

Silent upsurge of gestational diabetes: Are we aware? A rural tertiary care experience of Central Gujarat

Charmi S. Shah¹, Smruti B. Vaishnav¹, Saptak P. Mankad¹,
Tanishq S. Sharma¹, Shilpa A. Sapre¹, Nitin S. Raithatha¹, Mamta R. Patel²,
Jyoti G. Mannari³

¹Departments of Obstetrics and Gynecology and ³Internal Medicine, Shree Krishna Hospital and Pramukh Swami Medical College, Karamsad, Gujarat, ²Central Research Services, Bhaikaka University, Karamsad, Gujarat, India

ABSTRACT

Background: The prevalence of Gestational Diabetes Mellitus has been on the rise. With the dramatic increase in the prevalence of overweight, obesity, and inactivity amongst the population, it's becoming a common problem affecting antenatal women and their offspring. **Subjects and Methods:** A prospective cross-sectional study was carried out involving antenatal women between 24-28 weeks of gestation at a tertiary care centre in a rural part of Gujarat. Patients were screened using the Diabetes in Pregnancy Study Group India (DIPSI) guidelines. Analysis was carried out using Chi-square and ANOVA test. **Results:** Patients having PG2BS ≥ 140 mg/dl were diagnosed as having Gestational Diabetes Mellitus (GDM), while those having PG2BS values between 120-139 mg/dl were diagnosed as having Gestational Glucose Intolerance (GGI). Out of the 300 patients screened, we found an overall prevalence of 52 (17.33%) having GDM and 65 (21.67%) having GGI. Most patients belonged to the age bracket of 21-30 years across all groups. The prevalence of GDM in rural antenatal women was 23 (44.2%) and in semi-urban antenatal women was 25 (48.1%) while GGI in the rural antenatal women was 45 (69.2%) followed by semi-urban antenatal women 19 (29.2). We found that Occupation, Residence, Lifestyle, Socio-Economic Class, Family history of Diabetes Mellitus, Body Mass Index (BMI) were all statistically significant whereas Antenatal Complications and Perinatal outcomes weren't. **Conclusion:** With such a high prevalence of GGI, almost equivalent to GDM, it is important to identify patients having GGI and monitor them to prevent progression to GDM by starting an appropriate treatment modality.

Keywords: Antenatal women, gestational diabetes mellitus, gestational glucose intolerance, perinatal outcomes

Introduction

The Prevalence of gestational diabetes mellitus (GDM) is increasing and is expected to increase further because of rising maternal age and obesity.^[1] It is estimated that annually 5 million women in India suffer from GDM.^[2] The recent trends towards

late marriage and advancing age of pregnancy, urbanization, change in eating habits and decreasing physical activity are all contributing towards it. Asian ethnicity increases our population's vulnerability to GDM by about 17%.^[1] The prevalence of diabetes in pregnancy is around 1 in 10 and amongst those diagnosed, 90% have GDM. The overall prevalence of GDM in India is between 3.8% to 17.9% reported in different parts of India.^[3]

Now a days primary care physicians, are well aware of increasing obesity in children, adolescents and females of reproductive age group. This is likely to lead to an epidemic of noncommunicable

Address for correspondence: Dr. Charmi S. Shah,
Department of Obstetrics and Gynaecology, Shree
Krishna Hospital and Pramukh Swami Medical College,
Bhaikaka University, Karamsad - 388 325, Gujarat, India.
E-mail: charmishah888@gmail.com

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diseases. GGI and GDM are manifestations of the same. Early identification and timely intervention by a family physician can help the woman towards adopting healthy lifestyle and shall improve her reproductive performance.

GDM causes many maternal complications in the form of gestational hypertension, pre-eclampsia, postpartum haemorrhage, etc.^[4,5] Fetal complications include macrosomia, respiratory distress syndrome, etc.^[6,7]

Controversies concerning the ideal strategy for the detection and diagnosis of GDM continue while the question regarding the best screening method for GDM remains unanswered. There is a need for a procedure that is both feasible and economical. The one-step procedure using Diabetes in Pregnancy Study Group India (DIPSI) Guidelines with a 75 g oral glucose tolerance test (OGTT) to diagnose GDM serves both as a screening and a diagnostic modality at the same time. Although there are many studies in India for knowing the prevalence of GDM, there aren't many loco-regional studies that highlight its prevalence at a district level such as in Anand, in Central Gujarat.

Hence, the present study was undertaken with an aim to evaluate the prevalence of GDM and cases of Gestational Glucose Intolerance (GGI) using DIPSI guidelines, study the associated factors along with the maternal and perinatal outcomes of such patients.

Subjects and Methods

Study design

A prospective cross-sectional study was carried out between February 2019 to May 2020 with inclusion criteria of selecting all the antenatal women in the gestational age of 24-28 weeks who were attending the Out-Patient Department (OPD) of Obstetrics and Gynaecology Department of our tertiary care centre in Anand District, which is a peculiar district with milk co-operative society, tobacco cultivating area, agricultural section, stone polishing industry over and above Institutes of National and International repute.

Patients were excluded if they were already diabetic, suffering from any medical illness such as cardiac disease, chronic hypertension and renal disorders; patients who had been referred during labour, and women whose gestational age was less than 24 weeks or greater than 28 weeks. Those patients who satisfied these criteria were selected using convenient sampling.

Methodology

After getting approval from the institutional ethics committee, the patients were enrolled as per the inclusion criteria.

Sample size calculation

The prevalence of GDM reported in other studies varies from 3.8% to 17.9% in India. Considering the prevalence of GDM at

14% in our studied population and an allowable error of 4% on either side (i.e. estimated prevalence would be 10% to 18%), a sample size of 290 was calculated with keeping confidence level 95%. It was the minimum desirable sample size.

After obtaining their written and informed consent in their vernacular language, a detailed history of the patient was collected using a standardized questionnaire that included information on age, gender, family history, past history, obstetric history, occupation, place of residence, education level, lifestyle, and socio-economic class. BMI was recorded. Single-step testing using 75-gram oral glucose dissolved in water irrespective of last meal was carried out followed by measuring the blood sugar using a venous blood sample 2 hours after ingestion. The solution had to be completely ingested within 5-10 minutes. If any patient experienced vomiting within 30 minutes of oral glucose intake, then the test was repeated. If vomiting occurred after 30 minutes, the test was continued. The threshold blood sugar level of ≥ 140 mg/dl was taken as the cut-off for the diagnosis of GDM. The blood sugar level of ≥ 120 mg/dl -139 mg/dl was classified as another group labelled as GGI and the findings were compared in three groups. Data was entered into Microsoft Excel. Analysis of the data was performed using STATA 14.2. Descriptive Statistics [Mean (SD), Frequency (%)] used to depict the baseline profile of the study participants. Chi-square/Fisher Exact test and ANOVA were used for analysis. A *P* value < 0.05 was considered statistically significant.

Results

Demographics

A total of 300 patients were screened for GGI and GDM. Out of those, 52 (17.33%) had Blood Sugar ≥ 140 mg/dl and were diagnosed as GDM while 65 (21.67%) had Blood Sugar between 120-139 mg/dl and they were diagnosed as having GGI [Figure 1].

Maximum participants were from the age group of 21-30 years. Amongst them, 129 (60.3%) were Normal, 45 (21%) had GGI, and 40 (18.7%) had GDM. In the age group of > 31 years i.e. elderly gravidas, the prevalence of GGI was 12 (24.49%) and that of GDM was 6 (12.24%). The majority of the patients belonged to Rural ($n = 194$, 64.67%) and semi-urban areas ($n = 94$, 31.33%). Amongst the GDM group, 23 (44.2%) belonged to the Rural area while 25 (48.1%) belonged to Semi-Urban areas. We categorized lifestyle according to the level of work. We found that in those patients having a sedentary lifestyle, the prevalence of GGI was 16 (34.8%) while that of GDM was 12 (26.1%). The lifestyle of a patient was significantly associated with the development of GGI or GDM. Looking at the Socio-Economic Sections of patients in the present study (based on Kuppuswami Classification), we found that GGI and GDM patients belonged more to the lower and middle socio-economic class which was statistically significant [Table 1]. We found that 16 (30.76%) of GDM, 6 (9.23%) of GGI patients had a positive family history which was a statistically significant finding [Figure 2].

Table 1: Socio Demographic Characteristics of Enrolled Patients

Variable	Normal (n, %)	GGI (n, %)	GDM (n, %)	P
Prevalence	183 (61)	65 (21.67)	52 (17.33)	
OGTT* [Mean (SD)]	100.58 (13.74)	128.12 (9.03)	169.88 (48.72)	0.000
Age				0.866
<=20 years	23 (12.5)	8 (12.3)	6 (11.5)	
21-30 years	129 (70.5)	45 (69.2)	40 (77)	
>30 years	31 (17)	12 (18.5)	6 (11.5)	
Occupation				0.000
Labourer	38 (20.76)	3 (4.6)	0	
House Wife	108 (59)	58 (89.2)	43 (82.7)	
Office work	37 (20.21)	4 (6.2)	9 (17.3)	
Residence				0.012
Rural	126 (69)	45 (69.2)	23 (44.2)	
Semi Urban	50 (27)	19 (29.2)	25 (48.1)	
Urban	7 (4)	1 (1.5)	4 (7.7)	
Education				0.09
Primary	117 (63.93)	40 (61.53)	24 (46.15)	
Secondary	49 (26.77)	22 (33.84)	20 (38.46)	
Graduate	17 (9.28)	3 (4.61)	8 (15.38)	
Lifestyle				0.008
Sedentary	18 (9.83)	16 (24.61)	12 (23.07)	
Household	130 (71.03)	41 (63.07)	31 (59.61)	
Office	6 (3.27)	2 (3.07)	5 (9.61)	
Labourer	29 (15.84)	6 (9.23)	4 (7.69)	
Socio Economic Class				0.001
Lower	105 (57.37)	46 (70.76)	18 (34.61)	
Middle	72 (39.34)	16 (24.61)	33 (63.46)	
Upper	6 (3.27)	3 (4.61)	1 (1.92)	

*OGTT - Oral Glucose Tolerance Test

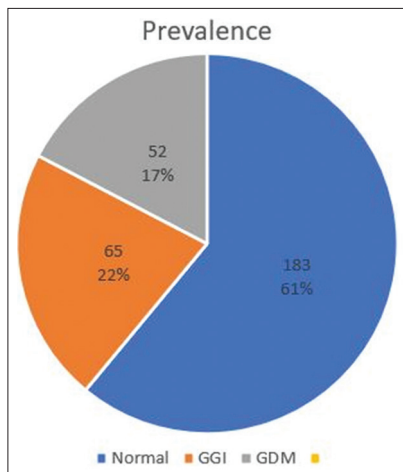


Figure 1: Prevalence of GGI, GDM in the screened patients

In the GDM and GGI group, 2nd and Multigravida patients were higher in comparison to Primigravids. Patients in the GGI group had a mean (SD) BMI of 25 (4.94), GDM group had 25.95 (6.02) as compared to the Normal 23.81 (3.53) [Table 2]. To compare BMI among all three groups (Normal, GII, GDM), a One-way ANOVA test was used. After getting significant results of ANOVA (*P* value = 0.004), pairwise comparison was performed by using the Posthoc Bonferroni test. We found BMI was significantly higher in the GDM group when compared to the Normal group. (*P* value = 0.006).

Past Histories of unexplained Intra Uterine Death (IUD), baby with congenital malformations, previous baby having macrosomia at birth, recurrent preterm pregnancies, Pregnancy Induced Hypertension (PIH) in a previous pregnancy, recurrent Urinary Tract Infections (UTI) in current pregnancy or GDM in previous pregnancies revealed no statistically significant associations.

Antenatal maternal complications

We found that PIH occurred equally amongst GGI and GDM patients. Preterm labour occurred in 1 patient of the GDM group. UTI occurred in 2 patients of the GDM group. These complications were statistically not significant. (*P* = 0.819) [Table 3].

Management and maternal outcome

Of the GDM group, 34 (65.38%) patients were advised Medical Nutrition Therapy (MNT) alone or in combination with another mode of treatment, 18 (34.61%) required either Metformin or Insulin. When we analysed mode of delivery in GDM patients, 15 patients (28.84%) had a normal vaginal delivery, 2 patients (3.84%) underwent operative vaginal delivery and 34 (65.38%) patients underwent Lower Segment Caesarean Section (LSCS). Upon analysing the type of labour, we found that 11 (21.15%) underwent spontaneous labour, and 7 (13.46%) underwent induced labour in the GDM group. Emergency LSCS

was carried out for 19 (36.53%) patients with indications being non-progress of labour, non-reassuring Non-Stress Test (NST), thick Meconium-Stained Liquor (MSL), fetal distress, etc., and 14 (26.92%) had elective LSCS with common indications being cephalo-pelvic disproportion, demand for LSCS, previous LSCS, etc., [Table 3].

Neonatal outcomes

As far as neonatal complications are concerned, macrosomia was found in 7 (13.46%) babies in the GDM group and 3 (4.61%) in the GGI group. Birth asphyxia was found in 1 (1.5%) patient of the GGI group and in 1 (0.5%) of the Normal group. Hyperbilirubinemia was found in 4 (7.69%) neonates in the GDM group. Hyaline Membrane disease was found in 2 (3.84%) of GDM and 2 (3.07%) of GGI. ($P = 0.022$) There was no statistically significant neonatal complication like hypoglycaemia, neonatal convulsions, Hypocalcemia, Intrauterine Fetal Death (IUFD) in GDM patients.

Table 2: Determinants of GDM and GGI

Determinant	Normal	GGI	GDM	P
Family history of DM*				0.000
Yes (n, %)	3 (1.64)	6 (9.23)	16 (30.76)	
No (n, %)	180 (98.36)	59 (90.76)	36 (69.23)	
Gestational age [Mean (SD)]	26.05 (1.21)	26.07 (1.1)	25.74 (1.13)	0.23
Gravida				
G1 (n, %)	67 (36.61)	22 (33.84)	25 (48.07)	
G2 (n, %)	49 (26.77)	20 (30.76)	16 (30.76)	
>=G3 (n, %)	67 (36.61)	23 (35.38)	11 (21.15)	
BMI† [Mean (SD)]	23.81 (3.53)	25 (4.94)	25.95 (6.02)	0.004

*DM - Diabetes Mellitus; †BMI - Body Mass Index

Discussion

The incidence of GDM is increasing globally. The present study was conducted on 300 consenting patients and found a prevalence of 17.3%. A study by Narendra *et al.*^[8] reported a prevalence of 2% in 1982 and 16.55% in 2002. Various other studies carried out in different cities of India have found a prevalence of 16.2% in Chennai, 15% in Trivandrum, 12% in Bangalore, and 6.94% in Jammu^[8-10] [Table 4]. This varying Prevalence reflects a variation throughout the subcontinent. This variation could be attributed to differences in Geographical conditions, urbanization, dietary habits, socioeconomic status, and lifestyle. It is also influenced by the criteria used for the screening and diagnosis. This difference

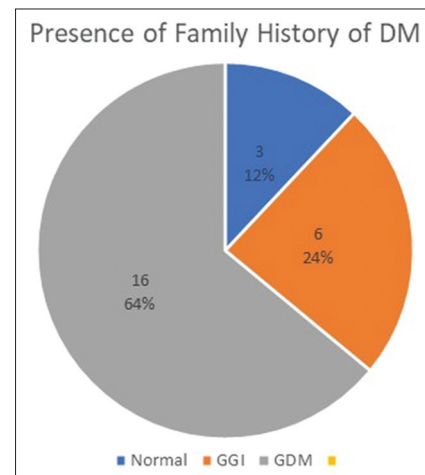


Figure 2: Presence of Family History of Diabetes Mellitus amongst Screened Patients

Table 3: Management and Maternal Outcomes

Variable	Normal (n, %)	GGI (n, %)	GDM (n, %)	P
Management				
MNT* + Exercise	0	64 (98.4)	34 (65.38)	0.000
Metformin/Insulin	0	1 (1.53)	18 (34.61)	0.000
Outcome of Labour				0.384
Vaginal Delivery	72 (39.34)	26 (40)	16 (30.76)	
Instrument Delivery	3 (1.63)	0	2 (3.84)	
LSCS†	108 (59.01)	39 (60)	34 (65.38)	
Labour Type				0.46
Spontaneous	50 (27.32)	13 (20)	11 (21.15)	
Induced	23 (12.56)	12 (18.46)	7 (13.46)	
Emergency LSCS	82 (44.8)	27 (41.53)	20 (38.46)	
Elective LSCS	27 (14.75)	13 (20)	14 (26.92)	
Baby Weight				0.141
<2.5 kg	63 (34.42)	17 (26.15)	20 (38.46)	
2.5-3.5 kg	108 (59.01)	45 (69.23)	25 (48.07)	
>3.5 kg	12 (6.55)	3 (4.61)	7 (13.46)	
Antenatal Maternal Complications				0.819
PIH‡	20 (10.92)	8 (12.3)	8 (15.38)	
Abortion	0	0	1 (1.92)	
Abruptio Placentae	2 (1.09)	0	0	
Preterm Labour	3 (1.63)	0	1 (1.92)	
UTI§	3 (1.63)	0	2 (3.84)	

*MNT - Medical Nutrition Therapy; †LSCS- Lower Segment Caesarean Section; ‡PIH- Pregnancy Induced Hypertension; §UTI - Urinary Tract Infection

Table 4: Comparative table showing GDM prevalence in various studies

Name of author	Year of publication	Population (State/Country)	GDM group Findings
Seshiah <i>et al.</i> ^[11]	2008	Tamil Nadu	17.8% In the Urban Population, 13.8% in Semi Urban, 9.9% in Rural.
Wahi <i>et al.</i> ^[10]	2011	Jammu	6.94%
Lowe <i>et al.</i> ^[4]	2011	International Multi Centre Study	A1C %- mean (SD) 4.79 (0.40) %
Kalyani <i>et al.</i> ^[12]	2013	Maharashtra	8.33%
Kalra <i>et al.</i> ^[4]	2013	Rajasthan	6.6%
Present study	2020	Karamsad, Gujarat	17.3%

in prevalence rate makes it more important to have data from other parts of India, in our case, from Anand district, Central Gujarat, India.

Many studies conducted in various areas of India have found out GDM is more common in the urban population as compared to the rural population. In a multicentric study conducted by Seshiah *et al.*^[11] the prevalence of GDM was found to be: Urban 17.8%, semi-urban 13.8%, and rural 9.9% while in the present study it was found more in Semiurban 25 (48.1%) followed by rural 23 (44.2) and urban 4 (7.7%). It might be due to the type of food and eating habits of the rural and semi-urban population. In addition to this, the semi-urban areas of Khambhat are known for their stone polishing industry wherein they polish their stones whilst sitting at a single place for long hours, therefore, following a sedentary type of lifestyle.

In the present study, it was found that the majority of patients belonged to the age group of 21-30 years. Age has been associated with the development of GDM in some studies.^[12] Kalyani *et al.* reported mean age of 24 ± 3.63 years in their patients along with GDM occurring more frequently in women more than 25 years of age.^[12] Various other studies also found that with increasing age, GDM was more common.^[2,4,13] The current study, on analysing Socio- economic class and its association with GDM and GGI, found lower and middle socio-economic classes had higher prevalence of GDM as well as GGI which could be attributed to the surrounding population that the tertiary care caters to as well as type of work. A study of the national survey by Swaminathan *et al.*^[2] for prevalence of GDM, found it to be higher in wealthy section of the society. It was found in various studies that mean BMI was positively associated and higher in patients of GDM.^[2,3,5,14] While looking at the present study, it was found that the mean (SD) BMI in the GDM group was 25.95 (6.02) which was higher than the mean (SD) BMI of the Normal group 23.81 (3.53). (P value = 0.004) In a study by Shrestha *et al.*^[15] they found that maternal obesity had severe consequences in the cardiovascular health, organ development and insulin sensitivity of the offspring. Untreated obesity in pre-natal period was found to be the basis of gestational hypertensive disorders, GDM, macrosomia and labor complications. They concluded that nutritional interventions as well physical activity interventions may help in alleviating such negative outcomes up to a certain extent but further studies were required on human as well as animal models.

There is a very strong correlation of family history of DM to the occurrence of GDM in a pregnant woman.^[4,9,16] Current study

also found similar statistically significant results while Prakash *et al.*^[5] and Wahi *et al.*^[10] found it was 23% and 24.19% respectively.

The present study showed PIH occurred equally amongst patients of the GGI and GDM groups. Antenatal complications such as prematurity, Abruption Placenta, Abortion, UTI didn't show statistical significance in the present study. A study carried out by Bener *et al.*^[13] showed PIH in 19.1% patients of GDM patients, Prematurity or preterm labour in 19.8% of GDM patients, Abruption Placenta in 19.2% patients of GDM, and UTI in 24.4% patients of GDM. Overall, 3.6% of patients had polyhydramnios in a study conducted by Capula *et al.*^[7] A study by Lin *et al.*^[17] showed that hypertensive disorders of pregnancy as well as Large for Gestational Age (LGA) babies' risk increased significantly with Insulin Resistance (IR). They concluded that IR in second trimester was associated with independent risk factors like pre-pregnancy BMI and weight gain, and Tri-Glycerides, Fasting Plasma Glucose and HbA1C were independent risk factors in First Trimester for IR. PIH could be prevented in some patients in the present study due to early detection of glucose intolerance and taking timely measures for the same along with other complications such as abruption, preterm labour, severe polyhydramnios, growth retardation, and sudden intrauterine death.

Of the GDM group and GGI group, all patients were advised MNT and exercises yet about one-third of GDM group and 1 (1.5%) of GGI group required pharmacotherapy. Overall, two-third patients of the GDM group and almost all patients of the GGI group improved by non-Pharmacological interventions. American Diabetes Association opined that family physicians play an important role whereby they can sensitise adolescents and her parents for having a healthy weight through interventions in food habits as well as physical activity. This would not only help in preventing diabetes in mother, but would also help in saving her offspring from a number of non-communicable diseases.^[18] Prakash *et al.*^[5] reported in their study that 58% of the patients received insulin for glycaemic control. The current study found that about 60% of patients were delivered via Caesarean Section. Similar findings were reported by other studies.^[7,19] However, Kalra *et al.*^[4] reported a very high incidence of caesarean section in GDM patients but attributed it to their lack of intrapartum fetal monitoring and patient load.

In the present study, it was found that the most common neonatal complication of statistical significance was Hyaline Membrane Disease ($P = 0.022$). There was no incidence of shoulder dystocia

probably owing to the majority of deliveries being carried out by way of LSCS. In a study by Prakash *et al.*^[5] 22% of neonates born to GDM mothers required NICU admission, 11% of neonates were preterm, 4.5% of neonates had hypoglycaemia and 11% had respiratory distress syndrome. Macrosomia was found in 7 (13.46%) patients of the GDM group in the current study. Macrosomia has been well studied and found to be positively associated with GDM.^[4,20] Crowther *et al.*^[21] studied perinatal complications between an intervention group and a routine care group of mothers having GDM and found that perinatal complications were significantly decreased in the former group. The current study also found similar results and therefore it can be inferred, with active intervention, the incidence of perinatal complications can be decreased to a minimum.

Strength of the study

1. We have studied one group separately in the form of Gestational Glucose Intolerance (GGI) which shows that by reducing the threshold for diagnosis of GDM we can recognize the patients with potential chances of development of GDM and hence reduce antenatal complications and perinatal complications which are common in such patients. By offering, sensitizing, and ensuring MNT with adequate physical exercises during pregnancy we can minimize the complications.
2. This study has found the occurrence of GGI and GDM even in the population of rural and semi-urban areas with an attempt to justify the reason for its higher prevalence in such populations.

Limitations

There are two limitations of this study. First limitation is that we did not screen patients who approached before 24 weeks of gestation. Second one is that our patients mainly comprised of semi-urban and rural areas owing to the geographic location of the tertiary care set up, therefore, we had little representation from Urban areas. Equal representation amongst all geographic areas would help in overcoming this limitation.

Conclusion

The present study indicates that the prevalence of Gestational Diabetes is like the tip of an iceberg showing equal or a greater number of patients having Glucose intolerance in pregnancy amongst the community so much so that in a rural tertiary care institute that is catering more to rural and semi-urban population, showed a high number of GDM and GGI patients which is a very alarming finding of the study. If timely diagnosis and intervention in the form of MNT and physical exercise are carried out, the majority of maternal and foetal complications except for PIH, foetal macrosomia can be prevented.

Maternal metabolic characteristics are crucial determinants of insulin resistance during pregnancy and in the offspring, therefore interventions in the form of exercise, weight loss, and

healthy diet before, during, and after pregnancy might be a key in preventing the vicious cycle that contributes to the epidemic of obesity, insulin resistance and Type 2 DM with cardiovascular diseases. Considering its intergenerational effect, we need to work on this data at the war footing level so that the population of the present generation becomes healthy and fit to give birth to a healthy generation in the future and therefore we should be screening all antenatal patients for GDM.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Key messages

- Prevalence of Impaired Glucose Tolerance as well as Gestational Diabetes has exploded not only in the urban population but also in the semi urban and rural population.
- We found that Single step 75 gm glucose ingestion test is a simple, feasible and patient friendly method for screening of GDM.
- Universal screening is advocated by the National Government, but since it's not being practised everywhere, we provide our humble recommendation that it be practised by all the antenatal centres with strict adherence.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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