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Female Awareness about Gestational Diabetes and its Health Risk Effect on Pregnancy Outcome among Women in the Kingdom of Saudi Arabia

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ABSTRACT

Uncontrolled gestational diabetes mellitus causes severe maternal and fetal complications such as pre-eclampsia, macrosomic baby, fetal demise, neonatal hyperbilirubinemia, and hypoglycemia and also increases obesity and type 2 DM risk in offspring later in life.

This study aimed to assess awareness of women in the Kingdom of Saudi Arabia regarding diabetes and its health risk effect on pregnancy outcome and to measure the prevalence of gestational DM among them.

This is a comparative cross-sectional descriptive study conducted in Department of Obstetrics and Gynecology, Faculty of Medicine Umm Al Qura University involving 480 women living in the Kingdom of Saudi Arabia during June 2021- June 2022. Data was collected through an online questionnaire formulated to survey saudi women due to covid 19 pandemics measures.

About 20% had DM. Prevalence of gestational DM was 11.5% among currently pregnant participants. 76% of participants had family history of diabetes. After doing linear regression of predictors for knowledge about gestational DM, gravidity and parity became non-significant, however being in medical field, husband in medical field, having DM, past or family history of DM remained significant ($p<0.001$, 0.045, <0.001, 0.002 and 0.006 respectively). The highest predictor is being in medical field (β =7.218), followed by having DM (β =2.697), followed by husband in medical field (β =2.159), past history of DM (β =1.945), then family history of DM (β =1.727).

Health care efforts and interventions are required to increase the awareness especially about the importance of screening for gestational DM due to the bad sequences of gestational DM.

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INTRODUCTION

The American Diabetes Association defines gestational diabetes mellites (GDM) as glucose intolerance which was not present before pregnancy.[1] Gestational diabetes is considered a risk factor for developing diabetes mellitus in two consecutive generations. So, increasing awareness among women in the reproductive period will lead to increase prevention and early diagnosis of this disease.[2]

Several risk factors may lead to developing gestational DM such as past and family history of gestational DM, cigarette smoking, increase maternal age,[3] previous delivery of macrosomic baby, family history of DM type II,[4] and weight gain between pregnancies which is the commonest modifiable risk factor for gestational DM.[5,6] Uncontrolled gestational DM causes severe maternal and fetal complications such as pre-eclampsia, macrosomic baby, fetal demise, neonatal hyperbilirubinemia, and hypoglycemia and also increases obesity and type 2 DM risk in offspring later in life.

The suitable time for screening for gestational diabetes mellitus depends on risk factors presence. If pregnant women have any risk factors, then we should do screening in the first prenatal visits. If she does not have any risk factors, then we do screening at 24 to 28 weeks of pregnancy. Screening is done by oral glucose tolerance test.[7] They also should be screened 6-12 weeks post-partum for persistent high glucose level as recommended by both the ADA and the American College of Obstetricians and Gynaecologists.[8,9]

The Kingdom of Saudi Arabia is one of the top 10 countries with high prevalence of diabetes.[10,11] A study by Wahabi *et al*.[12] showed that 24.2% of Saudi women get DM during pregnancy which is high risk for developing type 2 DM and 4.3% have pre gestational DM and concluded that Saudi pregnant

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population is one of countries with the highest prevalence of gestational DM and pre gestational DM. So, we aimed to assess awareness of women in the Kingdom of Saudi Arabia regarding gestational diabetes and its health risk effect on pregnancy outcome and to highlight the effect of different sources of knowledge on the awareness of women in the Kingdom of Saudi Arabia regarding gestational diabetes and its health risk effect on pregnancy outcome. We also aimed to measure the prevalence of gestational DM among women in the Kingdom of Saudi Arabia during 2021 to see if any trend occurred which requires health care efforts to increase the awareness especially about the importance of screening for gestational DM due to the bad sequences of gestational DM.

METHODS

The study is comparative cross-sectional descriptive study. Target population were women living in the Kingdom of Saudi Arabia during June 2021- June 2022. An online survey was formulated to survey women due to covid 19 pandemics measures. The questionnaire was formed of 3 parts. The first section assessed demographic data. The second section assessed obstetric history. The third section assessed medical history and knowledge of women about gestational diabetes and its health risk effect on the mother and foetus. 480 women filled the questionnaire. Consent was obtained from participants during questionnaire filling. No potential risks to the participants.

Statistical Analysis

Statistical analysis was done using SPSS (statistical package for social science) version 22. Qualitative data was expressed as numbers and percentages while qualitative data as mean and SD. One way ANOVA test was used for comparing knowledge score. Boneferroni test for pairwise comparison was used. Linear regression was used to assess predictors for higher knowledge. Statistical significance will be considered when P value is less than 0.05.

RESULTS

The mean age of participants was 35±7 years. Out of 480 participants, about 57% had family income more than 10000 SR. 81.5% were non-smokers. 64% were living in urban regions. More than two thirds had university education. About fourth of participants have been married for more than 15 years. Only 6% were non-Saudi. 42% had two or more children. 49% were housewives. 40% of participants' husbands had administrative works. The mean weight was 70±14 kg, while the mean height was 160±8 cm (Table 1).

Only 18% were pregnant. Near half had gravidity of two to four. About 54% had no previous abortion. 42% had one or two normal labors, while 36% had one or two C/S labor (Table 2).

Only 9% had pre-eclampsia. About 20% had DM. Prevalence of gestational DM was 11.5% among currently pregnant participants. 76% of participants had family history of diabetes (Table 3, figure 1 & 2).

Regarding knowledge about gestational DM effect, the most frequent information with wrong answers were that preexisting

Table 1: Demographical characteristics of the studied women in the Kingdom of Saudi Arabia (n=480)

		N	*%*
Age (mean ± SD)		35±7	
Husband age (mean ± SD)		38±11	
Family income in SR	1. less than 3000	17	3.5%
	2. 3000-6000	54	11.3%
	3. 6000-10000	136	28.3%
	4. more than 10000	273	56.9%
Smoking	1. yes	61	12.7%
	2. no	391	81.5%
	3. previous smoker	28	5.8%
Residence	1. urban	451	94.0%
	2. rural	29	6.0%
Educational level	1. ignorant	2	0.4%
	2. primary	1	0.2%
	3. secondary	49	10.2%
	4. university	328	68.3%
	5. postgraduate	100	20.8%
Husband educational level	1. ignorant	2	0.4%
	2. primary	28	5.8%
	3. secondary	90	18.8%
	4. university	239	49.8%
	5. postgraduate	121	25.2%
Marriage period	1. less than 5 years	112	23.3%
	2. 5 to 10 years	139	29.0%
	3. 11 to 15 years	103	21.5%
	4. more than 15 years	126	26.3%
Nationality	Non-Saudi	30	6.3%
	Saudi	450	93.8%
Husband nationality	Non-Saudi	43	9.0%
	Saudi	437	91.0%
Children	Zero	30	6.3%
	One	102	21.3%
	Two to three	202	42.1%
	More than 4	146	30.4%
Occupation	Non-medical field	456	95.0%
	Medical field	24	5.0%
Husband occupation	Non-medical field	452	94.2%
	Medical field	28	5.8%
Weight in kg (mean ± SD)		70±14	
Height in cm (mean ± SD)		160±8	

DM affects placenta and causes intrauterine growth restriction (54%), followed by frequent urinary tract and vagina infections (53%) then increases the chance of high blood pressure or preeclampsia (39%) and that gestational diabetes is diagnosed after the sixth month (39%).

Regarding knowledge about gestational DM effect, 80% did not know that there is no screening methods for ensure fetal wellbeing when the mother has diabetes. 70% did not know that there is relationship between cumulative high blood sugar levels before pregnancy or in the first months and fetal abnormalities. 65% did not know that preexisting diabetes,

can lead to fetal anomalies such as congenital heart disease, spine and renal anomalies. About half of participants did not know that high blood sugar during pregnancy could increases the chance of assisted vaginal delivery such as vacuum or forceps, macrosomia, can cause shoulder dystocia and they are also not aware the poor control DM can lead to fetal death. Regarding knowledge about post-natal gestational DM effect, more than 70% did not know that maternal high blood sugar level intrapartum increases the risk and the severity of neonatal hypoglycemia. More than 65% were not aware that poor maternal diabetic control increases the risk and chance of neonatal respiratory distress syndrome (RDS) due to the effect of hyperglycemia of delaying fetal lung maturity. (Table 4).

When comparing knowledge mean score according to demographic characteristics, obstetric and medical history of participants, occupation, husband occupation, gravidity, parity, having DM, past and family history of DM showed significant difference (p<0.001, 0.010, 0.002, <0.001, <0.001, <0.001 and <0.001 respectively). Being in medical field either the wife or her husband had higher mean score than not being (18.25 vs. 10.27 and 13.46 vs.10.5). Those with gravidity of five or more had higher mean score than those with zero or one gravidity (11.95 vs. 7.21 and 9.61 respectively) (figure 3). Those with parity of three or more had higher mean score than those with zero or one or two parity (11.67 vs. 6.11 and 10.07 respectively) (Figure 4). Those having DM, past or family history of DM had higher mean knowledge score than those not having (14.55 vs. 9.84, 13.23 vs. 9.68 and 11.22 vs. 8.22 respectively) (Figure 5) (Table 5).

After doing linear regression of predictors for knowledge about gestational DM, gravidity and parity became non-significant,

Table 2: obstetric history of the studied women in the Kingdom of Saudi Arabia (n=480)

		N	%
Currently pregnant?	Yes	87	18.1%
	No	393	81.9%
Gravidity	Zero	19	4.0%
	One	95	19.8%
	Two to four	246	51.2%
	Five or more	120	25.0%
Abortion	No	258	53.8%
	One or two	183	38.1%
	Three or more	39	8.1%
Normal labor	Zero	155	32.3%
	One or two	200	41.7%
	Three or more	125	26.0%
C/S labor	Zero	247	51.5%
	One or two	171	35.6%
	Three or more	62	12.9%

Table 3: medical history of the studied women in the Kingdom of Saudi Arabia (n=480)

		N	%
Pre-eclampsia	Yes	42	9%
	No	438	91%
DM	Yes	95	20%
	No	372	78%
	I don't know	13	3%
Type of DM	Type 1	17	4%
	Type 2	41	9%
	Gestational DM	37	8%
	GDM among currently pregnant (n=87)	10	11.5%
Past history of gestational DM	Yes	134	28%
	No	346	72%
Family history of DM	Yes	366	76%
	No	88	18%
	I don't know	26	5%

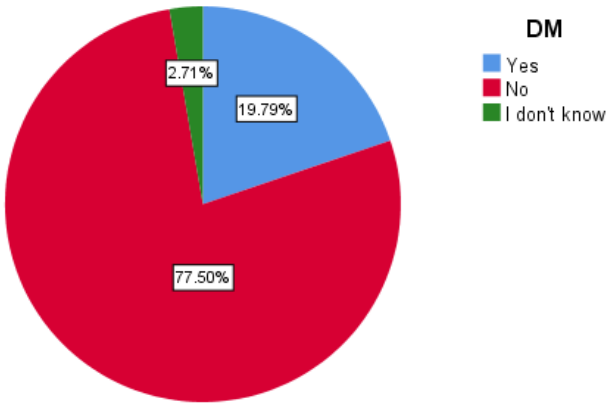

Fig. 1: DM prevalence among the studied women in the Kingdom of Saudi Arabia (n=480)

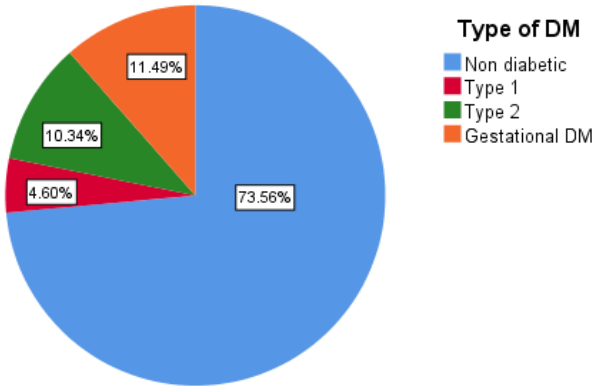

Fig. 2: Prevalence of different types of DM among currently pregnant participants (n=87).

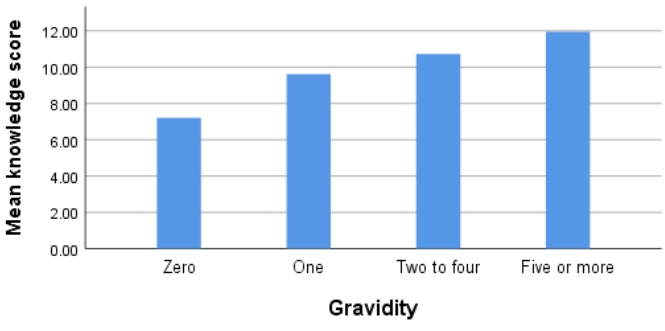

Fig. 3: Knowledge mean scores of the studied women in the Kingdom of Saudi Arabia according to gravidity

Table 4: Knowledge of the studied women in the Kingdom of Saudi Arabia about gestational DM effect on pregnancy outcome (n=480)

	wrong answer		*correct answer*	
	N	*%*	*N*	*%*
Knowledge about antenatal gestational DM effect				
29. Did you know that gestational diabetes is diagnosed after the sixth month?	189	39%	291	61%
30. Did you know that high blood sugar causes frequent infections in the urinary tract and vagina?	252	53%	228	48%
31. Did you know that high blood sugar affects placenta and causes a decrease in fetus growth?	260	54%	220	46%
32. Did you know that high blood sugar causes an increase in fetus weight to more than 4 kg?	135	28%	345	72%
33. Did you know that high blood sugar increases the chance of high blood pressure or preeclampsia?	185	39%	295	61%
Knowledge about natal gestational DM effect				
34. Did you know that high blood sugar causes premature labor?	199	41%	281	59%
35. Did you know that there are no screening methods that insures the safety of the fetus when the mother has diabetes?	385	80%	95	20%
36. Did you know that chronic diabetes especially before pregnancy, can lead to fetal deformities in the heart, spine and kidneys of the fetus?	314	65%	166	35%
37. Did you know that there is relationship between cumulative high blood sugar levels before pregnancy or in the first months and fetal abnormalities?	337	70%	143	30%
38. Did you know that high blood sugar during pregnancy can cause shoulder dystocia during normal labor?	231	48%	249	52%
39. Did you know that high blood sugar during pregnancy increases incidence of cesarean delivery due to increase in size of fetus?	171	36%	309	64%
40. Did you know that high blood sugar during pregnancy increases incidence of suction or forceps assisted delivery due to increase size of fetus?	268	56%	212	44%
41. Did you know that high blood sugar during pregnancy can lead to fetal death?	234	49%	246	51%
Knowledge about postnatal gestational DM effect				
42. Did you know that high blood sugar during pregnancy causes an increase in incidence of vaginal fissures that reach the rectum due to increase size of fetus?	315	66%	165	34%
43. Did you know that high blood sugar causes an increase in wound infection?	145	30%	335	70%
44. Did you know that high blood sugar in the mother during labor increases incidence of neonatal jaundice?	369	77%	111	23%
45. Did you know that high blood sugar in the mother during labor causes neonatal hypoglycemia?	339	71%	141	29%
46. Did you know that high blood sugar in the mother during pregnancy increases incidence of delayed maturation of the lungs, and thus putting neonate on breathing machines after birth?	332	69%	148	31%
47. Did you know that gestational diabetes can recur in the next pregnancy?	147	31%	333	69%
48. Did you know that high blood sugar in pregnancy can continue after labor, so you should follow up blood sugar after labor?	102	21%	378	79%
49. Did you know that adhering to the doctor's instructions, regulating blood sugar level, following a healthy diet, exercising, and reducing weight can reduce all the previous risks?	50	10%	430	90%

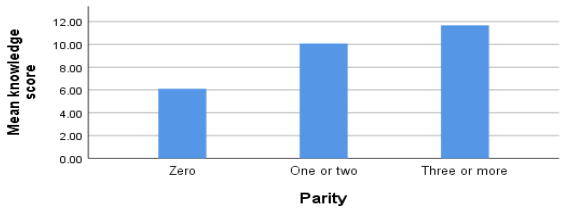

Fig. 4: Knowledge mean scores of the studied women in the Kingdom of Saudi Arabia according to parity

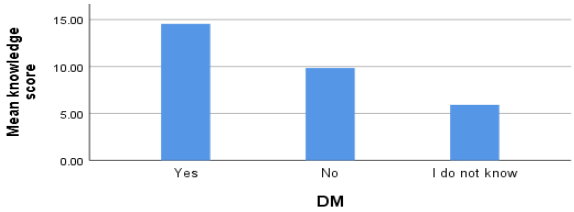

Fig. 5: Knowledge mean scores of the studied women in the Kingdom of Saudi Arabia according to being diabetic or not.

however being in medical field, husband in medical field, having DM, past or family history of DM remained significant (p<0.001, 0.045, <0.001, 0.002 and 0.006 respectively). The highest predictor is being in medical field (β =7.218), followed by having DM (β =2.697), followed by husband in medical field (β =2.159), past history of DM (β =1.945), then family history of DM (β =1.727) (Table 6).

Different superscripts signify statistical significance
One way ANOVA and T- test were used. Bonferroni test was used for pairwise comparison,

Table 5: Mean knowledge score according to demographic characteristics, obstetric and medical history of the studied women in the Kingdom of Saudi Arabia (n=480)

		Mean	*Standard Deviation*	*F or T*	*P-value*
Educational level	3. secondary	10.92	5.02	0.595	0.552
	4. university	10.47	5.17		
	5. postgraduate	11.15	5.01		
Family income in SR	1. less than 3000	9.94	4.13	0.553	0.647
	2. 3000-6000	9.89	4.66		
	3. 6000-10000	10.59	5.16		
	4. more than 10000	10.91	5.17		
Occupation	Non-medical field	10.27	4.79	45.138	<0.001
	Medical field	18.25	2.27		
Husband occupation	Non-medical field	10.50	4.84	6.693	0.010
	Medical field	13.46	6.76		
Smoking	No	10.68	5.95	0.018	0.894
	Yes	10.57	5.82		
Gravidity	Zeroa	7.21	3.05	5.172	P=0.002
	Onea	9.61	4.54		P1=0.007
	Two to four	10.72	4.56		P2=0.023
	Five or moreb	11.95	5.87		
Abortion	No	10.29	4.97	1.898	0.151
	One or two	10.87	5.12		
	Three or more	12.18	4.39		
Parity	Zeroa	6.11	2.43	9.062	P<0.001
	one or twob	10.07	4.85		P1=0.002
	three or morec	11.67	5.76		P2<0.001 P3=0.011
DM	Yesa	14.55	5.41	31.711	P=<0.001
	Nob	9.84	4.66		P1<0.001
	I don't knowc	5.92	2.17		P2<0.001 P3=0.039
Past history of gestational DM	Yes	13.23	5.21	37.387	P<0.001
	No	9.68	4.90		
Family history of DM	Yesa	11.22	5.53	9.558	P<0.001
	Nob	8.22	4.03		P1<0.001
	I don't know	11.15	5.13		

Table 6: Linear regression of predictors for knowledge about gestational DM

	Unstandardized Coefficients		*P*	*95.0% Confidence Interval for B*	
	B	*t*	*Lower Bound*	*Upper Bound*	
Occupation	7.218	6.255	**<0.001**	4.950	9.486
Husband occupation	2.159	2.014	**0.045**	0.053	4.266
Gravidity	0.785	1.741	0.082	-0.101	1.671
Parity	0.944	1.590	0.113	-0.223	2.111
DM	2.697	3.919	**<0.001**	1.345	4.050
Past history of gestational DM	1.945	3.074	**0.002**	0.701	3.189
Family history of DM	1.727	2.761	**0.006**	0.498	2.956
F=20.060 p=<0.001 R^2=0.245					

The highest percent of participants said they got information mostly from physicians (41.7%) followed by google, social media (about 17%) (Table 7).

Thirty-three percent had poor knowledge, 37% had fair knowledge while 30% had good knowledge (Figure 6).

Table 7: Participants' responses regarding their source of information

	N	%
Google	82	17.1
Social media	80	16.7
Physicians	200	41.7
Health care workers	32	6.7
Friends and neighbors	76	15.8
TV and radio	10	2.1

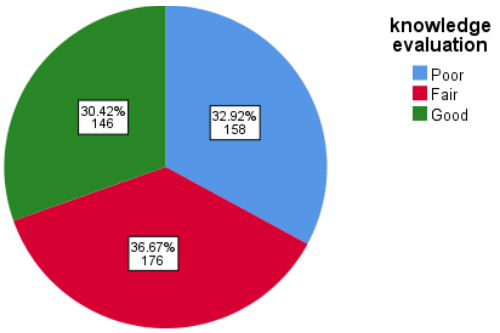

Fig. 6: Knowledge evaluation among the studied women in the Kingdom of Saudi Arabia (n=480)

DISCUSSION

Gestational DM is quite common during pregnancy. It occurs in about 14% of pregnant women all over the world as reported by International Diabetes Federation estimates[13]. GDM may occur at any time of pregnancy but mostly occurs after 24 weeks, so it is recommended for all pregnant women to do oral glucose tolerance test between 24th to 28th week.[14]

To summarize our findings, the prevalence of gestational DM was 11.5% among currently pregnant participants. When comparing knowledge mean score according to demographic characteristics, obstetric, and medical history of participants, there was a significant relationship between higher knowledge and being in medical field either the wife or her husband, higher gravidity, higher parity, having DM, past and family history of DM. After doing linear regression, gravidity and parity became non-significant the highest predictor was having DM, followed by family history of DM, followed by past history of DM.

This study found that the prevalence of gestational DM was 11.5% among currently pregnant participants. When reviewing previous studies done in the Kingdom of Saudi Arabia, we found a prospective study done by Alfadhli *et al.* [15] at Medina on pregnant woman from 2011 to 2014 which estimated that 39.4 % of pregnant women had gestational diabetes[15]. Another cross-sectional study by Al-Rubeaan *et al.*[16] done on 13627 pregnant woman estimated the prevalence was 36.6%. A study by Wahabi *et al.*[12] showed that 24.2% of Saudi women get DM during pregnancy which is high risk for developing type 2 DM and 4.3% have pre gestational DM and concluded that Saudi pregnant population is one of the highest prevalence of gestational DM and pre gestational DM. Another study by Alharthi *et al.*[17] in the Kingdom of Saudi Arabia showed the lack of awareness about gestational DM among the study group although the prevalence of gestational DM was high. Furthermore, a study by Nabrawi *et al.*[18] showed the prevalence of gestational DM in 2019 to be 19.6% in Saudi study population. We can conclude that the prevalence of GDM in the Kingdom of Saudi Arabia is high, however it shows a decreasing pattern which is good. This can be due to increasing awareness of women about GDM and its complications. Furthermore, they become more aware about the importance of screening test for early detection and management of GDM including diet, life style modification and proper treatment.

Regarding knowledge about DM effect in pregnant women, half of participants did not know that preexisting DM associated with placental insufficiency that lead to intrauterine growth restriction and DM in general increases the risk of recurrent urinary tract and vagina infection.

Most participants did not know that no screening test to ensures fetal wellbeing and also were not aware that periconceptional poor diabetic control increase the risk of fetal anomalies. Half of them were not aware that poor maternal diabetic control associated with increase fetal and neonatal morbidities and mortalities including IUFD, birth trauma assisted vaginal deliver neonatal metabolic disorder as hypoglycemia, jaundice etc.

Most participants were not aware that poor maternal diabetic control increases the risk and chance of neonatal respiratory distress syndrome (RDS). Similarly, a previous study done in the Kingdom of Saudi Arabia in 2020 found that most participants were unaware with the bad consequences of gestational DM[19].

Being in medical field either the wife or her husband, had higher mean score of knowledge than those who's not. Having DM, past or family history of DM had higher mean knowledge score than those not having.

A previous study done in the Kingdom of Saudi Arabia in 2018 found that working in medical field, having chronic diseases or family history of chronic diseases were more likely to have higher knowledge[20].

The highest percent of participants said they got information mostly from physicians followed by google and social media. Similarly, a previous study found that participants got information mostly from friends and health workers[21].

Only 30.4% of participants had good knowledge. Another study found that the same percentage had good knowledge about complications of GDM[21].This is nearly similar to a previous study which showed that 36% of participants had good knowledge about gestational DM[19].

The strength of our study was that the sample size was large, and the population was diverse as data was collected using online survey. One of study limitations was the cross-sectional nature of the study. Another one was that it did not involve only pregnant women.

CONCLUSION

The prevalence of GDM in the Kingdom of Saudi Arabia is high, however it shows a decreasing pattern which is good. This can be due to increasing awareness of women about GDM and its complications. Furthermore, they become more aware about the importance of screening test for early detection and management of GDM including diet, life style modification and proper treatment. The highest predictor for higher knowledge was having previous gestational DM, followed by family history

of DM, followed by past history of DM. Health care efforts and interventions are required to increase the awareness especially about the importance of screening for gestational DM due to the bad sequences of gestational DM.

Conflect of Intrest: None

Fund: Self

Ethical approval

Ethical approval was obtained from National Committee of Bio Ethics (No. HAPO-02-K-012-2020-70-416) . Confedentiality was respected and data were not used for any other purpose.

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