

ORIGINAL ARTICLE

Do Our Diabetic Patients Ready for Safe Pregnancy? Attitude Towards Preconception Care and Its Associated Factors Among Women With Diabetes Attending Government Health Clinics in Terengganu

Hassan Basri Mukhali¹, Nik Nor Ronaidi Nik Mahdi², Aniza Abd Aziz², Shaiful Ehsan Shalihin³, Anisah Jalaluddin⁴, Kasemani Embong⁵, Sunita Suhimi⁵

¹ Family Medicine Unit, Faculty of Medicine, Universiti Sultan Zainal Abidin, Medical Campus, Jalan Sultan Mahmud, 20400, Kuala Terengganu, Terengganu, Malaysia.

² Community Medicine Unit, Faculty of Medicine, Universiti Sultan Zainal Abidin, Medical Campus, Jalan Sultan Mahmud, 20400, Kuala Terengganu, Terengganu, Malaysia.

³ Department of Family Medicine, Kulliyah of Medicine, UIAM Kuantan Campus, Jalan Sultan Ahmad Shah, 25200 Kuantan, Pahang, Malaysia.

⁴ Obstetrics and Gynaecology Unit, Faculty of Medicine, Universiti Sultan Zainal Abidin, Medical Campus, Jalan Sultan Mahmud, 20400, Kuala Terengganu, Terengganu, Malaysia.

⁵ Terengganu State Health Department, Ministry of Health Malaysia, 5th Floor, Wisma Persekutuan, Jalan Sultan Ismail, 20920 Kuala Terengganu, Terengganu, Malaysia.

ABSTRACT

Introduction: Women with uncontrolled diabetes may conceive but will result in poor pregnancy outcomes. This study aimed to assess the level of knowledge and attitude and determine factors associated with attitude towards preconception care. **Method:** A cross-sectional study was conducted in various government health clinics from all districts in Terengganu by using multistage random sampling. A self-administered questionnaire was applied to assess the level of knowledge and attitude towards preconception care. Multiple logistic regressions were applied to determine factors associated with attitude towards preconception care. **Results:** A total of 422 respondents were involved. The prevalence of respondents with unsatisfactory knowledge and attitude were 41.7% and 84.1%, respectively. Knowledge was not significantly associated with attitude. Respondents who used contraception had a better attitude (Adj. OR: 0.44, 95% CI:0.23,0.84). Low household income was associated (Adj. OR: 2.40, 95% CI:1.10,5.26) with an unsatisfactory attitude towards preconception care. **Conclusion:** Attitude towards preconception care amongst diabetic women who were attending primary care clinics was unsatisfactory. A structured and focused preconception educational programme care is necessary, especially amongst low-income women.

Keywords: Diabetes mellitus, Women, Preconception care, Knowledge, Attitude

Corresponding Author:

Hassan Basri Mukhali, MMed (Family Medicine)

Email: drhassanbasri@gmail.com

Tel: +609-6275546

INTRODUCTION

The world's prevalence of diabetes is rising, affecting a significant proportion of the younger population. Globally, more men have diabetes than women (1). However, in Malaysia, the data revealed that women had a higher prevalence than men (18.3% vs 16.7%) (2). Besides, evidence indicated that women of reproductive age have more inadequate glycaemic control than those of non-reproductive age, particularly those with longer duration of diabetes, who are of Malay and Indian

ethnicity (3). The finding is alarming as the women may conceive with uncontrolled hyperglycaemia, taking potentially teratogenic oral antidiabetic agents, antihypertensive medications, and statin. The risk of pregnancy is even higher if they do not practise effective contraception methods, eventually ending up with poor pregnancy outcomes.

Available data have established an association between uncontrolled diabetes and unfavourable obstetric outcomes. Mothers are at higher risk of miscarriage, undergo operative and preterm deliveries, and pre-eclampsia (4–7). The foetus of a diabetic mother is exposed to the risk of congenital malformation and macrosomia, while the foetus of a long-standing Type 2 diabetes mellitus (T2DM) mother can be small for

gestational age (4,5,8). Although the overall cases of congenital malformation are scaling down, there was a notable hike in the case of congenital malformation attributed to pre-pregnancy diabetes in one population-based study (9). This signifies that diabetes amongst women substantially impacts the pregnancy outcome and should be seriously treated.

Furthermore, pregnancy exacerbates pre-existing diabetic complications. In the diabetes control and complication trials (DCCT), Type 1 diabetes mellitus (T1DM) women who were treated less aggressively before pregnancy had significant worsening of retinopathy, especially those with substantial improvement in glycaemia during pregnancy (10). It could be severe as a few respondents even required photocoagulation laser therapy during pregnancy, and the deleterious effect could persist until the postpartum period (10).

A preconception care programme is consistently found to ameliorate the detrimental impact of diabetes on pregnancy. This programme component includes achieving tight glycaemic control with HbA1c below 6.5%, replacing potentially harmful medications with safer medications, switching oral antidiabetic agents to insulin before conception, and consuming folic acid three months before conceiving (11). Those with unsatisfactory glycaemic control, potentially harmful medications, or unfit for pregnancy must be on effective and reliable contraception. Besides, ophthalmologists' comprehensive eye assessment and nephropathy screening are necessary before they embark on pregnancy (11). The preconception programme improves glycaemic control, enhances the periconceptional intake of folic acid, and encourages earlier booking visits amongst women with diabetes (4,6,12,13). Furthermore, there are significant reductions in congenital malformation, miscarriage, asphyxia, operative delivery, macrosomia, shoulder dystocia, and neonatal hypoglycaemia cases (6,12,14). Therefore, ideally, all women with diabetes should be instructed to plan their pregnancy and participate in a preconception programme if they intend to get pregnant.

Despite the favourable outcome of preconception care, the proportion of women involved in this programme is still unsatisfactory. In Europe, data revealed that only 19.8% to 39% of women attended preconception counselling, and up to 69.7% of women with diabetes had their pregnancy planned (5,6,8). Besides, most respondents were also unaware of the safe glycaemic levels for pregnancy. They were unsure of the consequence of uncontrolled hyperglycaemia on pregnancy and the growing foetus (15,16). Moreover, almost 80% did not practice an effective contraception method, although their glycaemic control was suboptimal (15,16). This trend could be attributed to the low level of knowledge and attitude, which leads to poor participation in

preconception care and a discouraging state of diabetes control and contraceptive practice. In Malaysia, a study amongst women attending antenatal clinics revealed that only 47% had their pregnancy planned, while only 52% had a sufficient understanding of preconception health (17). This indicated that preparation for safer pregnancy amongst the population was far from satisfactory, and thus effective measures are urgently required to improve the current situation.

Available data have explained that women with greater knowledge, awareness, and perception of preconception care are more likely to utilise this service (18), indicating the importance of obtaining more information regarding this topic. Besides, identifying the current level of knowledge and attitude will also facilitate the health authorities to allocate adequate resources and develop focus and structured education specific to the population of interest. Nevertheless, although this topic is well studied, particularly in European countries, local data is limited. Thus, this study is aimed to assess the level of knowledge and attitude of preconception care amongst women with diabetes and determine the factors associated with the attitude towards preconception care.

MATERIALS AND METHODS

Study design and sampling

A cross-sectional study was conducted at various government primary care clinics from all districts in Terengganu. Women of reproductive age, defined as 18 to 49 years by the World Health Organisation (WHO), diagnosed with T1DM or T2DM for at least 12 months, were included in the study (19). Those who had already undergone a hysterectomy or not consented were not eligible for the study.

For sample size calculation, a single proportion formula was used and based on the proportion of women with good knowledge of preconception care in Kelantan, i.e., 51.9% (17) and precision of 5%. Therefore, the calculated sample size was 384, and after considering the 10% non-response rate, the adjusted sample size was 427.

A multistage sampling method was used for the study. Firstly, a proportionate simple random sampling was used to select the government primary health clinic in each district of Terengganu. Two clinics from each district were selected randomly, and overall, 16 clinics were selected to represent reproductive-age women with diabetes. Next, at the clinic level, systematic random sampling was utilised to determine eligible patients for recruitment. The sampling interval for each clinic was calculated using the following formula: Sampling interval, $k = N/n$ where N = total number of reproductive age women with diabetes in five months, n = number of samples required from the clinic.

Study instrument

A newly developed self-administered questionnaire on knowledge and attitude towards preconception care was developed based on literature review and extensive discussion amongst a panel of experts, consisting of four family medicine specialists, an endocrinologist, an obstetrician, and a statistician. The questionnaire comprised questions about respondent's sociodemographic, clinical information, obstetrics history, as well as knowledge and attitude towards preconception care.

As for knowledge items, a score of 2, 1, or 0 was given for each correct, unsure, or wrong answer, respectively. Meanwhile, a score of 4 to 0 was given for the most to least appropriate attitude. Scoring for knowledge and attitude was further categorised into satisfactory and unsatisfactory. The cut-off point for satisfactory knowledge and attitude was determined based on critical analysis of each item according to the researchers' scientific point of view. The minimum acceptable score for knowledge and attitude was 53 and 73, respectively. Therefore, the knowledge level was categorised into unsatisfactory (less than 53 scores) and satisfactory (53 scores and above), while attitude was categorised into unsatisfactory (less than 73 scores) and satisfactory (73 scores and above).

Face validity was conducted amongst 50 randomly selected samples to ensure that the questionnaire was clear and understood by respondents. Factor analysis was also performed to ensure appropriate construct validity of the questionnaire. The questionnaire demonstrated good internal consistency reliability with Cronbach's alpha of 0.95.

Operational definition

Respondents were considered to practice self-blood glucose monitoring if they had performed blood glucose monitoring using a glucometer machine at home, regardless of the testing frequency. Blood pressure measured during data collection was taken for analysis and classified as normal if the blood pressure was less than 130 mmHg for systolic and 80 mmHg for diastolic, as recommended by the Malaysian clinical practice guideline (11). It was categorised as normal if both readings were normal and categorised as abnormal if either systolic or diastolic or both were abnormal. The latest HbA1c level within six months of data collection was included for analysis. Respondents were classified as having diabetic complication if they had developed retinopathy, nephropathy, neuropathy, diabetic foot, myocardial infarction, or stroke. They were also classified as having obstetric complication if they had a diabetic history related to obstetric complications, such as miscarriage, macrosomia, congenital malformation, intrauterine death, caesarean section, polyhydramnios, or shoulder dystocia in their previous pregnancies.

Statistical Analysis

Data analysis was carried out by using Statistical package for social sciences (SPSS) Version 22.0 software and presented as mean (SD or IQR) for the continuous data and frequencies (%) for categorical data. Univariable and multivariable analyses were applied to determine factors associated with preconception care attitudes amongst women of reproductive age with diabetes. The independent variables (age, race, marital status, educational level, occupational status, monthly household income, self-monitoring of blood glucose, blood pressure control, HbA1c level, diabetic complications, history of planned or unplanned pregnancy, use of contraception within the past six months, history of pregnancy after diagnosis of diabetes, history of obstetrics complication, and knowledge on preconception care) were screened by using simple logistic regression prior to further steps in multivariable analysis. The independent variables were selected based on the significance level of a p-value less than 0.25 for the multivariable analysis. These variables were then entered using forward stepwise likelihood ratio (LR), backward stepwise likelihood ratio (LR), and manually by using enter mode to obtain a preliminary model. Multicollinearity problems and interactions between variables were checked. The final model fitness was assessed with the Hosmer-Lemeshow test, classification table, and receiver operator characteristic (ROC) curve. The final model was presented in crude and adjusted odds ratio with 95% CI and p-value. A p-value of less than 0.05 was considered statistically significant.

Ethical Issue

Ethical approval was obtained from UniSA Human Research Ethics Committee, (UHREC) UHREC/2017/3/005, and the Medical Research and Ethics Committee (MREC), Ministry of Health Malaysia. To keep the confidentiality of respondent details, an anonymous technique was used throughout the study so that only researchers could retrieve the data.

RESULTS

A total of 422 respondents who met the study criteria were included in the analysis. The median age (IQR) of respondents was 43(8) years. The preponderances of respondents were Malays, married, had secondary education, unemployed, and had low household income, as shown in Table I. Table II shows the self-monitoring practice of blood glucose, blood pressure control and HbA1c level, the status of diabetic complications, contraception, pregnancy and obstetric complication characteristics of respondents.

Table III and Table IV show items of descriptive statistics of knowledge and attitude on preconception care amongst respondents. The prevalence of respondents with unsatisfactory knowledge and attitude were 41.7%

Table I: Sociodemographic characteristics of the respondents (n=422)

Characteristics	Mean (SD)	Frequency (%)
Age		
< 40 years		126 (29.9)
≥ 40 years		296 (70.1)
Race		
Malays		412 (97.6)
Non-Malays		10 (2.4)
Marital status		
Married		380 (90.0)
Single		21 (5.0)
Divorced / widow		21 (5.0)
Educational level		
Primary		31 (7.4)
Secondary		292 (69.2)
Tertiary		98 (23.2)
Missing data		1 (0.2)
Occupational status		
Employed		171 (40.5)
Unemployed		251 (59.5)
Monthly household income (RM)		
Low (≤ RM3000)	1500 (1500)	295 (69.9)
High (>RM3000)		49 (11.6)
Missing data		78 (18.5)

and 84.1%, respectively (Table V).

The final model is shown in Table VI. Only monthly household income and contraception usage were significantly associated with attitude towards preconception care in the multivariable analysis. Low monthly household income respondents had 2.40 times the odds of having an unsatisfactory attitude towards preconception care as compared to respondents with high household income (95% CI: 1.10 to 5.26, p-value = 0.028), and respondents who used contraception had 0.44 times the odds of having an unsatisfactory attitude towards preconception care as compared to those who did not use contraception (95% CI: 0.23 to 0.84, p-value = 0.013).

DISCUSSION

The current study represented women with diabetes who attended follow up at various government primary care clinics in Terengganu and were managed by primary care doctors. In contrast, respondents of other studies were mainly followed up at tertiary centres and treated by physicians or diabetologists (15,16,20,21). Therefore, the study was expected to provide specific information on the level of knowledge and attitude amongst women with diabetes in the primary care setting.

In the present study, 70% of respondents knew and

Table II: Clinical, contraception, pregnancy and obstetric complication characteristics of the respondents (n=422)

Characteristics	Mean (SD)	Frequency (%)
Self-monitoring of blood glucose		
Yes		158 (37.4)
No		263 (62.3)
Missing data		1 (0.2)
Blood Pressure control		
Normal		116 (27.5)
High		296 (70.1)
Missing data		10 (2.4)
HbA1c	8.73 (2.33)	
Diabetic complications		
No		357 (84.6)
Yes		61 (14.5)
Missing data		4 (0.9)
Using contraception within the past 6 months		
No		249 (59.0)
Yes		145 (34.4)
Not related		26 (6.1)
Missing data		2 (0.5)
History of pregnancy after diagnosis of diabetes		
No		292 (69.2)
Yes		130 (30.8)
Planned or unplanned pregnancy (n=130)		
Planned		59 (45.4)
Unplanned		71 (54.6)
Obstetrics Complications (n=130)		
No		45 (34.6)
Yes		85 (65.4)

agreed that clinical assessment of the eye, heart, kidney, nerves, and blood pressure is vital before they embark on pregnancy. Nevertheless, 33.8% did not acknowledge that pregnancy can lead to a significant progression of retinopathy and nephropathy. The study finding was quite similar to other studies conducted in the European countries, further establishing that knowledge amongst women with diabetes concerning preconception care is still deficient. This finding has raised concern as pregnancy can exacerbate pre-existing diabetic complications like retinopathy and nephropathy, especially those with poor glycaemic control (10,22). Low awareness regarding this matter could lead to low uptake of retinopathy and nephropathy screening programmes during early pregnancy, exposing themselves to loss of vision risk and renal failure. Therefore, the American Diabetes Association (ADA) advocates for eye and renal assessment and frequent monitoring with a specialist before pregnancy or in the first trimester for women with T1DM and T2DM who plan to get pregnant (23).

Table III: Items descriptive statistics of knowledge on preconception care among respondents (n=422)

No.	Items	Mean score (SD)	Frequency (%)		
			No	Unsure	Yes
1	The following should be checked for every woman who suffers from diabetes before pregnancy:				
1a	Eye	1.74 (0.52)	17 (4.0)	76 (18.0)	329 (78.0)
1b	Heart	1.71 (0.53)	16 (3.8)	89 (21.1)	317 (75.1)
1c	Kidney	1.69 (0.55)	19 (4.5)	93 (22.0)	310 (73.5)
1d	Blood pressure	1.85 (0.42)	9 (2.1)	47 (11.1)	366 (86.7)
2	The following conditions are not safe for pregnancy:				
2a	Kidney failure	1.69 (0.56)	22 (5.2)	85 (20.1)	315 (74.6)
2b	Eye damage due to diabetes	1.53 (0.66)	38 (9.0)	122 (28.9)	262 (62.1)
2c	Uncontrolled blood sugar levels	1.75 (0.54)	21 (5.0)	63 (14.9)	338 (80.1)
3	The following problems can occur in mothers who have diabetes during pregnancy:				
3a	Eye damage (n = 421)	1.57 (0.60)	25 (5.9)	130 (30.9)	266 (63.2)
3b	High blood pressure	1.78 (0.48)	11 (2.6)	72 (17.1)	339 (80.3)
3c	Kidney damage (n = 420)	1.57 (0.58)	19 (4.5)	142 (33.8)	259 (61.7)
3d	Urinary tract infections (n = 421)	1.67 (0.54)	14 (3.3)	112 (26.6)	295 (70.1)
3e	Low lying placenta (Placenta Praevia) (n = 420)	0.60 (0.62)	30 (7.1)	193 (46.0)	197 (46.9)
4	The following problems can occur in the womb of diabetic mothers:				
4a	Miscarriage	1.73 (0.50)	12 (2.8)	88 (20.9)	322 (76.3)
4b	Congenital anomaly	1.74 (0.49)	11 (2.6)	87 (20.6)	324 (76.8)
4c	Premature delivery	1.68 (0.53)	12 (2.8)	112 (26.5)	298 (70.6)
4d	Too much amniotic fluid	1.40 (0.56)	16 (3.8)	220 (52.1)	186 (44.1)
4e	Big baby (weight more than 4 kg)	1.77 (0.50)	14 (3.3)	71 (16.8)	337 (79.9)
4f	Overdue delivery (postdate)	0.65 (0.67)	192 (45.5)	184 (43.6)	46 (10.9)
4g	Intrauterine death	1.66 (0.54)	14 (3.3)	117 (27.7)	291 (69.0)
5	Taking the following medications should be referred to a doctor when planning a pregnancy:				
5a	Cholesterol medication	1.69 (0.52)	13 (3.1)	104 (24.6)	305 (72.3)
5b	Blood pressure medication	1.74 (0.48)	9 (2.1)	90 (21.3)	323 (76.5)
5c	Diabetes medication	1.81 (0.43)	7 (1.7)	65 (15.4)	350 (82.9)
6	Folic acid must be taken 3 months before planning to conceive.	1.47 (0.60)	24 (5.7)	177 (41.9)	221 (52.4)
7	Folic acid must be taken during pregnancy.	1.79 (0.46)	10 (2.4)	67 (15.9)	345 (81.8)
8	HbA1c readings should be less than 6% before pregnancy.	1.51 (0.56)	14 (3.3)	179 (42.4)	229 (54.3)
9	Blood pressure readings should be less than 130/80 mmHg before pregnancy.	1.61 (0.55)	14 (3.3)	137 (32.5)	271 (64.2)
10	Eye problems due to diabetes should be treated before pregnancy.	1.57 (0.58)	19 (4.5)	143 (33.9)	260 (61.6)
11	Family planning methods should be used if blood sugar levels are not controlled.	1.72 (0.51)	12 (2.8)	96 (22.7)	314 (74.4)
12	Birth control pills are not recommended for women with diabetes.	1.03 (0.69)	95 (22.5)	219 (51.9)	108 (25.6)
13	Natural methods are the most ineffective method of family planning.	1.18 (0.67)	64 (15.2)	217 (51.4)	141 (33.4)
14	Condom is the best family planning method for women with diabetes.	1.12 (0.68)	74 (17.5)	222 (52.6)	126 (29.9)
15	The Intrauterine device is the best family planning method for women with diabetes.	1.22 (0.64)	51 (12.1)	227 (53.8)	144 (34.1)
16	Weight loss before pregnancy can help to control blood sugar levels.	1.66 (0.55)	17 (4.0)	109 (25.8)	296 (70.1)
17	Exercise can help control blood sugar levels.	1.77 (0.47)	9 (2.1)	80 (19.0)	333 (78.9)

About 70% of respondents were aware that their medication might require modification if they intend to get pregnant. This finding was parallel to other studies, whereby most respondents admitted the necessity to comply with the prescribed medication

and probability of increment in insulin dosage for the pregnancy preparation (15,16,21). Although only a minority of respondents were unsure whether their medications require modification and adjustment, it could be detrimental to their pregnancy outcomes since

Table IV: Items descriptive statistics of attitude towards preconception care among respondents (n=422)

No.	Items	Mean score (SD)	Frequency (%)				
			Highly disagree	Disagree	Neutral	Agree	Highly agree
1	I believe if I am pregnant with uncontrolled diabetes, I am at high risk for the following problems						
1a	Eye damage	2.72 (0.83)	12 (2.8)	24 (5.7)	78 (18.5)	265 (62.8)	43 (10.2)
1b	High blood pressure	2.76 (0.85)	14 (3.3)	22 (5.2)	65 (15.4)	271 (64.2)	50 (11.8)
1c	Kidney damage	2.75 (0.85)	14 (3.3)	21 (5.0)	72 (17.1)	266 (63.0)	49 (11.6)
1d	Caesarean delivery	2.75 (0.87)	17 (4.0)	19 (4.5)	67 (15.9)	267 (63.3)	52 (12.3)
2	I believe if I am pregnant with uncontrolled diabetes, my baby is at high risk for having the following problems						
2a	Miscarriage (n = 421)	2.86 (0.81)	11 (2.6)	19 (4.5)	50 (11.9)	280 (66.5)	61 (14.5)
2b	Congenital anomaly (n = 421)	2.85 (0.81)	10 (2.4)	20 (4.8)	56 (13.3)	273 (64.8)	62 (14.7)
2c	Big baby (weight more than 4kg)	2.90 (0.79)	9 (2.1)	17 (4.0)	50 (11.8)	277 (65.6)	69 (16.4)
2d	Intrauterine death (n = 421)	2.81 (0.86)	12 (2.9)	22 (5.2)	65 (15.4)	255 (60.6)	67 (15.9)
3	Before I get pregnant, it is important for me to undergo the following check-ups						
3a	Eye (n = 421)	2.92 (0.73)	8 (1.9)	10 (2.4)	51 (12.1)	289 (68.6)	63 (15.0)
3b	Heart (n = 421)	2.98 (0.69)	8 (1.9)	5 (1.2)	42 (10.0)	299 (71.0)	67 (15.9)
3c	Kidney (n = 421)	2.96 (0.70)	8 (1.9)	5 (1.2)	49 (11.6)	292 (69.9)	67 (15.9)
3d	Blood pressure	3.01 (0.67)	8 (1.9)	5 (1.2)	29 (6.9)	312 (73.9)	68 (16.1)
3e	Nerves (n = 421)	2.90 (0.75)	8 (1.9)	11 (2.6)	61 (14.5)	277 (65.8)	64 (15.2)
4	If I am pregnant						
4a	The doctor may need to change my high blood pressure medication (n = 421)	2.83 (0.74)	7 (1.7)	16 (3.8)	67 (15.9)	283 (67.2)	48 (11.4)
4b	The doctor may need to change my diabetes pill medication to insulin injection. (n = 421)	2.92 (0.75)	5 (1.2)	16 (3.8)	57 (13.5)	272 (64.6)	71 (16.8)
4c	I need to follow the doctor's instruction in taking medication to avoid side effects	3.13 (0.67)	4 (0.9)	3 (0.7)	36 (8.5)	269 (63.7)	110 (26.1)
5	I cannot conceive safely in the following situations						
5a	Kidney damage	3.02 (0.72)	6 (1.4)	6 (1.4)	50 (11.8)	270 (64.0)	90 (21.3)
5b	High blood pressure	3.03 (0.73)	6 (1.4)	7 (1.7)	50 (11.8)	265 (62.8)	94 (22.3)
5c	High blood sugar levels	3.05 (0.72)	5 (1.2)	7 (1.7)	48 (11.4)	265 (62.8)	97 (23.0)
6	I will continue the family planning method if my HbA1c reading exceeds 10%	2.78 (0.85)	9 (2.1)	25 (5.9)	82 (19.4)	241 (57.1)	65 (15.4)
7	I believe						
7a	Weight loss is important	3.14 (0.66)	5 (1.2)	2 (0.5)	31 (7.3)	275 (65.2)	109 (25.8)
7b	Exercise provides health benefits in controlling my diabetes.	3.15 (0.67)	5 (1.2)	1 (0.2)	36 (8.5)	264 (62.9)	116 (27.5)

medications like ACE-inhibitor, ARB, or statin are linked to the teratogenic effect if taken during early pregnancy. Regarding glucose control, insulin is the preferred agent above oral antidiabetic agents for a few reasons. Insulin has a low concentration in the placenta circulation, does not demonstrate teratogenicity potential, and easier dose titration to match the blood sugar level (23). Therefore, a comprehensive educational intervention by the governing health authority in addressing medication safety in pregnancy is essential to be highlighted and disseminated to diabetic women with reproductive potential.

ADA and the Malaysian clinical practice guidelines recommend achieving preconception HbA1c of less than 6.5% (11,23), whereas the American College of Obstetrics and Gynaecology (ACOG) advocate stricter glycaemic control with HbA1c of less than 6% for those with minimal hypoglycaemic risk to avoid adverse pregnancy outcomes (24). The Malaysian guideline also recommends achieving blood pressure below 130/80 mmHg for women with chronic hypertension before they conceive (11): to reduce the risk of intrauterine growth restriction (IUGR), foetal loss, superimposed pre-eclampsia, and preterm delivery (25).

Table V: Knowledge and attitude on preconception care among 422 respondents.

Variables	Frequency (%)
Knowledge:	
Satisfactory	244 (57.8)
Unsatisfactory	176 (41.7)
Missing data	2 (0.5)
Attitude:	
Satisfactory	65 (15.4)
Unsatisfactory	355 (84.1)
Missing data	2 (0.5)

Table VI: Associated factors for attitude towards preconception cares among respondents by univariable and multiple logistic regression analysis (n = 422)

Variables	Crude OR ^a (95% CI)	b (SE) ^b	Adjusted OR ^b (95% CI)	P – value ^b
Monthly household income				
High (>RM3000)	1.00	0.00	1.00	
Low (≤ RM3000)	2.12 (1.02, 4.41)	0.88 (0.40)	2.40 (1.10, 5.26)	0.028
Use of contraception				
No	1.00	0.00	1.00	
Yes	0.46 (0.26, 0.82)	-0.824 (0.33)	0.44 (0.23, 0.84)	0.013

a = Simple Logistic Regression; b = Multiple Logistic Regression
Hosmer-Lemeshow test P-value = 1.000; Area under Receiver Operating Characteristics curve = 0.63.

Although the majority (70%) of respondents agreed that poorly controlled diabetes is risky for mother and foetus during pregnancy, more than a quarter of them were not aware of the safe level of HbA1c and blood pressure for pregnancy. However, the level of awareness varies in previous studies. For example, studies conducted amongst T1DM in Poland and France showed that 32.9% and 82% of the respondents could identify the accurate HbA1c level for safe pregnancy, respectively (16,20). The possible reason is that the respondents in Poland were younger and recently diagnosed. Moreover, they did not consider pregnancy as their primary agenda during their regular clinic visits. In contrast, the current study respondents were mainly adults, and a few of them had experienced being pregnant before. Meanwhile, in France, the respondents were managed by diabetologists, where specific HbA1c value is constantly emphasised to avoid long-term complications (20).

In this study, although 72% of respondents were aware that using contraception is crucial if their HbA1c is more than 10%, half of them did not know the most reliable and recommended contraception method to prevent unplanned pregnancy. This knowledge is essential, as

every method has its efficacy, suitability, and side effects based on women's preferences and health profiles. Diabetic women without complications can use a wide range of contraceptive methods, including hormonal and non-hormonal methods (26). However, for women who have developed advanced macrovascular disease, neuropathy, and nephropathy, hormone-containing contraception like a combined oral contraceptive pill (COCP) and Depo-Provera are not preferred (26). Long-acting reversible contraception, including intrauterine contraceptive devices (IUCD), intrauterine system, a progestogen-only injection and implants, and the combined hormonal vaginal ring, are highly effective and do not require patient's memory. The progestogen-only injectable is a convenient contraceptive method as it only requires two to three monthly injections. However, particular side effects could occur, including the alteration of lipid metabolism, delay in returning to fertility, menstrual disturbance, weight gain, and reduction of bone mineral density (27).

For patients with diabetes, IUCD and Implanon are considered contraception methods of choice. They are highly reliable with extremely low failure rates. These contraception methods do not rely on patients' compliance and can be used as a long-term and reversible contraceptive effect immediately upon removal. Both can also be safely used without significantly affecting the user's metabolic control or pose significant complications to the user (28). However, these methods are not widely available in the local setting as the device is limited and expensive. Many respondents did not favour these methods, as they are perceived as invasive and sometimes painful during the insertion. For perfect use of contraception method, a method with the lowest failure rate is Implanon, followed by intrauterine system and IUCD, Depo-Provera injection, and COCP, while condom has about 2% failure rate (29).

In addition, more than one-third (41.9%) of respondents did not know that folic acid should be taken three months before they plan to conceive. The Malaysian Health Ministry recommended folic acid supplementation of 5 mg to be consumed three months before conceiving until the end of the first trimester (11). A Cochrane review demonstrated that folic acid supplementation provided a protective effect in preventing neural tube defects compared to no intervention or placebo (30).

The current study found that sociodemographic profiles, blood pressure, glycaemic control, and preconception care knowledge had no significant association with an unsatisfactory attitude towards preconception care. The study also revealed that respondents who used contraception had better attitudes towards preconception care than those who did not. Nevertheless, it was found that respondents with low household incomes were significantly associated with an unsatisfactory attitude towards preconception care. These patients perhaps

live in a rural and socially deprived area, whereby the awareness of preconception health is low, contributing to their poor attitude. In other studies, it was more likely that diabetic women living in the deprived area did not have inadequate preparation for safe pregnancy and lacked knowledge and awareness of the importance of preconception care (31–33). Patients with lower incomes might not put their health as a priority and tend not to be present for preconception care, resulting in low awareness and knowledge on this topic (34). In local, participation in pre-pregnancy care services is at 44%, which is still below the desired level (18). Even more than 55% of the local housewives had never planned their pregnancies before (35). Nevertheless, a significant association between respondents' poor knowledge and attitude was not discovered in the study.

The current study's strength is its generalisability to the women with diabetes attending the government primary care clinic in Terengganu, as the study samples were recruited among these women throughout the government primary care clinic in Terengganu. Nevertheless, there are a few limitations to this study. Women's demographic profile in Terengganu is distinctive from other states, especially regarding education and household incomes. Therefore, there are limitations in generalising the current study result with the population in different Malaysian states. The respondents were also not categorised into either T1DM or T2DM. Therefore, the difference of knowledge between these groups of respondents cannot be compared.

CONCLUSION

In conclusion, women with low household income and never on contraceptive methods were significantly associated with an unsatisfactory attitude towards preconception care. Knowledge on preconception care amongst women with diabetes was unsatisfactory, but it was not found to influence their attitude significantly. There is an urgent need to design an educational intervention on diabetics, especially for low-income women, regarding the impact of pregnancy on diabetic complications and ideal contraception choice.

ACKNOWLEDGEMENTS

We would like to thank the Director-General of Health, Malaysia, for his permission to publish this article and convey our greatest appreciation to the Terengganu State Health Department for permitting us to conduct this study. Our most generous gratitude to all diabetic educators who helped in the data collection and all participants involved in this study. This work is supported by University Sultan Zainal Abidin (UniSZA) under the Dana Penyelidikan Universiti (UniSZA/2017/DPU/31) grant.

REFERENCES

1. International Diabetes Federation. IDF Diabetes Atlas ninth edition. 2019.
2. Institute for Public Health. National Health & Morbidity Survey 2015 (NHMS 2015). Vol. II: Non-communicable diseases, risk factors & other health problems. Vol. II. 2015. 1–30 p.
3. Cheong AT, Lee PY, Sazlina SG, Mohamad Adam B, Chew BH, Mastura I, et al. Poor glycemic control in younger women attending Malaysian public primary care clinics: findings from adults diabetes control and management registry. *BMC Fam Pract.* 2013;14:1–7.
4. Galindo A, Burguillo AG, Azriel S, De La Fuente P. Outcome of fetuses in women with pregestational diabetes mellitus. *J Perinat Med.* 2006;34(4):323–31.
5. Gizzo S, Patrelli TS, Rossanese M, Noventa M, Berretta R, Di Gangi S, et al. An update on diabetic women obstetrical outcomes linked to preconception and pregnancy glycemic profile: a systematic literature review. *Sci World J.* 2013;2013.
6. Kekäläinen P, Juuti M, Walle T, Laatikainen T. Pregnancy planning in type 1 diabetic women improves glycemic control and pregnancy outcomes. *J Matern Neonatal Med.* 2015;29(14):2252–8.
7. Lapolla A, Dalfrà MG, Di Cianni G, Bonomo M, Parretti E, Mello G, et al. A multicenter Italian study on pregnancy outcome in women with diabetes. *Nutr Metab Cardiovasc Dis.* 2008;18(4):291–7.
8. Suhonen L, Hiilesmaa V, Teramo K. Glycaemic control during early pregnancy and fetal malformations in women with type I diabetes mellitus. *Diabetologia.* 2000;43(1):79–82.
9. Liu S, Rouleau J, Leyn JA, Sauve R, Joseph KS, Ray JG, et al. Impact of pre-pregnancy diabetes mellitus on congenital anomalies, Canada, 2002–2012. *Heal Promot Chronic Dis Prev Canada.* 2015;35(5):79–84.
10. The Diabetes Control and Complications Trial Research Group. Effect of pregnancy on microvascular complications in the Diabetes Control and Complications Trial. *Diabetes Care.* 2000;23(8):1084–91.
11. Ministry of Health Malaysia. Management of diabetes in pregnancy. 2017.
12. Wahabi HA, Alzeidan RA, Esmaeil SA. Pre-pregnancy care for women with pre-gestational diabetes mellitus: a systematic review and meta-analysis. *BMC Public Health.* 2012;12:792.
13. Yamamoto JM, Hughes DJF, Evans ML, Karunakaran V, Clark JDA, Morrish NJ, et al. Community-based pre-pregnancy care programme improves pregnancy preparation in women

- with pregestational diabetes. *Diabetologia*. 2018;61(7):1528–37.
14. Xie GH, Zheng Z, Liu TC, Qing LL, Hong XQ, Zha WT, et al. Health care and risk of adverse pregnancy outcomes among diabetic women: an updated meta-analysis. *Arch Gynecol Obstet* [Internet]. 2019;299(3):891–9. Available from: <https://doi.org/10.1007/s00404-019-05042-x>
 15. Sapiano K, Savona-Ventura C, Calleja-Agius J, Serracino-Inglott A, Azzopardi LM. Attitudes towards preconception care in Maltese women with type 1 diabetes mellitus. *Gynecol Endocrinol*. 2012;28(12):1006–9.
 16. Wołoszyn-Durkiewicz A, Zalińska M, Brandt A, Myśliwiec M, Ściesińska M, Kuhn J. Assessing the knowledge of the consequences of uncontrolled diabetes in pregnancy and its effects on fetal development, among female adolescents with type 1 diabetes. *Pediatr Endocrinol Diabetes Metab*. 2017;23(4):188–96.
 17. Kasim R, Draman N, Kadir AA, Muhamad R. Knowledge, attitudes and practice of preconception care among women attending appointments at a rural clinic in Kelantan. *Educ Med J*. 2016;8(4):57–68.
 18. Abu Talib R, Idris IB, Sutan R, Ahmad N, Abu Bakar N. Patterns of pre-pregnancy care usage among reproductive age women in Kedah, Malaysia. *Iran J Public Health*. 2018;47(11):1694–702.
 19. Reproductive Health and Research. World Health Organisation. Reproductive health indicators. Guidelines for their generation, interpretation and analysis for global monitoring. World Health Organization. 2006. 9–12 p.
 20. Diabetes and Pregnancy Group France. Knowledge about preconception care in French women with type 1 diabetes. *Diabetes Metab*. 2005;(31):443–7.
 21. Moura ERF, Evangelista DR, de Castro Damasceno AK. The knowledge of women with diabetes mellitus regarding preconception care and maternal-fetal risks. *Rev da Esc Enferm da USP*. 2012 Feb;46(1):22–8.
 22. Piccoli GB, Tavassoli E, Melluzza C, Grassi G, Monzeglio C, Donvito V, et al. Severe diabetic nephropathy in type 1 diabetes and pregnancy - a case series. *Rev Diabet Stud*. 2013;10(1):68–78.
 23. American Diabetes Association. 14. Management of diabetes in pregnancy: standards of medical care in Diabetes 2020. *Diabetes Care*. 2020;43(January):S183–92.
 24. American College of Obstetric and Gynecologists. Pregestational diabetes mellitus. ACOG Practice Bulletin No. 201. *Obs Gynecol*. 2018;132(No 6):e228-248.
 25. Sugrue R, Zera C. Pregestational diabetes in pregnancy. *Obs Gynecol Clin North Am* [Internet]. 2018;45(2):315–31. Available from: <https://doi.org/10.1016/j.jogc.2018.01.002>
 26. Robinson A, Nwolise C, Shawe J. Contraception for women with diabetes: challenges and solutions. *Open Access J Contracept*. 2016;7:11–8.
 27. Jacobstein R, Polis CB. Progestin-only contraception: injectables and implants. *Best Pract Res Clin Obstet Gynaecol* [Internet]. 2014; Available from: <http://dx.doi.org/10.1016/j.bpobgyn.2014.05.003>
 28. World Health Organisation. Medical eligibility criteria for contraceptive use. Fifth edition. 2015.
 29. Trussell J. Contraceptive failure in the United States. *Contraception*. 2013;83(5):397–404.
 30. De-Regil LM, Peca-Rosas JP, Fernández-Gaxiola AC, Rayco-Solon P. Effects and safety of periconceptional oral folate supplementation for preventing birth defects. *Cochrane Database Syst Rev*. 2015;(12).
 31. Glinianaia S V., Tennant PWG, Crowder D, Nayar R, Bell R. Fifteen-year trends and predictors of preparation for pregnancy in women with pre-conception Type 1 and Type 2 diabetes: A population-based cohort study. *Diabet Med*. 2014;31(9):1104–13.
 32. Murphy HR, Roland JM, Skinner TC, Simmons D, Gurnell E, Morrish NJ, et al. Effectiveness of a regional prepregnancy care program in women with type 1 and type 2 diabetes: benefits beyond glycemic control. *Diabetes Care* [Internet]. 2010 Dec 1;33(12):2514–20. Available from: <http://care.diabetesjournals.org/cgi/doi/10.2337/dc10-1113>
 33. Sina M, MacMillan F, Dune T, Balasuriya N, Khouri N, Nguyen N, et al. Development of an integrated, district-wide approach to pre-pregnancy management for women with pre-existing diabetes in a multi-ethnic population. *BMC Pregnancy Childbirth*. 2018;18(1):1–15.
 34. O'Higgins S, Mcguire BE, Mustafa E, Dunne F. Barriers and facilitators to attending pre-pregnancy care services: The ATLANTIC-DIP experience. *Diabet Med*. 2014;31(3):366–74.
 35. Rahman M, Rahim NA, Arif MT. Barrier, weakness and utilization of pre-pregnancy clinic services. *Arch Public Heal*. 2017;75(1):1–10.