Screening and diagnosis of gestational diabetes mellitus in a primary health-care center in Assiut

Lobna F. El Toony, El-Gibaly M. Omaima, Walaa A. Khalifa,
El-Sayed G. Rowyda

Department of Internal Medicine, Faculty of
Medicine, Assiut University, Assiut, Egypt

Correspondence to Rowyda EL-Sayed Gooda,
MSc, Mahmoud Rashwan street, Assiut, 71511,
Egypt. Tel: 00201000177067;
e-mail: roro.rody.7@gmail.com

Background

Gestational diabetes mellitus (GDM), defined as glucose intolerance with onset or first recognition in pregnancy, is a common complication of pregnancy. The American Diabetes Association 2017 redefined GDM as follows: 'diabetes diagnosed in the second and third trimesters of pregnancy.' It is estimated by the International Diabetes Federation that 21.3 million or 16.2% of live births to women in 2017 had some form of hyperglycemia in pregnancy. An estimated 86.4% of those cases were due to GDM.

Aim

The aim was to evaluate the prevalence of gestational diabetes using Diabetes in Pregnancy Study Group India criteria and to determine the magnitude of gestational diabetes among pregnant women at 24–28 weeks gestation attending Al-Fath Primary Health-care Center in Assiut Governorate to identify the possible risk factors of GDM among this group of pregnant women and to increase awareness about GDM and importance of early detection in primary health-care providers and among population as a whole.

Patients and methods

A cross-sectional clinical study which included 500 pregnant women not known to have diabetes mellitus before gestation, who attended the Al-Fath Primary Health-care Center in Assiut Governorate between the period of July 2015 and July 2016.. Non-fasting oral glucose tolerance test at 24–28 weeks gestation using 75 g glucose anhydrous in 250–300 ml water and woman was considered to have GDM if 2h-postprandial blood glucose exceeded 140 mg/dl (Diabetes in Pregnancy Study Group India criteria) and HBA1C was indicated only if 2 h Blood sugar greater than or equal to 200 g/dl to exclude pre-pregnancy diabetes from GDM. This study was part of a Gestational Diabetes Care in Upper Egypt project in collaboration with World Diabetes Foundation 13–797.

Results

The present study included 500 pregnant women, 8% of them had GDM, 24 (60%) GDM women had significantly different risk factors for GDM, 10 of them (25%) had a family history of GDM, eight of them (20%) had multiple risk factors, and four (10%) women had a previous history of twins. A high percentage of GDM women (about 40%) had no definite risk factor and this encourages universal screening of GDM to pick up more and more cases of GDM. Increased age of pregnant women (>30 years, 40%) is a significant risk factor for GDM. BMI was significantly higher in those with GDM (85%), As regards dietary habits, significant difference between women with GDM and those without GDM presented only with excess consumption of sweets/desserts.

Conclusion

The prevalence of GDM in the Al-Fath district of Assiut was 8%, in which a family history of diabetes mellitus was the most frequent risk factor for GDM. Presence of multiple risk factors, previous history of twins, advanced maternal age, and increased BMI were other risk factors for GDM. Sweet/deserts were the most frequent type of food among GDM women.

Keywords:

diagnosis, Diabetes in Pregnancy Study Group India criteria, gestational diabetes mellitus, OGTT, PHC center, screening

Introduction

Gestational diabetes mellitus (GDM), defined as glucose intolerance with onset or first recognition during pregnancy, is a common complication of

pregnancy. Its prevalence varies worldwide, according to the characteristics of the underlying population and the diagnostic criteria being applied. A recent review of data published over the past decade indicated that the highest prevalence was reported in Middle East and North Africa, with a median estimate of 13%, whereas the lowest was in Europe, with a median prevalence of 5.8% [1]. The American Diabetes Association redefined GDM as follows: 'diabetes diagnosed in the second and third trimesters of pregnancy [2].' It is estimated by the International Diabetes Federation that 21.3 million or 16.2% of live births to women in 2017 had some form of hyperglycemia in pregnancy. There are some regional differences in the prevalence of hyperglycemia in pregnancy, with the South-East Asian Region having the highest prevalence at 24.2% compared with 10.4% in the Africa Region. The vast majority (88%) of cases of hyperglycemia in pregnancy were in low- and middle-income countries, where access to maternal care is often limited [3]. Screening for GDM is usually done at 24–28 weeks of gestation because insulin resistance increases during the second trimester and glucose levels rise in women who do not have the ability to produce enough insulin to adopt this resistance [4]. There is no consensus regarding screening and diagnostic methods for GDM. Screening and diagnostic criteria can be either universal or risk-based one-step or two-step procedure. Diabetes in Pregnancy Study Group India (DIPSI) diagnosis of gestational diabetes if the 2 h venous plasma glucose post consumption of 75 gram glucose was greater than or equal to 140 mg/dl, which is a modified WHO criteria designed as per Indian standards. It is simple, convenient, and can be used as a universal screening test [5]. About 40–60% of women with GDM have no demonstrable risk factor; for this reason many advocate to screen all pregnant women [6]. Well-documented risk factors for GDM include advanced maternal age, family history of diabetes, previous GDM, having a macrosomic baby, non-Caucasian race/ethnicity, being overweight or obese, and cigarette smoking [7]. Pregnant women with GDM have an increased incidence of preeclampsia, preterm labor, pyelonephritis, polyhydramnios, and cesarean delivery. The long-term complications include a higher risk of developing type 2 diabetes mellitus (DM) and cardiovascular disease [8]. In addition, there are many potential effects of GDM on the fetus. Short-term effects include a much larger birth weight (fetal macrosomia), shoulder dystocia, difficult or operative delivery, stillbirth, and increased perinatal morbidity and mortality. Long-term effects include an increased incidence of childhood obesity and early adulthood type 2 DM [9].

Aim

The aim of the study was primarily to evaluate the prevalence of gestational diabetes using DIPSI criteria and to determine the magnitude of gestational diabetes among pregnant women at 24–28 weeks gestation attending the primary health-care centers in Assiut Governorate. Also, the study was to identify the possible risk factors of GDM among this group of pregnant women and to increase awareness about GDM and the importance of early detection in primary health-care providers and among population as a whole.

Patients and methods

Patients

This was a cross-sectional clinical study including 500 pregnant women not known to have DM before gestation, who attended the Al-Fath Primary Health-Care Center in Assiut Governorate between the period of July 2015 and July 2016.

Inclusion criteria

All pregnant women at 24–28 weeks of gestation who attended Al-Fateh Primary Health-Care Centers in Assiut.

Exclusion criteria

Those with pre-GDM and diabetes in the first trimester were excluded.

All pregnant women in our study were subjected to the following: detailed history with emphasis on the outcome of previous pregnancies, history of abortion, history of stillbirths, history of macrosomic baby or multiple/twin pregnancies, family history of diabetes, history of polycystic ovary, and dietary habits by a simple questionnaire. Clinical examination, systemic examination, and laboratory Investigation including oral glucose tolerance test at 24–28 weeks gestation using 75 g glucose anhydrous and diagnosis of gestational diabetes if the 2 h venous plasma glucose was greater than or equal to 140 mg/dl (DIPSI criteria) and HBA1C if 2 h blood sugar greater than or equal to 200 g/dl to exclude prepregnancy diabetes from GDM.

Statistical analysis

The collected data was analyzed statistically using IBM-SPSS version 20 (Armonk, NY: IBM Corporation, NY, USA). Continuous data were expressed in the form of mean±SD and analyzed by using Student's t-test while nominal data will be expressed in the form of frequency and proportion and compared by χ^2-test. χ^2-Test was performed to

test for differences in the proportion of categorical variables between two or more groups. Student's *t*-test (two-tailed) was used to determine the significance. Multivariate regression analysis was used to determine the predictors for GDM. The level of *P* less than 0.05 was taken as the cut off value for significance.

Ethics and consents

The study protocol was approved by the local Ethics Committee in the Faculty of Medicine, Assiut University

---

Results

This study included 500 pregnant women, 40 (8%) women who had 2h-post 75 g glucose blood sugar greater than or equal to 140 mg/dl. Consequently, the frequency of GDM in the study was 8%.

Demographic Characteristics of the Study Population: It was found that increasing age greater than 30 years was a significant risk factor among GDM women with *P* value of 0.02. Also, the mean age of marriage among GDM women although only numerically was less than the non-GDM women. The same for increasing parity (3.70±2.24 times), which was more prevalent among GDM women although not reaching the significant value.

Clinical characteristics of the study population: it was found that 40% of GDM women had no definite risk factor for GDM and this encourages the concept of universal screening of all pregnant women rather than selective screening in areas with high prevalence of DM to pick up more and more cases with GDM. It was also demonstrated that a family history of DM was the most frequent risk factor for GDM (25%) in our study with *P* value of 0.001. There was also significant difference between GDM and non-GDM women as regards the presence of multiple risk factors (20%) and previous history of twins (10%) with *P* value of 0.02 and 0.001, respectively. In addition, our study found that obesity was a significant risk factor for GDM with BMI greater than 30 with *P* value of 0.04 as obesity is

one of the major risk factors for DM in our population which is defined as BMI greater than or equal to 30 kg/m^2 (Table 1).

Data were expressed in the form of frequency (percentage) (Figs 1–5 and Table 2).

Data were expressed in the form of frequency (percentage). *P* value was considered of statistical significance if less than 0.05 (between GDM and non-GDM women).

As regards dietary habits, significant difference between women with GDM and women without GDM presented only with excess consumption of sweets/desserts, where 25% of those with GDM consumed it mostly in the day (*P*=0.03). No significant differences presented between women with GDM and those without GDM as regards other types of food (*P*>0.05).

Figure 1
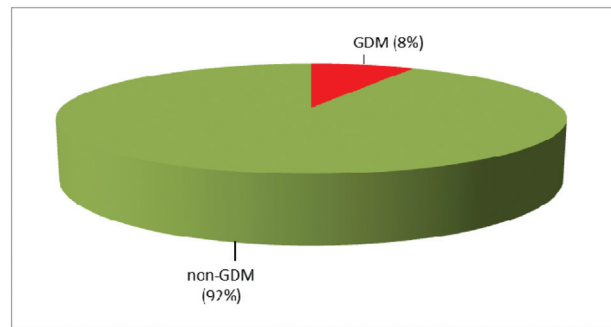
Frequency of gestational diabetes mellitus in our study according to 2 h PPS where data are expressed in form of percentage.
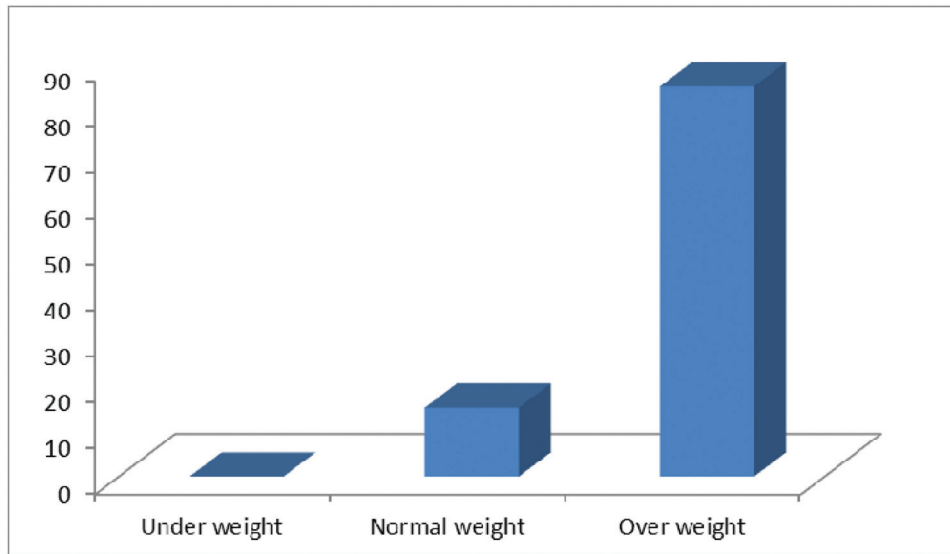
Figure 2
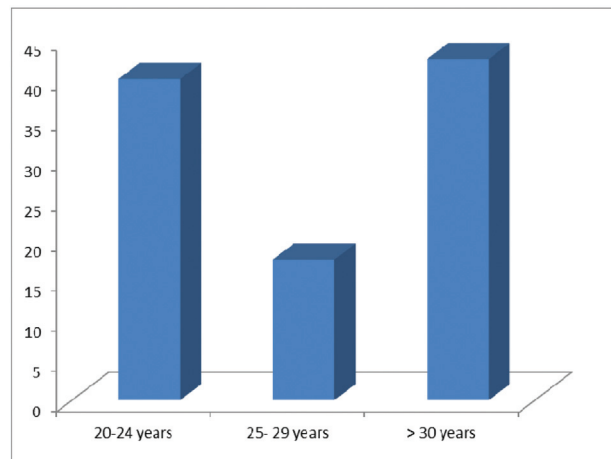
Age groups of women with gestational diabetes mellitus. Data are expressed in the form of percentage.

Table 1 Frequency of gestational diabetes mellitus in all pregnant women in our study according to Diabetes in Pregnancy Study Group India criteria

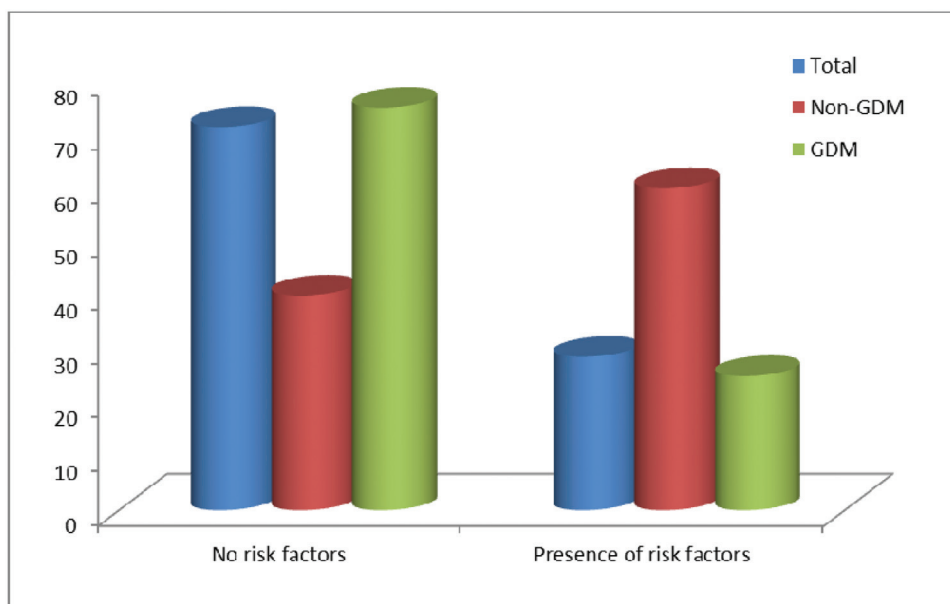| Valid	Frequency (%)
2h-postprandial sugar (mg/dl)	
Non-GDM	460 (92)
GDM	40 (8)

GDM, gestational diabetes mellitus.

Figure 3

BMI of women with gestational diabetes mellitus. Data are expressed in the form of percentage.

Figure 4

Presence of risk factors in those women with gestational diabetes mellitus versus without gestational diabetes mellitus.

Discussion

GDM is a public health problem that currently affects a large part of the female population and has short- and long-term consequences for the fetus and the mother [10]. The highest prevalence was reported in Middle East and North Africa, with a median estimate of 13%, whereas the lowest was in Europe, with a median prevalence of 5.8% [1]. As per the International Diabetes Federation, Diabetes Atlas 2015, one in seven births are affected by GDM [11]. To our knowledge, there were no previous reports about the prevalence of GDM in Egypt, although Egypt was expected to show a higher prevalence of GDM as the rates of diabetes in Egypt has significantly increased exceeding international rates and Egypt is now ranked the eighth in the world in terms of the disease [3]. So, there is a need for cost-effective universal screening and diagnostic method. Unfortunately, there is no international consensus on the screening and diagnostic criteria for GDM.

Figure 5
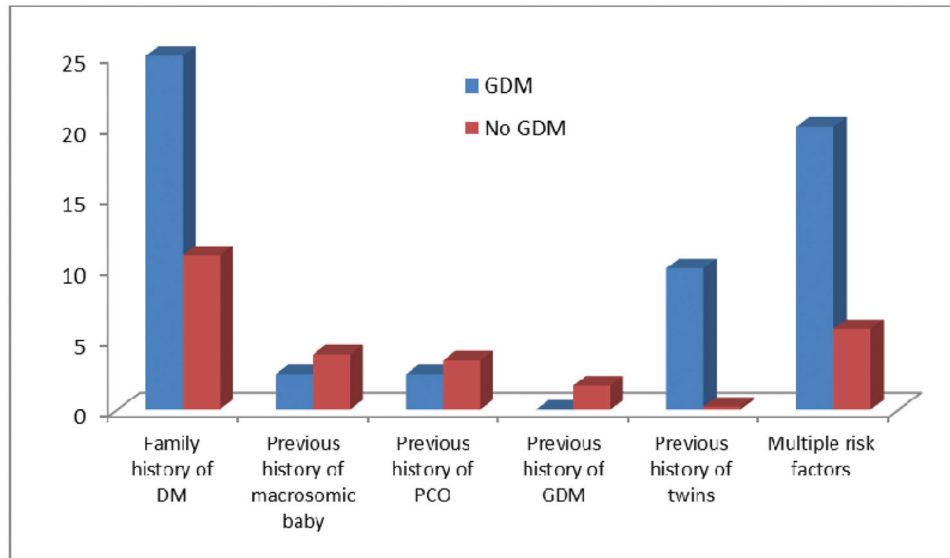
Percentage of risk factors for gestational diabetes mellitus on those women with gestational diabetes mellitus versus those without gestational diabetes mellitus.

Table 2 Risk factors for gestational diabetes mellitus in our study

Risk factors	Frequency (%)			
	All women (*n*=500)	GDM women (*n*=40)	Non-GDM women (*n*=460)	*P* value
No risk factors	357 (71.4)	16 (40)	341 (75)	**0.001**
Multiple risk factors	34 (6.8)	8 (20)	26 (5.7)	**0.02**
Previous history of twins	5 (1)	4 (10)	1 (0.2)	**0.001**
Family history of DM	60 (12)	10 (25)	50 (10.9)	**0.001**
Previous history of macrosomic baby	19 (3.8)	1 (2.5)	18 (3.9)	0.08
Previous history of PCO	17 (3.4)	1 (2.5)	16 (3.5)	0.32
Previous history of GDM	8 (1.6)	0	8 (1.7)	0.88
Age (years)	26.68±8.22	26.78±6.57	20.01±4.05	**0.02**
Age of marriage (years)	20.01±3.56	19.20±3.05	21.12±2.23	0.44
Gestational age (weeks)	24.50±2.13	24.45±1.82	24.11±2.02	0.57
Parity	3.21±2.13	3.70±2.24	3.01±2.11	0.78
BMI (kg/m^2)	27.38±5.94	30.42±2.07	26.99±4.56	**0.04**

DM, diabetes mellitus; GDM, gestational diabetes mellitus; PCO, polycystic ovary.

Our study included 500 pregnant women not known to have DM before gestation, who attended Al-Fath Primary Health-Care Center in Assiut Governorate between the period of July 2015 to July 2016. In our study, the overall prevalence of GDM was 8% which is higher than the study done in Nigeria by Wokoma *et al.* [12]. Also, this percentage was consistent with earlier studies conducted in New Delhi, India by Tripathi *et al.* [13] and in Pune city in India by Junnare *et al.* [14] and in Rajasthan, India by Kalra *et al.* [15]. In a study of Adam *et al.* [16], they found that the prevalence of GDM was 25.8% if universal screening and the International Association of Diabetes in Pregnancy Study Groups criteria were used. And if universal screening and the National Institute for Health and Care Excellence criteria were used, the prevalence was

17.0%.Furthermore, we found that 40% of GDM women had no definite risk factor for GDM which encourage the concept of universal screening rather than selective screening in areas with high prevalence of DM and this was consistent with the Farrar *et al.* study [17].

Moreover, it was demonstrated that a family history of DM was the most frequent risk factor for GDM. This was in agreement with the Moosazadeh *et al.* study [18]. There was also significant difference between GDM and non-GDM women as regards the presence of multiple risk factors (20%) and previous history of twin/multiple pregnancies. Obesity and age with BMI greater than 30 and age greater than 30 years, respectively, were significant risk factors for GDM women.

As regards dietary habits, significant difference between women with GDM and women without GDM presented only with sweets/desserts.

Conclusion

The prevalence of GDM in AL-Fath was 8%. Family history of DM (25%) was the most frequent risk factor for GDM followed by presence of multiple risk factors (20%) and lastly previous history of twins (10%). Also, increased age of pregnant women of more than 30 years (40%) and obesity were significant risk factors for GDM. There was 40% of GDM women with no definite risk factor and this advocates the universal screening of GDM for all pregnant women attending health-care centers to pick up more and more cases with GDM. The mean age at marriage and multigravida were other risk factors for GDM in our locality. Sweet/deserts were the most frequent type of food in GDM women.

Recommendations

We recommend that:

(1) There are still various controversies regarding the ideal approach for screening gestational diabetes. Preventive measures should be suggested to improve insulin sensitivity. Further research should be done to develop efficient and cost-effective screening protocols.
(2) Further advanced studies among a larger population are required to generate more reliable data to prevent false positives and to increase the specificity of the test.
(3) About 40–60% of women with GDM have no demonstrable risk factor; for this reason, many advocate to screen all women. Women with GDM exhibit no symptoms which is another reason for universal screening.
(4) The action taken in screening all pregnant women for glucose intolerance, achieving euglycemia, and ensuring adequate nutrition may prevent the vicious cycle of transmitting glucose intolerance from one generation to another. Hence, universal screening, instead of selective screening for GDM, is ideal for our population.
(5) Follow up of those with GDM for future type 2 DM for mothers and their offsprings through lifestyle modification to avoid obesity.

Conflicts of interest
There are no conflicts of interest.

References

1 Zhu Y, Zhang C. Prevalence of gestational diabetes and risk of progression to type 2 diabetes: a global perspective. Curr Diabetes Rep 2016; 16:7.
2 American Diabetes Association, Classification and diagnosis of diabetes. Diabetes Care 2017; 40:S11.
3 International Diabetes Federation. Diabetes Atlas: 8th ed., 2017 Chapter 3: hyperglycemia in pregnancy.
4 International Association of Diabetes and Pregnancy Study Groups Consensus Panel, Metzger BE, Gabbe SG, et al. International Association of Diabetes and Pregnancy Study Groups recommendations on the diagnosis and classification of hyperglycemia in pregnancy. Diabetes Care 2010; 33:676–682.
5 Havilah P. Adenosine deaminase activity in type-2 diabetes mellitus–an independent marker of glycemic status and stimulator of lipid peroxidation. Int J Chem Life Sci 2017; 2:1175–8.
6 Precis V. An update on obstetrics and gynecology. ACOG, 1994. p. 170. Online publication info Website title: Wikipedia Publisher/sponsor: Wikimedia Foundation URL: https://en.wikipedia.org/wiki/O% 27sullivan_test Electronically publishd: 27 April 2012.
7 Zhang C, Ning Y. Effect of dietary and lifestyle factors on the risk of gestational diabetes: review of epidemiologic evidence. Am J Clin Nutr 2011; 94 (Suppl 6):1975S–9S.
8 Coustan DR, Jovanovic L. Gestational diabetes mellitus: glycemic control and maternal prognosis. UpToDate [Internet]. Waltham, MA: UpToDate. 2014.
9 Riskin A. Garcia-Prats JA. Infant of a diabetic mother. Rev. Uptodate. 2014:1–1.
10 Christenson RH, Gregory LC, Johnson L. Appleton & Lange Outline Review: Clinical Chemistry. New York, NY, Chicago, IL, Lisbon, Madrid: McGraw Hill Professional; 2011.
11 Atlas D. International diabetes federation. IDF Diabetes Atlas, 7th edn. Brussels, Belgium: International Diabetes Federation. 2015.
12 Wokoma FS, Celestine TJ, Enyindah CE. Gestational diabetes mellitus in a Nigerian antenatal population. Trop J Obstet Gynaecol 2001; 18:56–60.
13 Tripathi R, Verma D, Gupta VK, Tyagi S, Kalaivani M, Ramji S, Mala YM. Evaluation of 75 g glucose load in non-fasting state [Diabetes in Pregnancy Study group of India (DIPSI) criteria] as a diagnostic test for gestational diabetes mellitus. Indian J Med Res 2017; 145:209.
14 Junnare KK, Adhau SR, Hegde MV, Naphade PR. Screening of gestational diabetes mellitus in antenatal women using DIPSI guidelines. Int J Res Med Sci 2016; 4:446–9.
15 Kalra P, Kachhwaha CP, Singh HV. Prevalence of gestational diabetes mellitus and its outcome in western Rajasthan. Indian J Endocrinol Metab 2013; 17:677.
16 Adam S, Rheeder P. Screening for gestational diabetes mellitus in a South African population: prevalence, comparison of diagnostic criteria and the role of risk factors. South Afr Med J 2017; 107:523–7.
17 Farrar D, Simmonds M, Bryant M, Lawlor DA, Dunne F, Tuffnell D, Sheldon TA. Risk factor screening to identify women requiring oral glucose tolerance testing to diagnose gestational diabetes: a systematic review and meta-analysis and analysis of two pregnancy cohorts. PLoS One 2017; 12: e0175288.
18 Moosazadeh M, Asemi Z, Lankarani KB, Tabrizi R, Maharlouei N, Naghibzadeh-Tahami A, et al. Family history of diabetes and the risk of gestational diabetes mellitus in Iran: a systematic review and meta-analysis. Diabetes Metab Syndrome 2017; 11:S99–104.