ORIGINAL ARTICLE

Cross-Sectional Study of Glycaemic Control Among Women with Type 2 Diabetes Mellitus in A Primary Health Care Clinic: A Call for Tailored Intervention

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ABSTRACT

INTRODUCTION: More than two thirds of the women attending primary health care (PHC) clinics have poor glycaemic control with lifestyle, stress, and attitudes as risk factors towards poor type 2 diabetes mellitus (T2DM) control. This study aims to determine the prevalence and identifying the factors associated with poor glycaemic control among the T2DM women in PHC clinic. **MATERIALS AND METHODS:** This is a cross-sectional study on women with T2DM in Seremban Health Clinic (HC), Negeri Sembilan, conducted over 3 months from January-April 2023. The women were recruited through systematic random sampling. Information was gathered using medical records and self-administered questionnaires. Factors associated with poor glycaemic controlled were determined using multiple logistic regression analysis. **RESULTS:** The prevalence of poor glycaemic control among women with T2DM in Seremban HC is 57.8%. Factors found to be associated with poor glycaemic control among these women included age ≥60 years old (aOR 2.26; 95% CI 1.35, 3.78), non-Malay ethnicity (aOR 1.89; 95% CI 1.05, 3.40), non-insulin treatment (aOR 7.56; 95% CI 4.13, 13.84), and perceived social support (aOR 1.47; 95% CI 1.12, 1.91). **CONCLUSION:** Over half of the women with T2DM attending Seremban HC have poor glycaemic control, associated with factors such as age ≥ 60 years, non-Malay ethnicity, non-insulin treatment, and perceived higher social support. This suggests a need for a women-centred primary care strategies to manage T2DM, potentially enabling the development of tailored interventions specifically for women. Collaboration with healthcare providers and policymakers could further enhance the glycaemic control among women with T2DM.

Keywords
Type 2 diabetes mellitus, women, glycaemic control

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INTRODUCTION

The global prevalence of diabetes mellitus (DM) is estimated at 10.5%, affecting approximately 537 million individuals worldwide and 90% of them are diagnosed with Type 2 Diabetes Mellitus (T2DM).[1] The rising prevalence of T2DM in Asia, now ranging from 8.1% to 9.6%, has emerged as a leading cause of death with varying impacts across regions.[2,3] Achieving optimal glycaemic control in T2DM individuals is crucial, assessed through multiple parameters, however HbA1c stands out as the most recommended metric, correlating with average plasma glucose over the past 8-12 weeks.[4] Optimal control based on HbA1c, typically within the range of 6.5%-8.0%, with a preferred target of 7.0%, aims to mitigate long-term complications.[1,5,6]

Diverse factors contribute to the susceptibility and outcomes of T2DM especially among women with T2DM as they often exhibit poorer glycaemic control than men, leading to increased risks of complications such as cardiovascular disease, mortality, and mental health

challenges.[7,8] A significant proportion of women with T2DM are treated in primary healthcare settings.[9] Studies conducted in Indonesia, Saudi, and Morrocco PHC settings revealed that 47.7%-71.4% of women with T2DM had poor glycaemic control.[10-12] Thus, identifying and addressing the factors related to glycaemic control is crucial for managing T2DM, especially among women.[2,4]

In Malaysia, DM has increased significantly over the past decades, with a prevalence of 14.3%, higher than that of its neighbouring countries.[13] Out of 1,698,683 active DM individuals, 99.33% are diagnosed with T2DM, with 57.02% being females.[14] Poor glycaemic control among T2DM women is reported to be between 66.1%-79.5% in PHC clinics.[14-16] Negeri Sembilan, a state with a substantial T2DM burden and the highest prevalence in Malaysia, may serve as a model for understanding and addressing these challenges, highlighting the urgency for comprehensive strategies.[14, 17] However, in the last 5 years, only 1 study on T2DM patients has been conducted in the state, focused on diabetes literacy and knowledge.[18] Therefore, the current study in Seremban seeks to bridge the gaps by determining the prevalence of poor glycaemic control and identifying the factors associated with glycaemic control among women with T2DM, offering actionable recommendations. Given the limited focus on gender-specific management methods for glycaemic control, this research aims to contribute significantly to the field.

MATERIALS AND METHODS

Study design and population

This study was a cross-sectional study involving women with T2DM under follow-up at the Non-Communicable Disease (NCD) Unit in Seremban Health Clinic, conducted over 3 months from 12 January-12 April 2023. Written informed consent was obtained from all participants prior to enrolment. Women with T2DM who met the study criteria (i) aged 18 years old and above (ii) diagnosed with T2DM for at least one year, (iii) able to write and read in Malay language *(Bahasa Melayu)* or English were included in the study. Those with (i) acute complaint/life threatening event during visit, (ii) cognitive impairment, (iii) hearing/vision impairment, (iv) psychiatric illness, or (v) physical disability were excluded from the study. Seremban Health Clinic, is one of the largest government primary health clinics in Negeri Sembilan, with approximately 800 women with T2DM attending the clinic monthly. The current study is part of bigger study on glycaemic controls, and the details of the study also have been published elsewhere. [19]

The sample size for the study was calculated using the OpenEpi Sample Size Calculation software with a two-sided confidence interval of 95%, power of 80%, and precision of ±0.05 based on a reference study by Ghouse et al., which assessed the effect of diabetes duration on the relationship with glycaemic control.[20] The authors reported that among those who has been diagnosed with T2DM for less than 5 years, 18.9% had poor glycaemic control, whereas 42.6% of those diagnosed with T2DM for 5 years or more had poor glycaemic control. From the calculated sample of 134 women, an additional 10% of the sample was added to compensate for missing data and non-response, resulting in a minimal final sample size of 148 women. A systematic sampling method was used in this study. All women with T2DM registered for follow-up at Seremban Health Clinic were identified and numbered. Those with even numbers (6th number) were chosen at a random point and invited to participate in the study.

Study Instruments

A bilingual (English and Malay language) self-administered structured questionnaires was used to collect data in this study.[19] The questionnaires were divided into six parts: (i) sociodemographic, clinical characteristics and medication, (ii) The Summary of Diabetes Self-care Activities (SDSCA), (iii) problem-focused coping strategies using the Brief Coping Orientation to Problems Experienced (Brief-COPE), (iv) The Scale for Measuring Role Strain in Women with Diabetes (SMRSWD), (v) The Multidimensional Scale of Perceived Social Support (MSPSS), (vi) perceiving diabetes as a priority. Permission to use the questionnaires from the original authors was obtained prior to the study.

The SDSCA by Toobert et. al., 1988, is used to assess the level of self-care among women.[21] The original version of consists of a 12-item scale, but the latest version of the SDSCA comprises of 10 items for self-care, organised into four key domains: (i) general diet (2 items) and specific diet (2 items), (ii) exercise (2 items), (iii) blood sugar (2 items), and (iv) foot care (2 items), utilising a 7-point Likert scale. General diet refers to overall healthy eating habit whereas specific diet is eating behaviours for diabetes control. Participants choose a score between 0-7 to indicate their self-care activities for the past seven days, with 0 representing 'none of the days' and 7 representing 'all seven days'. The total score ranges from 0-70, with higher scores indicating better performance of self-care activities for the past seven days. The Malay version of the SDSCA is used in this study. It has acceptable internal consistency (Cronbach's α=0.740).[22]

The assessment of problem-focused coping strategies was done using the Brief-COPE by Carver et al., 1989. The Brief-COPE comprises 14 scales with a total of 28 questions.[23] Three scales, each with 2 items, totalling 6 questions, are utilised in this study to measure problem-focused coping strategies. It has been established that effective problem-solving in individuals with T2DM, especially women, can lead to improved disease outcomes, including glycaemic control.[24] Participants rate themselves on a scale of 1 (I have not been doing this at all) to 4 (I have been doing this a lot). Scores for each question ranged from 2-8. The minimum total score is 12, and the maximum total score is 48. A higher total score indicates increased use of problem-focused coping strategies among the participants. In this study, the Malay Brief COPE is used, and it has high internal consistency (Cronbach's α=0.83); the test-retest reliability value was 0.69 ($p<0.001$).[25]

The Scale for Measuring Role Strain in Women with Diabetes (SMRSWD), was developed by Wang RH (2020) from Taiwan based on the Chinese version of the Women's Role Strain Inventory (WRSI) for working women, which originally contained 36 items.[26] The short-form scale developed contains 9 items with 2 subscales: (i) role guilt, and (ii) role conflict. Each statement is scored on a scale of 1 (strongly disagree) to 5 (strongly agree). The total score ranged from 9-45 with higher scores indicating a higher role strain experienced by the women. The original questionnaire of the SMRSWD is available in English; permission was sought to translate it into Malay. Following the guidelines outlined by Tsang et al., the translation of the SMRSWD was done proceeded with validation by panel of experts and pilot study involving 60 women with reliability assessment yielded a Cronbach's α value of 0.91 for the English version and 0.80 for the Malay version.[19,27]

The MSPSS instrument, developed by Zimet G et. al (1988), is used to assess participants' perception of social support.[28] The instrument contains 12 items with 3 subscales: (i) family (4 items), (ii) friends (4 items), and (iii) significant others (4 items). It is rated using 7-point Likert scale ranging from 1 (very strongly disagree) to 7 (very strongly agree). The total score of the 12 items is added together (ranged 12 to of 84) and then divided by 12. A higher score indicates greater perceived social support, or it can be scored according to its subscales [29]. In this study, the Malay version MSPSS will be used.[30]. The instrument has good internal consistency (Cronbach's α=0.89), parallel form reliability (0.94) and test-retest reliability (0.77). Perceiving diabetes as priority consisted of one question developed by the authors. The women were asked to rate a statement indicating the degree of their priority in managing diabetes by using a 10 -point Likert-scale ranging from 1 (strongly disagree) to 10 (strongly agree). A higher score indicates a higher priority in managing diabetes.

Outcome variable

The outcome variable for the study is the glycaemic control level, which is measured by glycated haemoglobin (HbA1c) level, with a cut-off point of >7.0% indicating poor glycaemic and ≤7.0% indicating good glycaemic control.[6] This cut-off point also recommended by Canadian guidelines.[31]

Independent variables

There are eight independent variables in this study: (i) sociodemographic (7 items), (ii) clinical characteristics (3 items), (iii) medication (1 item), (iv) self-care in diabetes

using the SDSCA (10 items), (v) problem-focused coping strategies using the Brief-COPE (6 items), (vi) role strain by using the SMRSWD (9 items), (vii) social support by using the MSPSS (12 items), and (viii) perceiving diabetes as priority (1 item). For the sociodemographic, women with T2DM were categorised into different age groups, marital statuses, ethnicities, educational levels, occupations, household income, living arrangements, clinical characteristics, and comorbidities accordingly. The further categories such as age and occupation group were adapted from National Health Morbidity Survey whereas household income was from Department of Statistic Malaysia.[17,32] Comorbidities were defined as the presence of namely high blood pressure, high cholesterol level or other chronic disease.

The SDSCA was measured with scores ranging from 0-70, with higher scores indicating better performance of self-care activities over the past seven days. Problem-focused coping strategies were recorded using the Brief-COPE, where higher total scores indicate increased use of problem-focused coping strategies among the women. The SMRSWD was assessed with total scores ranging from 9-45, with higher scores indicating a higher role strain experienced by the women. In the MSPSS used in this study, higher scores indicate greater perceived social support. Perceiving diabetes as a priority was measured by a statement rated on a Likert-scale from 1 (strongly disagree) to 10 (strongly agree).

Statistical analysis

Data analyses were carried out using Statistical Packages for the Social Sciences (SPSS) version 26. Categorical nominal and ordinal variables are described as frequencies (n) and percentages (%). Continuous numerical variable is described as mean with standard deviation (SD) or median with interquartile range (IQR), depending on the data distribution. Each of the variables was then re-categorised to facilitate further regression analysis such as age group, ethnicity, occupation and BMI.[33]

Ethnicity was further categorised into Malay vs. non-Malay with Malay used as reference category to represent the majority group in the Malaysian population and to be comparable with other studies locally. Apart from that, dichotomisation ensured stability of regression estimate and the full breakdown of ethnic subgroups is presented in the result for transparency. BMI categories were further collapsed into two categories based on a cohort study on glycaemic control and obesity by Newson et al. and utilised ≥27.5kg/m² as obese cut-off point by Malaysian Guidelines.[34,35]

Simple and multiple logistic regression analysis were used to demonstrate the association between independent variables and poor glycaemic control. The crude and adjusted odds ratio (OR) with their corresponding 95% confidence interval (CI) were reported. The significance level was set at $p<0.05$. Any interaction term that differs insignificantly and is not of important difference will be regarded as not significant and will not be included in the regression model.[36]

RESULTS

Study population and characteristics

From January to April 2023, a total of 346 women met the criteria and completed the study. This number exceed the minimal sample size of 148. Based on Table I, which outlines the sociodemographic characteristics, most of the women were aged ≥60 years old (61.0%) and married (66.5%). Almost half of the women were of Indian ethnicity (48.3%). More than half had completed secondary education (51.7%), and the majority were housewives (57.8%). The majority of the women had a household income of ≤RM5000 (78.9%) and lived with family or friends (94.8%).

Regarding clinical characteristics, the majority had T2DM for ≥5 years (82.1%) and had other comorbidities present (86.1%). Half of the women were obese (50.9%). The most common mode of therapy among T2DM women was oral antidiabetic drugs (OAD) only (66.8%).

For self-care, the scores are as follows: general diet, 5.11 (SD 1.33), specific diet, 4.33 (SD 1.20); exercise, 2.97 (SD 1.34); self-monitoring blood-glucose, 0.72 (1.29); and foot care, 0.93 (SD 1.67). The total mean score for

problem-focused coping strategies was 15.04 (SD 4.98). The mean score for social role strain was 21.31 (SD 6.07). Most of the women had higher perceived social support (62.7%) from family, friends, and significant others, with a total score mean 5.38 (SD 1.00). The women with T2DM perceived T2DM as a priority, with a mean score of 7.07 (SD 1.90).

Table I: Study population and characteristics (N=346)

No	Factor	n (%)	Mean (SD)
1	**Glycaemic control (HbA1c level)**		
	i. Poor (>7.0%)	200 (57.8)	7.83 (1.73)
	ii. Good (≤7.0%)	146 (42.2)	
2	**Sociodemographic**		
	a) Age (years)		
	i. <40	13 (3.8)	
	ii. 40-49	32 (9.2)	
	iii. 50-59	90 (26.0)	
	iv. ≤60	211 (61.0)	
	b) Marital status		
	i. Single	9 (2.6)	
	ii. Married	230 (66.5)	
	iii. Divorced	20 (5.8)	
	iv. Widowed	87 (25.1)	
	c) Ethnic		
	i. Malay	81 (23.4)	
	ii. Non-Malay	265 (76.6)	
	- Chinese	91 (26.3)	
	- Indian	167 (48.3)	
	- Others	7 (2.0)	
	d) Education level		
	i. No formal education	5 (1.4)	
	ii. Primary	95 (27.5)	
	iii. Secondary	179 (51.7)	
	iv. Tertiary	67 (19.4)	
	e) Working status		
	i. Housewife	200 (57.8)	
	ii. Office work	54 (15.6)	
	iii. Self-employed	46 (13.3)	
	iv. Others	46 (13.3)	
	f) Household income (RM)		
	i. ≤5000	273 (78.9)	
	ii. >5000	73 (21.1)	
	e) Living arrangement		
	i. Alone	18 (5.2)	
	ii. Lives with family/friends	328 (94.8)	
3	**Clinical characteristics**		
	a) Duration of T2DM		
	i. < 5 years	62 (17.9)	
	ii. ≥ 5 years	284 (82.1)	
	b) Comorbidities*		
	i. None	48 (13.9)	
	ii. Yes	298 (86.1)	
	c) Body Mass Index (BMI)		
	i. Underweight	8 (2.3)	
	ii. Normal	53 (15.3)	
	iii. Overweight	109 (31.5)	
	iv. Obese	176 (50.9)	
4	**Mode of therapy**		
	a) OAD only	231 (66.8)	
	b) Insulin only	9 (2.6)	
	c) Combination of OAD and insulin	103 (29.8)	
	d) Lifestyle modifications	3 (0.9)	
5	**Summary of Diabetes Self-care Activities (day in a week)**		
	a) General Diet		5.11 (1.33)
	b) Specific Diabetic Diet		4.33 (1.20)
	c) Exercise		2.97 (1.34)
	d) Self-monitoring blood glucose		34 0.72 (1.29)
	e) Foot care		0.93 (1.67)
	f) Total score (total score range: 0 to 70)		28.12 (8.03)
6	**Problem-focused coping** (total score range: 12-48)		15.04 (4.98)
7	**Social role strain** (total score range: 9-45)		8.3 (16.07)
8	**Perceived social support**** (total score range: 1-7)		5.38 (1.00)
9	**Perceived diabetes as priority** (total score range: 1-10)		7.07 (1.09)

*high blood pressure, high cholesterol level or other chronic disease.
**psychological sense of belonging, acceptance, and aid that improves individuals' ability to cope with difficult situations

For self-care, the scores are as follows: general diet, 5.11 (SD 1.33), specific diet, 4.33 (SD 1.20); exercise, 2.97 (SD 1.34); self-monitoring blood-glucose, 0.72 (1.29); and foot care, 0.93 (SD 1.67). The total mean score for problem-focused coping strategies was 15.04 (SD 4.98). The mean score for social role strain was 21.31 (SD 6.07). Most of the women had higher perceived social support (62.7%) from family, friends, and significant others, with a total score mean 5.38 (SD 1.00). The women with T2DM perceived T2DM as a priority, with a mean score of 7.07 (SD 1.90).

Table II: Preliminary factors associated with poor glycaemic control.

No	Factor	Glycaemic Control		Crude OR	95% CI	*P* value
		Poor (n:200)	Good (n:146)			
1	**Sociodemographic**					
	a) Age (years)					
	i. <60	91 (67.4)	44 (32.6)	1.94	(1.23, 3.04)	0.004
	ii. ≥60	109 (51.7)	102 (48.3)			
	b) Marital					
	i. Single	3 (33.3)	6 (66.7)	0.36	(0.09, 1.45)	0.148
	ii. Ever married	197 (58.5)	140 (41.5)			
	c) Ethnic					
	i. Malay	52 (64.2)	29 (35.8)	1.41	(0.85, 2.37)	0.184
	ii. Non-Malay	148 (55.8)	117 (44.2)			
	d) Education level					
	i. No formal education	4 (80.0)	1 (20.0)	2.96	(0.33, 26.76)	0.334
	ii. Had formal education	196 (57.5)	145 (42.5)			
	e) Working status					
	i. Non-employed	113 (56.5)	87 (43.5)	0.88	(0.57, 1.36)	0.566
	ii. Employed	87 (59.6)	59 (40.4)			
	f) Household income (RM)					
	i. ≤5000	161 (59.0)	112 (41.0)	1.25	(0.75, 2.11)	0.394
	ii. >5000	39 (53.4)	34 (46.6)			
	g) Living arrangement					
	i. Alone	14 (77.8)	4 (22.2)	2.67	(0.86, 8.29)	0.089
	ii. Lives with family/friend	186 (56.7)	142 (43.3)			
2	**Clinical characteristics**					
	a) Duration of T2DM					
	i. < 5 years	28 (45.2)	34 (54.8)	0.54	(0.31, 0.93)	0.027
	ii. ≥5 years	172 (60.6)	112 (39.4)			
	b) Comorbidities*					
	i. None	25 (52.1)	23 (47.9)	0.76	(0.42, 1.41)	0.388
	ii. Yes	175 (58.7)	123 (41.3)			
	c) BMI					
	i. Non-obese	93 (54.7)	77 (45.3)	0.78	(0.51, 1.19)	0.252
	ii. Obese	107 (60.8)	69 (39.2)			
3	**Mode of therapy**					
	i. Insulin	96 (85.7)	16 (14.3)	7.50	(4.16, 13.51)	<0.001
	ii. Non-insulin	104 (44.4)	130 (55.6)			
4	**Summary of Diabetes Self-care Activities**	27.73 (7.83)	28.66 (8.29)	1.02	(0.99, 1.04)	0.286
5	**Problem-focused coping**	14.82 (4.83)	15.36 (5.18)	1.02	(0.98, 1.07)	0.318
6	**Social role strain**	21.29	21.34 (5.57)	1.00	(0.97, 1.04)	0.937
7	**Perceived social support****	5.28 (1.07)	5.52 (0.89)	1.28	(1.03, 1.60)	0.029
8	**Perceived diabetes as priority**	6.94 (2.00)	7.25 (1.76)	1.09	(0.97, 1.22)	0.131

*high blood pressure, high cholesterol level or other chronic disease.
**psychological sense of belonging, acceptance, and aid that improves individuals' ability to cope with difficult situations

The prevalence of poor glycaemic control among women with T2DM is 57.8% with a mean HbA1c of 7.83% (SD 1.73%). Simple logistic regression analysis revealed four factors associated with poor glycaemic control: (i) age

≥60, (ii) diabetes duration of ≥5 years, (iii) non-insulin treatment and (iv) higher perceived social support as shown in Table II. The multiple logistic regression model in Table III shows four final factors associated with poor glycaemic control among women with T2DM: (i) age ≥60 years old (aOR 2.26; 95% CI 1.35, 3.78), (ii) non-Malay ethnicity (aOR 1.89; 95% CI 1.05, 3.40), (iii) treatment using non-insulin (aOR 7.56; 95% CI 4.13, 13.84) and (iv) higher perceived social support (aOR 1.47; 95% CI 1.12, 1.91). Women with T2DM who scored one point higher in social support had odds of 1.47 for poor glycaemic control. Model is based on forward logistic regression, dataset fit to logistic model (Hosmer-lemeshow 0.557), 68.2% of cases predicted correctly with specificity of 67.5% and sensitivity of 69.2%. R^2=0.263 and no outlier.

Table III: Final factors associated with poor glycaemic control

No	Factor	Adjusted OR (95% CI)	*p* value
	Age		
1	<60 years old	2.26 (1.35, 3.78)	0.002
	≥60 years old		
	Ethnicity		
2	Malay	1.89 (1.05, 3.40)	0.035
	Non-Malay		
	Treatment		
3	Insulin	7.56 (4.13, 13.84)	<0.001
	Non-insulin		
4	**Perceived social support**	1.47 (1.12, 1.91)	0.005

DISCUSSION

The current study reveals a recent prevalence of poor glycaemic control among women with T2DM in Seremban PHC settings, affecting approximately half of the women studied. This finding diverges from studies conducted in Korea and Brazil, where the prevalence of poor glycaemic control among women with T2DM was reported to be 61.1% and 74%, respectively.[7,37] The study from Korea, although conducted in PHC settings, may exhibit disparity from the present study due to its definition of poor glycaemic control as HbA1c >6.5%, focusing solely on women diagnosed with T2DM within a year and on OHA as medication. Conversely, the study from Brazil defined poor glycaemic control as HbA1c ≥7.0% and was conducted as a multicentre study in hospital settings. The cut-off points usage variation is due to stringent level of 6.5% suggested to younger and newly diagnosed individuals. For most other adult with T2DM, a target level of <7.0% is recommended however with caution to those prone for hypoglycaemia.[5]

Furthermore, this study reveals that women with T2DM aged ≥60 years have twice the odds of poor glycaemic control. This finding aligns with studies conducted in Thailand and locally.[38, 39] However, conflicting results emerge from another local study, indicating that elderly and retired individuals have more time to dedicate to their health, potentially leading to increased access to healthcare post-retirement.[40] Additionally, current study also highlighted that being non-Malay is associated with poor glycaemic control among women with T2DM, with twice the odds. It is reported that Indian has higher HbA1c levels compared to Malay and Chinese.[17] Such findings justify the inclusion of ethnicity as an important factors in glycaemic control studies. However, due to small subgroup and distribution of ethnicity in the current study, ethnicity was categorised with Malay as reference to facilitate analysis.[33] In contrast, a local study with an equally distributed ethnic groups reported that Malay ethnicity was also associated with higher HbA1c levels, which related to genetic variations between ethnics.[41] Notably, the majority of the women in the current study are non-Malay. Disparities in glycaemic control among ethnic groups may be attributed to the distribution of ethnicities in populations and their sociodemographic status as discovered in the current study.[7]

Non-insulin treatment is associated with an 8-fold increase in the odds of poor glycaemic control. This finding is consistent with recommendations advocating for early combination therapy and the use of insulin for long-term glycaemic control, while non-insulin treatment in T2DM is associated with poor glycaemic control.[1, 5, 6] A cohort study done in Malaysia involving 40 PHC clinics reported that high medication count in the management of T2DM associated with poor glycaemic control.[42] The possible explanation is T2DM individuals mostly had at least one other condition such as hypertension, hyperlipidaemia or cardiovascular disorders which contributed to the additional medications.[43] Conversely, other studies have also associated insulin usage with poor glycaemic control, possibly due to low adherence to insulin regimens. [43, 44] Additionally, local

findings indicate that nearly 40% of patients with high HbA1C levels did not receive insulin due to concerns about potential adverse effects.[43] In the current study, adherence to medication is not investigated.

T2DM is a complex, chronic condition that can be challenging to manage both physically and mentally; it can have an impact not just on patients' medical well-being, but also on their relationships with loved ones. A psychological sense of belonging, acceptance, and aid that improves individuals' ability to cope with difficult situations is defined as social support.[45] The current study reveals that higher perceived social support is associated with poor glycaemic control in women with T2DM. Similarly, a local study found that increased perceived social support is associated with poor glycaemic control especially in older patients with T2DM and a longer duration of diabetes.[46] As elderly who lives with T2DM for an extended period, they could experience physical limitations due to neuropathy and peripheral artery disease.[47] Physical limitations or functional decline may hinder their ability to engage in self-care activities even with higher social support.[47] Notably, many of the women in this study were elderly, which necessitates further assessment. In addition, living with families that provide strong social support can negatively impact a patient's ability to manage their diet healthily, as eating is often viewed as a social engagement.[48] However, these findings are contrary to other previous research emphasizing the positive impact of social support especially on glycaemic control.[49]

The study provides valuable insights into adopting a gender-based approach with women centred primary care strategies socially and biologically in managing T2DM among women, aligning with recommendations from the World Health Organization (WHO) and the Sustainable Development Goals (SDGs).[50] These goals are interconnected and necessitate addressing other objectives such as SDG 3 (promoting healthy lives) and SDG 4 (ensuring quality education). Therefore, enhancing health and its approach is paramount for attaining these objectives for example addressing the specific issues pertaining to women for effective health services.

Nonetheless, the study acknowledges limitations. Firstly, the findings may not be generalisable to all PHCs as the study was conducted in single PHC although the site was selected for having the highest monthly attendance of T2DM women. Secondly, we acknowledge the grouping ethnicity into Malay vs non-Malay may mask intra-group differences. However, this grouping was chosen to ensure statistical stability and to align with epidemiological practice in Malaysia which majority to minority comparisons are frequently used. Future studies with larger samples are suggested to examine ethnic-specific effects more closely.

CONCLUSION

Over half of the T2DM women attending Seremban Health Clinic have poor glycaemic control. Factors such as age ≥60 years, being non-Malay, receiving non-insulin treatment, and having higher perceived social support are associated with poor glycaemic control. These findings offer new insights into employing a gender-based approach with women centred primary care strategies to manage T2DM among women particularly in Seremban HC. Thus, it may provide baseline information for designing interventions specifically tailored to address the unique needs of women with T2DM. Interventional studies are recommended to test tailored approaches targeting these unique needs, such as focused education programs, lifestyle interventions, and social support initiatives involving both T2DM women and their family. Collaboration with healthcare providers and policymakers to implement evidence-based strategies aimed at improving glycaemic control among women with T2DM is recommended.

INSTITUTIONAL REVIEW BOARD (ETHIC COMMITTEE)

This study was approved by the Medical Research and Ethics Committee of the Ministry of Health Malaysia (NMRR ID-22-02611-8TX-11R) and the Research Ethics Committee of Universiti Kebangsaan Malaysia (UKM) (JEP-2022-632). Permission to perform the study in the Seremban Health Clinic was obtained from the District Health Office and the Family Medicine Specialist in charge. Confidentiality was maintained by anonymising data and not including participants' addresses. All data

were entered into a password-protected computer, and access to the data is restricted. All data were analysed anonymously using Statistical Packages for the Social Sciences (SPSS) version 26.

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