Med & Health Jun 2021; 16(1): 207-222 https://doi.org/10.17576/MH.2021.1601.17

ORIGINAL ARTICLE

The Association between Neuroticism Personality Traits and Depressive Psychopathology with Quality of Life among Diabetic Patients

MUHAMMAD MEOR O[1], HATTA S[1], LUKE SYCW[1], FARRIS IMAN LEONG A[2], FARAH DEENA AS[1]

[1]Department of Psychiatry, Faculty of Medicine, Universiti Kebangsaan Malaysia Medical Centre, Jalan Yaacob Latif, Bandar Tun Razak, 56000 Cheras, Kuala Lumpur, Malaysia
[2]Lifestyle Science Cluster, Advanced Medical and Dental Institute, Universiti Sains Malaysia, Kepala Batas 13200, Pulau Pinang, Malaysia

ABSTRAK

Diabetes mellitus (DM) merupakan penyakit perubatan kronik yang terkait dengan sekuele psikologi dan trait personaliti khusus yang tertentu. Kajian ini bertujuan untuk mengkaji hubungan kualiti kehidupan (QoL) di kalangan pesakit DM dengan gejala 'mood' dan trait personaliti. Seramai 291 responden DM direkrut, di mana data sosio-demografik dan profil yang relevan menggunakan soal-selidik Beck Depression Inventory II (BDI-II), Generalized Anxiety Disorder scale (GAD-7), Big Five Inventory (BFI) dan World Health Organization Quality of Life Instrument-Short Form questionnaire (WHOQoL-BREF) telah direkodkan. Min umur responden adalah 60.43 tahun, di mana hampir separuh daripada mereka adalah lelaki dan telah berkahwin. Kebanyakan responden telah didiagnosa mengalami penyakit diabetes jenis 2 (N = 261, 89.7%) dan median tempoh mengalami penyakit ialah 14.17 tahun (sisihan piawai, SD = 9.72). Perkaitan di antara trait personaliti, komplikasi psikologi dan QoL telah diselaraskan mengikut data demografik, peribadi dan ciri klinikal. Berdasarkan model 'multiple linear regression', selepas penyelarasan mengikut umur, pekerjaan, status pendidikan, pendapatan bulanan, persepsi sokongan sosial, tempoh DM dan variabel lain, kami mendapati neurotisma (BFI) dan min skor BDI masing-masing dikaitkan dengan QoL yang rendah. Kenaikan 1-unit di dalam dua variabel tersebut menyebabkan 3.5 dan 0.6-poin skor pengurangan di dalam QoL (3.465 (95% julat keyakinan, CI -5.788 hingga -1.143) dan -0.560 (95% CI -0.779 to -0.341)) masing-masing dengan nilai p<0.001. Sesungguhnya, intervensi dengan memberi fokus kepada neurotisme dan peningkatan gejala psikopatologi kemurungan dapat membantu perawatan psikologi dalam kalangan para pesakit DM.

Address for correspondence and reprint requests: Professor Dr. Hatta Sidi. Department of Psychiatry, Faculty of Medicine, Universiti Kebangsaan Malaysia Medical Centre, Jalan Yaacob Latif, Bandar Tun Razak, 56000 Cheras, Kuala Lumpur, Malaysia. Tel: +603-9145 6143 Email: hattasidi@hotmail.com

Kata kunci: diabetes melitus, kemurungan, kualiti kehidupan (QoL), neurotisma

ABSTRACT

Diabetes mellitus (DM) is a chronic medical condition associated with psychological sequelae like depression and linked with specific personality traits. This study researched on quality of life (QoL) among patients with DM and its association with mood symptoms and personality traits. 291 diabetic respondents were recruited, where their socio-demographic data and other relevant profile were collected using the Beck Depression Inventory II (BDI-II), Generalized Anxiety Disorder scale (GAD-7), Big Five Inventory (BFI) and World Health Organization Quality of Life Instrument-Short Form questionnaire (WHOQoL-BREF). The mean age of the respondents was 60.43 years with approximately half of the respondents being males and married. Most respondents have been diagnosed with type 2 diabetes (N = 261, 89.7%) and the median duration of diabetes diagnosis was 14.17 years (SD = 9.72). The association between personality traits, psychological complications, and QoL after adjusting for demographic, personal, and clinical characteristics were studied. Based on the multiple linear regression models, after adjusting for age, employment, education status, monthly income, perceived social support, duration of DM and other variables, we found that the neuroticism (BFI) and mean BDI score was associated with poorer QoL, respectively. 1-unit increase in these two variables leading to 3.5- and 0.6-point decrease in QoL, (-3.465 (95% confidence interval, CI -5.788 to -1.143) and -0.560 (95% CI -0.779 to -0.341)) with $p<0.001$, respectively. An intervention focusing on the neuroticism and elevating the depressive psychopathology would help in the psychological management of patients with DM.

Keywords: depression, diabetes mellitus, neuroticism, quality of life

INTRODUCTION

According to the International Diabetes Federation (IDF), in 2019, 9.3% of the global population or more than 460 million people suffered from diabetes mellitus (DM). It has been estimated that by 2030, there will be almost 600 million adults with DM, and 700 million by 2045 (International Diabetes Federation 2019). In Malaysia, as of 2019, there are almost 4.0 million people who have DM, and the number is projected to rise to more than 6.0 million by 2045 (Institute for Public Health 2020). Obesity, unhealthy diets such as processed food and sedentary lifestyle have said to be some of the important contributing factors leading to the increase in DM cases (International Diabetes Federation 2019). Several studies have found that lower level of education, daily insulin usage, poorly controlled

DM and microvascular complications among patients with DM had negative impact on their quality of life (QoL) (Baghianimoghadam et al. 2007; Pouwer & Hermanns 2009; Cheah et al. 2012; Scollan-Koliopoulos et al. 2013).

Those with better glycaemic control and no diabetic complications probably are much more optimistic about their health, and this in turn increases their QoL (Cheah et al. 2012). In a study by Sundaram et al. (2007) geriatric patients with longer duration of DM were found to have better QoL. This is probably due to their greater acceptance of their health status with growing age and better experience in handling the disease. DM and psychiatric disorders shared a bidirectional association-both influencing each other in multiple ways (Renn et al. 2011) and past research have found an increased prevalence of depressive symptoms in patients with Type 2 Diabetes Mellitus (T2DM). In a meta-analysis, Anderson et al. (2001) showed that the presence of DM significantly doubles the odds of comorbid depression as compared to those without DM.

A meta-analysis of 9 longitudinal studies reported by Knol et al. (2006) suggested that adults who are clinically depressed have more than one-third increased risk of developing T2DM compared with those who are clinically euthymic. Those with depression have impaired self, social, and occupational functioning. This will both directly and indirectly affect their QoL as they will face much more difficulties in managing their DM. Subsequently, these psychological domains (depression and impaired functioning) may lead to increased likelihood of DM complications. Although there is increasing interest worldwide on the association between personality and chronic medical illnesses, there is still a paucity of research on the association between DM and personality. A study conducted by Sutin et al. (2010) found that metabolic syndrome was associated with high neuroticism and low agreeableness, while high conscientiousness was a protective factor. These findings were in keeping with another study by van Dooren et al. (2016), which showed that those with T2DM had low agreeableness and low conscientiousness, and they were less extraverted and more emotionally unstable. This shows that, to a certain extent, personality factor does matter in the development and clinical course of DM. In this study, we aimed to determine the QoL among Malaysian patients with DM and to determine its association with personality traits and psychological morbidity.

MATERIALS AND METHODS

Study Design and Participants

This cross-sectional study was conducted over a period of two months from August 2019. Patients with DM were recruited at the outpatient Endocrine Clinic of Universiti Kebangsaan Malaysia Medical Centre (UKMMC), a major tertiary referral centre in a suburban area of the Klang Valley, a metropolitan area with a population of 8 million people, which

is in central Peninsular Malaysia. This study received ethical approval from the Research Ethics Committee UKMMC with a code of FF-2019-342. The respondents were recruited via convenience sampling, in which the target population were all patients diagnosed with DM and registered under the Endocrine Clinic follow-up of UKMMC. Respondents were approached by the research team and provided with detailed explanation regarding the objectives, eligibility criteria, and procedures of the study. Those who were 18 years old and above, diagnosed with type I and II DM, and without impaired mental capacity, i.e., absence of psychotic symptoms and cognitive impairment, were invited to participate in the study. Then, informed consent for study participation was obtained from all respondents before they were enrolled in the study. Respondents who were found to have depressive and anxiety disorders were offered referral for professional help after they completed the study.

Measures

The respondents were administered a semi-structure questionnaire to record data on their demographic, perceived social support, and clinical characteristics. The World Health Organization Quality of Life-BREF (WHOQoL-BREF) questionnaire was administered to assess the level of QoL of the respondents. The Big Five Inventory (BFI) was administered to measure the personality traits of the respondents. The Beck Depression Inventory II (BDI-II) and the Generalized Anxiety Disorder (GAD-7) scale were employed to evaluate the severity of depressive symptoms and the severity of anxiety symptoms reported by the respondents, respectively.

The data on demographic characteristics of the respondents included age, marital status, employment, education status, and household monthly income were collected. The personal characteristics assessment included smoking status and perceived social support. Age was recorded as a continuous variable and marital status was coded into "married" and "single/divorced/widowed". Employment status was grouped into "employed" and "unemployed/retired". Education status was coded into "primary or secondary education" and "tertiary education". Household monthly income was categorised into "<Ringgit Malaysia (RM) 3000.00" and "≥ RM3000.00" (equivalent to USD 741). Smoking status was categorised into "smokers" and "non-smoker/ex-smoker". Finally, perceived social support was assessed with the following question: "How would you rate the level of social support you received from your friends, family, and significant others?" and the responses were classified into two groups, which were "poor support" and "good support".

The clinical characteristics reported by the respondents included types of DM, glycaemic control, insulin therapy, duration of DM, presence of comorbid hypertension and dyslipidemia, and presence of diabetic complications, such as ischaemic heart disease (IHD),

cerebrovascular accident, and renal impairment. The types of DM were assessed with the following question i.e. "Which type of diabetes mellitus you were diagnosed with?" and reported as "type I diabetes mellitus" and "type II diabetes mellitus". Glycaemic control was assessed by reference to the serum glycated haemoglobin (HbA1c) level of the respondents, in which a HbA1c of ≤7% was regarded as good glycaemic control while a HbA1c of >7% was considered as poor glycaemic control. The use of insulin therapy was evaluated with the question i.e. "Were you currently treated with insulin therapy?" and the response was coded into "No" and "Yes". The presence of comorbid hypertension was assessed with the question i.e. "Were you diagnosed with hypertension in addition to diabetes mellitus?" and the response were coded as "No" and "Yes". The presence of comorbid dyslipidemia was assessed with the question i.e. "Were you diagnosed with elevated serum lipid and/or cholesterol in addition to diabetes mellitus?" and the response were coded as "No" and "Yes". The presence of IHD was evaluated with the question i.e. "Were you diagnosed with ischaemic heart disease in addition to diabetes mellitus?" and the response were coded as "No" and "Yes". The presence of cerebrovascular accident was evaluated with the question i.e. "Were you diagnosed with stroke in addition to diabetes mellitus?" and the response were coded as "No" and "Yes". The presence of renal impairment was assessed with the question i.e. "Were you diagnosed with abnormal kidney function in addition to diabetes mellitus?" and the response were coded as "No" and "Yes". Data on clinical characteristics recorded from the questionnaire was supplemented by information from respondents' medical records.

World Health Organization Quality of Life-BREF (WHOQoL-BREF)

The WHOQoL-BREF is a self-reported instrument to evaluate the level of QoL of respondents. It consists of 26 items with four domains measuring on the physical health, psychological, social relationship, and environmental QoL. Each item is scored in a Likert scale ranging from 1 to 5. Item 1 and 2 are general questions on the overall perceived health and QoL of the respondents, while physical health QoL comprised of 7 items, psychological QoL has 6 items, social relationship QoL consists of 3 items, and environmental QoL makes up 8 items. Items 3, 4 and 26 are negatively framed and hence, their scores must be reversed when calculating the sum of the scores of each domain and the total QoL score. The total score of the WHOQoL-BREF is calculated as the sum of scores of all the items. The WHOQoL-BREF has good psychometric properties and is a reliable and valid alternative to the WHOQoL-100 for assessment of QoL (WHOQOL 1998). The Malay version of the WHOQoL-BREF has been validated in the Malaysian population and exhibited an excellent Cronbach's α of 0.89 (Hasanah et al. 2003).

Big Five Inventory (BFI)

The BFI is a self-reported tool to assess five personality traits of respondents, which are extraversion, agreeableness, conscientiousness, neuroticism, and openness. It is comprised of 44 items in 5 subscales and each item is scored in a Likert scale from 1 to 5. The BFI exhibited good psychometric properties (John et al. 1991) and the Malay version of the BFI has been validated in the Malaysian population. The Malay version of the BFI has an acceptable Cronbach's of 0.74 (Muhamad et al. 2018).

Beck Depression Inventory-II (BDI-II)

The BDI-II is a self-reported instrument to assess the severity of depressive symptoms among respondents. It contains 21 items, and each item is scored in a Likert scale from 0 to 3. Hence, its total score ranges from 0 to 63. Higher score indicates greater severity of depressive symptoms. The BDI-II exhibited excellent Cronbach's α of 0.91 (Beck et al. 1988). The BDI-II has been validated in the Malaysian population and exhibited acceptable Cronbach's α ranging from 0.71 to 0.91 (Muhktar & Oei 2008).

Seven-item Generalized Anxiety Disorder Scale (GAD-7)

The GAD-7 is a self-reported questionnaire which screens for severity of generalised anxiety disorder symptoms of the respondents. It comprised of 7 items, where each item is scored in a Likert scale of 0 to 3. Hence, the total score ranges from 0 to 21. Higher score indicates greater severity of anxiety symptoms. The GAD-7 has excellent psychometric properties, and the Malay version of GAD-7 has been validated in the Malaysian population with good psychometric properties (Spitzer et al. 2006; Sidik et al. 2012).

Statistical Analysis

Data analysis was carried out with the Statistical Package for Social Sciences version 20 (SPSS 20, IBM, Armonk, NY). Descriptive statistics were reported for demographic, personal, and clinical characteristics, the BFI, BDI-II, GAD-7 and WHOQoL-BREF scores of the respondents. Categorical variables were presented as frequency and percentage while continuous variables were presented as mean and standard deviation. Then, simple linear regression analysis was performed to determine the association between demographic, personal, and clinical factors and the total WHOQoL-BREF ($p<0.1$). Subsequently, stepwise multiple linear regression analyses were performed to evaluate the association between personality traits (extraversion, agreeableness, conscientiousness, neuroticism, and openness), psychological morbidity (depression and anxiety scores) and the total QoL score (dependent variable) while adjusting for significant demographic, personal, and clinical factors (confounding factors). The first multiple linear regression model was adjusted for significant demographic factors. The second multiple linear

Table 1: Demographic, personal and clinical characteristics of the respondents

Variables	N	%
Age (years)	60.43[#]	13.34[$]
Gender		
Male	154	52.9
Female	137	47.1
Marital status		
Married	227	78.0
Single/divorced/widowed	64	22.0
Employment		
Employed	78	26.8
Unemployed/retired	213	73.2
Education status		
Primary or secondary education	174	59.8
Up to tertiary education	117	40.2
Monthly income:		
< Malaysian Ringgit 3000.00	176	60.5
≥ Malaysian Ringgit 3000.00	115	39.5
Cigarette smoking		
Smoker	18	6.2
Non-smoker/ex-smoker	273	93.8
Perceived social support		
Poor support	57	19.6
Good support	234	80.4
Types of diabetes mellitus		
Type I	30	10.3
Type II	261	89.7
Diabetic control		
Good	90	30.9
Poor	201	69.1
Insulin therapy		
Yes	179	61.5
No	112	38.5
Duration of diabetes mellitus (years)	14.17[#]	9.72[$]
Co-morbid hypertension		
Yes	215	73.9
No	76	26.1
Co-morbid dyslipidemia		
Yes	151	51.9
No	140	48.1
Diabetic complications: Ischemic heart disease		
Yes	82	28.2
No	209	71.8
Cerebrovascular accident		
Yes	26	8.9
No	265	91.1
Renal impairment		
Yes	52	17.9
No	239	82.1

[#]Mean, [$]standard deviation

regression model was adjusted for significant demographic factors and personal factor. The third multiple linear regression model was adjusted for significant demographic factors, personal factor, and clinical factors. The normal probability plot of residuals of all the multiple linear regression models (normal P-P plot of regression standardised residual) demonstrated that all the points lay in a reasonably straight diagonal line from bottom left to top right, indicating that the errors of the linear regression models were normally distributed. Meanwhile, the variance inflation factor of all the independent variables in the models were <10, indicating absence of multicollinearity. Significant level was set at $p<0.05$ and all p-values were two-sided.

RESULTS

Demographic, Personal, and Clinical Characteristics of the Respondents

The demographic, personal, and clinical characteristics of respondents are summarised in Table 1. By the end of this study, data was collected from 291 respondents. The mean age of the respondents was 60.43 years (SD=13.34). Approximately half of the respondents were males (N=154, 52.9%). Most respondents were married (N=227, 78%), unemployed or retired (N=213, 73.2%), and were non-smokers or ex-smokers (N=273, 93.8%). More than half of the respondents received primary or secondary level of education (N=174, 59.8%) and a similar proportion of respondents earned less than RM3000.00 per month (N=176, 60.5%). A large proportion of respondents perceived their social support as good (N=234, 80.4%). For clinical characteristics, most respondents had been diagnosed with T2DM (N=261, 89.7%). Approximately two thirds of participants had poor glycaemic control (N=201, 69.1%) and a similar proportion of them were on insulin therapy (N=112, 38.5%).

Table 2: Psychological complications, personality traits and quality of life of the respondents

Variables	Mean	Standard deviation
BFI subscale:		
Openness	3.27	0.50
Conscientiousness	3.67	0.46
Neuroticism	2.46	0.57
Agreeableness	3.84	0.43
Extraversion	3.40	0.52
Mean BDI score	6.11	3.47
Mean GAD score	2.48	1.81
WHOQoL-BREF:		
Physical health QoL	24.73	4.27
Psychological QoL	22.82	3.32
Social QoL	11.37	1.96
Environmental QoL	30.16	4.23
Total WHOQoL-BREF score	96.04	12.47

The median duration of diabetes diagnosis was 14.17 years (SD=9.72). For comorbidities, a large proportion of respondents had hypertension (N=215, 73.9%) and half of them had dyslipidemia (N=151, 51.9%). Majority of the respondents did not have any DM complications, such as ischemic heart disease (N=209, 71.8%), cerebrovascular accident (N=265, 91.1%), and renal impairment (N=239, 82.1%).

Psychological Complications, Personality Traits and QoL of the Respondents

Table 2 shows the mean scores for personality traits, psychological complications, and QoL of the respondents. The lowest mean value for BFI subscale was neuroticism (2.46, SD 0.57), whereas the highest was agreeableness (3.84, SD 0.43). The mean BDI and GAD scores were 6.11 (SD 3.47) and 2.48 (SD 1.81), respectively. For the mean WHOQoL-BREF score, environmental QoL (30.16, SD 4.23) had the highest value whereas social QoL (11.37, SD 1.96) had the lowest value.

Association between Individual Demographic, Personal, Clinical Characteristics and Total WHOQoL-BREF Score among the Respondents

Table 3 summarises the findings from the simple linear regression analysis examining associations between individual demographic, personal, and clinical characteristics and total WHOQoL-BREF score. The demographic and personal characteristics significantly associated with WHOQoL-BREF ($p<0.1$) score were age, employment, education status, monthly income, and perceived social support. Variables significantly associated with reduced WHOQoL-BREF score ($p<0.1$) were age and duration of diabetes. The older the age [B=-0.105, 95% CI (-0.212 to 0.003)] and the longer the duration of diabetes [B=-0.231, 95% CI (-0.384 to 0.078)], the poorer the QoL. There were a few variables significantly associated with increased WHOQoL-BREF score ($p<0.1$). Demographically, those who were unemployed or retired [B=6.52, 95% CI (3.355 to 9.684)], had tertiary education (B=5.837, 95% CI (2.973 to 8.702)), had a household monthly income of above RM3000.00 (B=5.552, 95% CI (2.69 to 8.414)), had better QoL. Those who perceived their social support as good (B=10.916, 95% CI (7.513 to 14.32)), had better QoL. For clinical characteristics, those without any comorbid hypertension (B=6.783, 95% CI (3.598 to 9.968)), and those without any cerebrovascular accident (B=5.282, 95% CI (0.268 to 10.297)), and renal impairment (B=5.365, 95% CI (1.656 to 9.075)), had a significantly better QoL compared to those that had these conditions.

Association between Personality Traits, Psychological Morbidity, and QoL after Adjusted for Demographic, Personal, and Clinical Characteristics

Results from the stepwise multiple linear regression analyses between

Table 3: The association between individual demographic, personal, clinical characteristics and total WHOQoL-BREF score among the respondents

Variables	B (95% CI)	p-value
Age (years)	-0.105 (-0.212 to 0.003)	0.057*
Gender		
Male	Reference	0.675
Female	-0.616 (-3.502 to 2.270)	
Marital status		
Married	Reference	0.444
Single/divorced/widowed	-1.355 (-4.830 to 2.120)	
Employment		
Employed	Reference	< 0.001*
Unemployed/retired	6.520 (3.355 to 9.684)	
Education status		
Primary or secondary education	Reference	< 0.001*
Up to tertiary education	5.837 (2.973 to 8.702)	
Monthly income:		
< Malaysian Ringgit 3000.00	Reference	< 0.001*
≥ Malaysian Ringgit 3000.00	5.552 (2.690 to 8.414)	
Cigarette smoking		
Smoker	Reference	0.562
Non-smoker/ex-smoker	-1.761 (-7.739 to 4.217)	
Perceived social support		
Poor support	Reference	< 0.001*
Good support	10.916 (7.513 to 14.320)	
Types of diabetes mellitus		
Type I	Reference	0.258
Type II	-2.704 (-7.398 to 1.989)	
Diabetic control		
Good	Reference	0.668
Poor	-0.680 (-3.797 to 2.436)	
Insulin therapy		
Yes	Reference	0.930
No	-0.140 (-3.290 to 3.010)	
Duration of diabetes mellitus (years)	-0.231 (-0.384 to -0.078)	0.003*
Co-morbid hypertension		
Yes	Reference	< 0.001*
No	6.783 (3.598 to 9.968)	
Co-morbid dyslipidemia		
Yes	Reference	0.271
No	-1.614 (-4.491 to 1.264)	
Diabetic complications: Ischemic heart disease		
Yes	Reference	0.151
No	2.333 (-0.859 to 5.524)	
Cerebrovascular accident		
Yes	Reference	0.039*
No	5.282 (0.268 to 10.297)	
Renal impairment		
Yes	Reference	0.005*
No	5.365 (1.656 to 9.075)	

*p<0.1

Table 4: The association between personality traits, psychological complications, and quality of life after adjusted for demographic, personal, and clinical characteristics

Variables	β (95% CI)[a]	β (95% CI)[b]	β (95% CI)[c]
BFI subscale:			
Openness	0.647 (-1.895 to 3.188)	0.531(-1.975 to 3.036)	0.528 (-2.060 to 3.116)
Conscientiousness	4.100* (1.206 to 6.995)	4.125* (1.273 to 6.978)	4.126* (1.189 to 7.064)
Neuroticism	-4.300* (-6.556 to -2.044)	-4.054* (-6.283 to -1.826)	-3.465* (-5.788 to -1.143)
Agreeableness	3.805* (0.854 to 6.755)	3.406* (.0487 to 6.325)	3.183* (0.167 to 6.199)
Extraversion	2.914* (0.458 to 5.370)	2.568* (0.138 to 4.999)	2.692* (0.181 to 5.203)
Mean BDI score	-0.647* (-0.860 to -0.435)	-0.624* (-0.834 to -0.414)	-0.560* (-0.779 to -0.341)
Mean GAD score	-0.168 (-0.539 to 0.203)	-0.147 (-0.513 to 0.218)	-0.243 (-0.623 to 0.137)

*statistical significance at $p<0.05$, [a]multiple linear regression model with $F(11,280) = 30.342$, $p<0.001$ with adjusted $R^2=0.536$ (adjusted for age, employment, education status and monthly income), [b]multiple linear regression model with $F(12,279)=29.398$, $p<0.001$ with adjusted $R^2=0.550$ (adjusted for age, employment, education status, monthly income and perceived social support), [c] multiple linear regression model with $F(16,275) = 21.755$, $p<0.001$ with adjusted $R^2=0.567$ (adjusted for age, employment, education status, monthly income, perceived social support, duration of diabetes mellitus, comorbid hypertension, cerebrovascular accident and renal impairment)

personality traits (extraversion, agreeableness, conscientiousness, neuroticism, and openness), psychological morbidity (depression and anxiety scores) and total QoL score while adjusting for significant demographic, personal, and clinical factors are summarised in Table 4. For all the regression models, both neuroticism personality trait and mean BDI score were associated with significant decrease in QoL. Other personality traits (conscientiousness, agreeableness, and extraversion) were shown to be significantly associated with an increase in QoL. There were no significant associations between openness personality trait and mean GAD score and QoL. Based on the third multiple linear regression model, after adjusting for age, employment, education status, monthly income, perceived social support, duration of diabetes mellitus, comorbid hypertension, cerebrovascular accident, and renal impairment, 1 unit increase in neuroticism and mean BDI score was associated with a 3.5 (95% CI -5.788 to -1.143) and 0.6 (95% CI -0.779 to -0.341) point decrease in QoL, respectively ($p<0.001$).

DISCUSSION

This study examined the QoL among Malaysian patients with DM and to determine its association with personality traits and the psychological morbidity. This investigation revealed several pivotal findings. Higher levels of neuroticism and depressive psychopathology were associated with low QoL. These findings were vigorous, as we included several important covariates in our final regression model.

The most notable finding from this study was a direct association between neuroticism and QoL. These findings shed further light into why DM adherence may prove to be more difficult and problematic

for some individuals, and not others, as reported by others in their studies (Taylor et al. 2003; Wheeler et al. 2012; Momeniarbat et al. 2017). These explained why medical intervention efforts aimed at improving adherence strategies may, at times, fails. The amalgamation of personality-emotional factors is associated with patient's dietary and behavioural activation (BA), like regularly practicing physical exercise.

Neuroticism is a personality trait characterised by the tendency toward anxiety and depressive psychopathology, self-doubt, and other negative feelings (Costa & McCrae 1987; Goldberg 1992). In theory, having depression with a concomitant neurotic personality trait would further impair the QoL among the DM patients. This is possibly linked by constantly chronic elevation of blood-sugar level mediated by the poor adherence to self-care and self-medication as results of self-neglect due to depressive psychopathology (low mood and worthlessness) and neurotic personality characteristic (irritability and self-doubt). This research is trying to link a path of guidance in the management of DM by focusing on these often-overlooked psychological nexuses.

For patients with higher neuroticism, it was associated with less focus on their DM efficacy control, as patients were preoccupied with their ongoing mental states such as anxiety, worry, fear, anger, frustration. Higher neuroticism is also associated with lower patient dietary and exercise adherence via their own depressive mental schema (Gonzalez et al. 2008). Our finding supports earlier evidence on the relationship between depressive psychopathology, such as anhedonia (lack of interest), impaired judgment (due to hopelessness and worthlessness) and poor DM control (self-neglect) (Gonzalez et al. 2008).

Neuroticism is an important personality characteristic that is associated with both patient dietary and exercise adherence, possibly mediated through mechanisms of poor BA (interest for involvement in an active lifestyle) and depressive psychopathology (perceived everything outside in the world as 'gloomy'). Neuroticism is associated with poorer DM management behaviours as results of unfavourable outcomes from the mental set like grumpiness, irritability, and depressive presentation. As the depressive symptoms lead to a sense of low motivation, the patients develops a lack of confidence in managing his or her chronic DM illness (Anderson et al. 2001; Pouwer 2017). Patient's adherence to DM management is more vulnerable to his or her negative mood symptoms including anger, low mood, and impaired vegetative functions (sleep and appetite). As a result, disturbed sleep, poor food intake and medication neglect disturbs the haemostatic and blood sugar regulation. Sense of being sick predisposes to an emotional reaction which may be more outwardly demonstrated, and on another hand, depressive symptoms may be more internally experienced (eg., low mood, feelings of hopelessness and worthlessness). Patients who are

clinically depressed and have a highly neuroticism personality formed a combined negative construct in the perspective of his or her life in relation to medication's adherence. As the patient deepens into a depressive state, the mental state captures fewer broad emotional reactions. This subsequently will decrease the patient's confidence level and ability to manage their DM holistically.

Identifying individual personality traits, i.e. patient's characteristic may assist medical personnel in handling patients with DM for a more effective medication adherence. This could be linked with an individualised therapy, psychosocial intervention, or enhancing patients' resilience by nurturing positive coping skill based on their unique personality traits. There are growing interests in regulating interventions at the conscious and unconscious processes through which personality is expressed in behaviour and subsequently effects the QoL. For example, approaches for DM evaluation and assessment could be pursued based on personality characteristics during regular clinical sessions, with the goal of enhancing QoL (Hampson 2012). Identifying the relationships of a personality trait to QoL may be able to enhance individual DM self-management. It is also possible that the self-knowledge by individuals of their own personality traits/characteristics and the predictable connection of these psychosocial characteristics to their well-being may affect their tendency to adopt unique targeted mediations in regulating the blood sugars (Hampson 2012). For example, in relation to the personality characteristics, it is worth explaining the processes by which the 'psychological make-up', like being moody at times, may cause the patient to be inclined in neglecting their medications. Subsequently, the chronicity of the uncontrolled blood sugar may cause dehydration, chronic fatigue, and malaise that exacerbated the depressive psychopathology. This ultimately will lead to crucial outcomes such as feeling of lack of well-being, poorer longevity and low QoL over the course of life (Roberts et al. 2007). The personality characteristics - the 'psychological make-up' would determine the QoL outcomes probably by mediating the link between variables of interest, i.e. treatment regimens and QoL outcomes. Hence, the personality variables should be accounted for in the future study or research design to understand and clearly interpret on the subsequent roles and impact of traits versus states on QoL.

This study has several limitations. First, this is a cross-sectional study, so it is difficult to elucidate accurately the causal relationships. It would be ideal to conduct a prospective study on the same group of respondents in the future to establish the possible long-term effects of a personality trait, like neuroticism, on the QoL and DM self-care. Second, there was a recall-bias potential in providing the information needed, as many respondents were of older age. Third, we did not measure the magnitudes for the corresponding associations between specific personality characteristics to either psychosocial or physical aspects of

QoL, as neuroticism may be associated with mental aspects of QoL. Personality trait involvements have indirect, intermediating and moderating effects on different domain of QoL. Construing these complex relationships may be problematic due overlap in how the constructs of personality and QoL are operationalised. With regards to QoL, further research is required to differentiate between the various constructs and measures of personality and affective domains. The thoughtful and systematic registry of personality data could be valuable and beneficial for both research and clinical practice in managing DM. Lastly, there will be difficulties to generalise this study outcome to the general population as a large proportion of respondents in this study had severe diabetes.

DM is a metabolic disorder characterised by hyperglycaemia frequently resulting from insufficient insulin production or an ineffective cellular response to insulin. Due to the chronicity, management of DM is a life-long process. Patients with DM often feel stressed with their daily self-care demands such as dietary control and adherence to the medication. Uncontrolled and prolong hyperglycaemia can lead to multi-organ failure and reduce the QoL. Furthermore, patients with DM are more prone to suffer from psychological complications such as depression and anxiety, which further reduces their QoL (Anderson et al. 2001). This will consequently affect the motivation and adherence to the treatment and self-care. Thus, this will worsen their glycaemic control and, in the end, increases their risk for psychological complications even further. Furthermore, a person's personality trait also is a pivotal factor that determines adherence to the diabetic treatment regime. Neuroticism, in particular, is a personality trait characterised by the tendency toward anxiety, depression, self-doubt, and other negative feelings (Costa & McCrae 1987; Goldberg 1992). In fact, researchers have reported an empirical link between high neuroticism traits and poor health (Smith & MacKenzie 2006) as well as a sense of low well-being (Kessler et al. 2010). In theory, having depression with a neurotic personality trait would further impair the adherence to self-care, thus affecting QoL even more. This research was conducted to offer guidance on management of DM focusing on these often-overlooked factors. There is an opportunity to propose and create personality measures into the electronic medical and health record (EMHR) as a form of patient-generated data registry for future studies as the COVID-19 pandemic may restrict face to face (in person) data collection and analysis (Wu et al. 2013). This study focuses on the association between neuroticism personality traits and depressive psychopathology with the quality of life among patients with DM. It will be more comprehensive if other factors related to diabetes such as exercise and dietary intake are included in this study.

CONCLUSION

In the conclusion, DM is a chronic

medical disorder characterised by impaired blood sugar control, which is a life-long process course of illness and associated with mental-health comorbidities. As patients with DM are often struggling with adhering to their oral and injectable hypoglycemic agents, they also felt stressed with their daily self-care demands, i.e., maintenance of a well-controlled dietary food intake in order to prevent complications, like poor wound healing, sense of 'being sick' as results of poor glycaemic control, and prevention of diabetic foot ulcer. Patients with DM are associated with more with psychological sequele such as depressive psychopathology may add to the patients' misery and reduces their QoL. This psychiatric morbidity will consequently affect the motivation and adherence to the treatment and self-care. Thus, this will aggravate their glycaemic control and regulation, and in the end, pushes their risk for mental-health-problem even further. The clinical and research importance of the interactions between personality and QoL suggested farther implications for health policy and good clinical practice. We believe that personality characteristics should be measured more routinely in our clinical practice, as well as for clinical and health care exploration.

REFERENCES

Anderson, R.J., Freedland, K.E., Clouse, R.E., Lustman, P.J. 2001. The prevalence of comorbid depression. *Diabetes Care* **24**(6): 1069-78.

Baghianimoghadam M.H., Afkhami Ardakani, M., Mazloomi, S.S., Saaidizadeh, M. 2007. Quality of life in diabetes type II patients in Yazd. *J Shaheed Sadoughi Univ Med Sci* **14**(4): 49-54.

Beck, A.T., Steer, R.A., Carbin M.G. 1988. Psychometric properties of the Beck Depression Inventory: twenty five years of evaluation. *Clin Psychol Rev* **8**(1): 77-100.

Cheah, W., Lee, P., Lim, P., Nabila, A., Luk, K., Nur Irwana, A. 2012. Perception of quality of life among people with diabetes. *Malays Fam Physician* **7**(2-3): 21-30.

Costa, P.T., McCrae, R.R. 1987. Neuroticism, somatic complaints, and disease: Is the bark worse than the bite? *J Pers* **55**(2): 299-316.

Goldberg, L.R. 1992. The development of makers of the Big-Five factor structure. *Psyhological Assess* **4**(1): 26-42.

Gonzalez, J.S., Peyrot, M., McCarl, L.A., Collins, E.M., Serpa, L., Mimiaga, M.J., Safren, S.A. 2008. Depression and diabetes treatment nonadherence: A meta-analysis. *Diabetes Care* **31**(12): 2398-403.

Hampson, S.E. 2012. Personality processes: Mechanisms by which personality traits "get outside the skin". *Annu Rev Psychol* **63**: 315-39.

Hasanah, C.I., Naing, L., Rahman, A.R. 2003. World Health Organization quality of life assessment : brief version in Bahasa Malaysia. *Med J Malaysia* **58**(1): 79-88.

Institute for Public Health 2020. National Health and Morbidity Survey (NHMS) 2019: Non-communicable diseases, healthcare demand, and health literacy-Key Findings. http://iku.gov.my/images/IKU/Document/REPORT/NHMS2019/Infographic_Booklet_NHMS_2019-English.pdf. {24 December 2020}

International Diabetes Federation 2019. *IDF Diabetes Atlas, 9th edn. Brussels, Belgium*. https://www.diabetesatlas.org. {6 January 2021}

John, O.P., Donahue, E.M., Kentle, R.L. 1991. The big five inventory: Versions 4a and 54. Berkeley: University of California, Institute of Personality and Social Research.

Kessler, R.C., Ruscio, A.M., Shear, K., Wittchen, H.U. 2010. Epidemiology of anxiety disorders. *Curr Top Behav Neurosci* **2:** 21-35.

Knol, M.J., Twisk, J.W., Beekman, A.T., Heine, R.J., Snoek, F.J., Pouwer, F. 2006. Depression as a risk factor for the onset of type 2 diabetes mellitus. A meta-analysis. *Diabetologia* **49**(5): 837-45.

Momeniarbat, F., Karimi, J., Erfani, N., Kiani, J. 2017. The role of neuroticism and psychological flexibility in chronic fatigue and quality of life in patients with type 2 diabetes. *Rom J Diabetes Nutr Metab Dis* **24**(2): 137-48.

Muhamad, H., Roodenburg, J., Moore, D.W. 2018. The adaptation of the Big Five Inventory in measuring Malaysian youths' personality traits. *Int J Adv Appl Sci* **5**(7): 8-14.

Muhktar, F., Oei, T.P. 2008. Exploratory and confirmatory factor validation and psychometric

properties of the Beck Depression Inventory for Malays (BDI-Malay) in Malaysia. *Malaysian J Psychiatry* **17**(1): 51-64.

Pouwer, F. 2017. Depression: a common and burdensome complication of diabetes that warrants the continued attention of clinicians, researchers and healthcare policy makers. *Diabetologia* **60**(1): 30-4.

Pouwer, F., Hermanns, N. 2009. Insulin therapy and quality of life. A review. *Diabetes Metab Res Rev* **25**(Suppl 1): S4-10.

Renn, B.N., Feliciano, L., Segal, D.L. 2011. The bidirectional relationship of depression and diabetes: A systematic review. *Clin Psychol Rev* **31**(8): 1239-46.

Roberts, B.W., Kuncel, N.R., Shiner, R., Caspi, A., Goldberg, L.R. 2007. The power of personality the comparative validity of personality traits, socioeconomic status, and cognitive ability for predicting important life outcomes. *Perspect Psychol Sci* **2**(4): 313-45.

Scollan-Koliopoulos, M., Bleich, D., Rapp, K.J., Wong, P., Hofmann, C.J., Raghuwanshi, M. 2013. Health-related quality of life, disease severity, and anticipated trajectory of diabetes. *Diabetes Educ* **39**(1): 83-91.

Sidik, S.M., Arroll, B., Goodyear-Smith, F. 2012. Validation of the GAD-7 (Malay version) among women attending a primary care clinic in Malaysia. *J Prim Health Care* **4**(1): 5-11.

Smith, T.W., MacKenzie, J. 2006. Personality and risk of physical illness. *Annu Rev Clin Psychol* **2**: 435-67.

Spitzer, R.L., Kroenke, K., Williams, J.B., Lowe, B. 2006. A brief measure for assessing generalized anxiety disorder. *Arch Intern Med* **166**(10): 1092-7.

Sundaram, M., Kavookjian, J., Patrick, J.H., Miller, L.A., Madhavan, S.S., Scott, V.G. 2007. Quality of life, health status and clinical outcomes in type 2 diabetes patients. *Qual Life Res* **16**(2): 165-77.

Sutin, A.R., Costa, P.T., Uda, M., Ferrucci, L., Schlessinger, D., Terracciano, A. 2010. Personality and metabolic syndrome. *Age* **32**(4): 513-9.

Taylor, M.D., Frier, B.M., Gold, A.E., Deary, I.J. 2003. Edinburgh Prospective Diabetes Study. Psychosocial factors and diabetes-related outcomes following diagnosis of Type 1 diabetes in adults: the Edinburgh Prospective Diabetes Study. *Diabet Med* **20**(2): 135-46.

van Dooren, F.E., Denollet, J., Verhey, F.R., Stehouwer, C.D., Sep, S.J., Henry, R.M., Kremers, S.P., Dagnelie, P.C., Schaper, N.C., van der Kallen, C.J., Koster, A., Pouwer, F., Schram, M.T. 2016. Psychological and personality factors in type 2 diabetes mellitus, presenting the rationale and exploratory results from The Maastricht Study, a population-based cohort study. *BMC Psychiatry* **16**: 17.

Wheeler, K., Wagaman, A., McCord, D. 2012. Personality traits as predictors of adherence in adolescents with type I diabetes. *J Child Adolesc Psychiatr Nurs* **25**(2): 66-74.

Wu, A.W., Kharrazi, H., Boulware, L.E., Snyder, C.F. 2013. Measure once, cut twice - Adding patient-reported outcome measures to the electronic health record for comparative effectiveness research. *J Clin Epidemiol* **66**(8): S12-20.

Received: 19 Jan 2021
Accepted: 19 Feb 2021