

# Prevalence and risk factors of gestational diabetes mellitus in Asia: a review

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## Abstract

**Introduction.** Gestational diabetes mellitus (GDM) is a global problem that occurs in the world. This case occurred in pregnant women at 24-28 weeks of gestation. The global prevalence of GDM varies widely from 1% to 28%.

**Objective.** The purpose of this study is to describe the prevalence of GDM in Asia and the risk factors for GDM.

**Materials and Methods.** This research method used a systematic review for observational studies. The research inclusion criteria were original English papers, with full text published in peer-reviewed journals. Method of 23 international articles in 2012-2022, which have articles that meet the requirements to be researched subjects regarding the description of the average prevalence of GDM cases in Asia and the risk factors for GDM.

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**Results.** The results of the study found that the lowest prevalence of GDM was in India at 1.9%, and the highest prevalence was found in Australia at 30%. The average risk factors for GDM are a family history of DM, BMI > 25 kg/m<sup>2</sup>, multiparity and history of GDM in previous pregnancies, and history of abortion. The results of a journal review also show that mothers who give birth to GDM have a 48% risk of developing DM in the future.

**Conclusion.** Based on the conclusion in this study, with the wide variation in GDM prevalence rates, it is better to set a GDM risk factor score so that other health services can use these indicators as the gold standard for screening GDM.

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## Introduction

Gestational Diabetes Mellitus (GDM) is a collection of symptoms in pregnant women caused by an increase in blood glucose levels due to a progressive decrease in insulin secretion, this diabetes is characterized by an increase in blood sugar during pregnancy in 24th week of pregnancy and blood sugar levels will return to normal after pregnancy.<sup>6,7</sup> ACOG (American College of Obstetricians and Gynecologists) recommends two step approach for screening and diagnosis of gestational diabetes mellitus, step one give 50 gram oral glucose solution without regard to time of day, measure venous plasma or serum glucose concentration at one hour after administration, glucose  $\geq$  135 mg/dl or  $\geq$  140 mg/dl is elevated and requires administration of a 100 gram glucose tolerance test, step two measure fasting venous plasma or serum glucose concentration, give 100 gram oral glucose solution, measure venous plasma or serum glucose concentration at one, two and three hour after administration, a positive test in generally defined by elevated glucose concentration at two or more time points.<sup>8,9</sup>

The indicator in determining Maternal Mortality Rate (MRI) is determining the degree of public health and success of development in health sector.<sup>6</sup> The high number of AKI is an indicator of health problems, health services and human resources in a region. Based on the Millennium Development Goals (MDG's) in point 5, namely increasing the maternal health target by reducing AKI to 102 from 100,000 in 2015. The target to be achieved until 2015 is to reduce  $\frac{3}{4}$  risk of maternal mortality.<sup>5</sup>

Gestational diabetes mellitus is a global problem in terms of its incidence and impact.<sup>1</sup> According to similar studies,<sup>10,11,12</sup> 7% of pregnancies each year are with gestational diabetes mellitus. The variation in prevalence of gestational diabetes is 1% -14%. This number depends on the population studied and screening criteria used.

According to research,<sup>13</sup> explores that Risk for GDM is 41.3% in the following pregnancy, while in women who do not have a previous history of GDM is only 4.2%. The risk of developing diabetes in the next 5 years diagnosed GDM is 6.9% and after 10 years to 21.1%, therapy with GDM will reduce the risk of macro-

somia, shoulder dystocia and gestational hypertension.<sup>14</sup>

In Indonesia the prevalence of Gestational diabetes mellitus (GDM) ranges from 1.9-3.6% and about 40-60% of women who have experienced GDM in postpartum following up observation will have diabetes mellitus or glucose tolerance disorders.<sup>6</sup>

Mothers with gestational diabetes during pregnancy have a higher risk for hypertension (preeclampsia), large birth weight (BBLB), abortus, old partus, premature new-borns and secsio caesarea delivery.<sup>15</sup> Meanwhile, postpartum mothers with GDM can increase the risk of complications from pre-existing diabetes, such as: heart, kidneys, nerves, and vision disorders, and are at risk of developing type II diabetes mellitus within 10 years of pregnancy.<sup>16</sup>

The prevalence of GDM disease in Asia varies due to differences in the way screening is conducted and large population screened. Gestational diabetes mellitus has a positive association for increased perinatal complications and mothers with Gestational Diabetes Mellitus, 5-10 years in the future have a risk of developing diabetes mellitus. This gestational diabetes mellitus increases neonate morbidity, for example hypoglycaemia, icterus, polycythaemia, and macrosomia. This happens because babies from GDM mothers secrete more insulin so that they can stimulate baby growth and macrosomia. The frequency of GDM is approximately 3-5% and mothers are at increased risk of becoming DM in the future.<sup>17</sup>

Results of study conducted.<sup>18</sup> explained that prevalence of GDM incidence in Taiwan will increase at productive age which is 12.378% where the prevalence of respondents with multiparity is higher, about 12.98% compared to primipara about 9.69%, respondents with an obesity risk prevalence of GDM cases is higher, about 16.81% than not obese, about 11.70%, and respondents with previous GDM history higher GDM prevalence rate, about 37.26% than those without GDM history, about 11.22%.

Asia is the largest and most population (60% of the world's population). With an increasing prevalence of GDM.<sup>19</sup> The eastern and southeastern subregions include 18 countries, with more than

30% of the Asia population and contributing approximately 80% to the Asia economy. Give the rapit socioeconomic and nutrition transition and the increasing prevalence of GDM.<sup>20</sup>

Based on the introduce, researches interested in conducting research by observing literature review og the prevalence and risk factors og GDM in Asia.

## Materials and Methods

The research method used in this study is *literature review* of several sources of articles on magnitude of prevalence and risk factors associated with the incidence of GDM in Asia.

### Literature source search strategy

Sources data of this research are review of journal articles from BMC Public Health, BMC Pregnancy and Childbirth, International Journal of Computational Intelligence Systems, Plus One Journal, Journal of Diabetes Investigation, Wiley Journal, BMC Paediatrics, Diabetic Medicine Journal, cardiovascular Diabetology Journal, Journal of Diabetes Research, Diabetes care Journal, Nutrition and Metabolism Journal and use journals relevant to "Gestational diabetes mellitus" as well as taking information sources from the who and *International diabetes federation* by reviewing published results. Furthermore, from various sources of literature, the article was identified on relevant results.

### Inclusion criteria

In order to maintain the validity of this research, the researcher made eligibility criteria or called inclusion criteria, where the inclusion criteria are as follows: Research results are only on the scope of Asian Countries (Indonesia, Australia, Singapore, Hongkong, Bangladesh, Japan, Taiwan); Indexed and published international journals from 2012-2022; Results of journal findings, namely prevalence and risk factors for GDM, are presented in Figure 1.

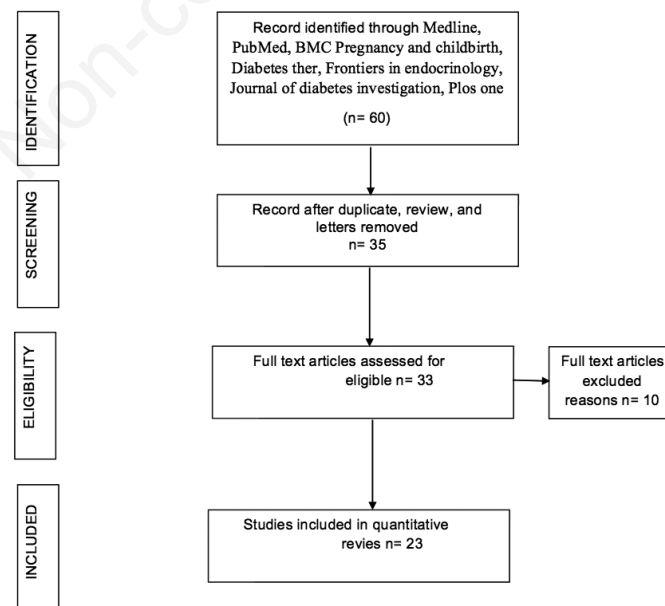


Figure 1. Flow chart showing the detailed procedure for inclusion or exclusion of studies.

Table 1. Study characteristics of published studies included in the literature review.

| No | Country   | Year | Author   | Total sample                          | Total GDM | Prevalence (%) | Screening                  | Risk Factors  |
|----|-----------|------|--|---------------------------------------|-----------|----------------|----------------------------|---|
| 1  | Australia | 2022 | Luiza oleszczuk modzelewska, aneta malinowska polubiec, ewa romejko wolniewicz, agnieszka zawiejska, kzajkowski. <sup>24</sup> | 487 (case), 285 control (202)         | 285       | 16%            | 75 grams OGTT              | BMI > 25 (37.7%, p-value= <0.006)<br>Multiparity (61.80%, p-value=0,024)<br>GDM history (18.8%, p-value=0,001)<br>Macrosomia (16.50%, p-value 0,249)  |
|    |           | 2019 | E.U. Nwose, M. Mogbusiaghan, P.T. Bwititi, G. Adoh, O. Agofure, E.O. Igumbor <sup>25</sup>                                     | 119                                   | 91        | 16,20          | NA                         | BMI > 25 (21%)<br>Obesity (22%)<br>Hypertension (2.6%)  |
|    |           | 2020 | H. david mcintyre, patrick catalano, culin zhang, gemot desoye, elisabeth R mathiesen, peter dam. <sup>26</sup>                | NA                                    | NA        | 30%            | OGTT/WH O                  | Preclampsia (9.1%, p-value=0.001)<br>Primary caesarean deliver (24.4%, p-value 0,001)   |
|    |           | 2022 | Heather louise ford, Isabella champion, Anna wan, Maya reddy. <sup>27</sup>  | 2048                                  | 647       | 15%            | 2 h OGTT                   | BMI > 25 (p-value 0,001)<br>Parity (Multiparity) 28.4%, p-value: 0.001)   |
|    |           | 2012 | G. Mukerji, M. Chiu, B.R. Shah. <sup>28</sup>  | 1,050,108                             | 7755      | 7,1 %          | 75 grams or 100 grams OGTT | Age > 30 years (88%)  |
| 2  | China     | 2013 | Chenghan gao, xin sun, li lu, fangwei liu, jing yuan. <sup>29</sup>  | 79,064                                | NA        | 14.80%         | 75 grams OGTT              | Obesity (30.3%, p-value=0.01)<br>Family history with DM (32.90%, p-value=0.01)  |
|    |           | 2022 | xue yang, yi ye, yi wang, ping wu, qi lu, yan liu, yuan et al. <sup>30</sup>   | 996                                   | 332       | NA             | 75 grams /2 h- OGTT        | BMI >25 (32.90%, p-value=0.05)<br>Family history with DM (17.06%, p-value=0.05)   |
|    |           | 2022 | Zhimin song, yan cheng, tingting li, yongfang fan, qingying zhang, haidong Cheng. <sup>6</sup>                                 | 15,472 (hospital of fudan university) | NA        | 12,40%         | NA                         | Family history with DM(2.5%, p-value=0,46)  |
|    |           | 2020 | Guoju li, tao wei, wei ni, ai zhang, yuhan xing, quansheng xing. <sup>31</sup>   | 17,145                                | 2966      | 17,45%         | OGTT                       | BMI >25 (11.67%, p-value=0.001)<br>Multiparity (31.1%, p-value=0.004)<br>Family history with DM (4.5%, p-value=0.001)<br>History of childbirth macrosomia (0.30%, p-value=0.001)  |
|    |           | 2022 | Jingbo qiu, lei chen, xiaohua wang, wei zhu. <sup>32</sup>   | 15,092                                | 2313      | 15,33%         | 75 grams OGTT              | Family history with DM(35.7%, p-value=0.001)  |
|    |           | 2022 | shuang zhang, huikun liu, nan li, wei dong, weiqin li, leishen wang, yu zhang, ying zi yang, junhong leng. <sup>33</sup>       | 41,845                                | 4257      | 10.17%         | 75 grams OGTT              | BMI >25 (OR=2.792, p-value=0.01)<br>History of caesarean birth (OR= 2.019, p-value=0.01)<br>GDMhistory (OR=3.545, p-value=0.01)<br>History of hypertension (OR= 3.924, p-value=0.01)<br>Family history of DM (OR= 4.925, p-value=0.001) |
|    |           | 2019 | yuxin fan, weiqin li, huikun liu, leishen wang, shuang zhang, wei li,  | 76325                                 | 4644      | 6,1%           | 75 grams /2 h- OGTT        | Family history with DM (p-value=0.001)  |

## Data selection

First of all, identify the relevant journals from databased and websites that are important into references to duplicate data. The second stage is a review of relevant titles and abstracts in articles that meet the inclusion criteria, the third stage is if article does not include the information needed about GDM, then the journal is subsequently completed by discussing between author.<sup>21</sup>

## Data Analysis

Diagnostic criteria in the determination of GDM diagnoses to determine the average prevalence of GDM is done by making the same grouping as based on literature review. GDM risk factors based on literature review odd ratio (OR).

## Results

Based on the identification results of 60 articles reviewed from Medline, PubMed, BMC Pregnancy and childbirth, Diabetes ther, Frontiers in endocrinology, Journal of diabetes investigation, Plos one, 35 journals were found that had duplicates of authors and titles. After screening based on the title and abstract, there were 23 selected articles. From the next 23 eligible articles included in the research by looking at the prevalence of GDM in pregnant women from 13 countries in Asia including Indonesia, India, Vietnam,

Pacific Islands, South Korea, South China, Taiwan, Hong Kong, Malaysia, Thailand, Japan, Bangladesh and Pakistan.

Research conducted.<sup>22</sup> and.<sup>23</sup> has the same prevalence rate of 21% where the risk factor for GDM in Vietnam is women who have controlled physical activity will reduce the risk of GDM with an OR=0.66. P-value 0.002 and risk factors in Japan were history of macrosomia (OR=2.4) and family history of DM (OR=2.9). Below is described flow chard procedure literature review.

## Discussion

Table 1 shows the variation in the prevalence of GDM in ASIA where the variation in prevalence can occur due to variation in screening conducted and the subjects studied. Based on research conducted.<sup>26</sup> that the prevalence of GDM reached 30% with GDM risk factors of Preclampsia (9.1%, p-value=0.001) and primary caesarean delivery (24.4%, p-value=0.001). The second highest prevalence rate was research conducted<sup>41</sup> in Bangladesh where the prevalence of GDM reached 28.3% with risk factors, namely mothers who had BMI>30 kg/m<sup>2</sup> p-value = 0.001.

The results of research conducted<sup>40</sup> the prevalence GDM in Singapore women 17,60 with risk factors is family history of GDM 30,6%, mothers who hacc a history of GDM 2,6%, mother who have a history of giving birth to macrosomia 0,2%, mother have

**Table 1. Study characteristics of published studies included in the literature review.**

| No | Country   | Year | Author   | Total sample | Total GDM | valence (%) | Screening         | Risk Factors  |
|----|-----------|------|--|--------------|-----------|-------------|-------------------|---|
|    |           |      | hongyan liu, junhong leng, yun shen, et al. <sup>24</sup>  |              |           |             |                   | BMI > 28 kg/m <sup>2</sup> (p-value=0.001)  |
|    |           | 2021 | yanmei wang, zhijuan ge, lei chen, jun hu, wenting zhou, shanmei shen, dalong zhu, yan bi. <sup>15</sup> | 1640         | 855       | NA          | NA                | Maternal age (OR=1.049, p-value<0.001)<br>BMI >28 kg/m <sup>2</sup> (OR= 2.792, p- (value=0.170)<br>GDM history (OR=3.545, p-(value=0.198)<br>Family history of DM (OR= 4.925, p-value=0.01)<br>History of hypertension (OR= 3.924, p-value=0.01)                     |
|    |           | 2019 | Yuxin fan, Weiqin li, Huikum liu, Leishen wang, et al. <sup>24</sup>                                     | 1968         | 1263      | 10.2%       | 2 h 75 grams OGTT | BMI > 28 KG/m <sup>2</sup> P-value 0.0001 (31.9%)<br>OR= 6.85<br>Hyperglycemia, P-value = 0.0001,OR=3.20  |
| 3  | Japan     | 2022 | rogatien mwandjalulu kisindja, pierrot lundimu tugirimana et al. <sup>22</sup>                           | 392          | 391       | 21.20%      | NA                | History of childbirth macrosomia (OR=2.4)<br>Family history with DM (OR=2.9)  |
| 4  | Indonesia | 2016 | Liong Boy Kurniawan <sup>36</sup>  | NA           | NA        | 11.6%       | 75 grams TTGO     | Pregnant women with GDM had a 41.3% risk of developing GDM in subsequent pregnancies, while in women without a previous history of GDM it was only 4.2%.<br>The risk of suffering from DM 5 years after being diagnosed with GDM is 6.9% and after 10 years to 21.1%. |
|    |           | 2016 | Anita rahayu, rodiana. <sup>37</sup>   | NA           | NA        | 5,1%        | 75 grams TTGO     | Macrosomia of 5% of all births  |
| 4  | India     | 2021 | Puja chebrolu, Ravi kurbude, Manju thakur, Naman shah, Rachna jan. <sup>38</sup>                         | 575          | 11        | 1.9%        | 75 grams TTGO     | Blood pressure (TD) 10-117 mmHg (p-value=0.04)<br>Prehypertension increases the risk of GDM with value OR=4.0   |
| 5  | Vietnam   | 2018 | Allie carew, Linda dodds, Stefan Kutke, Susan Kirkland, Christy Woolcott. <sup>23</sup>                  | 1987         | 432       | 21.7%       | NA                | Women who have controlled physical activity will decreasing the risk of GDM occurrence with an OR=0.66. P-value 0.002   |

multiparity 55,6%.

The prevalence of countries for which the table was found systematic review that assessed GDM in Asia was 14%, the results of this study are the same as the studies that have been carried out.<sup>43,44,45</sup> the total incident of GDM in mainland China was 14,8% (95% confidence interval 12,8-16,7%). Subgroup analysis showed that the age, body weight and family history of diabetes mellitus could significantly increase the incidence of GDM.

## Conclusion

Based on literature reviews that have been conducted in 23 journals and 13 countries in Asia, namely Australia, China, Japan, Indonesia, northern China, southern Asia, India, Vietnam, Taiwan, Hong Kong, Singapore, Bangladesh and Pakistan, the lowest prevalence of GDM based on research conducted.<sup>38</sup> is 1.9% with GDM risk factors, namely mothers who have blood pressure between 100-119 mmHg have a significant relationship to the incidence of GDM with a p-value of 0.05, while the highest prevalence rate based on research conducted by (12) in Australia is 30% where the GDM risk factor is Preeclampsia (9.1%, p-value=0.001) and primary caesarean deliver (24.4%, p-value=0.001).

The results of literature review showed a variation in the risk factors of GDM where most studies showed the risk factors of GDM based on research conducted<sup>25</sup> BMI > 25 kg/m<sup>2</sup> with a p-value of 0.006, research conducted.<sup>12</sup> was BMI >25 kg/m<sup>2</sup> with a proportion of 21% and research.<sup>29</sup> with BMI >25 kg/m<sup>2</sup> p-value of

0.05 which means that it has a significant relationship to the incidence of GDM. Another risk factor that affects the incidence of GDM is multiparity such as the results of research conducted.<sup>25</sup> in Australia with a statistical p-value of 0.024 which means that there is a significant relationship of multiparity with the incidence of GDM with a proportion value of 61.8%. Another risk factor that dominates the incidence of GDM is family history with DM based on the results of research conducted.<sup>6</sup> with a p-value of 0.46, research conducted with a p-value of 0.05.

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**Table 1. Study characteristics of published studies included in the literature review.**

| No | Country    | Year | Author  | Total sample | Total GDM | valence (%) | Screening         | Risk Factors   |
|----|------------|------|---|--------------|-----------|-------------|-------------------|--|
| 6  | Taiwan     | 2020 | Wen-ling su, Chin-li lu, Santi martini, Yu-hueih hsu, Chuung-yi li <sup>18</sup>  | 371          | 43,538    | 11.73%      | NA                | GDM prevalence is higher in autumn (12.48%) than summer (11.77%), snow season (11n65%), spring (10.95%)<br><br>Prevalence of GDM cases in women of greater multiparity which is 12.98% of the primipara which is 9.69%<br><br>The prevalence of obese women with GDM was 16.81% The prevalence of women with a history of GDM was 37.26% |
| 7  | Hongkong   | 2021 | Huanhuan zhang, Qiong wang, Tarik benmarhnia, Bin jalaludin, Xiaoting shen, Zengli yu, Meng ren, Qianhong liang, Jingzhe wang, Wenjun ma, Cunrui huang. <sup>39</sup> | 5165         | 604       | 11.7%       | NA                | Increased risk of severe GDM with increased DTRper <sup>10c</sup> during weeks 21-24 of gestation with value OR = 1.03 95% CI = 1.002-1.06   |
| 8  | Singapore  | 2022 | Mukesh kumar, Li chen, Karen tan, Li tang ang, Cindy ho, Gerard wong, Shu E soh, Kok hian tan, et al <sup>40</sup>  | 1072         | 909       | 17.60%      | 2 h 75 grams OGTT | The prevalence of mothers with a family history of DM was 30.6%<br><br>The prevalence of GDM mothers who have a history of GDM is 2.6%<br><br>The prevalence of GDM mothers who have a history of giving birth to macrosomia is 0.2%<br><br>Prevalence of GDM mothers who have large multiparity 55.6%                                   |
| 9  | Bangladesh | 2021 | Rebecca Garcia, Nasreen ali, Andy guppy, Malcolm Griffiths, Gurch Randhawa. <sup>41</sup>   | 15211        | 15211     | 28.3%       | NA                | Mothers who have BMI > 30 kg/m <sup>2</sup> p-value = 0.001  |
| 10 | Pakistan   | 2019 | Sobia alyas, Nabola roohi, Samina ashraf, sadaf ilyas, azhar ilyas. <sup>42</sup>   | 300          | NA        | 8,20        | NA                | There is a significant relationship between cholesterol, triglyceride, HDL, LDL and VLDL levels for pregnant women suffering from GDM with p-value < 0.0001  |

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