ORIGINAL ARTICLE

Perceived Barriers to Exercise in Women with Gestational Diabetes Mellitus

Valliammai Jayanthi Thirunavuk Arasoo[a], Nisha Angela Dominic[a], Amutha Ramadas[a], Kean Heng Lim[a], Chong Wei Tiong[a], Ena Liew[a] (MBBS), Jing Ling Tang[a], Ravichandran Jeganathan[b]

[a]*Jeffrey Cheah School of Medicine and Health Sciences, Monash University Malaysia*
[b]*Department of Obstetrics and Gynaecology, Hospital Sultanah Aminah Johor Bahru, Malaysia*

ABSTRACT

Introduction: Good control of glycaemia negates potential maternal and fetal complications. A diet suitable for women with gestational diabetes mellitus (GDM) is a first line approach. However, little is said about suitable exercise in pregnancy that will potentially help control glycaemia. This pilot study seeks to understand the perceived barriers to exercise in women with GDM. **Materials and Methods:** This cross-sectional study recruited patients with GDM on diet control at the antenatal clinic of Hospital Sultanah Aminah Johor Bahru, Malaysia between October 2017 and January 2018. Those who fulfilled the recruitment criteria were approached and 89 women consented to participate. Data was obtained from antenatal records and a self-administered questionnaire. **Results:** The mean age of the participants was 33.3 years. More than 80% were Para 1 and above. 69.6% were either overweight or obese at booking of pregnancy. 80.9% were aware that exercise was necessary for women with GDM. Only 6.7% say that healthcare professionals were their source of information on exercise in pregnancy. 77.3% of the women with low physical activity had full time jobs. Housewives (64.5%) had the highest level of physical activity. Tiredness (43.8%), childcare duties (38.2%) and lack of time (27.0%) were the most common perceived barriers to exercise. Nulliparity was significantly associated with tiredness. **Conclusion:** Main barriers to exercise are tiredness and childcare duties. Health care professionals did little in educating women with GDM on suitable exercise.

KEYWORDS: exercise; barrier; gestational diabetes

INTRODUCTION

Gestational diabetes mellitus (GDM) is one of the most common metabolic disorders during pregnancy. GDM is defined as any degree of glucose intolerance with onset or first recognized during pregnancy.[1] Insulin resistance and relative pancreatic ß-cell dysfunction is thought to lead to GDM.[2,3] GDM occurs when a woman's ß-cells are insufficient, leading to an inability to overcome the diabetogenic state of pregnancy.[3] GDM affects approximately 4% of pregnant women, while the prevalence may range from 1-14% of all pregnancies depending on population and screening modality.[4] In Malaysia, a 2010 epidemiological study showed that the incidence of GDM was 8.66%, with most in the age range of 31-40 years old.[5]

Risk factors for GDM include ethnicity, maternal obesity, maternal age, family history and history of GDM in a previous pregnancy.[6] GDM can result in maternal and fetal complications. The mother suffers an increased risk of Caesarean and operative vaginal delivery and the fetus faces increased risk of macrosomia and shoulder dystocia.[7]

A meta analysis of 20 relevant studies from 1960 to 2009 showed a seven fold increased maternal risk of developing type 2 diabetes.[8]

The mainstay of treatment of GDM is to optimize glucose control and improve pregnancy outcome,

Corresponding author:
Valliammai Jayanthi Thirunavuk Arasoo
Clinical School Johor Bahru
Jeffrey Cheah School of Medicine and Health Sciences,
Monash University Malaysia
8 Jalan Masjid Abu Bakar
80100 Johor Bahru, Malaysia
Tel: +6072190616
Email: t.jayanthi@monash.edu

which generally involves diet modification and implementation of an exercise regime. If glycemic control is not achieved, pharmacological therapy is introduced. Exercise has been shown to play an effective role in glycemic control.[9] The American College of Obstetricians and Gynecologists (ACOG) recommends exercise and dietary changes before starting medication to control glycaemia in GDM .[10] Current guidelines suggest aerobic and resistance exercises of moderate intensity for 30-45 minutes a day for 5 times a week. [11,12] It has been shown in previous publications that exercise can reduce levels of HbA1c and blood sugar profile, in addition to decreasing the risk of developing type 2 diabetes and improving pregnancy outcomes.[11,13] Abnormal glucose regulation was also shown in Asian women with poor sleep quality or short nocturnal sleep duration.[14]

Maternal compliance towards exercise has generally been poor, with only a reported 34% achieving adequate physical activity. The barriers to exercise participation in women have largely been female ideologies of good mothering, with common cited barriers such as lack of childcare facilities and lack of time.[15,16] Maternal perceptions towards exercise are therefore one of the largest influences on the physical activity levels of pregnant women. This study explored maternal attitudes, beliefs and awareness towards exercise as a tool for controlling GDM, as well as to further understand the barriers to exercise participation. The findings aim to provide invaluable data for future health promotion programs and guidelines for GDM, which can be customized to the specific needs of the population.

METHODS

Study design

This was a cross-sectional study conducted at Hospital Sultanah Aminah, Johor Bahru, Malaysia between October 2017 and January 2018. The study has obtained ethics approval from Malaysian Medical and Research Ethics Committee (16-2542-32208) and Monash University Research and Ethics Committee (8708).

Study population

Every patient with GDM attending the antenatal clinic sessions who fulfilled the inclusion and exclusion criteria, and on diet control were approached for consent. A total of 89 patients agreed to be interviewed and 15 patients declined consent.

Inclusion Criteria

1. Women pregnant with singleton pregnancies aged 18 above and able to provide informed consent.
2. Individuals diagnosed with gestational diabetes mellitus as determined by an abnormal Modified Glucose Tolerance Test (MGTT) undertaken in either the first or second trimester. An abnormal MGTT is defined as 2-hour post-glucose challenge, a plasma glucose level of 7.8 mmol/litre and above based on Ministry Of Health guidelines before 1/7/2018.
3. Individuals on diet control only for their GDM.

Exclusion Criteria

1. Individual with underlying type 1 or type 2 diabetes mellitus.
2. Individual is on antiepileptic or antipsychotic medications.
3. Individual is on insulin therapy for her GDM. Metformin is not a treatment option at the study site.
4. Individual with medical or obstetrical contraindications to exercise in pregnancy, which are: pregnancy-induced hypertension, pre-term rupture of membranes, pre-term labour during the prior or current pregnancy, incompetent cervix or cerclage placement, persistent second- or third-trimester bleeding, placenta previa, intrauterine growth retardation, chronic hypertension, thyroid function abnormality, cardiac disease, vascular disease and pulmonary disease.

Assessment

A structured questionnaire consisting of two sections administered by the interviewer and two self-administered sections was compiled with the aim of assessing the daily physical activity level of patients with GDM and their perceived barriers to physical activity. Secondary objectives assessed in the questionnaire are the socio demographics and pertinent obstetric history of the participants and their perception towards GDM and exercise whilst pregnant.

In the first section, socio demographic data and details of current and past pregnancies were obtained from individual antenatal booklets and were recorded by the interviewer. Next, details of daily physical activity was obtained using either the

validated English or Malay language versions of The World Health Organisation Global Physical Activity Questionnaire (http://www.who.int/ncds/surveillance/steps/GPAQ/en/). The third part consisted of a few questions asking participants on their knowledge of exercise in a patient with GDM. The final part was an open-ended question on what the respondents felt were their barriers to exercise. Four blank lines were given and respondents were free to write as many barriers as they wanted. To ensure uniformity in administering the questionnaire, data was collected by a single interviewer during every antenatal clinic session held in the study period. The interviewer had been briefed by the team on proceedings of the questionnaire prior to initiation of data collection.

Statistical analysis

The demographic characteristics and awareness on exercise were described using either mean (standard deviation), median (interquartile range) or frequency (percentage). The association between demographic characteristics and level of physical activity as well as perceived barriers to exercise was analysed using chi square or Fisher's exact test. Data analysis was performed using IBM® SPSS® Statistics V22. A p-value of less than 0.05 was considered as significant.

RESULTS

The mean age of the respondents were 33.3±5.5 years, with majority being Malays (62.9%). A majority of them were full-time workers (52.8%), followed by homemakers (44.9%) and only two women were working on shift. Almost 45% of them do not have a personal income and About 48% of them were earning between RM1,000 and 4,999. More than 80% of them were Para 1 and above. The current median gestational age was 36 (IQR=4.5) weeks, with 12.5 (IQR=3.9) weeks median gestational age at booking. We found 69.6% of

Table 1: Description of respondents (N=89)

Description		Mean	SD	n	%
Age (years)		33.3	5.5		
Age group (years)	<30			22	24.7
	30-39			53	59.6
	≥40			14	15.7
Ethnicity	Malay			56	62.9
	Chinese			15	16.9
	Indian			16	18
	Others			2	2.2
Working status	Full time			47	52.8
	Shift work			2	2.2
	Not working			40	44.9
Personal income per month (RM)	<1,000			3	3.4
	1,000-4,999			42	47.2
	≥5,000			4	4.5
	No income			40	44.9
Parity[a]		1	1		
Parity category	Nullipara			17	19.1
	Para 1 & above			72	80.9
Current gestational age (week)[a]		36	4.5		
Gestational age at booking (week)		12.5	3.9		
Booking BMI (kg/m^2)		28.1	5.6		
BMI category	Normal			27	30.3
	Overweight			31	34.8
	Obese			31	34.8
Past pregnancies with GDM	Yes			26	29.2
	No			63	70.8

[a]Median (IQR)

women to be overweight or obese based on their booking BMI. Less than 30% of them had a history of GDM in past pregnancies. Table 1 presents the characteristics of the study respondents.

On a positive note, about 81% of the respondents were aware that exercise is necessary for women with GDM (Table 2). About two thirds knew exercise could assist in lowering the blood glucose level. However, only 32.6% were aware that exercise helps to decrease weight, and a smaller proportion was aware that it could help to increase insulin level (15.7%). Majority of the women (43.8%) said women with GDM require normal exercise level, while 29 of them said that group will require more exercise than usual is required. News articles were the most common source of information on exercise (12.4%). However, it was worrying that more than 56% claimed that they were never told about the importance of exercise by anyone. Only 6.7% said that healthcare professionals were their source of information on suitable exercise during pregnancy.

Table 2: Awareness on exercise

		n	%
Exercise is necessary for women with GDM	Yes	72	80.9
	No	7	7.9
	Do not know	10	11.2
Exercise helps to decrease body weight	Yes	29	32.6
	No	60	67.4
Exercise helps to decrease glucose in blood	Yes	54	60.7
	No	35	39.3
Exercise helps to increase insulin	Yes	14	15.7
	No	75	84.3
Amount of exercise needed by women with GDM	More exercise	29	32.6
	Normal exercise	39	43.8
	Rest more	1	1.1
	Do not know	20	22.5
Source for information about exercise	Health care professionals	6	6.7
	News articles	11	12.4
	Friends	2	2.2
	Others	20	22.5
	Not told by anyone	50	56.2

Table 3 shows the factors associated with the level of physical activity as measured by GPAQ. We found significant association between level of physical activity and working status (p=0.010) as well as personal income (p=0.024). More than three quarters of the women with low physical activity had full time jobs, while the highest percentage of high level of physical activity can be seen among housewives (64.5%). This finding corresponds to the association found between personal income and physical activity.

An analysis showed tiredness (43.8%), childcare duties (38.2%) and lack of time (27.0%) to be the most common perceived barriers to exercise (Figure 1) among these women. Tiredness was noted in 39.2% of those of Malay ethnicity but the figure rose to 46.7% in ethnic Chinese and a glaring 62.5% for ethnic Indians. Only 11.2% of them did not find any barriers to exercise. Further exploration on these common barriers is shown in Table 4. Nulliparity was significantly associated with tiredness (p=0.013) although they had no childcare duties (p=0.002). As expected, lack of time was associated with working status (p=0.002) and personal income (p=0.001).

DISCUSSION

The participants' characteristics showed that 34.8% of them were overweight and another 34.8% were obese at booking. The risk of developing GDM is 2.14 -fold higher for overweight (BMI: 25.0–29.9), 3.56-fold higher for obese (BMI: ≥30.0) and 8.56-fold higher for severely obese women (BMI: ≥40.0) compared to normal weight pregnant women (BMI: <25.0).[17] These patients will benefit from exercising not only during pregnancy but also beyond as exercise increases insulin sensitivity. It was noted that only 24.7% scored low levels of activity. Another 40.5% and 34.8% scored medium and high levels of activity. This did not correlate with the BMI recorded. Obesity generally develops when energy intake exceeds energy expenditure over a period of time. This suggests that energy intake is excessive in the participants who were overweight or obese. Alternatively, the participants could have overestimated their level of physical activity in GPAQ. Sedentary time was significantly underestimated and vigorous physical activity was significantly overestimated in a study using GPAQ compared to an objective measure of physical activity.[18]

Table 3: Factors associated with level of physical activity (GPAQ)

		Physical activity (MET Level)			*P*
		Low n (%)	Medium n (%)	High n (%)	
Age (years)	<30	7 (31.8)	9 (25.0)	6 (19.4)	0.827
	30-39	11 (50.0)	22 (61.1)	20 (64.5)	
	≥40	4 (18.2)	5 (13.9)	5 (16.1)	
Ethnicity	Malay	13 (59.1)	22 (61.1)	21 (67.7)	0.121
	Chinese	4 (18.2)	9 (25.0)	2 (6.5)	
	Indian	5 (22.7)	3 (8.3)	8 (25.8)	
	Others	0 (0.00	2 (5.6)	0 (0.0)	
Parity category	Nullipara	6 (27.3)	7 (19.4)	4 (12.9)	0.422
	Para 1 & above	16 (72.7)	29 (80.6)	27 (87.1)	
BMI category	Normal	6 (27.3)	10 (27.8)	11 (35.5)	0.3
	Overweight	10 (45.5)	9 (25.0)	12 (38.7)	
	Obese	6 (27.3)	17 (47.2)	8 (25.8)	
Working status	Full time	17 (77.3)	20 (55.6)	10 (32.3)	0.010*
	Shift work	0 (0.0)	1 (2.8)	1 (3.2)	
	Not working	5 (22.7)	15 (41.7)	20 (64.5)	
Personal income (RM)	<1,000	1 (4.5)	1 (2.8)	1 (3.2)	0.024*
	1,000-4,999	14 (63.6)	19 (52.8)	9 (29.0)	
	≥5,000	2 (9.1)	1 (2.8)	1 (3.2)	
	No income	5 (22.7)	15 (41.7)	20 (64.5)	
Awareness for need of exercise in women with GDM	Yes	17 (77.3)	30 (83.3)	25 (80.6)	0.82
	No	1 (4.5)	3 (8.3)	3 (9.7)	
	Not sure	4 (18.2)	3 (8.3)	3 (9.7)	

Data analysed with Chi Square of Fisher's Exact test.

*significant at p<0.05

A worrying but definitely correctable point is the lack of health care professionals' advise (6.7%) on suitable exercise in pregnancy. Although 56.2% say that nobody told them of the need to exercise, 80.9% knew that exercise was necessary for women with GDM. This can be attributed to logical reasoning. This leads to the question of the credibility of information source of the remaining 43.8% of participants. There were various responses to the amount of exercise required ranging from not knowing to more exercise than usual. The lack of health care professionals advise on exercise is not peculiar to our study as the same has been highlighted in a Finnish study.[19] The Ministry of

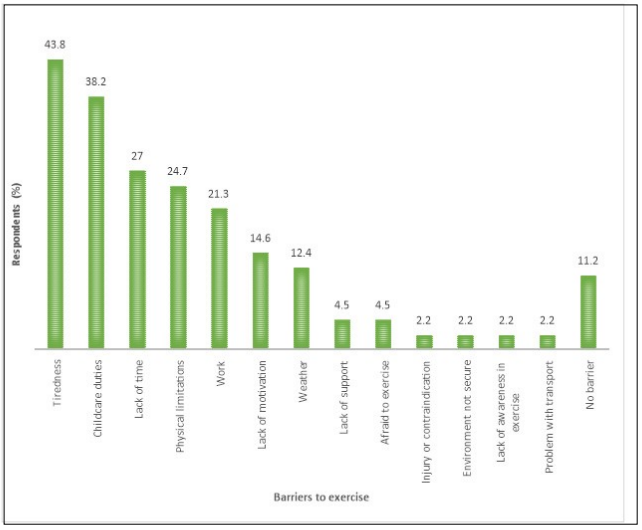

Figure 1 : perceived barriers to exercise

Health Malaysia has a comprehensive advise on exercise during pregnancy (http://aktif.myhealth.gov.my/en/exercise-during-pregnancy2/) and (http://www.myhealth.gov.my/en/antenal-excercise/). Despite this, health care professionals have largely not broached the subject of exercise and educate the patients on where to get further information. Implementation of a low-cost, culturally appropriate model of care for a group of women with GDM in South India brought positive behavioural change in the form of improved physical activity and reduction of sedentary time. This model included counselling on GDM and its implications, nutritional advise and personalised session on the benefits of exercise. A booklet with illustrated exercises that are safe in pregnancy was also given.[20] Adopting a similar approach will be helpful. Health care professionals can play a pivotal role in educating pregnant women on the recommendations and the benefits of exercise.[21]

The most commonly cited barrier to exercise in this study is tiredness otherwise known as fatigue, which was identified by 43.8% of respondents. Similarly, in other studies, tiredness is often cited as a barrier to physical activity in pregnant women.[19,22] A longitudinal study following 42 women from preconception to post-pregnancy period showed a significant increase in fatigue in pregnant women compared to pre-pregnancy period. A possible explanation on how tiredness affects physical activity is a higher fatigue level results in higher levels of perceived stress which is shown to decreases physical activity levels.[23,24]

The causes of tiredness can be explained by physiological changes and pathological medical

Table 4: Socio-demographic factors associated with most common perceived barriers to exercise

		Perceived barriers to exercise								
		Tiredness		*P*	Childcare duties		*P*	Lack of time		*P*
		Yes n (%)	No n (%)		Yes n (%)	No n (%)		Yes n (%)	No n (%)	
Age (years)	<30	11 (28.2)	11 (22.0)	0.129	8 (23.5)	14 (25.5)	0.921	4 (16.7)	18 (27.7)	0.41
	30-39	19 (48.7)	34 (68.0)		20 (58.8)	33 (60.0)		17 (70.8)	36 (55.4)	
	≥40	9 (23.1)	5 (10.0)		6 (17.6)	8 (14.5)		3 (12.5)	11 (16.9)	
Ethnicity	Malay	22 (56.4)	34 (68.0)	0.253	18 (52.9)	38 (69.1)	0.454	14 (58.3)	42 (64.6)	0.683
	Chinese	7 (17.9)	8 (16.0)		7 (20.6)	8 (14.5)		4 (16.7)	11 (16.9)	
	Indian	10 (25.6)	6 (12.0)		8 (23.5)	8 (14.5)		6 (25.0)	10 (15.4)	
	Others	0 (0.0)	2 (4.0)		1 (2.9)	1 (1.8)		0 (0.0)	2 (3.1)	
Parity	Nullipara	12 (30.8)	5 (10.0)	0.013*	1 (2.9)	16 (29.1)	0.002*	4 (16.7)	13 (20.0)	1
	Para 1 & above	27 (69.2)	45 (90.0)		33 (97.1)	39 (70.9)		20 (83.3)	52 (80.0)	
BMI category	Normal	12 (30.8)	15 (30.0)	1	8 (23.5)	19 (34.5)	0.538	8 (33.3)	19 (29.2)	0.832
	Over-weight	13 (33.3)	18 (36.0)		13 (38.2)	18 (32.7)		7 (29.2)	24 (36.9)	
	Obese	14 (35.9)	17 (34.0)		13 (38.2)	18 (32.7)		9 (37.5)	22 (33.8)	
Working status	Full time	24 (61.5)	23 (46.0)	0.281	18 (52.9)	29 (52.7)	1	19 (79.2)	28 (43.1)	0.002*
	Shift work	1 (2.6)	1 (2.0)		1 (2.9)	1 (1.8)		1 (4.2)	1 (1.5)	
	Not working	14 (35.9)	26 (52.0)		15 (44.1)	25 (45.5)		4 (16.7)	36 (55.4)	
Personal income (RM)	<1,000	1 (2.6)	2 (4.0)	0.411	2 (5.9)	1 (1.8)	0.801	1 (4.2)	2 (3.1)	0.001*
	1,000-4,999	22 (56.4)	20 (40.0)		16 (47.1)	26 (47.3)		19 (79.2)	23 (35.4)	
	≥5,000	2 (5.1)	2 (4.0)		1 (2.9)	3 (5.5)		0 (0.0)	4 (6.2)	
	No income	14 (35.9)	26 (52.0)		15 (44.1)	25 (45.5)		4 (16.7)	36 (55.4)	

Data analysed with Chi Square of Fisher's Exact test.

*significant at p<0.05

conditions that arise during pregnancy, psychological factors (identity, mental status and coping skills) or situational factors (age, lifestyle, support system, parity, duration of sleep, exercise and socio-economical background).[15] In addition, the determinants of fatigue differ in each trimester. Age and physiological factors contributes the most to fatigue in the first trimester while duration of sleep is the most important determinant of fatigue in the third trimester.[25]

During pregnancy, many physiological changes can precipitate tiredness. Pregnancy is a period where many physiological changes occur in order to meet the needs for fetal development and subsequent labour.[26] These changes include cardiovascular, respiratory, gastrointestinal, metabolism and hormonal changes. Firstly, plasma volume progressively expands throughout pregnancy and it exceeds the increase in red cell mass. This haemodilution results in a drop in hemoglobin levels, which pushes the body to synthesise more red blood cells. The increased requirement for haemoglobin as well as the reduced oxygen carrying capacity of the blood is one possible explanation for tiredness during pregnancy. When there is severe haemoglobin drop, with Hb levels of <110g/L, this becomes pathological and is defined by World

Health Organization as anemia in pregnancy.[27]

Secondly, the increased oxygen demand in pregnancy, which is a result of an elevation in metabolic rate and oxygen consumption, by 15% and 20% respectively, can sometimes result in physiological subjective feeling of breathlessness.[26] This could contribute to the tiredness felt among pregnant women.

Sleep duration and quality is also often cited as a cause of tiredness in pregnancy. Daily perceived fatigue was shown to be associated with total amount of sleep and depressive symptoms but not sleep quality in nulliparous pregnant women.[28] A pattern of decrease in deep sleep, increase in interrupted sleep and increase duration of sleep was identified in pregnancy.[25] The occurrence of sleep disturbance in pregnancy is noted to increase significantly throughout pregnancy which resulted in more fatigue in pregnant women.[29]

In this study we observed a significantly higher prevalence of tiredness as a perceived barrier in nulliparous women (p=0.013) and a non-significant but higher percentage of Indians experiencing tiredness as a barrier. In contrast, most studies showed higher or equal fatigue level in multiparous women compared to nulliparous women due to factors such as a poorer sleep quality, more stress and childcare duties which should result in higher fatigue level.[30-32] There was a study that showed nulliparous women having less efficient sleep than multiparous women, however another showed no association between quality of sleep and perceived fatigue level. [28,33] Therefore, the difference in perceived barrier resulting from fatigue is more likely due to better coping mechanism to fatigue in pregnancy such as familiarity with pregnancy experience rather than actual level of fatigue.[30]

Among the perceived barriers to exercise in pregnancy, lack of time was a substantial barrier in 27.0% of the respondents, especially noted in this study where over 50% of the respondents were working full-time. This finding also corroborates the findings of other previous studies.[34-36] Given that there was a significant association indicating that women with low physical activity levels were more likely to have full-time jobs (p=0.010), this finding suggests that full-time employment in Malaysia significantly reduces the available time for women to exercise. Long work hours are typical in the current economic climate of Malaysia.[37] Nonetheless, it is also noted that barriers related to lack of time are usually found in studies conducted in the general population and are not specifically related to pregnancy.[38,39]

Time constraint due to childcare duties was a significant barrier (38.2%) to exercise in our cohort, of whom 80.9% were Para 1 and above. The significant correlation between increasing parity and perceiving childcare duties as a barrier reflects on how female ideologies of motherhood tend to displace physical activity in daily life. Other studies have demonstrated that childcare duties as an interpersonal barrier is particularly reported among non first-time mothers who were from a lower socioeconomic background. [40,41] It is thus beneficial to explore home based exercise routines that can be done when the child is asleep or attending preschool. Alternatively, exercise can be incorporated into mother and child fitness play time. A long term view of exercise should be taken and women should be encouraged to continue exercising post-partum and beyond. This is imperative as women with GDM run a seven fold increased risk of developing Type 2 Diabetes Mellitus subsequently[8] .

This pilot study has strengths and limitations. The main strength lies in detecting correctable perceived barriers to exercise in women with GDM in Malaysia. An open ended question on perceived barriers to exercise allows spontaneous response as opposed to pre-determined response options. However, the limitations are that of not collecting data that could contribute to tiredness such as haemoglobin levels, thyroid function status and sleep patterns. A larger scale longitudinal study that includes these limitations should be done to find out if lifestyle changes advised is practised long term.

CONCLUSION

The perceived barriers to exercise in this study include tiredness and child care responsibilities. This is also the common thread in prior studies. Exercise by itself can combat tiredness and improve wellbeing. However, the lack of health care professionals' involvement in educating women with GDM on exercise especially when this is readily available on the Ministry of Health's website can be addressed by creating awareness. A dedicated

diabetic care educator who is well trained in aspects of GDM management such as nutrition and exercise in centres managing women with GDM will be useful. Inculcating lifestyle modification during various stages of pregnancy and post-partum can lead to healthy changes. This is important as Malaysia has an undesirable large number of overweight and obese population.

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