medical Research Registry (NMRR), Ministry of Health Malaysia.

Procedures and measures

Data on diabetes were collected through a self-administered questionnaire, where women were asked 'Have you EVER been told by a doctor that you have diabetes (high blood sugars)?', with response options 'yes' or 'no'. Subjects were categorized as having diabetes if they had been told by a physician that they had diabetes. This information was further confirmed by patients' medication records, fasting plasma glucose ≥7.0 mmol/l, and random plasma glucose greater than or equal to 11.1 mmol/l. Subjects were not recruited if data on their fasting glucose levels were missing.

Women participating in this study were assessed for depressive symptoms using the Center for Epidemiologic Studies Depression Scale (CES-D), 10-item and for quality of life using the Outcomes Survey Short Form (SF), 12-item scales.

Construct validity of MENQOL domains

We assessed the validity of the MENQOL domains against the presence or absence of diabetes. We also examined the differences in the symptoms commonly reported in both diabetes and postmenopause. We determined the degree to which presence or absence of diabetes was related to quality of life on the MENQOL domains, as individuals with diabetes are linked to significant decrements in dimensions of quality of life[8,28].

The MENQOL is a validated instrument used to measure quality of life and is able to capture not only the existence of frequent menopausal symptoms, but also the extent to which the symptom(s) is/are bothersome[15,21]. For analyses, we scored the items from 1 to 8 in the following manner: (1) The subject responded 'No', she did not experience the problem; (2) the subject experienced the problem and rated it as '0' on the bothered scale; (3) the subject experienced the problem and rated it as '1' on the bothered scale; (4) rated as '2'; (5) rated

as '3'; (6) rated as '4'; (7) rated as '5'; (8) rated as '6'. Each domain score ranges from 1 to 8; '1' implies good health and '8' implies poor health[15,21].

We re-validated the MENQOL psychosocial and physical domains against the Short Form (SF-12) instrument, a validated and generic measure of health status that assesses both physical and mental quality of life[29–31]. SF-12 is a multipurpose survey instrument comprising 12 questions, developed as a legitimate alternative to the SF-36. The two summary scales, the Mental (MCS) and the Physical Component Summary (PCS), provide an insight into mental and physical health[32]. As described elsewhere[32,33], the MCS score assessing impact of health on mental health function was calculated. The MCS includes subscales that measure vitality (VT), social function (SF), mental health (MH), and role function-emotional (i.e. the extent to which one's emotional problems limit one's role function, RE). The PCS includes subscales that measure physical functioning (PF), role physical (RP), bodily pain (BP), and general heath (GH). The scores were calculated using the scores of the questions that range from 0 to 100; '0' implies poor health and '100' implies good health. Unlike the MENQOL domains, higher SF-12 component scores represent better quality of life. We assessed the validity of the MENQOL's sexual domain indirectly against marital status. The rationale behind this indirect validation is described elsewhere[22,34].

We also examined the degree to which depression symptoms were associated with quality of life on the MENQOL psychosocial domain. CES-D 10, a screening tool for depressive symptoms[35], has been used in people with diabetes[36] and was now used to assess depression symptoms. The shorter form contains ten depression items and is easier and quicker to administer in clinical and non-clinical settings. It has been shown to have reliability and validity comparable to the standard 20-item CES-D instrument and is considered a good instrument for screening depression in patients with diabetes[36]. The CES-D 10 uses a 0–3 response scale, with total symptom severity scores ranging from 0 (no depression) to 30 (severe depression)[37]. Participants in this study were categorized as depressed if they scored 11 or more on the CES-D 10 scale. Higher scores on the MENQOL indicate a poorer quality of life. Higher scores on the CES-D indicate greater depression symptoms.

Statistical analysis

The data were analyzed using the Statistical Package for Social Sciences (SPSS)® version 20 and STATA IC® version 12, with a significance level of ≤ 0.05. Descriptive statistics were used to calculate percentage frequencies, means and standard deviations. Since MENQOL had not been previously validated in a sample of women with diabetes, we conducted a principal component analysis (PCA) to examine the underlying components or domains of MENQOL. In order to achieve a favorable ratio (> 10 : 1) of respondents over instrument items, a minimum of 200 participants was required to conduct factor analysis. Next we performed the Kaiser–Meyer–Olkin test (KMO) to measure sampling adequacy of > 0.7. An eigenvalue > 1 was used for retaining factors in PCA. However, there are chances of potential biases that can be introduced by the use of a cut-off value > 1. Therefore, we inspected the Scree plot, as a superior factor selection method to determine the appropriate number of factors to retain for rotation. Bartlett's test of sphericity was used to measure significant correlations between variables. The corrected item-total score correlations were also examined. Reliability of MENQOL items and domains were assessed using Cronbach's α and intra-class correlation coefficients, where an α of 0.70–0.90 was considered good.

The independent *t*-test was applied to obtain the mean (95% confidence interval) and statistical differences between mean MENQOL symptoms and domain scores (continuous variable) and diabetes (categorized as 'yes' or 'no'). To validate the MENQOL physical and psychosocial domains against the SF-12 physical and mental component summary scores, linear regression was used. Age was included as a covariate (continuous variable) in the regression analyses to control for potential confounding effects. Education and diabetes were included as covariates to control for potential effects on quality of life[8–10,38]. Age, education and diabetes were included as covariates in all linear and logistic regression analysis used in this study. Linear regression was also used to validate the sexual domain with marital status. Finally, logistic regression analysis determined the degree to which depression symptoms and diabetes were associated with quality of life on the MENQOL domains.

RESULTS

Sociodemographic characteristics

Out of total of 640 participants, half (*n* = 320) were identified as 'case' while the remaining half (*n* = 320) were identified as 'control'. The overall mean age was 57.43 years, standard deviation ± 6.28 years. The mean age at diabetes diagnosis was 47.75 ± 9.81 years, with all receiving oral hypoglycemic drugs and/or insulin. Diabetes subjects were older than control subjects (60.22 vs. 54.64 years). The majority of the women were Malay and had attained secondary education. Women with diabetes were mostly homemakers with no paid jobs and no monthly income, while control subjects were mostly government or non-government employees, working 41 h or more per week with a monthly income of less than RM 3500.

Both 'case' and 'control' subjects experienced their first period around the same age (mean age 13.25 vs. 13.10 years, *p* = 0.680). Similarly, they achieved menopause around the same age (mean age 49.35 vs. 48.87 years, *p* = 0.426). Regarding menopausal status, more diabetes subjects had attained menopause compared to control subjects (37.7% vs. 15.0%, *p* = 0.001). However, more control subjects had perimenopausal status compared to women with diabetes (11.2% vs.

Table 1 Descriptive statistics of issues related to reproduction, by case and control ($n = 640$). Data are given as mean $\pm$ standard deviation or n (%)

	Diabetes	Control	p Value
Age at time of study (years)	60.22 ± 7.07	54.64 ± 5.49	0.001
Age at last pregnancy (years)	27.53 ± 4.32	29.41 ± 3.28	0.001
Age at menopause (years)	49.35 ± 5.19	48.87 ± 4.16	0.426
Age when periods started (years)	13.25 ± 3.27	13.10 ± 1.37	0.680
Number of pregnancies	4.15 ± 1.93	3.64 ± 1.94	0.001
Menopausal status			
Premenopausal	63 (9.8%)	152 (23.7%)	0.001
Perimenopausal	16 (2.5%)	72 (11.2%)	0.001
Postmenopausal	241 (37.7%)	96 (15.0%)	0.001

2.5%, $p = 0.001$). Diabetes subjects had a higher number of pregnancies compared to control subjects (mean 4.15 vs. 3.64, $p = 0.001$) (Table 1).

Score distributions

There were small 'floor' effects for all domains and the total score. However, there was a modest amount of 'ceiling' effect, particularly in vasomotor and sexual domains, as shown in Table 2.

PCA and reliability

The 29 items of MENQOL were entered into an iterated PCA with Kaiser normalization. The KMO test of sampling adequacy was applied prior to factor extraction, which resulted in an overall index of 0.95, suggesting that the sample was adequate for factor analysis. Inspection of the corresponding Scree plot and identification of an 'elbow' point, after which the inclusion of additional factors does not result in substantial gains in variance explained, yielded the existence of four factors, with eigenvalues more than one. The non-rotated

factor produced the most explanation of the data and excellent loadings.

Reliability coefficients were constructed for each domain of the MENQOL. Cronbach's α statistics were acceptable for each of the domains (Table 2). The values for the physical, psychosocial, sexual and vasomotor domains were 0.86, 0.79, 0.79 and 0.70, respectively and 0.90 for the full scale of MENQOL. The Cronbach's α values of MENQOL domains were almost comparable for diabetes and control subjects.

Construct validity

Since MENQOL is only validated in a postmenopausal population, MENQOL assessment was restricted to postmenopausal women only (241 cases, 96 controls). Table 3 displays the results of the linear regression analysis of the validation instruments including covariates on MENQOL psychosocial and physical domains. Our results indicated that better quality of life on the SF-12 physical and mental component scores was significantly related to better quality of life on the physical (correlation coefficient = 0.497) and psychosocial (correlation coefficient = 0.436) domains of the MENQOL.

When the SF-12 mental component score increased by one unit, the MENQOL psychosocial domain score decreased by 0.029 units. Performance on the SF-12 mental component accounted for 20% of the variance in the MENQOL psychosocial domain scores. When the SF-12 physical component score increased by one unit, the MENQOL physical domain score decreased by 0.026 units. Performance on the SF-12 physical component accounted for 25% of the variance in the MENQOL physical domain scores.

When age increased by 1 year, the scores for MENQOL vasomotor domain ($p = 0.699$), psychosocial domain ($p = 0.444$), physical domain ($p = 0.442$), and sexual domain ($p = 0.394$) decreased by 0.005, 0.008, 0.007, and 0.010 units, respectively. The association between SF-12 summary scales and MENQOL domains remained significant after adjusting for age, education, and diabetes. The logistic regression analysis showed that MENQOL vasomotor, physical, and sexual domains actually decreased by small amounts, 0.099 (95% CI -0.463–0.264), 0.185 (95% CI -0.479–0.109), and 0.048 (95% CI -0.388–0.293), for women with diabetes. The effects on the psychosocial domain (increased by 0.310)

Table 2 Values of Cronbach's α and scores of participants with diabetes, by domains of the Menopause-specific Quality of Life (MENQOL) questionnaire ($n = 241$)

MENQOL domain	Cronbach's α	Mean $\pm$ standard deviation	Median	'Floor' effects (worst health score) n (%)	'Ceiling' effects (best health score) n (%)
Vasomotor	0.70	1.98 ± 1.25	1.33	0 (0.0)	63 (26.14)
Psychosocial	0.79	2.44 ± 1.38	2.00	1 (0.41)	20 (8.30)
Physical	0.86	2.85 ± 1.29	2.69	0 (0.0)	6 (2.49)
Vaginal sexual	0.79	1.53 ± 1.25	1.00	0 (0.0)	75 (31.12)
Total (full scale)	0.90	2.53 ± 1.09	2.38	0 (0.0)	0 (0.0)

Table 3 Results of linear regression analyses with the Menopause-specific Quality of Life (MENQOL) domains as the dependent variables and the SF-12 component scores, marital status, age, education, and diabetes as independent variables ($n = 337$)

	Parameter coefficients	p Value	95% confidence interval	Variance R^2	Correlation coefficients
Vasomotor domain (VS)					
Age	−0.005	0.699	−0.028–0.019	1.0	Age: VS = −0.052
Diabetes*	−0.099	0.591	−0.463–0.264		
Education†	0.088	0.630	−0.271–0.448		
Psychosocial domain (PS)					
SF-12 MCS	−0.029	0.001	−0.036 to −0.023	0.879	MCS: PS = −0.436
Age	−0.008	0.444	−0.029–0.013		Age: PS = −0.012
Diabetes	0.310	0.059	−0.011–0.629		
Education	−0.048	0.764	−0.366–0.269		
Physical domain (PHS)					
SF-12 PCS	−0.026	0.001	−0.031 to −0.022	0.804	PCS: PHS = −0.497
Age	−0.007	0.442	−0.026–0.012		Age: PHS = 0.045
Diabetes	−0.185	0.217	−0.479–0.109		
Education	−0.082	0.576	−0.372–0.207		
Vaginal sexual domain (VSS)					
Marital status‡	−0.482	0.006	−0.822 to −0.142	0.937	Age: VSS = −0.165
Age	−0.010	0.394	−0.033–0.129		
Diabetes	−0.048	0.373	−0.388–0.293		
Education	0.337	0.054	−0.006–0.679		

PCS, physical component score; MCS, mental component score

*, Diabetes refers diabetes or no diabetes (1 = diabetes; 0 = no diabetes); †, education was measured as 1 = primary schooling or lower; 2 = secondary schooling or higher; ‡, married = 1; not presently married, i.e. divorced, single, widowed = 0

are probably in the same direction to that expected, but for which the confidence intervals span negative and positive values.

Table 4 shows the results of the logistic regression analysis examining the association between depression symptoms and each of the four MENQOL domains. The odds that a woman was depressed on the CES-D scale increased 1.42 times when the MENQOL score on the psychosocial domain increased by one unit (95% confidence interval (CI) 1.01–2.02), and the odds ratio increased 1.27 times when the MENQOL score on the physical domain increased by one unit (95% CI 0.82–1.97).

The linear regression results also indicated that being married was associated with better quality of life on the MENQOL sexual domain; the mean sexual domain scores of married women were on average 0.482 units lower compared to those who were not married. Marital status accounted for 7% of variance in the MENQOL sexual domain scores. Women with secondary education or higher had greater quality of life complaints on the sexual domain compared to women with primary education or lower (Table 3).

The results of the logistic regression analysis examining the association between diabetes and quality of life, as determined by each of the four MENQOL domains, can be found in Table 5. The odds of presence or absence of diabetes increased

1.13 times when the MENQOL score on the psychosocial domain increased by one unit (95% CI 0.92–1.39), and the odds ratio increased 0.99 times when the MENQOL score on the physical domain increased by one unit (95% CI 0.80–1.22). However, none of them were statistically significant.

For symptoms associated with both diabetes and post-menopausal stage, diabetes subjects had significantly higher mean scores compared to control subjects (Table 6). Of the three vasomotor symptoms, i.e. night sweats, hot flushes and sweating, only hot flushes were significantly higher in control subjects.

DISCUSSION

The MENQOL questionnaire appears to be reliable and valid instrument based on good internal consistency and significant correlations with validated instruments. As a first study to explore the validity of a MENQOL measure in a sample of postmenopausal women with diabetes who completed the MENQOL, a quality-of-life measure developed and validated for both younger and older postmenopausal women, this study provides support for the validity of the MENQOL domains in women with diabetes. The MENQOL domains

Table 4   Results of logistic regression analyses with depression symptoms as the dependent variables and the Menopause-specific Quality of Life (MENQOL) domains, age, education, diabetes, and marital status as the independent variables ($n = 337$)

Depression*	Odds ratio point estimates	p Value	95% confidence interval	Variance R^2
Vasomotor domain	1.22	0.252	0.87–1.70	0.018
Age	1.01	0.818	0.92–1.12	
Diabetes	0.67	0.585	0.16–2.77	
Education	1.26	0.768	0.27–5.92	
Marital status	1.66	0.467	0.42–6.56	
Psychosocial domain	1.42	0.050	1.01–2.02	0.050
Age	1.01	0.780	0.92–1.12	
Diabetes	0.59	0.466	0.15–2.41	
Education	1.42	0.658	0.30–6.75	
Marital status	1.73	0.438	0.44–6.89	
Physical domain	1.27	0.289	0.82–1.97	0.022
Age	1.01	0.864	0.92–1.12	
Diabetes	0.64	0.534	0.16–2.62	
Education	1.34	0.711	0.28–6.35	
Marital status	1.66	0.470	0.42–6.62	
Vaginal sexual domain	1.23	0.246	0.87–1.72	0.023
Age	1.01	0.840	0.92–1.12	
Diabetes	0.66	0.563	0.16–2.65	
Education	1.18	0.836	0.25–5.64	
Marital status	1.91	0.369	0.47–7.86	

*, Depression was measured with CESD-10: depressed = 1; not depressed = 0

were significantly associated with the well validated and widely used CES-D and SF-36 MCS scales, supporting the construct validity of MENQOL for use among women with diabetes. Our observations also revealed that the MENQOL questionnaire is an easy-to-administer instrument for measuring menopausal symptoms.

The results provide evidence supporting the reliability of the MENQOL questionnaire for use among diabetes subjects. Values of Cronbach's α for the sexual, physical, vasomotor and psychosocial domains were 0.79, 0.86, 0.70, and 0.79, respectively. The full MENQOL scale had a high internal consistency of 0.90, suggesting that 29 items included in the instrument are reliable. Cronbach's α was more than 0.80 for both diabetes and control subjects. These values of α are comparable with those reported in a previous study[21]. An interesting finding of this study is the four-factorial model of the MENQOL, similar to the ones reported earlier[21], where the items loaded fully on the four factors, confirming the psychometric properties of MENQOL for use among women with diabetes. However, few items were cross-loaded on more than one domain. Consistent with the development of the scale, it is encouraging that items overwhelmingly operate in the way that they were intended.

The validity of the MENQOL psychosocial and physical domains was demonstrated through strong relationships with the equivalent SF-12 mental and physical component scales. Our results indicated that better SF-12 MCS and PCS scores were significantly related to lower psychosocial and physical

symptoms of the MENQOL. These results remained significant even when the covariates of age, education, and diabetes were included in the regression models. Interestingly, diabetes was not a significant covariate and did not change the association between SF-12 component scales and MENQOL physical and psychosocial domains, suggesting that presence or absence of diabetes does not change the quality-of-life measures on the MENQOL instrument.

Three domains on the MENQOL (vasomotor, physical and sexual domains) did not predict the risk of depressive symptoms. Consistent with a previous study, the psychosocial domain of the MENQOL did predict the likelihood of symptoms of depression[22]. This particular finding is important because the psychosocial domain consists of items measuring the influence of depressive symptoms, providing validity to the psychosocial domain of the MENQOL. This finding may be useful in a clinical setting as responses to MENQOL may suggest concurrent problems of depression.

Our observations also revealed that diabetes subjects had significantly higher mean scores compared to non-diabetes subjects for symptoms associated with both diabetes and the postmenopausal period. However, none of the domains on the MENQOL scale predicted the likelihood of diabetes. The study has also shown that the mean ages of occurrence of menopause in women with and without type 2 diabetes are not significantly different (49.35 vs. 48.87 years). However, more women with diabetes had attained menopause compared

Table 5   Results of logistic regression analyses with diabetes as the dependent variable and the Menopause-specific Quality of Life (MENQOL) domains, age, education, and marital status as the independent variables ($n = 337$)

Diabetes*	Odds ratio point estimates	p Value	95% confidence interval	Variance R^2
Vasomotor domain	0.93	0.460	0.78–1.12	0.177
Age	1.11	0.001	1.06–1.17	
Marital status‡	1.15	0.698	0.57–2.32	
Education†	0.16	0.001	0.10–0.39	
Psychosocial domain	1.13	0.249	0.92–1.39	0.179
Age	1.11	0.001	1.06–1.17	
Marital status	1.17	0.666	0.58–2.36	
Education	0.16	0.001	0.10–0.40	
Physical domain	0.99	0.923	0.80–1.22	0.175
Age	1.11	0.001	1.06–1.17	
Marital status	1.16	0.686	0.58–2.33	
Education	0.15	0.001	0.10–0.39	
Vaginal sexual domain	0.96	0.686	0.81–1.15	0.176
Age	1.11	0.001	1.06–1.17	
Marital status	1.13	0.741	0.55–2.30	
Education	0.16	0.001	0.07–0.39	

*, Diabetes refers diabetes or no diabetes (1 = diabetes; 0 = no diabetes); †, education was measured as 1 = primary schooling or lower; 2 = secondary schooling or higher; ‡, married = 1; not presently married, i.e. divorced, single, widowed = 0

to women without diabetes (37.7% vs. 15.0%, $p = 0.001$). The age of onset of menopause in this study is comparable with that reported in previous studies[27,39–41]. It should be noted that the menopausal state may be a potential risk factor for the development of metabolic syndrome[42] which could subsequently lead to diabetes.

Overlap of symptoms

Women with diabetes had significantly higher mean scores for the MENQOL symptoms or items that could be confounded with the symptoms of diabetes or poorly controlled diabetes compared to women without diabetes; we did not find significant differences for any of the MENQOL domains. This finding suggests that MENQOL can be administered in a population with diabetes. The instruments used for screening depression symptoms also contained some items that could be confounded with symptoms of diabetes or poorly controlled diabetes[43]. For example, questions relating to symptoms such as loss of appetite and restless sleep (which may also be related to symptoms of diabetes) are included in the CES-D scale[35].

Limitations

Although we applied systematic sampling, participants who frequently attended the outpatient clinics were more likely to

Table 6   Means and 95% confidence interval (CIs) of Menopause-specific Quality of Life (MENQOL) symptoms, associated with both diabetes and postmenopausal stage ($n = 337$)

Items	Diabetes Mean	Diabetes 95% CI	Control Mean	Control 95% CI	p Value
Feeling depressed, down or blue	2.53	2.26–2.80	1.88	1.55–2.22	0.008
Feeling anxious or nervous	2.27	2.02–2.52	1.76	1.46–2.05	0.023
Difficulty sleeping	3.02	2.68–3.36	2.33	1.89–2.78	0.026
Feeling tired or worn out	3.99	3.68–4.29	3.07	2.67–3.48	0.001
Feeling a lack of energy	3.77	3.46–4.10	2.43	2.10–2.77	0.001
Dry skin	2.63	2.35–2.91	2.49	2.13–2.85	0.581
Frequent urination	2.52	2.23–2.80	2.00	1.67–2.33	0.039
Avoiding intimacy	1.64	1.42–1.85	1.48	1.28–1.68	0.411

be sampled than those who attended less frequently, and therefore were presumed to have better quality of life. This might have introduced selection bias. This study is further limited by indirect validation of the sexual domain against marital status. This is based on the expectation that married women would be more bothered by the menopausal symptoms of this domain[22,34]. There may have been participant recall bias which would be a systematic error resulting from lack of completeness of memory of past events or experiences, which may have affected accuracy of self-reported information.

CONCLUSION

The MENQOL questionnaire appears to be reliable and valid instrument based on good internal consistency and significant correlations with validated instruments. This finding confirms the construct validity of MENQOL and it was found to be a valid measure to examine quality of life in postmenopausal women with diabetes. All four domains on the MENQOL did not predict the risk of diabetes. However, it should be noted that symptoms associated with both diabetes and the postmenopausal phase had significantly higher mean scores in diabetes subjects compared to control subjects. The psychosocial domain was significantly associated with depression, suggesting that scores on this domain of the MENQOL may be indicators of depression symptoms.

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