

# Prevalence of gestational diabetes mellitus in a suburban District in Sri Lanka: a population based study

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## Abstract

**Introduction** GDM is a leading metabolic cause of morbidity to mother and offspring. Determining its prevalence is important for health planning and implementation.

**Objective** Assess prevalence of GDM in the District of Gampaha.

**Method** Community based cross-sectional study was conducted in women attending field-based ante-natal clinics in two Medical Officer of Health (MOH) areas between January 2014 to March 2015.

Consecutive women were recruited by cluster sampling with probability proportionate to size using strict exclusion criteria. GDM diagnosis was based on fasting 75 g OGTT, WHO 1999. All responders underwent 2 hr PPBS in first trimester- >200 mg/dl with symptoms identified as abnormal, probably diabetes in pregnancy (DIP); those >120 and <200 mg/dl proceeded to OGTT before 16 weeks POA; all negatives were tested by OGTT between 24-28 weeks. Negatives for GDM at 24-28 weeks underwent OGTT between 32-36 weeks; venous plasma glucose tested by accredited laboratory.

**Results** Sample consisted of 160, non-response 4.2% (67); 1533 underwent 2 hr PPBS with 40 exceeding 120mg; 4 >200 mg diagnosed as GDM / DIP, 36 (PPBS >120 < 200 mg) underwent OGTT before 16 weeks with 15 GDM. One hundred and thirty four (8.38%) miscarried including one with early abnormal OGTT. Of 1381 eligible for OGTT (24-28 weeks) 150 had GDM (10.86%). Only 344 (27.94% of normal 1231) consented for third trimester OGTT, of whom 25 had GDM- yielding a total of 194 with GDM (13.9%).

**Conclusion** The current community prevalence of GDM in the suburban Gampaha District, Sri Lanka is high.

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from 5.5% in 1998 to 10.3% in 2004 [13,14]. No reports of community prevalence of GDM have been published from Sri Lanka after 2004. Nevertheless, urbanization and unhealthy lifestyle patterns have increased the risk, which requires quantification to enable health planners to implement timely appropriate screening and preventive measures. Hence the current study aimed to assess the community prevalence of GDM in rural/suburban areas within the district of Gampaha, Western Province of Sri Lanka.

## Methods

A community based cross sectional study was conducted among pregnant women in field ante-natal clinic settings in Medical Officer of Health (MOH) areas of Dompe and Gampaha within the District of Gampaha, Sri Lanka from January 2014 to March 2015. The District of Gampaha consists of 16 MOH areas, each area supervised by a Medical Officer of Health. Total population in the two selected MOH areas were 351 672 [15]. The study population consisted of women confirmed biochemically as pregnant with a period of amenorrhoea (POA) less than 12 weeks at the time of registration by the Public Health Midwife (PHM). Those diagnosed as having DM before pregnancy, prescribed diabetogenic drugs such as steroids, anti-epileptics and anti-psychotics, having severe co-morbidities or mental subnormality were excluded from the study at recruitment. The required sample size was 1324 with 1.96 of standard normal deviation for 5%  $\alpha$  error, 0.025 precision and 2.8 design effect. Most recent community prevalence of GDM in Sri Lanka (8.4%) was used for calculating the sample size [14]. A further 10% was added to compensate for non-responders and another 10% allowance made for miscarriages. The final calculated sample size was 1600.

The sample was selected in three stages; firstly, two MOH areas were randomly selected from the 16 areas. Secondly, within the selected MOH areas, all the PHM areas (n=88) with cumulative population were listed. The cluster size was considered as 20. This number was determined based on feasibility of recruiting the required total sample within the first 3 months of the study and local logistics. Thirdly, after selection of the first cluster randomly, 80 clusters were selected according to probability proportionate to size of the PHM areas. Finally, from the selected PHM areas, the Pregnancy Register was used to select pregnant women less than a POA of 12 weeks. First eligible name was selected randomly. Thereafter, every consecutive name until achieving the required number was recruited, adhering to the inclusion and exclusion criteria.

All registered pregnant women were requested to attend the identified field clinics. A survey carried out to assess the completeness of registration of pregnant women by the principal investigator revealed that pregnant women registration rate was over 98% in these two MOH areas.

Data were gathered from all consenting pregnant women using an interviewer administered structured questionnaire. The 2 hour post prandial plasma glucose (2 hr PPBS) test following a standard Sri Lankan meal and fasting 75 g oral glucose tolerance test (75 g OGTT) were chosen as the first trimester screening and diagnostic method respectively [16-19]. The 2 hr PPBS cut off value of 120 mg/dl was determined as a proxy measure to detect probable previously unknown diabetic women, since this is the internationally recognised glycaemic target recommended for managing diabetes during pregnancy [20]. We selected women based on 2 hr PPBS value exceeding 120 mg/dl as probable diabetes complicating pregnancy to be confirmed by the gold standard fasting 75 g OGTT performed in early pregnancy (before the prescribed timing of 24 weeks). GDM was diagnosed by WHO 1999 criteria (fasting plasma glucose value  $\geq$  126 mg/dl or 2 hour plasma glucose value of  $\geq$  140mg/dl) in 75 g OGTT to enable comparison with previous prevalence rates using the identical criteria [19].

All consenting participants were universally screened for GDM. Firstly, they underwent the 2 hr PPBS test in the first trimester; where those with a value above 200 mg were identified as having GDM (by WHO 1999 criteria) and most probably diabetes in pregnancy (DIP) and referred appropriately [21]. Those who had 2 hr PPBS above 120 mg/dl but less than 200 mg underwent fasting 75 g OGTT before 16 weeks of POA [16,17]. All mothers who had 2 hr PPBS values  $<$ 120 mg/dl in 1<sup>st</sup> trimester and those with  $>$ 120mg/dl and  $<$  200mg/dl but with normal OGTT at 16 weeks underwent mandatory fasting 75 g OGTT between 24-28 weeks if they remained pregnant [19, 22]. Those who were negative for GDM at 24-28 weeks underwent OGTT at 32-36 weeks. The 2 hr PPBS and fasting 75 g OGTT testing were performed with venous plasma in an accredited laboratory.

Approval for the study was granted by the Ethics Review Committee (ERC) of the Medical Research Institute, Colombo. Written informed consent was obtained from all patients.

## Results

The total number of pregnant women recruited for the study was 1600. Non response rate was 4.2% (n=67) and 1533 underwent 2 hr PPBS in first trimester (response rate 95.8%). Forty had 2 hr PPBS value  $>$  120 mg/dl, of them four had more than 200 mg/dl and were diagnosed as GDM/probable DIP. The remaining 36 (PPBS  $\geq$  120 mg/dl  $\leq$  200 mg) underwent OGTT before 16 weeks of POA. Of them 15 had GDM. Nineteen pregnant women developed GDM before 16 weeks of POA (1.2%). One hundred and thirty four (8.4%) had mis-carriages and were excluded from the study except one who had an early abnormal OGTT prior to pregnancy loss. The total population eligible for OGTT between 24-28 weeks was 1381, of them 150 had GDM (10.9%). A total of 169 pregnant women in the study sample developed GDM before 28 weeks POA yielding a prevalence of 12.1%.

Total population eligible for OGTT at 32-36 weeks was 1231 but only 344 (27.9%) of the eligible 1231 women consented for a third trimester OGTT. A further 25 were found to have GDM in the 3rd trimester. A total of 194 pregnant women had GDM, giving a prevalence of 13.9%. Considering individual MOH areas, 10.9% and 16.1% of prevalence were noted in Dompe and Gampaha, respectively. Age specific prevalence of the 15- 24 years was 5.5% (n=16), 13.2 % (n=116) for 25-34 years and 27.2% (n=62) for 35-49 years.

The final sample consisted of 1400 participants, whose characteristics are shown in Table 1.

**Table 1. Characteristics of the study population**

Characteristic	Pregnant women with GDM (n=194) Frequency (%)	Pregnant women without GDM (n=1206) Frequency (%)
<b>Age</b>		
15- 24 years	16 (5.5%)	276 (94.5%)
25-34 years	116 (13.2%)	764 (86.8%)
35-49 years	62 (27.2%)	166 (72.8%)
<b>Ethnicity</b>		
Sinhala	191 (13.8%)	1189 (86.2%)
Tamil	0 (0%)	5 (100.0%)
Muslim	3 (20%)	12 (80%)
<b>Religion</b>		
Buddhism	172 (13.4%)	1109 (86.6%)
Christian/Catholic	19 (18.6%)	83 (81.4%)
Hindu	0 (0%)	2 (100%)
Islam	3 (20%)	12 (80%)
<b>Level of education</b>		
Not schooled	0 (0%)	1 (100%)
Grade 1-5	1 (33.3%)	2 (66.7%)
Grade 6-O/L	45 (14.4%)	268 (85.6%)
Passed O/L	38 (9.7%)	353 (90.3%)
Completed A/L	80 (15.9%)	422 (84.1%)
Technical education	3 (18.8%)	13 (81.2%)
Diploma, university degree and above	27 (15.5%)	147 (84.5%)
<b>Monthly family income (SLR)</b>		
less than 10,000	12 (15.2%)	67 (84.8%)
10,000-19,999	43 (11.6%)	328 (88.4%)
20,000-29,999	54 (13.2%)	356 (86.8%)
30,000-39,999	38 (13.6%)	242 (86.4%)
40,000-49,999	17 (14.5%)	100 (85.5%)
Equal or above 50,000	30 (21%)	113 (79%)
<b>Employment status</b>		
Yes	69 (15.1%)	389 (84.9%)
No	125 (13.3%)	817 (86.7%)
<b>BMI</b>		
<18.5	23 (8.5%)	247 (91.5%)
18.5-24.99	89 (11.9%)	656 (88.1%)
25.00-30.00	67 (21%)	252 (79%)
>30	15 (22.7%)	51 (77.3%)
<b>Parental history of diabetes</b>		
Yes	91 (23.5%)	296 (76.5%)
No	103 (10.2%)	910 (89.8%)

Among those with GDM (n=194); mean age was  $31.74 \pm 5.11$  years, 64 (33%) were primigravid and 75 (38.7%) were in their second, 38 (19.6%) third, 11 (5.7%) fourth and fifth 5 (2.6%) pregnancies. Mean body mass index (BMI) was  $24.20 \pm 4.58$  but 8.5% were underweight. Sixty seven (34.5%) with GDM had maternal history of diabetes and 42 (21.6%) had paternal diabetes history. Overall, 91 (46.9%) participants with GDM had parental history of diabetes (one or both parent). Ten had past history of GDM; five in the first, three in second and one each in third and fourth pregnancies.

Univariate analysis revealed the following asso-

**Table 2. Comparison between two MOH areas**

Characteristic	MOH Dompe (n=613)	MOH Gampaha (n=787)
Mean age	$28.7 \pm 5.33$	$29.27 \pm 5.18$
Mean BMI	$22.05 \pm 4.46$	$22.95 \pm 4.40$
Maternal history of diabetes	16.2%	21%
Paternal history of diabetes	10.8%	13.5%
Parental history of diabetes	24%	30.5%
Past history of GDM	1.5%	1.5%

ciations- age  $\geq 35$  years (OR 2.94; 95% CI 2.09-4.15  $p < 0.0001$ ), maternal overweight (BMI  $\geq 25$ ) and obesity (BMI  $\geq 30$ ) (OR 2.18; 95% CI 1.60-2.98  $p < 0.0001$ ), father being diabetic (OR 2.29; 95% CI 1.55-3.37  $p < 0.0001$ ), mother being diabetic (OR 2.70; 95% CI 1.94-3.77  $p < 0.0001$ ), parity (OR 1.45; 95% CI 1.01-2.0  $p = 0.022$ ), and GDM in previous pregnancies (OR 5.90; 95% CI 2.47-14.10  $p < 0.0001$ ) were significantly associated with occurrence of GDM in the index pregnancy. In multivariate analysis, age  $\geq 35$  years (OR 2.81; 95% CI 1.96-4.04  $p < 0.0001$ ), maternal overweight (BMI  $\geq 25$ ) and obesity (BMI  $\geq 30$ ) (OR 1.68 95% CI 1.21-2.35  $p = 0.002$ ), father being diabetic (OR 1.65; 95% CI 1.06-2.56  $p = 0.028$ ), mother being diabetic (OR 2.30; 95% CI 1.62-3.26  $p < 0.0001$ ) and GDM in previous pregnancies (OR 4.58; 95% CI 1.81-11.61  $p = 0.001$ ) were identified as risk factors for GDM occurrence in the index pregnancy.

## Discussion

The current prevalence of GDM in the District of Gampaha, Sri Lanka is high. Age more than 35 years, maternal overweight/obesity, parental diabetes and previous GDM were significantly associated with the GDM after adjusting for the confounding effect.

The current study confirms that rate of GDM has increased in Sri Lanka. In 1998, 5.5% of a cohort of 721

pregnant women attending antenatal clinics at Sri Jayawardanepura General Hospital were identified as affected using the 75 g OGTT and WHO criteria [13]. A community based study conducted in 2004 of 853 pregnant women in Homagama MOH area reported a rate of 8.4% (75 g OGTT and 1999 WHO criteria) with the rate increasing with maternal age (<25 years 3%, 25-35 years 9.6% and ≥ 35 years 15.9%) and the age standardised prevalence was 10.3% [14]. The current study shows a prevalence of 13.9% in a more rural setting that confirms the increasing trend of gestational diabetes. This is a 65.5% increase compared to prevalence of GDM in Homagama MOH area, Colombo in 2004 [14].

In India prevalence of GDM of 18.9% was reported from an antenatal clinic of a Government Maternity Hospital, Chennai among 891 pregnant women in their second or third trimester (OGTT and WHO 1999 criteria) [23]. A study carried out among 4151, 3960 and 3945 pregnant women in urban, semi urban and rural areas, respectively in South India (Tamil Nadu), reported 17.8% in urban, 13.8% in semi urban and 9.9% in rural areas. Of 1679 women with GDM, 1204 (72%) were detected in the first visit and the remaining in subsequent visits [12]. Several studies have identified increasing maternal BMI as a significant risk factor for GDM [24-26]. BMI, family history of diabetes mellitus and age ≥ 35 years were found to be independent risk factors for GDM in other studies [27-29]. Findings from our study were compatible with these findings.

A limitation of the current study is the exclusion of those on prescribed diabetogenic drugs such as steroids, anti-epileptics and anti-psychotics, as well those with severe co morbidities, mental illnesses and pregnant women with miscarriages leading to a somewhat selected sample.

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## Conflicts of interest

There are no conflicts of interest.

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