International Journal of Biochemistry Research & Review
10(1): 1-6, 2016, Article no.IJBcRR.22624
ISSN: 2231-086X, NLM ID: 101654445

SCIENCEDOMAIN *international*
www.sciencedomain.org

Diabetes in Pregnancy Study Group in India (DIPSI) – A Novel Criterion to Diagnose GDM

Havilah Polur[1*], K. Durga Prasad[1], Pandit Vinodh Bandela[2], Hindumathi[3] and Shaik Hussain Saheb[4]

[1]Department of Biochemistry, Santhiram Medical College, Nandyal, Andhra Pradesh, India.
[2]Department of Biochemistry, Konaseema Institute of Medical Sciences and Research Foundation, Amalapuram, India.
[3]Department of OBG, Santhiram Medical College, Nandyal, Andhra Pradesh, India.
[4]Department of Anatomy, JJM Medical College, Davangere, Karnataka, India.

Authors' contributions

This work was carried out in collaboration between all authors. Author HP designed the study, wrote the protocol and wrote the first draft of the manuscript. Authors PVB, Hindumathi and SHS managed the literature searches and analysis of the study performed. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJBCRR/2016/22624
Editor(s):
(1) Chan-Min Liu, School of Life Science, Xuzhou Normal University, Xuzhou City, China.
(2) Dileep G. Nair, Ministry of Higher Education, Sultanate of Oman.
Reviewers:
(1) Jerzy Beltowski, Medical University, Lublin, Poland.
(2) Shigeki Taga, Kagawa Prefectural Central Hospital, Japan.
(3) Jahan Ara Ainuddin, Dow University of Health Sciences, Karachi, Pakistan.
(4) Marco Matteo Ciccone, University of Bari, Italy.
Complete Peer review History: http://sciencedomain.org/review-history/12940

Original Research Article

Received 15th October 2015
Accepted 9th December 2015
Published 11th January 2016

ABSTRACT

Background: Gestational diabetes mellitus (GDM) is defined as glucose intolerance recognised first only during pregnancy. Women with GDM are more prone to future diabetes and other maternal and fetal complications. Most of the people in India reside in rural areas and an Universal screening is required in such settings which is simple, convenient and economical. Diabetes in Pregnancy Study Group India (DIPSI) has recommended a modified 75 g oral glucose tolerance test (OGTT) to diagnose GDM. Very few studies are available to show the effectiveness of DIPSI.
Aim: Our aim is to compare and correlate WHO and DIPSI CRITERIA in diagnosing GDM.

**Corresponding author: E-mail: havilah.polur@gmail.com;*

Materials and Methods: 149 healthy pregnant women attending antenatal clinic of Santhiram General Hospital underwent 75 g OGTT between 24-28 weeks of pregnancy recommended by WHO. Two venous blood samples and urine samples, one fasting and other 2 hr sample after 75 g glucose load were obtained and analysed. Three days later all of them were made to undergo 75 g OGTT recommended by DIPSI. A single 2 hr blood sample was collected after the load and analysed. Both criteria values are subjected to statistical analysis.

Statistical Analysis: The mean and S.D of age and parity, BMI, 2 hr plasma glucose were calculated. Comparision and correlation of diagnostic criteria of GDM by WHO and DIPSI were analyzed by Fischer exact test (chi- square test) and significance done using Statistical analysis using SPSS software (version 20) and MedCalc (version 12.7.0).

Results: Out of 149 pregnant women who underwent screening for GDM, 63 were diagnosed to have GDM. The mean age and S.D of nonGDM and GDM pregnant women were 22.7±3.5 vs 24.35±4.77 year. The mean 2^{nd} hr glucose values and S.D of nonGDM and GDM cases were 98±14 vs154.32±8.7mg/dl. WHO identified 63 GDM cases and DIPSI identified 58 GDM cases i.e. 92% of GDM cases identified by WHO were found to be identified by DIPSI. Out of them 52 women were diagnosed as GDM by both WHO and DIPSI. We compared the correlation of DIPSI with WHO 2^{nd}hr sample for diagnosing GDM by Fischer exact t-test. P-value and its significance is calculated. Chi squared test equals to 75.181(P<0.0001) which is extremely significant.

Conclusion: DIPSI has all those qualities of a screening test. It is simple, single, convenient, economical, can be used as both diagnostic as well as screening test and with good perinatal outcome. So can be used in routine laboratory to diagnose GDM.

Keywords: Gestational Diabetes Mellitus (GDM); World Health Organization (WHO); Diabetes in Pregnancy Study Group in India (DIPSI); Impaired Glucose Tolerance (IGT).

1. INTRODUCTION

Gestational Diabetes Mellitus (GDM) is defined as any degree of glucose intolerance with onset or first recognition during pregnancy. The recent data on the prevalence of GDM in our country was 16.55% by WHO criteria of 2 hr PG≥140 mg/dl [1]. The maternal and fetal outcomes depend on proper screening of high risk patients. The conventional methods so far used to diagnose GDM are confusing, contradictory and country specific guidelines. DIPSI- a modified WHO criteria was designed as per Indian standards. It is simple, convenient and can be used as a universal screening test [1-3]. Our aim of the study is to compare WHO 2^{nd} hr sample and DIPSI CRITERIA in diagnosing GDM.

2. MATERIALS AND METHODS

The study was initiated after informed consent was taken from the participants and with the approval of the institutional ethical committee of Santhiram Medical College, Nandyal, Kurnool. The present study was a preliminary cross sectional study done during June 2015- Sep 2015. 149 pregnant women aged between 19-35 yrs attending antenatal o.p in the department of gynaecology and obstetrics, Santhiram general hospital were selected and followed till delivery. Details of their pregnancy, anthropometric measurements, family history of DM, prior history of GDM and other relevant history were recorded at their first visit. Inclusion criteria: Primi aged >25 yrs, women with gestation age of 24-28 weeks. past history of GDM, BMI>25 [4], first degree relative with diabetes, PCOS, precious pregnancy, Women with excessive weight gain during pregnancy, previous macrosomic baby (more than 4 kg) or a pasthistory of recurrent miscarriages, congenitalanomalies [4].

Women known to have pre-existing diabetes, previously undiagnosed diabetes if the woman is at low risk for diabetes, thin and no personal or family history of diabetes were excluded from the study. All the participants were screened during gestational period of 24 weeks - 28 weeks. Body mass index (BMI) was calculated using the formula weight (in kg) divided by height in meters (squared) in the first antenatal visit itself. Participant women were prepared for the day of GTT by instructing not to take food after 8 PM the previous night. Should not take any breakfast. This is to ensure 12 hours fasting. The patients are advised to remain in the hospital during the waiting period of two hours without any active exercise. On the day of the test fasting venous blood sample and urine samples are collected.

Oral Glucose Tolerance Test (OGTT) is performed based on WHO critera. 75 grams of glucose dissolved in 300 ml of water and instructed to take within 5 min and time is noted. After 2 hrs of giving glucose load another venous blood sample and urine samples are collected. Two blood samples collected in sodium fluoride vacutainers are subjected to centrifugation. Plasma is analysed for glucose levels by GOD-POD method using commercial kits supplied by Agappe diagnostics on a semi automated erba-chem -7 within an hour. Urine samples are analysed for glucose by urine dipstick method.

Two days later they were asked to visit the lab to undergo GTT according to DIPSI in a nonfasting state. As soon as they arrive, irrespective of time of last meal 75 g of glucose dissolved in 300 ml of water is administered and time noted. Venous blood samples are collected after 2 hrs and subjected to centrifugation and analysed in a semiautomated analyser. Women diagnosed as GDM were managed appropriately. Follow up is not done as these women did not complete their fullterm gestational age by the end of the study. Routine Ultra sonographic findings and anamoly scan details were assessed during the study for monitoring the morphology, growth and weight of the fetus.

2.1 Definitions of GDM (5)

1. According to WHO 1999 criteria, diagnosis was based on 1hr >126 mg/dl, 2-h VPG value of ≥140 mg/dl (7.8 mmol/l) done in the fasting state.
2. According to the DIPSI criteria, diagnosis of GDM was based on a 2-h VPG ≥140 mg/dl (7.8 mmol/l) in the non-fasting OGTT.

2.2 Statistical Analysis

WHO criteria and DIPSI were compared to diagnose GDM. According to WHO guidelines, any one criterion can be used to diagnose GDM fasting ≥ 126 mg/dl (7.0 mmol/l) or 2-hr value ≥140 mg/dl (7.8 mmol/l) [3,4]. According to DIPSI criteria irrespective of meals and time 2-hours value ≥ 140 mg/dl a single step, nonfasting procedure.

Descriptive statistics was used to calculate the mean and standard deviation. Z test was used on the results obtained and a 'p' value <0.05 was considered statistically significant The mean and S.D of age and parity were calculated. Comparision of WHO and DIPSI were analyzed by Fischer exact test (chi- square test) by using SPSS software (version 20) and MedCalc (version 12.7.0).

3. RESULTS

A total of 149 pregnant women underwent the initial fasting OGTT. Women vomited after consuming the glucose were not excluded from analysis. All participant women were requested to come back 2–3 days later, for the nonfasting OGTT. The mean age of the 149 women was 23±5.1 years, mean BMI 22.6±4 kg/m^2 and mean gestational age, 23.7±4.2 weeks. Of them 126 were primi and 23 were multipara. Of the 149 pregnant women 63 (42.28%) were diagnosed to have GDM using the WHO 1999 criteria whereas 58 (34.89 %) women were diagnosed to have GDM using the DIPSI criteria.

In Table 1 the mean age and S.D of pregnant GDM women were 24.35±4.77 years. The mean glucose values and S.D of GDM cases is 154.32±8.7. The mean BMI values and S.D of GDM cases is 23.5±4.6 kg/m^2.

Table 2 shows the number of cases diagnosed by WHO and DIPSI criteria. 63 cases were screened by WHO out of which 6 cases were diagnosed by 1st hr sample and rest of 57 cases by 2nd hr sample. By applying DIPSI to the same 63 GDM cases, 58 cases were diagnosed to have GDM. This shows that DIPSI was found to identify 58/63 (92.06%) of GDM cases identified by WHO. If we consider the 2nd hr samples out of 57 cases of WHO, 58 cases of DIPSI identified GDM (57/58) almost 98.27% cases could be screened by DIPSI. If we carefully observe the 1st hr sample normal range (126 mg/dl) it is diabetes range outside the pregnancy but not IGT or GDM. The reason for those 6 cases diagnosed by 1st hr seems to be over diagnosed by WHO criteria.

However, as shown in the (Fig. 1) Venn diagram Of the 63 women identified to have GDM by the WHO 1999 criteria, only 58 (92.06%) women were diagnosed by the DIPSI non-fasting criteria Only 52 women of the total 63 women with GDM (82.5%) were identified by both DIPSI and WHO criteria. Thus, 11/63 (17.4%) of the GDM women would have been missed if DIPSI criteria alone were used. Conversely, 6/63 (9.5%) of the GDM women would have been missed if WHO criteria alone was used.

Table 1. Antepartum charactersics of the study women

Antepartum characteristics	Non GDM	GDM	p-value
Number of cases	86	63	Total 149
Age	22.7±3.5	24.35±4.77 years	<0.001
BMI	22.8±5 kg/m^2	23.5±4.6 kg/m^2	<0.001
Mean glucose values of 2nd hr mg/dl	98±14	154.32±8.7	<0.0001

Table 2. Distribution of cases in WHO and DIPSI criteria

Diagnostic criteriae	1st hr	2nd hr
WHO n=63	6 cases	57 cases
DIPSI n=58	-	58 cases

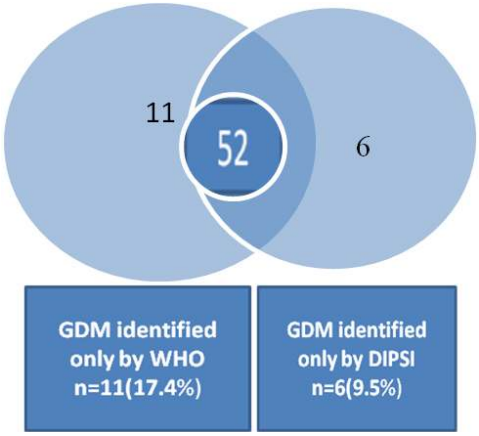

Fig. 1. Venn diagram

Table 3 shows the comparision of two diagnostic tests. When both criteriae were applied 52 cases were diagnosed, 11 cases were diagnosed only by WHO criteria, 6 cases were identified only by DIPSI criteria, and 80 cases were GDM negative by both. Fischer exact test (chi square) is applied to analyze the significance of both tests. P-value is extremely statistically significant. 92% of cases identified by WHO were also found by DIPSI. Chi square equals to 75.181 with 1 degrees of freedom. The two tailed p-value is < 0.0001. The association between rows and columns is considered to be extremely statistically significant. This shows DIPSI can be used not only as a screening test but also as a diagnostic procedure.

Table 3. Fischer's exact test

WHO	DIPSI positive	DIPSI negative	Total
Positive	52	11	63
Negative	6	80	86

4. DISCUSSION

Normal pregnancy is characterized by "facilitated insulin action" during 1st half of pregnancy and "diabetogenic stress" in the 2nd half of pregnancy. These changes are a result of high hormone levels (elevation of progesterone, oestriol, oestradiol, oestrone and human chorionic somatomammotropin (HCS) or human placental lactogen (HPL), decreased glucose disposal rate, increased fasting serum insulin levels, and decreased insulin secretion after meals.[(6)] A pregnant woman who is not capable of increasing her insulin levels against the developed insulin resistance land up in GDM.GDM is considered as IGT (impaired glucose tolerant)outside pregnancy. Diabetes setsin 3 phases. 1. Plasma glucose with demonstable insulin resistance (IR) normal insulin levels raised 2. IR worsens so that postprandial hyperglycemia develops despite increased insulin conc 3. IR doesnt change but declining secretion caused fasting hyperglycemia. Postprandial blood glucose (2 hr sample) is elevated prior to fasting glucose.

GDM is associated with increased rate of neonatal hypoglycaemia, preterm birth, hyperbilirubinemia, hypocalcemia, polycythemia, childhood obesity, neuropsychological disturbance. Women with GDM demonstrated high rate of caesarean section and future risk of diabetes [4]. With the alarming rising tide of GDM it is necessary to set standards that meet high risk Indian population [6,7,8]. Conventional diagnostic criteriae like American Diabetes Association (ADA) guidelines, American College of Obstetricians and Gynecologists (ACOG) guidelines and National Institute of Health and Clinical Excellence (NICE) guidelines and IADPSG guidelines (1) are controversial and country specific do not give any information about perinatal outcome. To standardize the diagnosis of GDM, the World Health Organization (WHO) recommends using a 2-hour 75 g oral glucose tolerance test (OGTT) with a threshold plasma glucose concentration of greater than 140 mg/dL at 2 hours, similar to that

of IGT (> 140 mg/dL and < 199 mg/dL), outside pregnancy.

"DIPSI- A modified version of WHO criteria is a one step procedure with a single glycemic value" In the antenatal clinic, a pregnant woman after undergoing preliminary clinical examination is given a 75 g oral glucose load, irrespective of whether she is in the fasting or non fasting state, without regard to the time of the last meal. A venous blood sample is collected at 2 hours for estimating plasma glucose by the GOD- POD method. GDM is diagnosed if 2- hour plasma glucose is ≥ 140 mg/ dl. [9,10] 2 hr plasma glucose values of both criteriae is same (>140 mg/dl). Both criteriae looks similar in every aspect except the fact that WHO requires fasting and DIPSI doesn't which is rational. After a meal, a normal glucose tolerant woman would be able to maintain euglycemia despite glucose challenge due to brisk and adequate insulin response. Whereas a woman with GDM who has impaired insulin secretion her glycemic excursion exaggerates further. Advantages of DIPSI are Pregnant women need not be fasting will not experience morning sickness, no nausea or vomiting after load, no waiting period, Causes least disturbance in a pregnant woman's routine activities, can diagnose pre GDM, Serves as both screening and diagnostic procedure and in management.

By following the usual recommendation universal screening is done between 24 - 28 weeks of gestation, early screening in the first trimester is suggested if the 2 hr PG > 200 mg/dl. The recent concept is to screen for glucose intolerance in the first trimester itself as the fetal beta cell recognizes and responds to maternal glycemic level as early as 16th week of gestation. If found negative at this time, the screening test is to be performed again around 24th-28th week and finally around 32nd–34th week. Gestational prediabetes worsens the cardivacular risk profile. So they are emphasized to undergo screening in early weeks during next pregnancy. If 2nd hr plasma glucose is >200 mg/dl and HbA1c is >6.5% it is confirmatory of pre GDM [10,11].

Our study shows 92% of cases identified by WHO has also been screened by DIPSI. This is in accordance with the study done by Sivagnanam Nallaperumal et al. where 98% of cases were picked up by DIPSI [12] when 2nd hr samples are considered out of 63 cases, 57 GDM cases were picked up by WHO criteria and 58 GDM cases by DIPSI. 98.27% (57/58) cases could be screened by DIPSI. The difference seen may be because of the inherent contradiction that exists in the normal range of 1st hr sample in WHO >126 mg/dl which is used to diagnose diabetes outside pregnancy, where as GDM is IGT outside pregnancy. Wahi et al. observed in their randomized controlled study, the advantage of adhering to a cut-off level of 2-hour PG ≥ 7.8 mmol/L in diagnosis and management of GDM for a significantly positive effect on pregnancy outcomes both in relation to mother as well the child [13]. Perucchini et al. also suggest one-step diagnostic procedure (2-hour PG ≥ 7.8 mmol/L) to diagnose GDM. Franks et al. documented that when maternal 2-hour PG was ≥ 7.8 mmol/L, the cumulative risk of offspring developing type 2 DM was 30% at the age 24 years [14,15,16]. In a study done by Viswanathan Mohan et al. DIPSI has poor sensitivity compared to both the WHO 1999 criteria (27.7 %) and the IADPSG criteria (22.6 %). It was found to miss 72.3 % of women with GDM diagnosed by the WHO 1999 criteria and 77.4% of women with GDM diagnosed by the IADPSG criteria. One interesting feature observed in our study is one of the riskfactor BMI was found to be in normal range in 70% of cases. Out of them 42% were found to have PCOS (polycystic ovarian syndrome). One of the limitations of this study is that maternal and foetal outcomes based on these recommendations are not available as it is done in a span of 4 months where women did not complete their term pregnancy. Instead we assessed ultrasonographic findings and TIFA scans for the morphological anamolies, growth and weight of the fetus. No significant changes were observed.

5. CONCLUSION

Traditional WHO requires fasting and is inconvenient to the patient whereas DIPSI, a nonfasting single step procedure has the same sensitivity and specificity in diagnosing and screening GDM. Perinata l outcome cannot be commented as the study is done in a short period of time. Further advanced studies among larger population are required to generate more reliable data to prevent false positives and increase the specificity of the test.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Havilah Polur, Radhika Arora, Pandit Vinodh Bandela. A mini review on

diagnostic criteria of gestational diabetes mellitus. J. Pharm. Sci. & Res. 2015;7(8): 538-541.

2. Amita Sharma, Manisha Gupta, Alpana Agrawal. Comparison of diagnostic accuracy of two one step procedures for screening of gestational diabetes mellitus. Int J Reprod Contracept Obstet Gynecol. 2015;4(1):81-85.
3. Seshiah V, Das AK, Balaji V. Gestational diabetes mellitus – guidelines. JAPI - DIPSI Guidelines. Gestational Diabetes Mellitus in India. JAssoc Physic of India. 2004;52:707–11.
4. Hillier TA, Vesco KK, Whitlock EP, et al. Screening for gestational diabetes mellitus. Agency for Health Care Research and Quality (Us). 2008;5:1-19.
5. Seshiah V, et al. Consensus evidence-based guidelines for management of gestational diabetes mellitus in India. J Assoc Physic of India. 2014;62:55-62.
6. Seshiah V, Sahay BK, Das AK, Balaji V, Siddharth Shah, Samar Banerjee. Chapter 44 diagnosis and management of gestational diabetes mellitus. Indian Guidelines 201-204.
7. Balaji V, Madhuri Balaji, Anjalakshi C, Cynthia A, Arthi T, Seshiah V. Diagnosis of gestational diabetes mellitus in Asian-Indian women. Indian Journal of Endocrinology and Metabolism. 2011; 15(3):187-190.
8. Viswanathan Mohan, Manni Mohanraj Mahalakshmi. Comparison of screening for gestational diabetes mellitus by oral glucose tolerance tests done in the non-fasting (random) and fasting states. Acta Diabetol. 2014;51(6):1007–1013.
9. Metzger BE, Gabbe SG, Persson B, Buchanan TA, Catalano PA, 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.
10. Sugaya A, Sugiyama T, Na Gata M, Toyoda N. Comparison of the validity of the criteria for gestational diabetes mellitus by WHO and by the Japan Society of Obstetrics and Gynecology by the outcomes of pregnancy. Diabetes Res Clin Pract. 2000;50:57-63.
11. V Seshiah. Fifth National Conference of Diabetes in Pregnancy Study Group. India J Assoc Physic of India. 2010;58:329-330.
12. Vijayalakshmi Udipi Badikillaya. Effectiveness of Diabetes in Pregnancy Study Group India (DIPSI) diagnostic criterion in detecting gestational diabetes mellitus – a pilot study in a rural population. Indian Journal of Basic & Applied Medical Research. 2013;6(2): 614-618.
13. Sivagnanam Nallaperumal, Balaji Bhavadharini. Comparison of the world health organization and the International association of diabetes and pregnancy study groups criteria in diagnosing gestational diabetes mellitus in South Indians. Indian J Endocr Metab. 2013;17(5):906-909.
14. Wahi P, Dogra V, Jandial K, et al. Prevalence of gestational diabetes mellitus (GDM) and its outcomes in Jammu region. J Assoc Physicians India. 2011;59:227-30.
15. Perucchini D, Fischer U, Spinas GA, et al. Using fasting plasma glucose concentrations to screen for gestational diabetes mellitus: Prospective population based study. BMJ. 1999;319(7213):812-5.
16. Franks PW, Looker HC, Kobes S, et al. Gestational glucose tolerance and risk of type 2 diabetes in young Pima Indian offspring. Diabetes. 2006;55(2):460-5.

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/12940