Diagnosis of Gestational Diabetes Mellitus Using the International Association of the Diabetes and Pregnancy Study Groups Criteria and Adverse Pregnancy Outcomes Among a Cohort of Filipino Women: An Association Analysis

Kristine S. de Luna, M.D.* and Elaine C. Cunanan, M.D.**

Abstract

Introduction: Locally, there is no unified set of diagnostic criteria for gestational diabetes mellitus (GDM) and this can lead to potential confusion on the part of the physician and the patient as well. Moreover, whether the adoption of the International Association of the Diabetes and Pregnancy Study Groups (IADPSG) threshold values for GDM diagnosis among Filipino women is appropriate is still unclear. This study serves to give a clinically important insight whether utilizing the abovementioned diagnostic criteria is appropriate in the local setting or not. The study aims to determine the association of the threshold values set up by the IADPSG to diagnose GDM with adverse pregnancy outcomes among a cohort of Filipino women.

Methods: A retrospective analysis of medical files of the women diagnosed with GDM using the IADPSG criteria from January 2013 to March 2016 was done. The results of seventy-five gram oral glucose tolerance test (75-g OGTT) were recorded. The association between each IADPSG threshold values (fasting blood glucose of ≥92 mg/dL, one-hour post glucose load of ≥180 mg/dL, two-hour post glucose load of ≥153 mg/dL) used to define GDM and maternal and perinatal outcomes were determined.

Results: One hundred twenty women with GDM were included in the analysis. Each of IADPSG-defined cut-off values was not significantly associated with increased likelihood of having adverse maternal outcomes namely: hypertensive disorders of pregnancy, miscarriage, primary cesarean section, operative vaginal delivery, and maternal death. Similarly, the likelihood of perinatal outcomes namely: macrosomia, perinatal death, prematurity, birth injuries, congenital anomalies, neonatal hypoglycemia, jaundice, low APGAR score, acute respiratory distress syndrome, and infection were not significantly higher even if these cut-off values were met.

Of note, high odds ratio was noted for neonatal hypoglycemia at FBS >92 mg/dL and <92 mg/dL and the low Apgar Score in first minute at >153 mg/dL and <153 mg/dL even though they were statistically not significant.

Conclusion: We did not find a statistically significant positive association between IADPSG threshold values and specified adverse maternal and perinatal outcomes.

Keywords: gestational diabetes mellitus, IADPSG criteria, 75-gram oral glucose tolerance test, adverse pregnancy outcomes

Introduction

Over the years, around the world, various sets of diagnostic criteria have been formulated to detect gestational diabetes mellitus (GDM) resulting in the lack of a unified consensus on how this condition should be diagnosed. Locally, two diagnostic criteria can be used to interpret GDM based on 75-g OGTT values. One is the International Association of Diabetes and Pregnancy Study Groups (IADPSG) criteria that is being endorsed by the Unite for Diabetes Philippines and widely applied.[1-3] The patient needs to undergo three blood extractions to obtain the baseline fasting blood glucose (FBS), one-hour post-glucose load, and two-hour post-glucose load values that might pose inconvenience and added expense to our usually resource-poor patients.

Historically, each of the three 75-g OGTT diagnostic thresholds is arbitrarily chosen based on Hyperglycemia Adverse Pregnancy Outcomes (HAPO) trial, where increasing maternal hyperglycemia showed strong associations with increasing birth weight and other outcomes such as prematurity, birth injury, neonatal intensive care unit (NICU) admission, hyperbilirubinemia, and preeclampsia.[4-6] However, due to the absence of any clear threshold of glucose concentration at which risk of adverse outcomes increased, the group reached a consensus that the thresholds for diagnosing GDM would be: the glucose

*Fellow-in-training, Section of Endocrinology, Diabetes, and Metabolism, Department of Medicine, University of Santo Tomas Hospital
**Consultant, Section of Endocrinology, Diabetes, and Metabolism, Department of Medicine, University of Santo Tomas Hospital

Corresponding author: Kristine S. de Luna, M.D., University of Santo Tomas Hospital, Manila, Philippines
Email:adobe0328@yahoo.com

values at which the odds ratios (ORs) reached 1.75 for birth weight greater than the 90th percentile, percent infant body fat (based on skinfolds) greater than the 90th percentile, and concentration of C-cord peptide greater than the 90th percentile.[5,7] Several other adverse pregnancy outcomes especially perinatal death were not taken into consideration due to the technical limitation of the HAPO trial for its analysis. In addition, only 29% were Asians in this trial based on self-reporting[1,4] thus questioning applicability of the IADPSG criteria to Filipinos. The studies of Urbanozo[1] and Serafica-Hernandez[3] bear similar findings with the HAPO study. In line with these findings, authors hypothesized that there will be an association between IADPSG threshold values and specified adverse maternal and perinatal outcomes. However, one expert noted that there was a diverse rate of GDM incidence among Asian groups leading to the theory that there may be differences in pregnancy outcomes among these groups.[1] The Philippine Obstetrics and Gynecological Society (POGS) system can be used and requires only two blood extractions to get the fasting blood glucose and two-hour post-glucose load values. The adoption of two systems in the diagnosis of GDM can add to potential diagnostic confusion and therapeutic dilemma (due to same FBS cut-off value but different two-hour post-glucose load cut-off value) especially if the patient is being seen by two specialties that usually happen. The issues above seem to have important clinical implication with regards to formulating a unified set of diagnostic criteria that may be more suitable to the Filipino population and more intelligible to the health care providers.

We therefore aimed to determine the association of IADPSG-defined cut-off values to diagnose GDM to adverse pregnancy outcomes among a cohort of Filipino women. The finding of our study will give a clinically important insight whether adopting this set of diagnostic criteria is appropriate in the local setting.

Methods

Study design and setting

This was a retrospective review and analysis of out-patient and in-patient medical records of Filipino women identified with GDM using the IADPSG criteria who attended and delivered at the University of Santo Tomas Hospital (USTH) pay and clinical division from January 2013 to March 2016. The pay division which is equivalent to the private section of a hospital, is attended by more financially-able patients, while the clinical division, due to its lower fees is attended by patients with a limited budget. GDM was diagnosed according to this set of criteria if at least one 75-g OGTT value equal or exceeds the following thresholds: FBS of 92 mg/dL, one-hour post-glucose load of 180 mg/dL, and two-hour post-glucose load of 153 mg/dL. Patients had 75-g OGTT in different laboratories since they were usually advised by their physician to have the blood test in a location that is convenient for them. Data from the medical charts of their corresponding neonates were also gathered and analyzed. The study was reviewed and approved by the Institutional Review Board of the USTH prior to its implementation.

Participants

Inclusion criteria for this study were the following: women whose GDM were diagnosed using IADPSG criteria, women 18 years old and above, and singleton pregnancy. On the other hand, exclusion criteria for this study were the following: diagnosis of pre-gestational diabetes mellitus (DM) or overt DM, women whose medical files contained insufficient data to be included in the analysis, and women whose neonate had missing and incomplete medical files.

Over a three year and three-month period, 153 women were identified as having GDM. Thirty-three medical records were excluded due to insufficient data (n= 30), and diagnosis of twin pregnancy (n= 3) which left a total of 120 files suitable for analysis

Study variables and definition of terms

Maternal antepartum characteristics gathered were the following: maternal age at delivery, parity, height in centimeters (cm), weight in kilograms (kg),body mass index (BMI) (which was calculated as weight divided by height squared in kg/m^2), 75-g OGTT values in milligrams per deciliter or mg/dL (which included FBS, one-hour post-glucose load, and two-hour post-glucose load), family history of diabetes mellitus (DM), macrosomia in the previous pregnancy, polycystic ovary syndrome (PCOS), chronic hypertension, dyslipidemia, pre-diabetes (which included a diagnosis of impaired fasting blood glucose or impaired glucose tolerance prior to pregnancy), GDM in the previous pregnancy, and treatment modality of GDM (whether treated with diet and physical activity or supplemental insulin).

The following adverse maternal pregnancy outcomes were collected: hypertensive disorders of pregnancy (which included gestational hypertension, pre-eclampsia and eclampsia),[8] miscarriage, primary cesarean section, and operative vaginal delivery (deliveries where either forceps or ventouse was used to deliver fetal head),[9] and maternal death.

The following adverse perinatal outcomes were collected: prematurity (defined as having gestational age at delivery of <37 weeks),[9] macrosomia (defined as birth weight more than 3.6 kg as set by the ASEAN Federation of Endocrine Society Study Group for Diabetes in Pregnancy[2] or having a notation of LGA in the chart), low APGAR score taken

at one minute and at five minutes (defined as having an APGAR score of less than seven),[10] neonatal hypoglycemia (defined as blood glucose value of less than 40 mg/dL[11] or having a notation of such condition in the chart), jaundice, perinatal death (term used for fetal and infant deaths),[12] acute respiratory distress syndrome, congenital anomalies, infection, and birth injury. Other data recorded were gestational age at delivery in weeks, birthweight in kilograms, capillary blood glucose (CBG)value taken at first hour of life in mg/dL, and APGAR score taken at one minute and at five minutes.

Statistical analysis

Descriptive statistics was used to summarize the clinical characteristics of the study population. Frequency and percentage was used for nominal variables, and mean and standard deviation (SD) for interval/ratio variables. Median and range was used for ordinal variables. Binary logistic regression analysis was used to determine the significant maternal and perinatal factors associated with blood glucose parameters of 75-g OGTT. A *p*-value of <0.05 was considered significant. All data were entered using the Microsoft Excel for Mac 2011 (Version 14.6.5). Statistical analysis was carried out using STATA 12.0 software.

Results

From January 2013 to March 2016, 153 women were diagnosed as having GDM, while 3122 women had no GDM. A total of 120 women with GDM were included in the analysis after fulfilling the inclusion criteria. Table I shows the maternal antepartum profile of 120 participants in the study. The participants had a young mean age. Two-thirds of the participants (n=81) were multigravid. They also had a high mean BMI of 28.88 kg/m^2. In terms of 75-g OGTT values, they had mildly elevated parameters: mean FBS of 95.14 mg/dL, mean one-hour post-glucose load value of 186.15 mg/dL, and mean two-hour post-glucose load value of 166.75 mg/dL. More than half of the participants had family history of diabetes mellitus. The most common maternal comorbidity was previous GDM (n=20), macrosomia (n=17), chronic hypertension (n=12), and PCOS (n=12).

Table II shows the summary of maternal outcomes. There were no cases of serious outcomes such as miscarriage and maternal death. Few women had hypertensive disorders of pregnancy (n=11, 9.17%). In terms of mode of delivery, almost half of the participants underwent primary CS (n=50, 41.67%) while only 2.5% (n=3) underwent forceps-assisted vaginal delivery.

Table III shows the perinatal profile of study participants. The mean birth weight was normal at 3.05 kg. Among the

Table I. Summary of maternal antepartum profiles (N=120)

Antepartum profiles	Data
Maternal age (years)	31.88 ± 5.4*
Parity Primiparous Multiparous	 38 (31.93)** 81 (68.07)**
Height (cm)	155.57 ± 9.91*
Weight (kg)	68.80 ± 12.27*
BMI (kg/m^2)	28.88 ± 8.86*
75-g OGTT values (mg/dL) FBS 1-hour post-glucose load 2-hour post-glucose load	 95.14 ± 20.36* 186.15 ± 48.98* 166.74 ± 54.82*
Mode of Treatment Diet and Physical Activity Supplemental Insulin	 64 (53.33)** 56 (46.67)**
Family history of DM PCOS Diagnosis of pre-DM prior to pregnancy Chronic hypertension Dyslipidemia GDM in previous pregnancy Macrosomia in previous pregnancy	70 (58.33)** 12 (10)** 2 (1.67)** 12 (10)** 1 (0.83)** 20 (16.67)** 17 (14.17)**

*Mean and Standard deviation
**Frequency and percentage

Table II. Summary of maternal outcomes (N=120)

Maternal outcomes	Frequency (%)
Hypertensive disorders of pregnancy	11 (9.17)
Miscarriage	0
Primary Cesarean section	50 (41.67)
Operative vaginal delivery	3 (2.5)
Maternal death	0

Table III. Summary of perinatal profiles of study participants (N = 120)

Perinatal profiles	Data
Birth weight (kg)	3.05 ± 0.61*
Macrosomia	16 (13.33)**
Gestational age at delivery (weeks)	37.82 ± 2.14*
Premature	14 (11.67)**
APGAR score 1st minute 5th minute	 8 (2 to 8)*** 9 (4 to 9)***
Perinatal death	3 (2.50)**
Jaundice	40 (33.33)**
CBG at 1st hour of life	65 (21 to 175)***
Neonatal hypoglycemia	5 (4.16)**
Congenital anomalies	5 (4.16)**
Acute respiratory distress syndrome	2 (1.67)**
Infection	18 (15)**
Birth injuries	1 (0.83)**

*Mean and standard deviation
**Frequency and percentage
***Median and range

Table IV. Proportion and association of adverse pregnancy outcomes in relation to IADPSG-defined FBS threshold value for GDM diagnosis (N = 120)

Maternal outcomes	FBS ≥ 92 mg/dL n=61	FBS < 92 mg/dL n=59	OR (CI)*	*p*-value
	Frequency (%)			
Hypertensive disorders of pregnancy	5 (8.20)	6 (10.17)	0.79 (0.23-2.74)	0.71
Miscarriage	0	0	-	-
Primary cesarean section	23 (41.07)	27 (45.76)	0.83 (0.39-1.73)	0.61
Operative vaginal delivery	1 (1.75)	2 (3.39)	0.51 (0.04-5.77)	0.59
Maternal death	0	0	-	-
Perinatal outcomes				
Macrosomia	9 (15.79)	8 (14.04)	1.15 (0.41-3.22)	0.79
Perinatal death	1 (1.75)	2 (3.39)	0.51 (0.04-5.77)	0.59
Prematurity	6 (10.71)	8 (13.79)	0.75 (0.24-2.32)	0.62
Birth injuries	0	1 (1.72)	-	-
Congenital anomalies	2 (3.51)	3 (5.17)	0.67 (0.11-4.15)	0.66
Neonatal hypoglycemia	4 (8.51)	1 (2.27)	4 (0.43-37.26)	0.22
Jaundice	21 (36.84)	19 (32.76)	1.20 (0.56-2.58)	0.65
Low APGAR score (<7) 1st minute 5th minute	 5 (8.77) 3 (5.26)	 6 (10.53) 4 (7.02)	 0.82 (0.23-2.85) 0.74 (0.16-3.45)	 0.75 0.70
Acute respiratory distress syndrome	0	2 (3.45)	-	-
Infection	9 (15.79)	9 (15.52)	1.02 (0.37-2.79)	0.97

*OR- odds ratio; CI- confidence interval

neonates in the study, the mean maturity was 37.82 weeks. Only sixteen neonates (13.33%) were macrosomic while 14 were born premature (11.67%). Three perinatal deaths (2.5%) were noted. Five neonates (4.16%) were noted to have congenital anomalies.

Table IV shows that women with an FBS of ≥92 mg/dLhad four times the odds of having infants with neonatal hypoglycemia. However, this was not statistically significant (*p*=0.22). There also seemed to have a non-significant and small increase in the likelihood of having macrosomic infants (OR=1.15, *p*=0.79), neonatal jaundice (OR=1.20, *p*=0.65), and neonatal infection (OR= 1.02, *p*=0.97).

As shown below in Table V, one-hour post-glucose load value of ≥180 mg/dL was associated with small increase in the odds of having hypertensive disorders of pregnancy (OR=1.09, *p*=0.89). There appeared to have a 1.71 times increase in the likelihood of giving birth to jaundiced infants among these women. In terms of other perinatal outcomes, reaching this one-hour post-glucose load value was associated with minimal increase in the likelihood of having macrosomia (OR=1.46, *p*-value=0.48), prematurity (OR= 1.28, *p*-value=0.67), neonatal hypoglycemia (OR=1.37, *p*-value=0.74), low five-minute APGAR score (OR=1.31, *p*-value=0.73), and infection (OR=1.22, *p*-value=0.70). However, all these values did not reach statistical significance.

Table VI shows that a two-hour glucose post-load value of ≥153 mg/dL, was associated with six times more likelihood (OR=6.61) of having an infant with a low one-minute APGAR score. Women with this glucose value were twice as likely to have macrosomic (OR=2.09), and premature infants (OR= 2.34). Moreover, a smaller increased rate of undergoing primary CS (OR=1.96), and having jaundiced infants (OR=1.56) was observed. Similar to the earlier findings, these values did not reach statistical significance.

Discussion

The results indicate that the rate of developing adverse maternal and perinatal outcome among women whose 75-g OGTT values reached the IADPSG-defined cut-off values was not significantly increased. This is contrary to the two local studies showing an association of specified 75-g OGTT values with some of the adverse pregnancy outcomes.[1,3] Urbanozo et al., demonstrated an increase in the risk of having large for gestational age (LGA) neonate with FBS of ≥92 mg/dL.[1] In addition, the study showed an increase in the risk of having primary CS with one-hour post-glucose load value of ≥ 180 mg/dL. Their findings are also in agreement with study by Black et al and Brankica et al. that elevated FBS was associated with higher risk of LGA.[13,14] However, they found that elevation of post-load values was associated with higher risk of pre-term delivery, gestational hypertension, and hyperbilirubinemia. On the other hand, Serafica-Hernandez

Table V. Proportion and association of adverse pregnancy outcomes in relation to IADPSG-defined 1-hour glucose post-load threshold value for GDM diagnosis (N = 120)

Maternal outcomes	1-hour post-load ≥ 180 mg/dL (n=63)	1-hour post-load < 180 mg/dL (n=57)	OR (CI)*	*p*-value
	Frequency (%)			
Hypertensive disorders of pregnancy	6 (9.52)	5 (8.77)	1.09 (0.32-3.8)	0.89
Miscarriage	0	0	-	-
Primary cesarean section	25 (41.67)	25 (45.45)	0.86 (0.41-1.79)	0.68
Operative vaginal delivery	1 (1.67)	2 (3.57)	0.46 (0.04-5.19)	0.53
Maternal death	0	0	-	-
Perinatal outcomes				
Macrosomia	10 (17.24)	7 (12.50)	1.46 (0.51-4.15)	0.48
Perinatal death	1 (1.67)	2 (3.57)	0.46 (0.04-5.19)	0.53
Prematurity	8 (13.56)	6 (10.91)	1.28 (0.41-3.96)	0.67
Birth injuries	0	1 (1.79)	-	-
Congenital anomalies	2 (3.39)	3 (5.36)	0.62 (0.10-3.86)	0.61
Neonatal hypoglycemia	3 (6.25)	2 (4.65)	1.37 (0.22-8.59)	0.74
Jaundice	24 (40.68)	16 (28.57)	1.71 (0.79-3.73)	0.18
Low APGAR score (<7) 1st minute 5th minute	 6 (10.34) 4 (6.90)	 5 (8.93) 3 (5.36)	 1.18 (0.34-4.1) 1.31 (0.28-6.13)	 0.80 0.73
Acute respiratory distress syndrome	2 (3.39)	0	-	-
Infection	10 (16.95)	8 (14.29)	1.22 (0.45-3.37)	0.70

*OR- odds ratio; CI- confidence interval

Table VI. Proportion and association of adverse pregnancy outcomes in relation to IADPSG-defined 2-hour glucose post-load threshold value for GDM diagnosis (N = 120)

Maternal outcomes	2-hour post-load ≥ 153 mg/dL (n=78)	2-hour post-load < 153 mg/dL (n=42)	OR (CI)*	*p*-value
	Frequency (%)			
Hypertensive disorders of pregnancy	6 (7.69)	5 (11.90)	0.62 (0.18-2.16)	0.45
Miscarriage	0	0	-	-
Primary cesarean section	36 (49.32)	14 (33.33)	1.96 (0.88-4.28)	0.10
Operative vaginal delivery	3 (4.05)	0	-	-
Maternal death	0	0	-	-
Perinatal outcomes				
Macrosomia	13 (18.06)	4 (9.52)	2.09 (0.64-6.90)	0.23
Perinatal death	3 (4.05)	0	-	-
Prematurity	11 (15.28)	3 (7.14)	2.34 (0.61-8.94)	0.21
Birth injuries	1 (1.37)	0	-	-
Congenital anomalies	3 (4.11)	2 (4.76)	0.86 (0.14-5.35)	0.87
Neonatal hypoglycemia	5 (8.47)	0	-	-
Jaundice	28 (38.36)	12 (28.57)	1.56 (0.69-3.53)	0.29
Low APGAR score (<7) 1st minute 5th minute	 10 (13.89) 7 (9.72)	 1 (2.38) 0	 6.61 (0.82-53.63) -	 0.08 -
Acute respiratory distress syndrome	1 (1.37)	1 (2.38)	0.57 (0.03-9.35)	0.69
Infection	13 (17.81)	5 (11.90)	1.60 (0.53-4.86)	0.40

*OR- odds ratio; CI- confidence interval

et al., found a weak association between FBS and birth weight.[3] However, they found that the one-hour post-glucose load is a significant predictor of birth weight. A European study yielded a similar finding wherein one-hour post-glucose level from 75-g OGTT may predict LGA babies.[14] In addition, FBS was found to also predict the said outcome.[9] Although the study population generally had a high metabolic risk profile to develop GDM or overt DM that can eventually lead to adverse pregnancy outcomes, each adverse maternal and perinatal outcome was not significantly increased. We then attributed our results to several reasons. First, the mean age of women in our study can be considered as somewhat young and low risk for developing undesirable pregnancy outcomes. Second reason is that the knowledge of a healthcare provider of elevated 75-g OGTT value/s could lead to provision of appropriate treatment (whether with diet and physical activity or supplemental insulin), blood glucose monitoring, and recommendation of timely follow-up to the patient. These measures might prevent adverse pregnancy outcomes. The other reason might be due to achievement of glycemic targets of the women throughout pregnancy as this was proven to reduce the incidence of some adverse pregnancy outcomes. Supporting these notions are the two large randomized trials done in Australia and United States.[15,16] The Australian Carbohydrate Intolerance Study in Pregnant Women (ACHOIS) trial group demonstrated a reduction in birth injury and perinatal death with treatment of GDM.[15] On the other hand, a different trial showed that treatment of such condition reduced the risks of fetal overgrowth, shoulder dystocia, cesarean delivery, and hypertensive disorders.[16] However, two studies demonstrated that despite GDM treatment, the association of specific adverse pregnancy outcomes to 75-g OGTT values persisted.[9,17] Disse et al., found in their study that delivery of LGA infants was more frequent in women with elevated FBS.[17] These women received treatment as part of the study protocol. Another study, found a persistence of antenatal complications women diagnosed with GDM using IADPSG criteria despite treatment.[9] Due to these conflicting study results, whether treatment of GDM can offset the association of 75-g OGTT values to adverse pregnancy outcomes needs to be verified. The neonatal population in our study was noted to have a normal mean birth weight and maturity. An infant with a normal birth weight and maturity has a low risk of developing perinatal complications. Moreover, only a small percentage of the neonates were premature, and macrosomic. Another logical explanation might be due to appropriate maternal weight gain during pregnancy. Notwithstanding, the mean BMI of these women were classified as obese. It is an accepted fact that excessive maternal weight gain during pregnancy leads to higher incidence of delivery of LGA infants.[18,19] A study by Ray et al. further showed that maternal weight gain also leads to higher incidence of cesarean delivery, gestational hypertension, NICU admission, and preterm birth.[18] Chen et al. also found that maternal BMI and weight gain have additive effects on the delivery of LGA infants.[19] In addition, we were only able to gather the latest recorded weight of the subjects prior to delivery to compute for the BMI. It is somewhat plausible to assume that majority of the subjects might have a low or normal pre-pregnancy BMI. Lastly, the small sample size of the study might have an impact on the degree of statistical significance.

The retrospective nature of the study limits the type of information that can be gathered from the medical charts. In addition, some medical charts were either unable to be retrieved or found. The earlier mentioned variables such as pre-pregnancy BMI, maternal glycemia during pregnancy, patient compliance to treatment and follow-up, and maternal weight gain which might have significant impact with respect to reduction in the incidence of adverse pregnancy outcomes can be addressed by performance of a prospective study involving a larger sample size. The authors also recommend inclusion of non-GDM patients for comparison. Performance of 75-g OGTT following a uniform protocol in one laboratory would also be appropriate. Patterning the study design to that of HAPO trial, taking into account the additional variables would provide a more thorough evaluation of the appropriateness of adopting the IADPSG criteria in the local setting. If ethically feasible, inclusion of untreated women with GDM in the study would give information whether treatment had an impact on the lack of significant association between IADPSG-defined cut-off values and adverse pregnancy outcomes. The economic and long-term impact of GDM on the mother and infant using this set of criteria may also be studied as well. In fact, studies in other countries comparing IADPSG criteria to other diagnostic approaches showed discrepant results with respect to pregnancy outcomes. Other showed decrease in adverse pregnancy outcomes with the usage of the IADPSG criteria.[20-23] While another study demonstrated an increase in the rates of adverse pregnancy outcomes.[24] Two local studies comparing it to POGS criteria showed no difference with regards to adverse maternal and perinatal outcomes.[1,3] Furthermore, a systematic study was done that demonstrated the high inconsistency of the IADPSG criteria.[25]

Despite the limitations of the study, we were able to include women regardless of their socioeconomic status as the medical files were gathered from both pay and clinical division of the institution. This adds to the generalizability of the results. We were also able to analyze several adverse maternal and perinatal outcomes that might have an association with 75-g OGTT cut-off values.

Conclusion

In conclusion, the study did not find a statistically significant positive association between IADPSG threshold values and adverse maternal and perinatal outcomes.

However, the study findings have important clinical implications with regards to finding the suitable diagnostic approach to GDM in the local setting.

References

1. **Urbanozo H, Isip-Tan IT**: Association of gestational diabetes mellitus diagnosed using the IADPSG and the POGS 75 gram oral glucose tolerance test cut-off values with adverse perinatal outcomes in the Philippine General Hospital. JAFES, 29(2):157-162, 2014.
2. **Jimeno C**, for the Technical Review Committee of the UNITE for DM Clinical Practice Guidelines on the Diagnosis and Management of Diabetes: A summary of the Philippines UNITE for diabetes clinical practice guidelines for the diagnosis and management of diabetes. Part I: Screening and diagnosis of DM. JAFES, 26(1): 26-30, 2011.
3. **Serafica-Hernandez SA, Espina-Tan C, Tremendal MA, Diaz-Roa LJ**: Local versus international criteria in predicting gestational diabetes mellitus-related pregnancy outcomes. Philipp J ObstetGynecol, 38(1):33-42, 2014.
4. **The HAPO Study Cooperative Research Group.** Hyperglycemia and adverse pregnancy outcomes. N Engl J Med, 358(19):1991-2002, 2008.
5. **International Association of Diabetes and Pregnancy Study Groups Consensus Panel**: International Association of Diabetes and Pregnancy Study Groups recommendations on the diagnosis and classification of hyperglycemia in pregnancy. Diabetes Care, 33(3):676-682, 2010.
6. **Leary J, Pettitt DJ, Jovanovic L**: Gestational diabetes guidelines in a HAPO world. Best Pract Res ClinEndocrinolMetab, 24:673-685, 2010.
7. **Farrar D, Fairley L, Santorelli G, Tuffnell D, Sheldon TA, Wright J, van Overveld L, Lawlor DA**: Association between hyperglycemia and adverse perinatal outcomes in south Asian and white British women: analysis of data from the Born in Bradford Cohort. Lancet Diabetes Endocrinol, 3:795-804, 2015.
8. **Gongora MC, Wenger NK**: Cardiovascular complications of pregnancy. Int J MolSci, 16:23905-23928, 2015. DOI: 10.3390/ijms161023905
9. **Nayak PK, Mitra S, Sahoo JP, Daniel M, Mathew A, Padma, A**: Feto-maternal outcomes in women with and without gestational diabetes mellitus according to the International Association of Diabetes and Pregnancy (IADPSG) diagnostic criteria. Diabetes and Metabolic Syndrome: Clinical Research and Reviews, 7:206-209, 2013.
10. **Leuthner SR, Das UG**: Low APGAR scores and the definition of birth asphyxia. Pediatr Clin North Am, 51:737-745, 2004.
11. **Jain A, Aggarwal R, Sankar MJ, Agarwal R, Deorari AK, Paul VK**: Hypoglycemia in the newborn. Indian J Pediatr, 77:1137-1142, 2010.
12. **Barfield WD**, the Committee on Fetus and Newborn: Clinical reports- standard terminology for fetal, infant, and perinatal deaths. Pediatrics, 128:177-181, 2011. DOI: 10.1542/peds.2011-1037
13. **Black MH, Sacks DA, Xiang AH, Lawrence JM**: Clinical outcomes of pregnancies complicated by mild gestational diabetes mellitus differ by combinations of abnormal oral glucose tolerance test values. Diabetes Care, 33(12):2524-2530, 2010.
14. **Brankica K, Valentina VN, Slagjana SK, Sasha JM**: Maternal 75-g OGTT glucose levels as predictive factors for large-for-gestational age newborns in women with gestational diabetes mellitus. Arch EndocrinolMetab, 60(1):36-41, 2016.
15. **Crowther CA, Hiller JE, Moss JR, McPhee AJ, Jeffries WS**, Robinson JS for the Australian Carbohydrate Intolerance Study in Pregnant Women (ACHOIS) Trial Group: Effect of treatment of gestational diabetes mellitus on pregnancy outcomes. N Engl J Med, 352:2477-2486, 2005.
16. **Eunice Kennedy Shriver National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network**: A multicenter, randomized trial of treatment for mild gestational diabetes. N Engl J Med, 361:1339-13348, 2009.
17. **Disse E, Graeppi-Dulac J, Joncour-Mills G, Dupuis O, Thivolet C**: Heterogeneity of pregnancy outcomes and risk of LGA neonates in Caucasian females according to IADPSG criteria for gestational diabetes mellitus. Diabetes Metab, 39:132-138, 2013.
18. **Ray JG, Vermeullen MJ, Shapiro JL, Kenshole AB**: Maternal and neonatal outcomes in pregestational and gestational diabetes mellitus, and the influence of maternal obesity and weight gain: the DEPOSIT study. QJM, 94:347-356, 2001.
19. **Chen Q, Wei J, Tong M, Yu L, Lee AC, Gao YF, Zhao M**: Associations between body mass index and maternal weight gain on the delivery of LGA infants in Chinese women with gestational diabetes mellitus. J Diabetes Complications, 29:1037-1041, 2015. http://dx.doi.org/10.1016/j.jdiacomp.2015.08.017
20. **Hung T-H, Hsieh T-T**: The effects of implementing the International Association of Diabetes and Pregnancy Study Groups Criteria for diagnosing gestational diabetes on maternal and neonatal outcomes. PLoS ONE, 10(3):e0122261, 2015.
21. **Sibartie P, Quinlivan J**: Implementation of the International Association of Diabetes and Pregnancy Study Groups Criteria: not always a cause for concern. J Pregnancy, 2015:1-5, 2015. http://dx.doi.org/10.1155/2015/754085
22. **Duran A, Saenz S, Torrejon MJ, Bordiu E, del Valle L, Galindo M, Perez N, Herraiz MA, Izquierdo N, Rubio MA, Runkle I, Perez-Ferre N, Cusihuallpa I, Jimenez S, de la Torre NG, Fernandez MD, Montanez C, Familiar C, Calle-Pascual AL**: Introduction of IADPSG criteria for the screening and diagnosis of gestational diabetes mellitus results in improved pregnancy outcomes at a lower cost in a large cohort of pregnant women: the St. Carlos Gestational Diabetes Study. Diabetes Care, 37:2442-2450, 2014. DOI: 10.2337/dc14-0179
23. **Wu ET, Nien FJ, Kuo CH, Chen SC, Chen KY, Chuang LM, Li HY, Lee CN**: Diagnosis of more gestational diabetes lead to better pregnancy outcomes: comparing the International Association of the Diabetes and Pregnancy Study Group Criteria, and the Carpenter and Coustan Criteria. J Diabetes Investig, 7:121-126, 2016. DOI: 10.1111/jdi.12378
24. **O'Sullivan EP, Avalos G, O'Reilly M, Dennedy MC, Gaffney G, Dunne F on behalf of the Atlantic DIP collaborators**: Atlantic Diabetes in Pregnancy (DIP): the prevalence and outcomes of gestational diabetes mellitus using new diagnostic

criteria. Diabetologia, 54:1670-1675, 2011. DOI: 10.007/s00125-01102150-4

25. **Wendland EM, Torloni MR, Falavigna M, Trujillo J, Dode MA, Campos MA, Duncan BB, Schmidt MI**: Gestational diabetes and pregnancy outcomes- a systematic review of the World Health Organization (WHO) and the International Association of Diabetes in Pregnancy Study Groups (IADPSG) diagnostic criteria. BMC Pregnancy Childbirth, 12:23, 2012. DOI: 10.1186/1471-2393/12/23/prepub