Original Article

Prevalence of gestational diabetes mellitus and associated risk factors in pregnant Chinese women: a cross-sectional study in Huangdao, Qingdao, China

Li Wu MD[1], Lei Han MD[2], Ying Zhan MD[3], Lianhua Cui PhD[4], Wei'ai Chen MD[5], Li Ma PhD[2], Jing Lv MD[2], Rongfang Pan MD[2], Didi Zhao MPH[1], Ziyi Xiao MD[1]

[1]*School of Public Health, Medical College, Qingdao University, Qingdao, Shandong, China*
[2]*Clinical Nutrition Department of the Affiliated Hospital of Qingdao University Medical College, Qingdao, Shandong, China*
[3]*Obstetrical Department of the Affiliated Hospital of Qingdao University Medical College, Qingdao, Shandong, China*
[4]*The College of Public Health Qingdao University, Qingdao, Shandong, China*
[5]*Obstetrical Department of Hospital of Huangdao Traditional Chinese Medicine, Qingdao, Shandong, China*

Background and Objectives: This study explored the prevalence of gestational diabetes mellitus (GDM) in Chinese pregnant women and identified risk factors for GDM after the implementation of the universal two-child policy. **Methods and Study Design:** On the basis of income and population, we randomly selected three hospitals through stratified and cluster sampling. From January 1 to July 31, 2016, 4959 women who had been registered within 12 weeks of gestation received a 75-g 2-h oral glucose tolerance test (OGTT) at 24–28 gestational weeks. International Association of Diabetes and Pregnancy Study Group criteria were used for the diagnosis of GDM. **Results:** The OGTT was positive in 1080 (21.8%; 1080/4959) women, who were then diagnosed as having GDM on the basis of their results. GDM was positively associated with the following factors: advanced maternal age (p<0.001; adjusted odds ratio [OR]=4.88; 95% confidence interval [CI]=2.38–10.0, pre-pregnancy body mass index overweight (OR=2.44, 95% CI=1.78–3.34)/obesity (OR=10.9, 95% CI=6–19.6; p<0.001), paternal history of diabetes (p=0.003; OR=2.54, 95% CI=1.38–4.67), and maternal history of diabetes (p<0.001; OR=3.6, 95% CI=2.16–5.98). **Conclusions:** Qingdao has an exceptionally high estimated prevalence of GDM. Widely recognized risk factors for GDM were advanced age, pre-pregnancy overweight/obesity, and a family history of diabetes in first-degree relatives. More options to prevent and manage GDM must be explored.

Key Words: gestational diabetes mellitus, prevalence, risk factors, universal two-child policy, medical nutrition therapy

INTRODUCTION

The prevalence of diabetes has been rising worldwide, which poses serious health problems. In 2006, the International Diabetes Federation announced that the prevalence of diabetes in China was the second highest in the world.[1] Growing interest in exploring and assessing the impact of "new" links among health conditions may facilitate identifying efficient interventions. Gestational diabetes mellitus (GDM) represents any degree of glucose intolerance with onset or first recognition during pregnancy.[2] Established risk factors for GDM are mainly advanced maternal age, obesity and family history of diabetes.[3] Women with a history of GDM are also at an increased risk of developing type 2 diabetes mellitus (T2DM) over 5–10 years after pregnancy, and their children have a higher risk of developing obesity and T2DM early in life.[4]

The prevalence of GDM is increasing globally. In the United States, the prevalence of GDM is 14%, which is equal to 200,000 cases annually.[5] In addition, the prevalence of GDM is between 8% and 18% in Canada,[6] and it ranges between 6.8% and 10.4% in China.[7] India has an exceptionally higher estimated prevalence of GDM (27.5%) compared with Sri Lanka (9.9%) and Bangladesh (9.8%).[8] Therefore, identifying and providing appropriate care for women with GDM could substantially impact the health of populations in both high- and low-income countries.

Since 1979, the implementation of the "one-child policy," a population control program in China, has limited the number of children in each urban family to one. From January 1, 2016, all Chinese couples are allowed to have two children. This is thus expected to engender a period

Corresponding Author: Dr Lei Han, Clinical Nutrition Department of the Affiliated Hospital of Qingdao University Medical College, Qingdao, Shandong Province 266002, China.
Tel: +8618661809226; Fax: +86-0532-82911840
Email: 13963903030@163.com
Manuscript received 12 August 2016. Initial review completed 08 November 2016. Revision accepted 08 December 2016.
doi: 10.6133/apjcn.032017.03

when more babies are born than usual. According to Vice Minister Wang Pei'an, approximately 60% of eligible women are older than 35 years. After the implementation of this policy, the number of pregnant and lying-in women of advanced age will significantly increase, signifying a higher risk of comorbidities and complications during pregnancy.[9] A district of Qingdao, Huangdao is China's ninth national-level zone and forms the west coast of Qingdao city. Few studies have been performed on GDM in Qingdao, and little information regarding the prevalence of GDM and associated risk factors is available.

This study thus assessed the prevalence of GDM in accordance with the International Association of Diabetes and Pregnancy Study Group (IADPSG) criteria and examined its associations with numerous risk factors in a sample of pregnant women from Huangdao.

METHODS

Participants and study design

Huangdao, the west coast and municipal district of Qingdao city, is the ninth national district in China. As a national overall development area, Huangdao District is a land and sea international high-end marine industrial concentration area and marine economic international cooperation demonstration zone. In addition, it is an international shipping hub, and the first blue peninsula economic zone in Shandong province. China has set up the west coast economic district of Qingdao, including global, the Huangdao District. After the completion of the merger, its total area is approximately 2096 km^2, and the total population is 1.71 million. Antenatal care is delivered through a three-tier prenatal care system consisting of 12 street health service centers (the first tier), 2 maternal and child healthcare hospitals and 2 secondary obstetric hospitals (the second tier), and 2 first-class hospitals (the third tier).

The sample size was calculated according to the 9.3% prevalence of GDM in Tianjin.10 We used a proportional stratify cluster sampling investigation, according to the Gross Domestic Product (GDP) level of district is divided into three levels, and then according to the stochastic principle in the different level of GDP from three hospitals and then in each hospital sample drawn to scale, according to the formula to calculate sample size n, plus 20% of the sampling error, finally determine the sample size is at least 4681. Sample size calculation formula is as follows.

$\alpha = 0.05$, z = 1.96, d = 0.1 × p, n = 400 × (q/p), P = 9.3%, q = 1-p,

n = 3901, n*20% + 3901 = 4681

We estimated that this would require a study of 4681 subjects; therefore, 5000 pregnant women were recruited in the present study. After 41 unqualified questionnaires were eliminated, the effective sample size was 4959. Unqualified questionnaire mean some pregnant women intolerance OGTT test lead to lack of blood samples. Inclusion criteria were pregnant women with a confirmed intrauterine pregnancy and an established maternal healthcare handbook who received a 75-g 2-h OGTT at 24–28 gestational weeks in Huangdao, Qingdao. Exclusion criteria were women diagnosed as having prepregnancy diabetes mellitus. Ethics approval for the study was given by the local research ethics committee at each hospital.

Diagnosis of GDM

The IADPSG cutoff value has been used in PUFH since May 1, 2011, and it was applied in this study for GDM diagnosis; one-step GDM screening was performed through the 75-g OGTT at 24–28 gestational weeks. According to the IADPSG criteria, a diagnosis of GDM can be made when any one of the following values is met or exceeded in the 75-g OGTT: 0-h (fasting), ≥5.1 mmol/L; 1-h, ≥10.mmol/L; or 2-h, ≥8.5 mmol/L.[11] Detailed information on the OGTT and blood biochemical assessment: (1) During 24 to 28 weeks pregnancy, all pregnant women have not been diagnosed with diabetes. (2) Three days before taking on OGTT test keep normal physical activity, diet, pregnant women eat carbohydrate may not be less than 150 g per day. (3) Within eight hours before test, before the OGTT, day after supper fast 8 to 14 h tomorrow morning 8:30 (no more than the latest at 9 am), but can drink, to relieve thirst. (4) Pregnant women should ban smoking, wine and coffee, the victim rest 15 to 30 min, take on an empty stomach blood specimens after drinking 75 g glucose with 300mLwater, and time from the first sip, drinking within 5 minutes, sit-ins during test, strong physical labor and drinking is not permitted. (5) If pregnant women appear pale, nausea, vomiting, dizziness, collapse should immediately stop the test.

Data collection

Pregnant women answered a structured questionnaire containing the following items: age, educational background, occupation, monthly household income, height, weight, family history of diabetes mellitus in first-degree relatives, number of pregnancies, parity, and 24-h dietary recall. After being questioned regarding the risk factors for GDM, the pregnant women received physical examinations performed at training workshops. Body mass index (BMI) was calculated as the weight in kilograms divided by the square of the body height in meters. Obesity and overweight were defined as per the criteria recommended by the Working Group on Obesity in China[12] (i.e., underweight: BMI <18.5 kg/m^2; normal weight: BMI=18.5–23.9 kg/m^2; overweight: BMI=24.0–27.9 kg/m^2; and obesity: BMI=28.0 kg/m^2). All data of related biochemical indices were obtained from the affiliated hospital of Qingdao University.

Statistical analyses

This study used the Student test for unpaired data, the chi-square test, or Fisher's exact test (SPSS/PC statistical program, version 17.0 for Windows) as appropriate. Logistic regression analysis was performed for GDM risk factors by using a backward model. In this analysis, GDM was considered the dependent variable. Associated risk factors for GDM were considered independent variables. Results are presented as arithmetic mean ± standard deviation for quantitative data and percentages for qualitative data. Binary logistic regression was performed to obtain odds ratios (ORs) and 95% confidence intervals (CIs) for risk factors for GDM in univariable and multivariable analyses. Moreover, p values of <0.05 were considered significant.

Table 1. Prevalence of GDM among pregnant women in Huangdao

Parameter	Non-GDM	GDM	*p*-value
N	3879	1080	
Maternal age, years	29.2±3.56	32.0±4.32	<0.001†
Age group, years			<0.001†
<25	363 (9.4%)	39 (3.6%)	
25-29	2076 (53.5%)	360 (33.3%)	
30-34	1068 (27.5%)	354 (32.8%)	
≥35	372 (9.6%)	327 (30.3%)	
Gestation week	35.7±2.67	35.3±2.62	0.706‡
Level of education			<0.001†
Primary	0	6 (0.6%)	
Secondary and High school	684 (17.6%)	339 (31.4)	
College school and above	3091 (82.4)	712 (68%)	
Household income			0.266‡
1000-2999	42 (1.1%)	18 (1.7%)	
3000-4999	519 (13.4%)	144 (21.7%)	
5000-6999	1053 (27.1%)	321 (23.4%)	
7000-9999	1329 (34.3%)	327 (30.3%)	
≥10000	936 (24.1%)	267 (24.7%)	
Pre-pregnancy waistline [cm]	71.7±14.3	75±7	0.744‡
Weight during pregnancy [kg]	14.4±4.15	15.1±4.81	0.002‡
Pre-pregnant BMI [kg/m^2]	21.1±2.88	23.8±3.82	<0.001†
<18.49	711 (18.3%)	45 (15.2%)	
18.5-23.99	2613 (67.4%)	567 (64.1%)	
24-27.99	498 (12.8%)	315 (16.4%)	
≥28	57 (1.5%)	153 (4.2%)	
Height [cm]	163±7.07	162±10.5	0.404‡
Height group			
<160	549 (14.2%)	231 (21.4%)	<0.001†
160-165	1623 (41.8%)	429 (39.7%)	
≥165	1707 (44%)	420 (38.9%)	
Number of pregnancies			<0.001†
1	2115 (54.5%)	504 (33.1%)	
2	1239 (31.9%)	540 (40.6%)	
≥3	525 (13.5%)	36 (26.4%)	
Parity			<0.001†
0	1814 (70.1%)	504 (46.7%)	
1	722 (27.9%)	540 (50%)	
≥2	50 (1.9%)	36 (3.3%)	
Father of diabetes			<0.001†
No	2522 (97.5%)	664 (92.2%)	
Yes	64 (2.5%)	56 (7.8%)	
Mather of diabetes			<0.001†
No	2504 (96.8%)	628 (87.2%)	
Yes	82 (3.2%)	92 (12.8%)	
Hb [g/L]	121±7.97	124±8.23	0.003‡
FBG [mmol/L]	4.39±1.55	4.84±2.67	0.23‡

BMI: body mass index; Hb: hemoglobin; FBG: fasting blood-glucose; GDM: gestational diabetes mellitus.
Data are reported as mean±SD or number (%).
†Derived from Student's t- test.
‡Derived from the chi-square test or Fisher's exact test.

RESULTS

Prevalence of GDM in Huangdao

From January 1 to July 31, 2016, this study included 5000 pregnant women. After the elimination of 41 unqualified questionnaires, the effective sample size was 4959. In Huangdao, the OGTT was positive in 1080 (21.8%; 1080/4959) women who were diagnosed as having GDM on the basis of their results, in accordance with the IADPSG criteria.

Characteristics of the study population

Table 1 presents the characteristics of the studied pregnant women. Among the 4959 pregnant women, the mean gestational ages of the non-GDM and GDM groups were 35.7 (SD: 2.67) and 35.3 (SD: 2.62) weeks, respectively. The difference in the gestational ages between the two groups was not statistically significant (p=0.706). The mean maternal age of the GDM group was higher than that of the non-GDM group (32.0±4.32 vs 29.2±3.56 years, p<0.001). The percentage of women with a mean maternal age of ≥30 years was higher in the GDM group than in the non-GDM group (63.1% vs 37.1%, p<0.001). The mean weight gain during pregnancy and the prepregnancy BMI were higher in women with GDM than in women without GDM. Table 1 shows that compared with women without GDM, those with GDM were shorter and more poorly educated, with parity ≥1, multiple pregnancies, and a maternal and paternal history of diabetes.

These differences were statistically significant (p<0.001). In addition, the average hemoglobin level was higher during early pregnancy in women with GDM than in women without GDM (124±8.23 vs 121±7.97 g/L, p=0.003).

Risk factors for GDM

Univariable analysis of binary logistic regression, which was used to detect the traditional risk factors for GDM, revealed the following associated factors (Table 2): maternal age ≥30 years, prepregnancy overweight/obesity, parity ≥1, number of pregnancies ≥2, and a family history of diabetes. We used multiple logistic regression to adjust for the results in Table 2, thus yielding Table 3, which shows that age ≥30 years, overweight/obesity, and a family history of diabetes in first-degree relatives remained associated with the risk of GDM. However, parity ≥1 and multiple pregnancies were no longer significantly associated with GDM. In addition, maternal history of diabetes (OR=3.98, 95% CI=2.16–5.6, p<0.001) was more positively associated with the risk of GDM than was paternal history of diabetes (OR=2.54, 95% CI=1.38–4.67, p=0.003).

DISCUSSION

This population-based study revealed that the prevalence of GDM in Huangdao, Qingdao, China, was 21.8% from January to July 2016. Factors such as maternal age ≥30 years, pre-pregnancy overweight/obesity, and a family history of diabetes in first-degree relatives were associated with GDM. This is the first study to analyze the prevalence and associated risk factors for GDM in Huangdao.

As the IADPSG guidelines use only one abnormal value to diagnose GDM, its prevalence is expected to significantly increase from 5%–6% to 15%–20%.[13] By contrast, two studies have reported that the prevalence of IADPSG-criteria-defined GDM was 14.7% during 2004–2009 (n=14593) and 18.9% (n=25674) during 2005–2012.[14,15] However, both studies were conducted at the Peking University First Hospital, which is a tertiary care institution that treats patients with a high medical risk or high socioeconomic status. Because of the potential bias, the results are hardly representative of the general pregnant female population. A prospective cohort study reported that the prevalence of GDM was 9.3% (n=18589) in Tianjin from 2010 to 2012.[14] The prevalence observed in our study is higher than that in other studies. This may be attributed to the decision of the Communist Party of China Central Committee and State Council to implement a comprehensive two-child policy at the start of 2016.

Several large prospective studies have reported the following risk factors for GDM: advanced age, higher prepregnancy BMI, Han nationality, higher systolic blood pressure, education level, a family history of diabetes, previous history of GDM, weight gain during pregnancy, habitual smoking, a history of recurrent vulvovaginal candidiasis, residency in south China, and a history of spontaneous abortion.[10,16-18] Our results are consistent with those of previous studies. Furthermore, we identified that a maternal history of diabetes (OR=3.98, 95% CI=2.16–5.6, p<0.001) was more positively associated with the risk of GDM than was a paternal history of diabetes (OR=2.54, 95% CI=1.38–4.67, p=0.003). Zhang reported that maternal diabetes heredity was more positively associated with the risk of GDM than was patrilineal diabetes heredity;[19] these findings are consistent with our results. However education level was not a independent risk factor in our study. We think there are differences between China and western country in economic devel-

Table 2. Univariable odds ratios for potential risk factors of GDM

Parameter	OR	95% CI	p-value
Age at registration, year			
<25	Reference		
25-29	1.61	0.882-2.95	0.12
30-34	3.09	1.68-5.67	<0.001
≥35	8.18	4.37-15.7	<0.001
BMI			
<18.5	0.292	0.169-0.503	0.210
18.5-23.99	Reference		
24-27.99	2.92	2.18-3.90	<0.001
≥28	12.4	7.14-21.4	<0.001
Number of pregnancies:			
1	Reference		
2	2.10	1.60-2.75	<0.001
≥3	3.24	2.36-4.44	<0.001
Parity			
0	Reference		
1	2.69	2.11-3.43	<0.001
≥2	2.59	1.28-5.26	0.008
Father of diabetes	3.32	1.97-5.6	<0.001
Mather of diabetes	4.47	2.89-6.94	<0.001
Level of education			
Primary	Reference		
Secondary and High school	0	0	0.999
College school and above	0	0	0.999

BMI: body mass index; GDM: gestational diabetes mellitus.
p values and 95% CIs of ORs were adjusted for multiple comparisons through the Ryan-Holm step-down Bonferroni procedure.

Table 3. A comparison of the characteristics of those who had and had not heard of coeliac disease (n=90)

Parameter	OR	95% CI	*p*-value
Age at registration, year			
<25	Reference		
25-29	1.62	0.847-3.11	0.145
30-34	2.29	1.16-4.5	0.016
≥35	4.88	2.38-10	<0.001
BMI			
<18.5	0.381	0.22-0.67	0.321
18.5-23.99	Reference		
24-27.99	2.44	1.78-3.34	<0.001
≥28	10.9	6.00-19.6	<0.001
Number of pregnancies:			
1	Reference		
2	1.14	0.754-1.71	0.545
≥3	1.35	0.823-2.2	0.237
Parity			
0	Reference		
1	1.34	0.886-2.01	0.167
≥2	0.934	0.371-2.35	0.885
Father of diabetes	2.54	1.38-4.67	0.003
Mather of diabetes	3.6	2.16-5.98	<0.001

BMI: body mass index; GDM: gestational diabetes mellitus.
Variables adjusted in the multivariable analysis include the variables listed in the model.
p values and 95% CIs of ORs were adjusted for multiple comparisons through the Ryan–Holm step-down Bonferroni procedure.

opment stage. And education levels are unclear in Huangdao district.

Advanced age (≥35 years) was significantly associated with GDM (OR=4.89, 95% CI=2.38–10, $p<0.001$). This finding is related to the implementation of the universal two-child policy, which is expected to result in more pregnant and lying-in women, especially those of advanced age.[20]

The GDM prevalence varies worldwide and even within a country's population, depending on the racial and ethical composition of the residents. One limitation of our study is that it is a local and regional study. Therefore, potential bias may have occurred, rendering the study population less representative of the general pregnant female population. Despite this limitation, this study does indicate the prevalence of and risk factors for GDM in Huangdao. Our innovative is the study based on the latest diagnostic criteria to investigation in Qingdao for gestational diabetes mellitus. After implementation two-child policy, it is the first time to study the prevalence of gestational diabetes in China.

In 2015, the American Diabetes Association published criteria for the diagnosis and management of GDM. Accordingly, all pregnant women should be screened for gestational diabetes at 24–28 gestational weeks. Furthermore, women with GDM should first receive diet and exercise therapy and, if required, drug therapy.[21-25] Vice Minister Wang Pei'an has committed that the government will strengthen maternal and child health care by improving the training of technicians.[9] Because the risk of developing GDM in subsequent pregnancies and overt diabetes in later life is high, regular assessment of these women is required in the future. We have set up the perinatal nutrition metabolism in obstetric outpatient service for pregnant women to provide professional nutritional guidance during pregnancy and help them control reasonable growth weight during pregnancy in order to reduce the prevalence of gestational diabetes mellitus. Lifestyle interventions should be offered to women with a history of GDM who develop prediabetes.[18,22,26,27] Additional studies on the prevention and management of GDM are warranted.

ACKNOWLEDGEMENTS

We thank all the doctors, nurses, and workers at maternal and child health care hospitals in Huangdao.

AUTHOR DISCLOSURES

The authors declare no conflict of interest. This project was supported by district science and technology plan in Huangdao (Project number: 1999).

REFERENCES

1. Enquobahrie DA, Denis M, Tadesse MG, Gelaye B, Ressom HW, Williams MA. Maternal early pregnancy serum metabolites and risk of gestational diabetes mellitus. J Clin Endocrinol Metab. 2015;100:4348-56. doi: 10.1210/jc.2015-2862.
2. Sims EA, Catalano PM. Response to the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Diabetes Care. 1998;21:467-8. doi: 10.2337/diacare.21.3.467
3. Catalano PM, Ehrenberg HM. The short- and long-term implications of maternal obesity on the mother and her offspring. BJOG. 2006;113:1126-33. doi: 10.1111/j.1471-0528.2006.00989.x.
4. Metzger BE, Lowe LP, Dyer AR, Trimble ER, Sheridan B, Hod M et al. The Hyperglycemia and Adverse Pregnancy Outcome (HAPO) Study. Int J Gynaecol Obstet. 2002;78:69-77. doi: 10.2337/db08-1112.
5. American Diabetes Association. Standards of medical care in diabetes--2009. Diabetes Care. 2009;32(Suppl 1):S13-61. doi: 10.2337/dc 09-S013.
6. Bhattacharyya OK, Shah BR, Booth GL. Management of cardiovascular disease in patients with diabetes: the 2008 Canadian Diabetes Association guidelines. CMAJ. 2008;179:920-6. doi: 10.1503/cmaj.080554.

7. Hirst JE, Raynes-Greenow CH, Jeffery HE. A systematic review of trends of gestational diabetes mellitus in Asia. Journal of Diabetology. 2012;3:4.
8. Guariguata L, Linnenkamp U, Beagley J, Whiting DR, Cho NH. Global estimates of the prevalence of hyperglycaemia in pregnancy. Diabetes Res Clin Pract. 2014;103:176-85. doi: 10.1016/j.diabres. 2013.11.003.
9. Department E. Interpretation of the universal two-child policy in China. China Population Today. 2015:9-19. doi: 10.3969/j.issn.1002-1965.2016.07.012. (In Chinese)
10. Leng J, Shao P, Zhang C, Tian H, Zhang F, Zhang S et al. Prevalence of gestational diabetes mellitus and its risk factors in Chinese pregnant women: a prospective population-based study in Tianjin, China. PLoS One. 2015; 10:e0121029. doi: 10.1371/journal.pone.0121029.
11. Metzger BE, Gabbe SG, Persson B, Buchanan TA, Catalano PA, Damm P et al. International association of diabetes and pregnancy study groups recommendations on the diagnosis and classification of hyperglycemia in pregnancy. Diabetes Care. 2010;33:676-82. doi: 10.2337/dc09-1848.
12. Chen C, Lu FC. The guidelines for prevention and control of overweight and obesity in Chinese adults. Biomed Environ Sci. 2004;17(Suppl):1-36.
13. Poomalar GK. Changing trends in management of gestational diabetes mellitus. World J Diabetes. 2015;6:284-95. doi: 10.4239/wjd.v6.i2.284.
14. Wei YM, Yang HX. Comparison of the diagnostic criteria for gestational diabetes mellitus in China. Zhonghua Fu Chan Ke Za Zhi. 2011;46:578-81. doi: 10.3760/cma.j.issn. 0529-567x.2011.08.005. (In Chinese)
15. Wei Y, Yang H, Zhu W, Yang H, Li H, Yan J, Zhang C. International Association of Diabetes and Pregnancy Study Group criteria is suitable for gestational diabetes mellitus diagnosis: further evidence from China. Chin Med J (Engl). 2014;127:3553-6. doi: 10.3760/cma.j.issn.0366-6999.20140 898.
16. Yang H, Wei Y, Gao X, Xu X, Fan L, He J et al. Risk factors for gestational diabetes mellitus in Chinese women: a prospective study of 16,286 pregnant women in China. Diabet Med. 2009;26:1099-104. doi: 10.1111/j.1464-5491. 2009.02845.x.
17. Liu W, Hua L, Liu WF, Song HL, Dai XW, Yang JK. The prevalence of glucose metabolism disturbances in Chinese Muslims and possible risk factors: a study from northwest China. Arq Bras Endocrinol Metabol. 2014;58:715-23. doi: 10.1590/0004-2730000002654.
18. Mpondo BC, Ernest A, Dee HE. Gestational diabetes mellitus: challenges in diagnosis and management. J Diabetes Metab Disord. 2015;14:42. doi: 10.1186/s40200-015-0169-7.
19. Zhang M, Yang H, Sun W. A prospective study of relationship between abnormal glucose metabolism during pregnancy and family history of diabetes. Chin J Diabetes 2005;13:163-6. doi: 10.3321/j.issn:1006-6187.2005.03.003. (In Chinese)
20. Sha L, Jie H, Wenxi L. To Implement Universal Two-child Policy and Build Healthy China-NHFPC Officials Answer Reporters' Questions. China Population Today. 2016:3-6. (In Chinese)
21. Kampmann U, Madsen LR, Skajaa GO, Iversen DS, Moeller N, Ovesen P. Gestational diabetes: a clinical update. World J Diabetes. 2015;6:1065-72. doi: 10.4239/wjd.v6.i8.1065.
22. Weile LK, Kahn JG, Marseille E, Jensen DM, Damm P, Lohse N. Global cost-effectiveness of GDM screening and management: current knowledge and future needs. Best Pract Res Clin Obstet Gynaecol. 2015;29:206-24. doi: 10. 1016/j.bpobgyn.2014.06.009.
23. Bao W, Bowers K, Tobias DK, Olsen SF, Chavarro J, Vaag A, Kiely M, Zhang C. Prepregnancy low-carbohydrate dietary pattern and risk of gestational diabetes mellitus: a prospective cohort study. Am J Clin Nutr. 2014;99:1378-84. doi: 10.3945/ajcn.113.082966.
24. Ho TC, Yan YH, Lu MC, Yu CW, Wang P. Influence of medical nutrition therapy on borderline glucose intolerance in pregnant Taiwanese women. J Matern Fetal Neonatal Med. 2016;29:1181-6. doi: 10.3109/14767058.2015.10395 08.
25. Rajput R, Yadav Y, Rajput M, Nanda S. Comparative evaluation of IADPSG criteria with ADA and WHO criteria for diagnosis of gestational diabetes mellitus. Journal Indian Academy of Clinical Medicine. 2015;16:27-32.
26. 22nd Annual Conference of the International Society for Quality of Life Research. Qual Life Res. 2015;24(Suppl 1): 1-191. doi: 10.1007/s11136-015-1078-4.
27. Jelsma JG, van Poppel MN, Galjaard S, Desoye G, Corcoy R, Devlieger R et al. DALI: vitamin D and lifestyle intervention for gestational diabetes mellitus (GDM) prevention: an European multicentre, randomised trial - study protocol. BMC Pregnancy Childbirth. 2013;13:142. doi: 10.1186/1471-2393-13-142.