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Original Article

Depression, anxiety, stress and socio-demographic factors for poor glycaemic control in patients with type II diabetes

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الملخص

أهداف البحث: هدفت هذه الدراسة إلى تحديد المخاطر الناجمة عن الاكتئاب والقلق والإجهاد، والعوامل ذات الارتباط الاجتماعي الديموغرافي بضعف التحكم في نسبة السكر في الدم بين مرضى السكري من النوع الثاني في كوالا تيرينجانو، ماليزيا.

طرق البحث: أُجريت هذه الدراسة المقطعية في عيادتين صحيتين ماليزيتين عن طريق توزيع نسخة استبانة ماليزية ذاتية التعبئة. تحتوي هذه الأداة على ملامح رعاية مرض السكري، والاكتئاب، والقلق، ومقياس الإجهاد ٢١، والدرجة الماليزية للالتزام بالدواء. أُجرِيَت تحليلات الانحدار اللوجستي البسيطة والمتعددة.

النتائج: استجاب ما مجموعه ٣٣٨ من مرضى السكري من النوع الثاني (معدل الاستجابة ٩٣.١٪). كانت نسبة المرضى الذين يعانون من ضعف السيطرة على مستوى السكر في الدم ٧٦.٠٪. وأظهر تحليل الانحدار اللوجستي المتعدد أن درجة الدعم الاجتماعي [نسبة الاحتمالية المعدلة (بفاصل ثقة ٩٥٪): ١.٠٦ (١.٠٣, ١.١٠)] والبطالة [نسبة الاحتمالية المعدلة (بفاصل ثقة٩٥٪): ٠.٤٦ (٠.٢٢,٠.٩٥)] والتقاعد [نسبة الاحتمالية المعدلة (بفاصل ثقة ٩٥٪): ٠.٢٨ (٠.١٣,٠.٦١)] وتصور داء السكري على أنه يعرقل نشاط الحياة اليومية [نسبة الاحتمالية المعدلة (بفاصل ثقة ٩٥٪): ٣.١٨ (١.١٧,٨.٧٠)] كانت عوامل هامة لضعف السيطرة على نسبة السكر في الدم.

الاستنتاجات: إن البطالة وتصور داء السكري على أنه يعرقل نشاط الحياة اليومية والدعم الاجتماعي مرتبطة بشكل كبير مع ضعف السيطرة على مستوى السكر في الدم. يُقترح إجراء مزيد من الدراسة لتقييم عوامل سريرية ونفسية اجتماعية هامة أخرى قد تؤثر على السيطرة على مستوى السكر في الدم. كما يُنصح بدراسة الأصغر سنا لتحقيق نتائج أفضل والتطبيق التداخلي للنتائج.

الكلمات المفتاحية: القلق؛ كآبة؛ السيطرة على مرض السكري؛ حالة نسبة السكر في الدم؛ الإجهاد

Abstract

Objective: This study aims to identify risks induced by depression, anxiety, stress, and socio-demographic factors associated with poor glycaemic control among type II diabetes mellitus patients in Kuala Terengganu, Malaysia.

Methods: This cross-sectional study was performed in two Malaysian health clinics by using the Malay version of a self-administered questionnaire. This instrument contains a diabetes care profile, a 21-item version of the Depression Anxiety Stress Scales (DASS21), and a Malaysian Medication Adherence Score (MalMAS). Simple and multiple logistic regression analyses were performed.

Results: A total of 338 type II diabetes mellitus patients responded (response rate 93.1%). The proportion of patients with poor glycaemic control was 76.0%. Multiple logistic regression analysis showed that 1) social support scores [Adj. *OR* (95% CI): 1.06 (1.03,1.10); p = 0.001]; 2) unemployment [Adj. *OR* (95% CI): 0.46 (0.22,0.95); p = 0.035]; 3) pensioner status [Adj. *OR* (95% CI): 0.28 (0.13,0.61); p = 0.001]; and 4) perception of diabetes as interfering with daily living activities [Adj. *OR* (95% CI):

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3.18 (1.17,8.70); p = 0.024] were significant factors for poor glycaemic control.

Conclusions: Unemployment, perception of diabetes' interference with daily living activities, and social support are significantly correlated with poor glycaemic control. Further studies assessing other important clinical and psychosocial factors that may influence glycaemic control are suggested. A younger age range of participants is recommended for better outcomes and interventional implementation of findings.

Keywords: Anxiety; Depression; Diabetes control; Glycaemic status; Stress

Introduction

A chronic and debilitating disease, diabetes has become a major public health concern. More than 180 million people worldwide have diabetes, and this number is expected to double by 2030.[1] In Malaysia, according to the 2006 National Health and Morbidity Survey (NHMS), the prevalence of diabetes in persons aged 18 years or older was 11.6%.[2] The 2015 NHMS showed an increase to 17.5%.[3] Despite aggressive health awareness campaigns, approximately one in five Malaysians over the age of 30 has diabetes.[4]

Cardiovascular disease events are more likely to happen in type II diabetes mellitus patients. The Framingham Heart Study (FHS) showed that subjects with diabetes were exposed to all major atherosclerotic diseases, the most common and lethal of which is coronary heart disease.[5] In Malaysia, the prevalence of diabetes patients with poor glycaemic control is almost 80%.[6] Achieving good glycaemic control requires patients to follow a treatment regime including lifelong behavioural changes, regulation through lifestyle changes, and self-management skills. These are the psychosocial factors involved in the management of diabetes.

The term 'psychosocial' has been defined in several ways. It is described variously as 1) pertaining to or involving both psychic and social aspects[7]; 2) referring to a person's psychological development in, and interaction with, a social environment[8]; and 3) the mind's ability to, consciously or unconsciously, adjust and relate the body to its social environment.[9] Psychosocial factors are believed to be involved in glycaemic control, and in patients' adherence to initial diabetes treatment.[10] Assessments of psychosocial relationship patterns (and their effects on glycaemic control among youth with insulin-dependent diabetes) have had variable outcomes. Accordingly, they have become an area of inquiry.[11]

In terms of psychological factors, patients with poor glycaemic control were less able to cope with stress than their counterparts.[10] Stress caused a significantly delayed decrease of glucose concentrations, thus rendering patients susceptible to worse glycaemic control.[12] A systematic review found that people with type II diabetes mellitus have almost double the risk of depression than those without diabetes.[13] Stress can indirectly disrupt diabetes control through the effects of diet, exercise, and other self-care behaviours.[14–16] The experience of stress elevates glucose levels, and causes the release of counter-regulatory hormones.[17]

With regard to social factors, patients with a shorter duration of diabetes (<5 years) had the best glycaemic control.[18] Older adults often have higher atherosclerotic disease burdens, reduced renal function, and more comorbidities.[19–21] Younger individuals may have more ambitious glycaemic targets compared to elderly persons with longstanding or more complicated disease histories.[21,22]

The main goals in diabetes care are to maintain satisfactory metabolic control, to minimise diabetes complications, and to improve quality of life.[23] Assessment of associated psychosocial factors would allow healthcare providers and patients to gain more informed knowledge, enabling them to make changes for better glycaemic control. Most of the studies on psychosocial factors involved children of type I diabetes patients. Limited studies were conducted among type II diabetes patients.

This study aimed to determine the prevalence of poor glycaemic control and its associated psychosocial factors in type II diabetes mellitus patients in Kuala Terengganu, Malaysia. In this study, poor glycaemic control is defined as a HbA_{1c} level $\geq$7.0%.[24] 'Psychosocial' refers to a person's psychological development in, and interaction with, a social environment.[8.] This was assessed based on the 21-item version of the Depression Anxiety and Stress Scales (DASS21) questionnaire.

Materials and Methods

Study design and sample

This is a cross-sectional study, conducted from December 2014 to June 2015. Two health clinics with family medicine specialists in Kuala Terengganu were involved. Adult patients aged 18 years and above, with a minimum five-year duration of type II diabetes mellitus, were included.[18,25] Patients with acute, severe illnesses or life-threatening conditions during a visit were excluded. These included ailments such as 1) acute coronary syndrome; 2) hypertensive urgencies; 3) acute stroke; 4) acute asthmatic attack; and 5) acute heart or renal failure. Patients with type I diabetes mellitus and/or diagnosed psychotic illnesses were also excluded.

The average number of type II diabetes mellitus patients visiting the clinics was 50–80 per day. Systematic random sampling in the ratio of 1:15 was applied in each clinic in order to obtain the calculated sample within the seven-month period. The sample size was calculated using single proportion testing, based on the 78% rate of poor glycaemic control among type II diabetes patients.[6] After taking into account the 20% non-response rate, it was determined that the necessary sample size for this study was 316 type II diabetes mellitus patients.

Research tools

The care report form has two components. First is the Malay version of a self-administered questionnaire requiring responses on socio-demographic and medical information, as well as social support (DASS21). Second is the Malaysian Medication Adherence Score questionnaire (MalMAS). The socio-demographic data questionnaire obtained information on 1) age; 2) gender; 3) race; 4) employment status; 5) income amount; 6) education level; 7) marital status; 8) smoking status; 9) living arrangement; 10) caretaker involvement; 11) transportation problems; and 12) perception of whether diabetes interferes with their daily activities. Diabetes records were reviewed to obtain information on patients' HbA_{1c} level within the past six months.

Social support: The Malay version the Diabetes Care Profile (DCP) has been used by the Michigan Diabetes Research and Training Centre[26,27] to assess psychosocial factors related to diabetes. These include the domains of 1) control; 2) social and personal factors; 3) positive attitude; 4) negative attitude; 5) self-care ability; and 6) exercise barriers. The original social support domain of DCP consists of four subdomains that determine 1) the type of help and support required by patients; 2) the type of help and support received by patients; 3) patients' feelings about the care received; and 4) the most caring person in diabetes patients' lives. The original scoring system allows every subdomain to be evaluated separately. In this study, only one subdomain (namely, the type of help and support received by patients) was applied. This subdomain consists of six items, scored using a 6-point Likert scale (0–5), with a total score of 30. Higher scores indicate better support from family or friends.[26] Reliability of the translated Malay version of DCP was tested among 45 diabetic patients, with the Cronbach's alpha of 0.76.

Malay version of DASS21: The Malay version of DASS21 is widely used to evaluate psychological aspects of type II diabetes mellitus in Malaysia.[28] It consists of 21 items, with three self-report scales to measure emotional states of depression, anxiety, and stress.[29] Each scale consists of seven items. The depression scale (i.e., items 3, 5, 10, 13, 16, 17 and 21) assesses dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest/involvement, anhedonia, and inertia. The anxiety scale (i.e., items 2, 4, 7, 9, 15, 19 and 20) assesses autonomic arousal, skeletal muscle effects, situational anxiety, and subjective experience of anxious affect. The stress scale (i.e., items 1, 6, 8, 11, 12, 14, and 18) is sensitive to levels of chronic non-specific arousal. It assesses difficulty relaxing, nervous arousal, being easily upset/agitated or irritable/over-reactive, and impatient.[30] Respondents were asked to use 4-point severity/frequency scales to rate the extent to which they had experienced each state over the past week.[31] Scores for each domain were calculated by summing the scores of the relevant items.[31] Scores were categorised into absence and presence of depression, anxiety, and stress.[32]

Malay version of MalMAS: MalMAS assesses medication adherence, and was based on the 8-item Morisky Medication Adherence Scale.[33,34] MalMAS consists of eight items. The first item has five answers: (i) all the time; (ii) often (>15 but less than 1 month); (iii) sometimes (6–15 times per month); (iv) rarely (1–5 times per month); and (v) never. These responses were scored, and the other seven items called for a dichotomous response of "Yes" or "No". The total MalMAS score ranged from 0 to 8. Medication adherence was categorised into high (score 8), medium (score 6-<8) and low (score <6).[33,34] The Cronbach's alpha of MalMAS was 0.689. None of its items showed significant difference in the test-retest analysis, indicating good reliability.[33]

Data collection

Type II diabetes mellitus patients were identified from the appointment list. Written informed consent was obtained from all patients prior to completing a 30-min, self-administered questionnaire. Diabetes records were reviewed for HbA_{1c} levels. In the absence of an HbA_{1c} level from the past six months, the test was performed on the day of the visit. Patients with abnormal laboratory findings or psychological problems were referred to the respective team for further evaluation and management.

Data analyses

Data entry and analysis were performed using SPSS version 22. Data exploration was performed using descriptive statistics and presented as mean (standard deviation, SD) or median (interquartile range, IQR). Simple and multiple logistic regression analyses were performed to determine associated factors for poor glycaemic control. Smoking status was categorized into current smoker (currently smoking or stopped smoking less than one year ago), ex-smoker (stopped smoking more than one year ago), and non-smoker (never smoked in their entire lifetime).[18,35] Living arrangement refers to those living with the respondents during day and night in the same house or compound area.

Results

A total of 363 type II diabetes mellitus patients were approached. Of these, 338 responded, yielding a response

Table 1: Socio-demographic characteristics of type II diabetes patients.

Characteristics	Total (n = 338) n (%)	Good glycaemic control (n = 81) n (%)	Poor glycaemic control (n = 257) n (%)
Age (years)	60.9 (10.3)[a]	63.56 (9.20)[a]	60.11 (10.49)[a]
Income (RM)	1000 (700, 2475)[b]	1000 (1800)[b]	1100 (1750)[b]
Social support score[b]	22.0 (5.5)	18 (13)	23 (11)
Gender			
Female	212 (62.7)	53 (65.4)	159 (61.9)
Male	126 (37.3)	28 (34.6)	98 (38.1)
Ethnicity			
Non-Malay	17 (5.0)	7 (8.6)	10 (3.9)
Malay	321 (95.0)	74 (91.4)	247 (96.1)
Educational level			
Tertiary	45 (13.3)	11 (13.6)	34 (13.2)
Secondary	181 (53.6)	42 (51.9)	139 (54.1)
Primary	81 (24.0)	21 (25.9)	60 (23.3)
No formal education	31 (9.2)	7 (8.6)	24 (9.4)
Marital status			
Married	267 (79.0)	61 (75.3)	206 (80.2)
Single	71 (21.0)	20 (24.7)	51 (19.8)
Employment status			
Employed	91 (27.0)	12 (14.8)	79 (30.9)
Unemployed	157 (46.6)	38 (46.9)	119 (46.5)
Pensioner	89 (26.4)	31 (38.3)	58 (22.6)
Smoking status			
Non-smoker	247 (73.1)	61 (75.3)	186 (72.4)
Ex-smoker	54 (16.0)	15 (18.5)	39 (15.2)
Current smoker	37 (10.9)	5 (6.2)	32 (12.4)
Living arrangement			
Family	218 (64.5)	42 (51.9)	176 (68.5)
Alone	106 (31.4)	35 (43.2)	71 (27.6)
Others	14 (4.1)	4 (4.9)	10 (3.9)
Caretaker			
Family	214 (63.3)	40 (49.4)	174 (67.7)
Alone	107 (31.7)	36 (44.4)	71 (27.6)
Others	17 (5.0)	5 (6.2)	12 (4.7)
Transportation problems			
No	289 (85.5)	73 (90.1)	216 (84.0)
Yes	49 (14.5)	8 (9.9)	41 (16.0)
DM interferes with ADL			
No	294 (87.0)	76 (93.8)	218 (84.8)
Yes	44 (13.0)	5 (6.2)	39 (15.2)

Note: ADL = activities of daily living, DM = diabetes mellitus, RM = Ringgit Malaysia.
[a] Value expressed in mean (standard deviation, SD).
[b] Value expressed in median (interquartile range).

rate of 93.1%. The proportion of patients with poor glycaemic control was 76.0% (n = 257), and the overall mean (SD) HbA_{1c} level was 8.6 (1.95%).

Socio-demographic, psychological, and medical characteristics

Table 1 shows the socio-demographic backgrounds of the 338 type II diabetes mellitus patients who were involved in this study. The respondents' ages ranged from 21 to 86 years old, with a mean (SD) of 60.9 (10.3) years. They were mostly female (62.7%). The respondents' social support scores ranged from 0 to 30, with a median score (IQR) of 22.0 (5.5).

Table 2 shows the psychological and medical characteristics of type II diabetes patients. Most respondents had no symptoms of depression, anxiety, or stress. Most patients were obese, had low to medium medication adherence, and had underlying comorbidities (including hypertension and dyslipidaemia).

Associated factors for poor glycaemic control

Table 3 shows the associated factors for poor glycaemic control using simple logistic regression analysis. Using

Table 2: Psychological and medical characteristics of type II diabetes patients.

Characteristics	Total (n = 338) n (%)	Good glycaemic control (n = 81) n (%)	Poor glycaemic control (n = 257) n (%)
Psychological			
Depression			
No	286 (84.6)	68 (84.0)	218 (84.8)
Yes	52 (15.4)	13 (16.0)	39 (15.2)
Anxiety			
No	272 (80.5)	70 (86.4)	202 (78.6)
Yes	66 (19.5)	11 (13.6)	55 (21.4)
Stress			
No	304 (89.9)	75 (92.6)	229 (89.1)
Yes	34 (10.1)	6 (7.4)	28 (10.9)
Medical			
Body mass index class			
Normal	66 (19.5)	23 (28.7)	43 (16.7)
Overweight	123 (36.4)	27 (33.3)	96 (37.4)
Obese	149 (44.1)	31 (38.3)	118 (45.9)
Compliance level			
Low adherence	144 (42.6)	18 (22.2)	126 (49.0)
Medium adherence	125 (37.0)	41 (50.6)	84 (32.7)
High adherence	69 (20.4)	22 (27.2)	47 (18.3)
Hypertension			
Yes	295 (87.3)	72 (88.9)	223 (86.8)
No	43 (12.7)	9 (11.1)	34 (13.2)
Dyslipidaemia			
Yes	297 (87.9)	72 (88.9)	225 (87.5)
No	41 (12.1)	9 (11.1)	32 (12.5)
Ischemic heart disease			
Yes	37 (10.9)	5 (6.2)	32 (12.5)
No	301 (89.1)	76 (93.8)	225 (87.5)
Cerebrovascular accident			
Yes	18 (5.3)	5 (6.2)	13 (5.1)
No	320 (94.7)	76 (93.8)	244 (94.9)
End stage renal failure			
Yes	12 (3.6)	4 (4.9)	8 (3.1)
No	326 (96.4)	77 (95.1)	249 (96.9)
Retinopathy			
Yes	93 (27.5)	14 (17.3)	79 (30.7)
No	245 (72.5)	67 (82.7)	178 (69.3)
Nephropathy			
Yes	167 (49.4)	35 (43.2)	132 (51.4)
No	171 (50.6)	46 (56.8)	125 (48.6)
Neuropathy			
Yes	150 (44.4)	24 (29.6)	126 (49.0)
No	188 (55.6)	57 (70.4)	131 (51.0)

Table 3: Associated factors for poor glycaemic control using simple logistic regression analysis.

Variable	Regression coefficient	Crude odds ratio (95% CI)	Wald statistic	p-value
Age (years)	−0.04	0.97 (0.94,0.99)	6.79	0.009
Income (RM)	0	2.97 (1.00,1.00)	0.53	0.467
Social support score	0.05	1.05 (1.02,1.09)	10.00	0.002
Gender				
Female		1		
Male	−0.15	0.85 (0.51,1.45)	0.33	0.563
Ethnicity				
Non-Malay		1		
Malay	−0.85	0.43 (0.15,1.16)	2.77	0.096
Level of education				
Tertiary		1		
Secondary	0.10	1.11 (0.38,3.27)	0.04	0.851
Primary	−0.08	0.92 (0.39,2.15)	0.03	0.924
None formal	0.07	1.07 (0.50,2.30)	0.03	0.861
Marital status				
Married	−0.28	1		
Single		0.75 (0.42,1.36)	0.87	0.351
Employment status				
Employed		1		
Unemployed	−0.74	0.48 (0.23,0.97)	4.22	0.040
Pensioner	−1.26	0.28 (0.14,0.60)	10.88	0.001
Smoking status				
Never smoke		1		
Ex-smoker	−0.16	0.85 (0.44,1.65)	0.22	0.637
Current smoker	0.74	2.10 (0.78,5.63)	2.17	0.140
Living arrangement				
Family		1		
Alone	−0.73	0.48 (0.29,0.82)	7.30	0.007
Others	−0.52	0.60 (0.18,2.00)	0.70	0.402
Care taker				
Family		1		
Alone	−0.79	0.45 (0.27,0.77)	8.62	0.003
Others	−0.60	0.55 (0.18,1.66)	1.13	0.289
Transportation problems				
No		1		
Yes	0.55	1.73 (0.78,3.87)	1.80	0.180
DM interferes with ADL				
No		1		
Yes	1.00	2.72 (1.03,7.15)	4.11	0.043
Depression				
No		1		
Yes	0.07	1.07 (0.54,2.12)	0.04	0.849
Anxiety				
No		1		
Yes	−0.55	0.58 (0.29,1.7)	2.35	0.125
Stress				
No		1		
Yes	−0.42	0.65 (0.26,1.64)	0.82	0.366

Note: ADL = activities of daily living, CI = confidence interval, DM = diabetes mellitus, RM = Ringgit Malaysia.

multiple logistic regression analysis, social support (p = 0.001), unemployment (p = 0.035), pensioner status (p = 0.001), and diabetes as interfering with activities of daily living (p = 0.024) were significant associated factors for poor glycaemic control (Table 4).

Model assumptions: The standard error and correlation were relatively small for the significant factors, and there is no significant interaction effect in the model (p > 0.05). Overall, the Hosmer−Lemeshow test (p-value = 0.321) correctly classified percentage of 76.3%, and the area under the receiver operating characteristic curve of 0.693 (95% CI: 0.63, 0.76) indicates that the model was fit.

Table 4: Associated factors for poor glycaemic control using multiple logistic regression analysis.

Variable	Regression coefficient	Adjusted odds ratio[a] (95% CI)	Wald statistic	p-value[a]
Social support score	0.06	1.06 (1.03,1.10)	11.80	0.001
Employment status				
Employed		1		
Unemployed	−0.78	0.46 (0.22,0.95)	4.46	0.035
Pensioner	−1.26	0.28 (0.13,0.61)	10.48	0.001
DM interfere ADL				
No		1		
Yes	1.16	3.18 (1.17,8.70)	5.11	0.024

Note: ADL = activities of daily living, CI = confidence interval, DM = diabetes mellitus.

[a] Forward LR multiple logistic regression model. No multicollinearity problem or significant interaction terms. Overall, the Hosmer–Lemeshow test (p = 0.321), correctly classified percentage of 76.3%, and area under the receiver operating characteristic curve of 69.3% indicates that the model was fit.

Discussion

Following the guidelines established by the American Association of Clinical Endocrinologists, the prevalence of poor glycaemic control in this study was 76.0% (based on HbA_{1c} of 7.0%).[36] A slight increase of poor glycaemic control was observed in comparison to a study done at the same facility in 2001–2002. That study, which used the same cut-off point, found a 72% rate of poor glycaemic control.[18] The Malaysia National Diabetes Registry (during the period of 2009–2012) and a local study both used the HbA_{1c} cut-off point of less than 6.5%. These studies reported poor glycaemic control rates of 76.2%[37] and 67.2%,[38] respectively. The latter study mainly involved respondents who were diagnosed as having diabetes for less than five years, but with a smaller sample (n = 61).

A study of approximately 900 diabetic patients (all of whom were less than 40 years old, with HbA_{1c} levels below 7.5%.) was conducted in nine centres in Malaysia. Among these patients, a 71.2% prevalence of poor glycaemic control was reported.[39] Worldwide, the prevalence of poor glycaemic control ranged from 67% to 76% of all diabetes patients.

Being employed, perceiving diabetes as an illness that interferes with daily activities, and better social support were significantly associated with poor glycaemic control. Previous studies reported associations between psychosocial factors and glycaemic control, but with mixed findings.[10,11,18,40–42]

Employment affects glycaemic control, possibly due to patients having less time for self-management of diabetes care. These self-care actions include taking medications, following a diet plan, getting adequate physical activity, and self-monitoring of blood glucose.[43] The perception that diabetes interferes with daily activities also contributes to poor glycaemic control. This is because improved health was related to better coping, as well as greater control over one's actions and decisions in managing the disease. Healthcare professionals should aim to increase patients' ability to make informed decisions about disease management. Efforts should also be made to improve patients' self-esteem and feelings of self-efficacy, thereby allowing them to become agents of their own health.[44]

Contradictory findings were reported on the topic of social support. Previous study showed that low adherence to diabetes medication regimes was found among participants with non-supportive family members.[45] However, health outcomes for persons with diabetes are determined by their bio-psycho-social characteristics and behaviours. Even with good social support, patients might have poor glycaemic control, as inner motivation, personal character, and behaviour play important roles in the self-management of illness.[46] Glycaemic control was directly affected by self-care behaviours, while self-care was directly affected by access to healthy foods and social support. Family and social support have indirect effects on glycaemic control, as these sources of aid act as instruments for the facilitation of diabetes self-care behaviours.[47]

In relation to glycaemic control, other studies have reported no association with sex,[48,49] education level,[49] or income.[49] However, associations with glycaemic control were reported with regard to age,[18] ethnicity,[18] marital status,[49,50] and duration of diabetes mellitus.[18]

We were unable to show any significant association between depression, anxiety, and stress with glycaemic control in our study population. A study conducted among a younger urban population in Malaysia showed that anxiety and stress have significant associations with higher HbA_{1c} levels (>8.5%). That study also reported a higher prevalence of anxiety and stress symptoms among type II diabetes mellitus patients, at 30.5% and 12.5%, respectively.[51]

Several studies have found associations between stress and glycaemic control.[52–54] A systemic review and meta-analysis study reported that anxiety disorders and symptoms were elevated in diabetes patients.[55] Positive relationships were found between psychological stress, anxiety, and depressive symptoms. A negative coping style was positively related to anxiety and depressive symptoms. In contrast, an active coping style and subjective social support were negatively associated with depressive symptoms.[56] Patients' perception of their health status was found to affect both anxiety and depression.[57] However, no correlation was found between glycaemic control and depression or anxiety.[57]

Depression is twice as common in those with diabetes than in the general population, and is associated with hyperglycaemic, early complications, and greater hospitalization rates. Despite the availability of effective antidepressant treatments, depression is under-diagnosed and under-treated in approximately 50% of cases.[58] We referred respondents with these issues to corresponding outpatient health clinics for further evaluation and management. Screening for psychological symptoms is important; greater levels of disability, diabetes symptoms, regimen distress, being female, less diabetes self-care, and a lack of HbA_{1c} are all factors which may worsen patients' psychological prognosis.[59]

Limitations and further research

A majority of the participants in Kuala Terengganu are Malays. Therefore, this sample is not representative of multiple ethnic groups. Other factors that influence glycaemic control (such as self-care, dietary intake, physical activity, and respondents' medical backgrounds) were not explored. Further study to assess other important clinical and psychosocial factors that may influence glycaemic control is suggested. The involvement of younger diabetes patients is recommended for better outcomes and interventional implementation of findings. This is a cross-sectional study; therefore, a causal relationship cannot be established.

Conclusions

The prevalence of poor glycaemic control among type II diabetes mellitus patients in Kuala Terengganu is 76.0%. Unemployment, perception of disease interference with the activities of daily living, and social support are factors significantly associated with poor glycaemic control. Further study to assess other important clinical and psychosocial factors that may influence glycaemic control is suggested. Studies of younger populations are recommended for better outcomes and interventional implementation of findings.

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None.

Conflict of interest

The authors have no conflict of interest to declare.

Ethical approval

The Human Research Ethics Committee Universiti Sains Malaysia (IRB Reg. No. 00004494) approved the protocol of this study. Patients were provided information related to the study along with an Information and Consent Form. Confidentiality was ensured and written informed consent was obtained.

Authors' contributions

NSMH conceived and designed the study, conducted research, provided research materials, and collected and organized data. NSMH, NMN analyzed and interpreted data. All authors wrote initial and final draft of article, and provided logistic support. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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