Risk Factors of Gestational Diabetes Mellitus in Gombak District, Selangor – A Case-Control Study

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Outline

• Introduction
• Problem
  Statement
• Rationale of Study
• Methods
• Results
• Discussion
• Recommendations
• Conclusion
Introduction

• Gestational Diabetes Mellitus (GDM)
  – Definition $^{1,2,3}$
  – Represents most common metabolic complication during pregnancy; early manifestation of type 2 diabetes $^{4,5}$
  – Certain characteristics (risk factors) in the women may predispose to development of GDM during pregnancy $^{3,6}$
Problem statement

• Prevalence of GDM varies from 1-14% between countries\textsuperscript{1,4,6}; varies in direct proportion to prevalence of type 2 diabetes in a given population\textsuperscript{7}

• In Malaysia
  – Diabetes prevalence (among adult $\geq$ 30yrs of age) had increased from 8.3% to 14.9% (1996 to 2006)\textsuperscript{8}
  – Diabetes admission based on type of diabetes (1994-2004): GDM represent $\approx$ 30% of total admission\textsuperscript{9}
  – GDM prevalence:
    \begin{itemize}
      \item 1993 (UMMC): 12.7\%\textsuperscript{10}
      \item 2001 (HUKM): 24.9\%\textsuperscript{11}
      \item 2003 (Alor Star): 18.3\%\textsuperscript{21}
    \end{itemize}
Problem statement (cont)

- GDM was the cause for 90% of all pregnancies complicated by diabetes\textsuperscript{22}
- Associated with maternal and foetal morbidity \textsuperscript{4,5}
- High proportion (>50%) have GDM in the subsequent pregnancy\textsuperscript{23}
- Associated with an increased risk of subsequent type 2 diabetes mellitus.
  - approximately 50% of the women with GDM progressed to DM within five years duration\textsuperscript{7}
  - 35-60% of women developed type 2 diabetes within 10 years after being diagnosed with GDM\textsuperscript{3}
Rationale of Study

• Literature search done showed scarcity of published article on study done in relation to GDM in this region

• Previous study done mostly at referral and specialised unit – results may not represent the true picture of the disease

• Identification of GDM risks factors will provide information in strengthening public health measures & prevent complications (maternal, foetal, development of overt diabetes & cardiovascular)
Study Objectives

• General Objectives
  – To determine the risk factors of GDM in Gombak District, Selangor.

• Specific Objectives
  1. To describe socio-demographic and obstetric characteristics of pregnant women with GDM.
  2. To determine the magnitude of association between the socio-demographic and obstetric characteristics with development of GDM.
  3. To determine the independent risk factors of GDM among pregnant women in Gombak District, Selangor.
Methods

• Study design
  – Case –control study (1:1)

• Study duration
  – June 2007- February 2008

• Study population
  – Pregnant women who had antenatal visits at MCH clinics of Gombak District, Selangor.

• Case
  – Pregnant women diagnosed with GDM using 75gm OGTT : 2hpp plasma glucose level ≥ 7.8 mmol/l

• Control
  – Pregnant women without GDM sampled from the same clinic on the same day each case was identified
Location of Study Area - Gombak District of Selangor State

Total land area 796,084 ha

Land area 65,008 ha
Methods of data collection

1. Face to face interview
   • Single interviewer
   • Pre-tested standardised structured questionnaire
     ➢ Socio-demographic characteristics
     ➢ Obstetric characteristics
     • Past-obstetric history
     • Present Obstetric history

2. Weight measurement
   • Using weighing machine existing in the clinic

3. R/V of antenatal records
   • Secondary data
     ➢ BMI, excessive weight gain, FBS, 2-HPP blood sugar, Urine sugar
   • Additional information
     ➢ Medical history, Family History
     Countercheck information
Variables

- **Dependent variable**
  - Gestational Diabetes Mellitus

- **Independent variables**
  - Socio-demographic
    - Age, ethnicity, educational level, household income.
  - Life style
    - BMI, excessive wt gain, Hb level
  - F/H of DM

- Obstetric characteristics
  1. Past-obstetric history
    - LSCS, Big baby, GDM, IUD, NND, Abortion, Congenital defect, Prematurity, Gest. Hypertension
  2. Present obstetric history
    - Glycosuria, PV discharge, Pruritus vulvae, UTI, Gest. Hypertension
## Factors associated with GDM

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Non-GDM (n-337)</th>
<th>GDM (n-337)</th>
<th>Crude OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maternal Age (yrs)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 25</td>
<td>93 (27.6%)</td>
<td>35 (10.4%)</td>
<td>Ref</td>
</tr>
<tr>
<td>25 – 35</td>
<td>214 (63.5%)</td>
<td>200 (59.3%)</td>
<td>2.48 (1.61, 3.83)</td>
</tr>
<tr>
<td>&gt;35</td>
<td>30 (8.9%)</td>
<td>102 (30.3%)</td>
<td>9.03 (5.15, 15.86)</td>
</tr>
<tr>
<td><strong>Income (RM)</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>&lt; 2000</td>
<td>162 (48.1%)</td>
<td>134 (39.8%)</td>
<td>Ref</td>
</tr>
<tr>
<td>≥2000</td>
<td>175 (51.9%)</td>
<td>203 (60.2%)</td>
<td>1.40 (1.03, 1.90)</td>
</tr>
<tr>
<td><strong>Prepregnant BMI (Kg/m²)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 18.5</td>
<td>49 (14.5%)</td>
<td>17 (5.1%)</td>
<td>Ref</td>
</tr>
<tr>
<td>18.5-24.9</td>
<td>180 (53.4%)</td>
<td>144 (42.7%)</td>
<td>2.31 (1.27, 4.18)</td>
</tr>
<tr>
<td>25.0-29.9</td>
<td>77 (22.9%)</td>
<td>90 (26.7%)</td>
<td>3.37 (1.79, 6.33)</td>
</tr>
<tr>
<td>≥30.0</td>
<td>31 (9.2%)</td>
<td>86 (25.5%)</td>
<td>7.99 (4.02, 15.91)</td>
</tr>
</tbody>
</table>
## Factors Associated with GDM

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<thead>
<tr>
<th>Characteristics</th>
<th>Non-GDM (n-337)</th>
<th>GDM (n-337)</th>
<th>Crude OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P/H LSCS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>310 (92.0%)</td>
<td>289 (85.8%)</td>
<td>Ref</td>
</tr>
<tr>
<td>Yes</td>
<td>27 (8.0%)</td>
<td><strong>48 (14.2%)</strong></td>
<td><strong>1.91 (1.16 , 3.14)</strong></td>
</tr>
<tr>
<td><strong>P/H Abortion</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>291 (86.4%)</td>
<td>262 (77.7%)</td>
<td>Ref</td>
</tr>
<tr>
<td>Yes</td>
<td>46 (13.6%)</td>
<td><strong>75 (22.3%)</strong></td>
<td><strong>1.81 (1.21 , 2.71)</strong></td>
</tr>
<tr>
<td><strong>P/H of Big baby</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>333 (98.8%)</td>
<td>312 (92.6%)</td>
<td>Ref</td>
</tr>
<tr>
<td>Yes</td>
<td>4 (1.2%)</td>
<td><strong>25 (7.4%)</strong></td>
<td><strong>6.67 (2.30 , 19.38)</strong></td>
</tr>
<tr>
<td><strong>H/O Glycosuria</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>335 (99.4%)</td>
<td>323 (95.8%)</td>
<td>Ref</td>
</tr>
<tr>
<td>Yes</td>
<td>2 (0.6%)</td>
<td><strong>14 (4.2%)</strong></td>
<td><strong>7.26 (1.64 , 32.20)</strong></td>
</tr>
</tbody>
</table>
### Factors Associated with GDM

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Non-GDM (n-337)</th>
<th>GDM (n-337)</th>
<th>Crude OR 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>H/O excess. Weight gain</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>208 (61.7%)</td>
<td>112 (33.2%)</td>
<td>Ref</td>
</tr>
<tr>
<td>Yes</td>
<td>129 (38.3%)</td>
<td>225 (66.8%)</td>
<td>3.21 (2.35, 4.40)</td>
</tr>
<tr>
<td><strong>H/O Gestational Hypertension</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>322 (95.5%)</td>
<td>298 (88.4%)</td>
<td>Ref</td>
</tr>
<tr>
<td>Yes</td>
<td>15 (4.5%)</td>
<td>39 (11.6%)</td>
<td>3.24 (2.36, 4.44)</td>
</tr>
<tr>
<td><strong>H/O PV discharge</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>291 (86.4%)</td>
<td>264 (78.3%)</td>
<td>Ref</td>
</tr>
<tr>
<td>Yes</td>
<td>46 (13.6%)</td>
<td>73 (21.7%)</td>
<td>1.75 (1.17, 2.62)</td>
</tr>
<tr>
<td><strong>H/O Pruritus vulvae</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>297 (88.1%)</td>
<td>278 (82.5%)</td>
<td>Ref</td>
</tr>
<tr>
<td>Yes</td>
<td>40 (11.9%)</td>
<td>59 (17.5%)</td>
<td>1.58 (1.02, 2.43)</td>
</tr>
</tbody>
</table>
## Independent risk factors for GDM

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Adjusted OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maternal age (Years)</strong></td>
<td></td>
</tr>
<tr>
<td>&lt; 25</td>
<td>Ref</td>
</tr>
<tr>
<td>25 – 34</td>
<td>2.03 (1.22, 3.37)</td>
</tr>
<tr>
<td>≥35</td>
<td>11.95 (6.13, 23.29)</td>
</tr>
<tr>
<td><strong>Pre pregnant BMI (kg/m(^2))</strong></td>
<td></td>
</tr>
<tr>
<td>&lt; 18.5</td>
<td>Ref</td>
</tr>
<tr>
<td>18.5-24.99</td>
<td>1.18 (0.59, 2.35)</td>
</tr>
<tr>
<td>25.0-29.99</td>
<td>1.37 (0.66, 2.85)</td>
</tr>
<tr>
<td>≥30.0</td>
<td>3.71 (1.38, 6.76)</td>
</tr>
<tr>
<td><strong>Household Income /month (RM)</strong></td>
<td></td>
</tr>
<tr>
<td>&lt; 2000</td>
<td>Ref</td>
</tr>
<tr>
<td>≥2000</td>
<td>1.49 (1.02, 2.18)</td>
</tr>
<tr>
<td><strong>Family History of DM</strong></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>Ref</td>
</tr>
<tr>
<td>Yes</td>
<td>3.62 (2.44, 5.36)</td>
</tr>
</tbody>
</table>
# Independent risk factors for GDM

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Adjusted OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P/H of GDM</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>Ref</td>
</tr>
<tr>
<td>Yes</td>
<td>3.41 (1.37, 8.51)</td>
</tr>
<tr>
<td>P/H of Big baby</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>Ref</td>
</tr>
<tr>
<td>Yes</td>
<td>5.83 (1.77, 19.20)</td>
</tr>
<tr>
<td>H/O Exc. vaginal discharge</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>Ref</td>
</tr>
<tr>
<td>Yes</td>
<td>2.25 (1.39, 3.65)</td>
</tr>
<tr>
<td>H/O Excessive weight gain</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>Ref</td>
</tr>
<tr>
<td>Yes</td>
<td>3.95 (2.69, 5.80)</td>
</tr>
</tbody>
</table>
Discussion

- **Socio-demographic**
  - Maternal age ≥ 25 yrs and the odds increases as age ≥ 35 yrs with OR and 95% CI of 2.48 (1.61, 3.83) & 9.03 (5.15, 15.86) respectively \(^1\), \(^3\), \(^5\), \(^6\), \(^9\)
  - Gravidity – the odds was 2.56 x higher in multigravid women (1.66, 3.94) \(^3\), \(^6\)
  - Economic status – The odds was 1.40x higher in higher household income → supported by other study \(^6\) but other studies \(^4\), \(^5\) were contradicting

- **Lifestyle**
  - Pre pregnant BMI – odds ↑ as BMI ↑, highest in obesity (7.99: 4.02, 15.91) \(^3\), \(^5\), \(^6\), \(^9\)
  - Excessive weight gain – OR: 3.21 (2.36, 4.44) \(^8\)
Discussion (cont)

• **Obstetric Characteristics**
  – Previous H/O GDM \(^{11, 17}\)
  – Previous H/O Big baby \(^{15, 16}\)
  – Previous H/O LSCS \(^{16}\)
  – Previous H/O Abortions \(^{11, 15, 16}\)
  – H/O glycosuria \(^{15}\)
  – H/O gestational hypertension \(^{15, 20}\)
  – H/O excessive vaginal discharge

• **Independent risk factors**
  – This study confirms results from the previous studies that risk factors for GDM are:
    • Maternal age \(^{11, 13, 15, 16, 19}\), Pre pregnant obesity \(^{13, 15, 16, 19}\), Excessive weight gain \(^{18}\), Family history of DM \(^{15, 17, 18, 19}\), Previous history of GDM \(^{11, 17}\), Previous history of big baby \(^{15, 16}\)
    • Higher income \(^{16}\) and excessive vaginal discharge
Strength of study

• Case and control group were comparable since they came from the same population – pregnant women from the same clinic

• High responds rate – as the respondents were not put into any risk and not subjected to any inconvenience of OGTT

• Study was done in Government Maternal and Child Health Clinics which covers almost 80% of antenatal population of the - Community Based
Limitation

• **The study design** – temporality cannot be ascertained
• **Information bias**
  – Respondents are subjected to **recall bias**
  – Interviewer bias in getting information
  – Steps taken:
    • compared information from the antenatal records
    • Single interviewer – reduced inter observer bias
• **Selection bias**
  – In selecting controls and cases – based on presence of risk factor/s
• **Measurement bias**
  – Weight measurement not properly done or weighing machine not properly calibrated
  – In defining cases – false positive/ negative result of plasma glucose level
• **Confounding bias**
  – Confounders are statistically controlled by subjecting variables to multiple logistic regression
• **Generalizability**
  – Result of study can only be generalised to the antenatal population attending the government health clinics
Recommendation

- Having GDM registry at periphery and the central level
- Considering maternal age ≥ 25 yrs, exc. vaginal discharge for OGTT
- Concerted effort, multidisciplinary approach in preventing and managing GDM
  - Antenatal services
  - Pre marital health care programme
  - Strengthening of family planning programme
- Strengthening the promotive and preventive health care in tackling the lifestyle factors associated with GDM
- Policy on universal screening of GDM using GCT
Conclusion

• Development of GDM is associated with presence of risk factors
• Strong and significant association between GDM and the identified independent risk factors in this study warrants serious attention in its prevention and management prior to and throughout pregnancy
• Screening of GDM using risk criteria should consider
  – Maternal age ≥ 25 yrs
  – Presence of excessive vaginal discharge in index pregnancy
Thank You
References


