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Gestational Diabetes Mellitus - A Public Health Concern in Rural Communities of Nepal

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ABSTRACT

Background: Gestational Diabetes Mellitus (GDM) is in increasing trend recently. It is associated with adverse effects on both mother and fetus. Thus, diagnosis of GDM is an important public health issue. This study aimed to determine the frequency of gestational diabetes mellitus in three rural districts of Nepal.

Methods: A hospital based study was conducted in three districts representing mountain, hill and Terai belts of Nepal during the period of July 2009 to June 2010. A total of 564 pregnant women were interviewed and tested for blood glucose as per WHO guideline

Results: In Nepal, only 2.5% of pregnant women had GDM according to WHO criteria while it was 6.6% according to IADPSG criteria. Overall mean blood glucose among pregnant women was 72.1 (fasting) and 95.8 (after 2 hrs of 75 gm glucose intake) in which it was 62.8, and 75.1 in Dhading, 78.7 and 88.9 in Dhangadhi, and 98.3 and 99.3 in Solukhumbu districts respectively.

Pregnant women with increased age were significantly at high risk of having GDM than those of younger women (p=0.04). There were non-significant differences in GDM by District, Ethnic group and family history of DM.

Conclusions: Gestational diabetes in the rural areas of Nepal is variable with two different criterias (2.5% vs 6.56%). Increasing age was an important influencing factor. Special attention should be given on women with increasing age. There was no significant difference in prevalence of GDM in three ecobelts of Nepal despite of altitude and cultural variability.

Keywords: Gestational diabetes mellitus; risk factors; rural nepalese women.

INTRODUCTION

Gestational Diabetes Mellitus (GDM) is defined as glucose intolerance during pregnancy.[1] The worldwide prevalence ranges from 1 to 14%. There exist ethnic differences in the prevalence of GDM in all parts of the world being more common in Asians.[2-5] The prevalence of GDM was found to be 16.55% in India.[6] A hospital based study in Nepal revealed 3.67 % of pregnancies had screening test value positive and 0.66% of pregnant women had GDM.[7] About 40-60% of women with GDM have no demonstrable risk factor; hence, diabetes screening in pregnancy is advocated.[8] Risk factors for GDM include history of macrosomia, strong family history of diabetes, ethnicity, obesity and age more than 25 years. Statistics show a double risk of GDM in smokers.[9-11] GDM offers an important opportunity for the development, testing and implementation of clinical strategies for diabetes prevention in these groups.[12]

GDM has various effects in the baby like fetal hyperinsulism, perinatal risks like nerve palsies and

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hypoglycemia. Sustained impairment of glucose tolerance, subsequent obesity and impaired intellectual achievement can occur.[13-15] Women with GDM develop hypertensive disorders more than women without GDM.[16]

The increased tendency of diabetes in women of the childbearing years indicates the need to routinely screen for gestational diabetes.[17] This study was designed to estimate the proportion and identifying the risk indicators of gestational diabetes among the women living in rural Nepal.

METHODS

A hospital based cross sectional study was undertaken in Mountain, Hilly and Terai region of Nepal. These three region represent three ecobelts of Nepal with variation in altitude and culture. Three study areas namely Solukhumbu, Dhading and Kailali districts were selected purposively representing the three regions respectively. The ANC clinics of Solu District Hospital, Dhading District hospital and Seti Zonal Hospital in Solukhumbu, Dhading and Kailali were the centre for the blood collection and face to face interview. The study was conducted among pregnant women, who visited the health facilities for antenatal checkup during the period of November 2009 to March 2010. They were pre-informed about the checkup by respective health workers in that area. A total of 564 women between 24 and 28 weeks of gestation were included in the study. Women with glucose intolerance before pregnancy or refusing to participate were excluded. Data were collected by using pre-tested semi-structured questionnaire which includes socio-demographic, reproductive and personal information. Clinical examinations included anthropometry and blood pressure measurements.

All the participants were instructed to come fasting on a certain pre-fixed day. The fasting blood samples were collected and 2 hr 75 gm OGTT was done as per WHO guideline.[18] Participants with abnormal fasting (≥126 mg/dl) and/or abnormal 2 hr post glucose (≥140 mg/dl) blood glucose level were diagnosed as having GDM. IADPSG (International Association of Diabetes and Pregnancy Study Groups) criteria was also used to diagnose GDM and to compare the prevalence between two criterias. The OGTT was preformed after an overnight fast of 8-14 hrs while the diet and physical activity had been unrestricted for at least 3 days beforehand. Participants were seated and did not smoke during the test period.

Women having discomfort after glucose intake were managed immediately by the health professionals and those who were diagnosed with GDM were consulted by Endocrinologists and obstetricians.

Ethical clearance for the study was obtained from Bangladesh Diabetic Association, Bangladesh and Nepal Health Research Council, Nepal. Each participant gave informed written consent.

Data entry, cleaning, editing and final analysis was done in SPSS version 11.5. Chi-square test was used to assess the association between categorical variables and the t-test for continuous variables. $p<0.05$ was considered statistically significant.

RESULTS

Among the 564 pregnant women, 14 women were diagnosed as GDM according to WHO criteria. The proportion of gestational diabetes in Solukhumbu, Dhading and Kailali districts were 1.3% 2.5% and 2.7% respectively making an overall frequency of GDM of 2.5%. But according to IADPSG criteria, 37 (6.6%) women were diagnosed as GDM. (Table 4)

The mean fasting blood glucose level among the participants was 72.1 mg/dl and mean 2 hour post glucose load blood glucose level was 95.8 mg/dl with the standard deviation of 13.5 and 16.2 respectively. There was slight variation in mean blood glucose levels in three districts.

Table 1. Socio-demographic characteristics of 564 pregnant women.

Variable	Dhading n=160	Kailali n=329	Solukhumbu n=75	Total n=564
	No (%)	No (%)	No (%)	No (%)
Age (years)				
≤25	122(76.2)	264(80.2)	44(58.7)	430(76.2)
>25	38(23.8)	65(19.8)	31(41.3)	134(23.8)
Education				
Illiterate	63(39.4)	101(30.7)	42(56)	206(36.5)
Literate	97(60.6)	228(69.3)	33(44)	358(63.5)
Family history of Diabetes				
Yes	5 (3.1)	12 (3.6)	1 (1.3)	18 (3.2)
No	113 (70.6)	211 (64.1)	18 (24)	342 (60.6)
Don't know	42 (26.3)	106 (32.2)	56 (74.7)	204 (36.2)
Smoking status				
Current smoker	6 (3.8)	4 (1.2)	4 (5.3)	14 (2.5)
Never smoked	152 (95)	324 (98.5)	70 (93.3)	546 (96.8)
Past smoker	2 (1.3)	1 (0.3)	1 (1.3)	4 (0.7)
Status of alcohol intake				
Yes	11 (6.9)	1 (0.3)	30 (40)	42 (7.4)
Never	146 (91.3)	328 (99.7)	45 (60)	519 (92)
Past history	3 (1.9)	0 (0)	0 (0)	3 (0.5)

Table 2. Reproductive characteristics of 564 pregnant women.

Variable	Dhading n=160	Kailali n=329	Solukhumbu n=75	Total n=564
Age at first pregnancy (years)	**No (%)**	**No (%)**	**No (%)**	**No (%)**
Below 19	57 (35.6)	149 (45.3)	30 (40)	236 (41.8)
20-24	97 (60.6)	155 (47.1)	35 (46.7)	287 (50.9)
25-29	6 (3.7)	22 (6.7)	8 (10.7)	36 (6.4)
Above 30	0 (0)	3 (0.9)	2 (2.7)	5 (0.9)
Number of pregnancies				
1	71(44.3)	131(39.9)	25(33.3)	227(40.2)
2-3	87(54.3)	197(59.9)	41(54.7)	325(57.6)
More than 3	2(1.2)	1(0.3)	9(12)	12(2.1)
Birth weight of the previous baby	**(n=26)**	**(n=91)**	**(n=13)**	**(n=130)**
Less than 2.5 kg	5 (19.2)	7 (7.7)	0 (0)	12 (9.2)
2.5-4 kg	21 (80.8)	79 (86.8)	13 (100)	113 (86.9)
More than 4 kg	0 (0)	5 (5.5)	0 (0)	5 (3.8)
Outcome of previous pregnancy	**(n=89)**	**(n=198)**	**(n=50)**	**(n=337)**
Term	76(85.3)	169(85.3)	44(88)	289(85.8)
Pre-term	6(6.8)	6(3)	0(0)	12(3.6)
Stillbirth	2(2.2)	8(4)	3(6)	13(3.9)
Abortion	5(5.7)	15(7.6)	3(6)	23(6.9)

Table 3. Mean blood glucose level of the participants.

	Districts			
	Dhading (n=160)	Kailali (n=329)	Solukhumbu (n=75)	Total (n=564)
Variable	mean (SD)	mean (SD)	mean (SD)	mean (SD)
Fasting blood sugar (mg/dl)	62.8 (14.6)	75.1 (10.8)	78.7 (12.0)	72.1 (13.5)
2 hrs post glucose load blood sugar	88.9 (20.2)	98.3 (13.3)	99.3 (14.0)	95.8 (16.2)

The socio-demographic and reproductive characteristics are given in (Table 1). Mean age of the participants was (23.3 ± 4.4) years and the majority were below 25 years of age (66.3%). The percentage of diabetic women increased as the age increased. (Table 4) As shown in Table 4, the proportion of GDM in the age group above or equal to 25 years was significantly more common than in those below 25 years (p=0.04) according to IADPSG criteria.

Most of the pregnant women were housewives (61%). Forty three percent of the pregnant women belonged to Brahmin/Chettri (uppercaste) ethnic group but Tamang/ Rai (Janajati) ethnic group constitutes the largest group in Solukhumbu district (65.3%).The proportion of GDM was slightly different in different ethnicities but not significant.

The mean systolic and diastolic blood pressure was 101.9 ±13.1 mmHg, and 65.5 ±9.9 mmHg, respectively. More than half (55%) of the pregnant women whose hemoglobin level was measured were anemic (n=265). There were no known HIV, Hepatitis or syphilis positive cases.

Approximately half of the women (51.4%) in all three districts got married in their teens and all of them got pregnant before 19 years of age. About 60% (337) of the women were multiparous, but most of them did not know the birth weight of their previous baby. Among the 130 women who did know, 87% of the babies had a birth weight between 2.5- 4 kg. Only 5(3.8%) women reported of having given birth to a baby more than 4 kg. Of those with previous pregnancies, miscarriage, stillbirth and preterm were 7%, 4% and 4% respectively. Only 2 (0.6%) of the 314 babies were born with birth defect.

As for lifestyle, the majority (96.8%) of the pregnant

Table 4. Gestational diabetes mellitus among pregnant women by socio-demographic characteristics and residence.

Variable	GDM according to different criteria of measurement					
	WHO Criteria			IADPSG Criteria		
	GDM	Non-GDM	Chi-square p-value	GDM	Non-GDM	Chi-square p-value
Study Districts						
Dhading	4 (2.5)	156 (97.5)		6 (3.8)	154(96.2)	
Kailali	9 (2.7)	320 (97.3)	0.78	26 (7.9)	303 (92.1)	0.22
Solukhumbu	1 (1.3)	74 (98.7)		5 (6.7)	70(93.3)	
Aggregate percent of GDM by different method						
	14 (2.5)	550 (97.5)		37 (6.6)	527 (93.4)	
Age of women						
≥ 25 years	8 (4.2)	182	0.06	18 (9.5)	172(90.5)	0.04
< 25 years	6 (1.6)	368 (98.4)		19 (5.1)	355 (94.9)	
Ethnic group						
Upper caste	10 (4.1)	233(95.9)		15 (6.2)	228(93.8)	
Janajati	1 (0.6)	156(99.4)	0.11	11(7.0)	146(93.0)	0.93
Terai caste	1(1.0)	101(99.0)		6 (5.9)	96 (94.1)	
Dalit	2 (3.2)	60 (96.8)		5 (8.1)	57 (91.9)	
Family history of DM						
Yes	2 (11.1)	16 (88.9)	0.05	1(5.6)	17 (94.4)	0.85
No	10 (2.9)	332 (97.1)		24 (7.0)	318 (93.0)	
Don't know	2 (1.0)	202 (99.0)		12 (5.9)	192 (94.1)	
Alcohol drinking practice						
Yes	0 (0..0)	45 (100)	0.53	2 (4.4)	43 (95.6)	0.52
No	14(2.7)	505 (97.3)		35 (6.7)	484 (93.3)	

women had never smoked during their lifetime and there was no significant association between smoking and GDM. The alcohol consumption rate was 7.4%. In Solukhumbu district, 40% of the pregnant women reported that they were currently taking alcohol in the form of local (home brewed), with no association between alcohol intake and GDM.

Family history of diabetes was reported in very few participants (3.2%) and none of the pregnant women had the history of GDM in the family. The reason for visiting the antenatal clinic in all the three districts was their knowledge about the importance of antenatal care (82.6%). Few were sent to the clinic by the health workers like Maternal and Child Health Worker/ Female Community Health Volunteer (15%). Eight percent of the women reported to have taken medications during pregnancy. None of the reported drugs contained steroids.

DISCUSSION

Gestational diabetes is now emerging as one of the serious issue in reproductive health which affects the health of both the mother and child. The difference in ethnicity, lifestyles, food habits, environment, genetic susceptibility, health care facilities etc play important roles in variation of prevalence of gestational diabetes in Nepal as in all other parts of the world. Thus exploration of these factors is a must for rational intervention against the disease both in terms of management and prevention.

The total number of GDM positive cases in our study were 14 (2.5%) among the 564 pregnant women according to WHO criteria and 37 (6.6%) according to IADPSG criteria. The highest percentage of GDM was found in Kailali with both the criterias.

Gestational diabetes is usually thought to be more prevalent in women living in urban area[19] and having

sedentary life. Surprisingly, it was found that the prevalence of gestational diabetes is higher in these rural areas compared to the hospital based study done in Tribhuvan University Teaching Hospital (TUTH), Kathmandu, where GDM was found in 0.6% of the women.[7] Similarly a hospital based study done in Dhulikhel revealed that the pregnant women who underwent the 50g GCT, 12.4% women were found to have an elevated level greater or equal to 140mg/dl and 0.75% women were found to have GDM.[20] This low rate of prevalence of gestational diabetes could be due to the fact that most of the women were young and had no associated risk factor for gestational diabetes.

Recent studies on weight gain after pregnancy and diabetes have revealed the fact that diabetes has been found to be common in people, including the women of child bearing age in urban Nepal.[21] Much of the parts in Nepal are difficult, underdeveloped terrains with high hills and mountains without accessible roads. Women have a lot of exercise and are slim. Diabetes could be expected to be low in such regions. But there is increasing urbanization and increasing population in rural areas in Nepal which are the indicators for the probable rise of diabetics in these areas.

Age is the established determining factor for GDM and its future progression to diabetes. The relative risk for developing GDM over the age of 35 was 2·57.[22] However our pregnant population were young, mean age being (23.3 yrs) highest in Solukhumbu (26.2 yrs). Most of the GDM cases were present in ≥25 years of age making the association significant (p=0.04) which is consistent with the study done in Patan hospital.[23]

As for lifestyle, other studies show a double risk of GDM in smokers.[11] However, among our pregnant women (n=564), only 14 (2.5%) were smokers and only one of them had GDM. Due to few numbers of smoking status, the association may not be shown. The status of alcohol intake was high in Solukhumbu (40%) but no association was seen with GDM (p=0.53). Half of the women who were consuming alcohol were above 25 years of age and very few below 21 years of age. More than half of those women who were consuming alcohol were illiterate and most of them (83%) were multiparous. The reason for high consumption of alcohol in this area may be due to the production of home made alcohol. Also the ethnic groups who reside in Solukhumbu district are more likely to consume alcohol than other ethnic groups residing in other two districts. Further studies are needed in this area.

With regard to ethnicity, there was no significant association with GDM (p>0.5). Ethnicity is responsible for variations in cultural and lifestyle activity, determining the dietary pattern, populations of type 1 and type 2 diabetes contributing to the risk of both GDM and future DM. Post-GDM progression to DM is more rapid in ethnic groups with high prevalence of type 2 diabetes and obesity. Onset of DM is closer to pregnancy in ethnic groups with higher rate of type 1 diabetes.[3]

Participants consisted of primi 40.2%. A study carried out in Chennai showed significant increase in the prevalence of GDM in relation to gravid.[19] Though there was no significant association of number of pregnancy with GDM (p=0.10) on statistical analysis, higher proportion of GDM positive cases were observed in multiparous women.

Family history of diabetes and gestational diabetes are very established and significant risk factor for the development of GDM. The most important factor according to logistic model was history of GDM, which increased the risk of GDM as high as 21 times approximately in a study conducted in Iran.[24] In this study 18 (3.19%) participants, reported of family history of diabetes and two of them were positive for GDM (p=0.05). None of the participants had the history of GDM in their previous pregnancies or in their family members. Lack of medical and diagnostic facility in the rural parts of Nepal is a major drawback due to which proper diagnosis of GDM is not possible. People are also unaware of their health status and do not seek medical advice.

Minimal alterations in maternal carbohydrate metabolism may have a significant impact on fetus and those patients with minimal alterations also require strict glycemic control to decrease the frequency of abnormal fetal outcomes. Not only GDM but also isolated abnormal blood glucose value is fetotoxic.[13,14] This could not be elaborated in our study because of the low number of GDM positive cases. None of the GDM positive cases had adverse birth outcome in the past.

Only 5 participants had their previous baby birth weight more than 4 kg and none of them developed GDM which is inconsistent with the study conducted in Sri Lanka where past history of macrosomic babies (over 4 kg) was present in 12·1% of GDMs compared to 8·4% of non-diabetic pregnancies.[22] The birth weight of the baby was asked with the mother, and the weight had all the subjective variations. Less number of positive cases also may have played role in such output.

Controversy surrounds the ideal approach for detecting GDM, and the approaches recommended for screening

and diagnosis are largely based on expert opinion. Ideally any such procedure should be simple, acceptable to women and inexpensive to perform as well as being both sensitive and specific. As much of the parts in Nepal are difficult to access and it takes hours to reach the ANC clinics, a direct 75 gm OGTT was done for the comfort of the participants. WHO criteria were used for determining the threshold of fasting and post 75 gm blood glucose level; fasting ≥126 and post glucose ≥140. IADPSG criteria was also used to diagnose GDM. More number of cases were diagnosed using this criteria. This could be due to more lineal blood glucose cut-off label used. GDM based on a 2-h 75-g OGTT defined by either WHO or ADA criteria predict adverse pregnancy outcomes [22].

CONCLUSIONS

Gestational diabetes in women living in the rural areas of Nepal is variable with two different criterias (2.5% vs 6.6%). The detection rate of GDM in rural areas of Nepal was found to be slightly lower than the other parts of the world. There could be various reasons for such a result. Our women were young, slim, lived in areas where the only way to get around are by walking. Their lifestyle was not promoting diabetes. But, as the trend of GDM and DM are increasing, it is expected the figures will rise in the days to come. Hence, screening of pregnant women for Diabetes at the end of 2nd trimester appears beneficial to rule out GDM. Increasing age was an important influencing factor, hence, special attention should be given on women with increasing age. There was no significant difference in prevalence of GDM in three ecobelts of Nepal despite of altitude and cultural variability. Identification of other risk pregnancies such as focusing upon the high alcohol consumption in pregnancy in certain areas is of utmost importance to prevent harmful effect on the offspring.

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REFERENCES

1. Buchanan TA, Xiang AH. Gestational diabetes mellitus. J Clin Invest. 2005; 115: 485-491.
2. American Diabetes Association. Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Diabetes Care. 2003; 26(1): 5-20.
3. Assiamira F. Increasing Prevalence of Gestational Diabetes Mellitus- A public health perspective. Diabetes Care. 2007; 30 (2):141-146.
4. Dornhorst A, Paterson CM, Nicholls JS, Wadsworth J, Chiu DC, Elkeles RS, Johnston DG, Beard RW. High prevalence of gestational diabetes in women from ethnic minority groups. Diabet Med. 1992; 9(9): 820–825.
5. Wang KW, Balakrishnan V, Liaw PCY, Chua EKM, Vengadasalam D, Tan YT. Gestational diabetes: What size the problem?. Singapore Med J. 1988; 29:53-5.
6. Seshiah V, Balaji V, Madhuri S Balaji, Sanjeevi CB, Anders Green. Gestational Diabetes Mellitus in India. J Assoc Physicians India. 2004; 52:707.
7. Rana A, Pradhan N, Gurung G, Singh M: Screening Test for Gestational Diabetes. Journal of Institute of Medicine. 1997; 20: 26-32.
8. Gestational Diabetes Mellitus (GDM): Current concept and a short Review. Bangladesh J Pathol. 2009; 24(1): 16-20.
9. Metzger 9. BE, Coustan DR. Summary and recommendations of the fourth international workshop-conference on gestational diabetes mellitus. Diabetes care. 1998; 21:161-167.
10. Dooley SL, Metzger BE, Cho NH. Gestational diabetes mellitus influence of race on disease prevalence and perinatal outcome in a US population. Diabetes. 1991; 40: 25-29.
11. Ross G. Gestational diabetes. Aust Fam Physician. 2006; 35: 392-396.
12. Dornhorst A, Rossi M. Risk and Prevention of type 2 Diabetes in women with Gestational Diabetes. Diabetes Care.1998; 21(2): 43-9.
13. Buchanan TA, Xiang A, Kjos SL, Watanabe R. What is Gestational Diabetes? Diabetes Care. 2007; 30(2): 105-111.
14. American Diabetes Association: Birth weight and Parental BMI Predict overweight in Children from mothers with Gestational Diabetes. Diabetes Care. 2005; 28: 1745-1750.

15. Hoffman L, Nolan C, Wilson JD. Gestational Diabetes Mellitus. Management Guidelines. Med J Aust. 1998; 169: 93-97.

16. The American College of Obstetricians and Gynecologists. Gestational Diabetes: Clinical Management Guideline for Obstetrician-Gynecologists. ACOG Practice Bulletin. 2001; 98(3): 525-541.

17. Buchanan TA, Xiang A, Kjos SL, Lee WP, Trigo E, Nader I, et. Al. Gestational Diabetes: Antepartum characteristics that predict postpartum glucose intolerance and type 2 diabetes in Latino women. Diabetes Care. 1998; 47: 1302-1310.

18. WHO: Definition, Diagnosis and Classification of Diabetes Mellitus and its Complications. World Health Organization; 1999.

19. Wild S, Roglic G, Green A, Sicree R, King H: Global Prevalence of Diabetes. Diabetes Care. 2004; 27: 1560-1569.

20. Shrestha A, Chawla CD. The Glucose Challenge Test for screening of Gestational Diabetes. Kathmandu University Medical Journal. 2011; 9(2):22-25.

21. Bhattarai MD, Singh DL: Excessive weight gain after pregnancy in urban areas: One important area to prevent diabetes. Nepal Medical College Journal. 2005; 7(2): 87-89.

22. Wagaarachchi PT, Fernando L, Premachadra P, Fernando DJS.: Screening based on risk factors for gestational diabetes in an Asian population. J Obstet Gynecol. 2001; 21: 32-34.

23. Sharma P.K, Shrestha A: Gestational Diabetes Mellitus: A prospective study. South Asian Federation of Obstetritics and Gynaecology. 2010; 2(2):109-113.

24. Yildrim Y, Tinar S, Oner R, Kaya B, Toz E. Gestational Diabetes Mellitus in Patients Receiving Long-Term Corticosteroid Therapy During Pregnancy. Obstetrical & Gynecological Survey. 2007; 62: 6-7.