



**Review Article**

# A Status on Gestational Diabetes Mellitus in Saudi Arabia: A Systematic Review

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**Abstract:** Removed all headings and made it as one paragraph as suggested by reviewer. Impaired glucose tolerance is the most common complication during pregnancy. The prevalence of gestational has increased all over the world recently and especially in Saudi Arabia. The gestational diabetes causes many problems to both mother and the fetus. The objective of this systematic review is to assess the GDM prevalence rate, its risk factors and its outcome in Saudi Arabia. One electronic data base called PubMed was searched by using appropriate key words and filters were applied in all possible ways to find the relevant literature. The language was limited only to English. The database identified 113 records out of which only 29 were relevant and unable to find full text in 6 articles. Only 9 articles were included in the systematic review. The prevalence of gestational diabetes ranges from 10.5% to as high as 51% and risk factors for gestational diabetes were increased maternal age, higher body weight & BMI, Previous history of GDM and Macrosomia. Most studies reported GDM increased the risk of cesarean section in mothers and hypoglycemia, higher birth weight, hyperbilirubinaemia and NICU admissions in fetus. The gestational diabetes remains a major public health problem in the kingdom of Saudi Arabia and it highlights the need for further research. Considering the burden of GDM early screening of pregnant women is highly recommend to reduce the maternal and neonatal complications.

**Keywords:** Gestational Diabetes, Pregnant Women, Saudi Arabia, Macrosomia, Hypoglycemia, Large for Gestational Age, Higher Body Weight & BMI

## 1. Introduction

Gestational diabetic mellitus (GDM) is defined as “any form of carbohydrate intolerance that is diagnosed during pregnancy [1].” According to WHO Gestational diabetes is defined as hyperglycemia with onset or first identified during pregnancy. [2]

Globally the prevalence of gestational diabetes is approximately 7% but in some of the developed countries the prevalence rates are higher (19%). [3] Recent studies show higher prevalence of gestation diabetes 37.7% in Norway and UAE followed by 30.1% in Mexico. [4], [5] The prevalence of gestational diabetes in kingdom of Saudi Arabia varies from

8.9%-12.5% according to studies reported in 2000. [6] Pregnant women who are diabetic are at risk of having cesarean sections because of fetal macrosomia and macrosomia is a complication of maternal hyperglycemia. [7] Approximately 95% of the maternal glucose level comes back to normal after delivery however they are at risk of developing type II diabetes in their later life. [8], [9], [10] The gestational diabetes is not only a risk for mother even the fetus is at risk of developing hyperbilirubinaemia, hypoglycemia and respiratory distress syndrome. [11] The risk factor for gestational diabetes includes both modifiable factors which are obesity and life style factors and non-modifiable factor which is a family history of diabetes. [12], [13] The prevalence of gestational diabetes is steadily increasing over a

period of years in the kingdom of Saudi Arabia therefore we performed a systematic review in order to present the prevalence rate of gestational diabetes and the reported complications of the same in both mother and the fetus. This review also describes the various risk factors for the gestational diabetes which are mentioned in the literature.

## 2. Methodology

The literature search was performed by using the electronic database “Pub Med”. The key words like “Gestational Diabetes” and Saudi Arabia were used. The alternative search terms such as “Impaired fasting glucose and pregnancy” and Saudi Arabia were used to collect the relevant literature. The filters were set for studies related to humans and the languages were limited to English. The attempt was made to collect all the literature related to gestational diabetes so the time limit was not set. The articles were screened for relevance by reading the title and abstract. The studies included in the analysis that fulfills the following criteria.

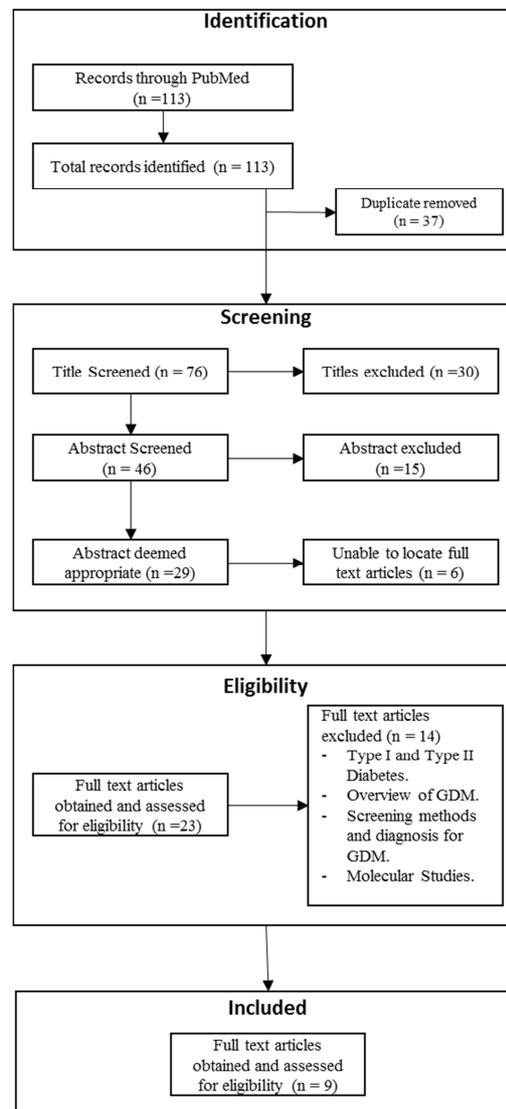
1. Prevalence of GDM.
2. Outcome of gestational diabetes in mother and fetus.
3. Predisposing factors for gestational diabetes.

If the studies were not about the above mentioned items they were excluded and in addition to that the studies were excluded if they were

1. Type I and Type II Diabetes.
2. Editorials.
3. Overview of GDM.
4. Screening methods and Diagnosis for GDM.
5. Molecular studies.
6. Comparisons of GDM testing regimes.

Data were extracted only from the full text articles which include, Sample Size, age of the pregnant women, gestational age, prevalence /Incidence of GDM, risk factors for gestational diabetes and the outcome of the gestational diabetes in both mother and the fetus.

## 3. Results



**Figure 1.** The flow diagram illustrating the number of included and excluded studies in the systematic review on gestational diabetes in Saudi Arabia.

### 3.1. Study Selection

One electronic database named PubMed was searched and identified a total of 113 records and out of 113 studies 37 duplicate Literature was removed.

The remaining 76 records were screened by using the title in that 30 were excluded because of its irrelevance. Out of 46 abstract screened only 29 were considered to be appropriate and the remaining 15 were excluded. As a result of not having access to particular journals we could not locate full text for 6 articles. Out of 23 full text articles only 9 fulfilled the eligibility criteria to be included in the systematic review and the rest 14 were excluded because it was type I and type II diabetes, overview of GDM, screening methods and diagnosis for GDM and molecular studies.

### 3.2. Study Character

The nine articles included in the systematic review were original research papers. The earliest study was published in the year 1988 and the latest was published in 2015 so the original research studies included in the review has a research span of about 27 years. Overall information regarding the prevalence and as well as the incidence of GDM, risk factors for GDM and complications of GDM was extracted from all the original studies.

Out of nine studies five were cross-sectional study looking at the prevalence of gestational diabetes and one was case control study determining the incidence of maternal and fetal complications of GDM and Two were prospective cohort study assessing the GDM incidence and one was retrospective cohort investigating the maternal and neonatal morbidities. [with reference to Table 1].

The latest study was done in Madinah, Saudi Arabia in the year 2015. The authors reported relatively high prevalence (51%) of gestational diabetes by using the IADPSG [14] criteria. The authors also stated that increase in the prevalence rate was due to single abnormal glucose value in 89.7% of the cases. He also stated that gestational diabetes increased with older maternal age, weight, BMI and blood pressure. He also found that newborns born to a GDM mothers were at risk of having neonatal hypoglycemia and were having high birth weight (3043gms) which was statistically significant. [15]

The Saudi Abnormal Glucose Metabolism and Diabetes Impact Study (SAUDI-DM study) was conducted all over Saudi Arabia among pregnant women in the year 2014.

The author found out the prevalence of gestational diabetes was 32.4%. The study also relieved the significant predisposing factors for gestational diabetes was previous history of GDM and Macrosomic Babies (> 4.5kg) and higher body mass index. [16]

The retrospective cohort study conducted in Riyadh, Saudi Arabia in 2012 found that the infants born to the gestational diabetic mother were at higher risk of Neonatal intensive care unit (NICU) admissions, long hospital stay and hypoglycemia which were also statistically significant. [17]

A study in a high- parity group of pregnant women in

Riyadh, Saudi Arabia in 2010 relieved 12.5% prevalence of gestational diabetes and the prevalence increases as the maternal ages increases and also Multiparous women were 8.29 times at risk of having gestational diabetes than the nulliparous women. [18]

A hospital based prospective study done in Riyadh, Saudi Arabia in 2006 showed the incidence of gestational diabetes was 8.6% and it also proved that the mode of delivery and pregnancy complications were highly statistically significant with NICU admissions. The risk of NICU admission were 2.5 times higher in women who had undergone non-spontaneous labor and 4.5 times higher in women who had non SVD procedures (Vento use/forceps, and CS) as mode of delivery and 4.6 times higher in women who had pregnancy complications like pre-term labor and 2 times higher in women had other complications such as polyhydramnios, oligohydramnios, IUGR and postdate pregnancy. [19]

Another prospective study in Jeddah, Saudi Arabia found the prevalence of gestational diabetes was 12.5% and the significant predisposing factors for the GDM were older maternal age, heavier body weight and higher gravity of mothers. They also observed the heavier fetal birth weight as a statistically significant complication of gestational diabetes. [20]

The study conducted in 1997 showed the incidence of gestational diabetes was 9.8% and maternal complications includes higher incidence of cesarean section and perineal lacerations. The infants born to GDM mothers were having higher rates of macrosomia and hypoglycemia. [21]

Another study in 1989 among the third trimester pregnant women determined the incidence of gestational diabetes was 11% and it increased with increasing maternal age, parity and weight. It also specifically stated that maternal age  $\geq 30$  years was the most common risk factor for gestational diabetes. [22]

The earliest study in 1988 proved the overall prevalence of gestational diabetes was 10.3% and the prevalence increased with higher maternal age, parity and body mass index which were statistically significant. [23]

## 4. Discussion

As per the authors knowledge no other systematic review was done to assess the prevalence of gestational diabetes, its risk factors and maternal and neonatal complications in Saudi Arabia. Gestational diabetes is defined as a glucose intolerance which is first identified during pregnancy and if gestation diabetes remains untreated there is an increased likelihood of both maternal complications and morbidities. [24], [25]

The result of the systematic review showed the prevalence of gestational diabetes was as low as 10.3% [23] and was high as 51% [15]. This disparity in the prevalence is possibly due to differences in the study design and methodology. The reported prevalence is higher than in Oman (4.2%) and in United Arab Emirates (24.9%). [26], [27]

The reported prevalence rate in other GCC countries was as low as 10.1% in Bahrain and 16.3% in Qatar. [28], [29]

The review found that the mean age of the women in Saudi Arabia with gestational diabetes was higher when compared to the previously reported studies involving Chinese and Indian Population and this could be because of the cultural variations which allows the women to become pregnant even at the older age. [30], [31], [32]

Another potential reason for increase in the prevalence of

gestational diabetes was higher body weight and higher BMI which is also supported by studies involving Caucasian and Asian populations. [33], [34]

This review also showed that the previous history of GDM is a risk factor for gestational diabetes which was less observed in other studies involving Persian, Indian and Caucasian populations but this could probably due to differences in the methodology, sample size, study settings and sampling strategy. [31], [35]

**Table 1.** Prevalence, Risk factors and Complications of Gestational Diabetes Mellitus (GDM) in Saudi Arabia.

Authors	Sample Size	Age of Women	Gestational age when tested for GDM	Risk factors for GDM	GDM Prevalence	Maternal and Neonatal Complications of GDM
Eman Mohammed Alfadhli et al, 2015 (15)	954	30.5 ± 6.1 years (16-49 years)	≥ 20 weeks	Older Maternal age, Weight, BMI and Blood Pressure.	51% (292/573)	Neonatal hypoglycemia and high birth weight (3043gms)
Khalid Al-Rubeaan et al, 2014 (16)	549	(33.26 ± 7.63 years (18-49 years)	Different trimesters	Previous history of GDM and Macrosomic Babies (> 4.5kg) and higher body mass index.	32.4% (178/549)	Not Stated
R. AlKhalifah et al, 2012 (17)	419 cases (GDM Mothers) and 347 controls	33.5 years	> 24 weeks	Not Stated	Not Applicable	Neonatal intensive care unit (NICU) admissions, long hospital stay and hypoglycemia.
AlRowaily MA et al, 2010 (18)	633	31.5 years (18-49 years)	Not Stated	Maternal age, Parity and History of abortion.	12.5% (79/633)	Not Stated
Malak M. Al-Hakeem, 2006 (19)	8000	32.9 ± 5.7 years	29.0 + 5.9 weeks	Not Stated	Not Stated but the Incidence was 8.6% (685/8000)	Mode of delivery (LSCS, Vento use/forceps) NICU admissions, polyhydramnios, oligohydramnios, IUGR and postdate pregnancy.
M. Salleh M. Ardawi et al, 2000 (20)	818	30. ± 5 years	24 – 28 weeks	Maternal age, Weight and parity.	12.5% (102/818)	Fetal macrosomia Hypoglycemia and Hyperbilirubinaemia..
El Mallah KO et al, 1997 (21)	972 cases (GDM Mothers) and 71 controls	27. ± 3.5 years	Not Stated	Not Stated	Not Stated but the Incidence was 9.8% (95/972)	Cesarean section Perineal lacerations Fetal macrosomia and Hypoglycemia.
Khawaja SS et al, 1989 (22)	455	28 ± 7.63 Years	Third trimester	Maternal age ≥ 30 years, Parity and Weight.	Not Stated but the Incidence was 11% (50/455)	Not Stated
AlShawaf T et al, 1988 (23)	1088	32.28	28 weeks	Maternal age, Parity and BMI.	10.3% (112/ 1088)	Not Stated

The review also showed a previous history of macrosomia increased the risk for gestational diabetes significantly among Saudi women which are also supported by studies in other ethnicities. [31], [36]

The review showed the mode of delivery was positively associated with NICU admission which other studies also indicate. [37], [38], [39]

The most important fetal complication in the review is the infants born to GDM mothers were more likely to experience hypoglycemia than the infants born to Non-GDM mothers which is also evident by other studies. [40], [41]

The another important fetal complications that the review found were fetal macrosomia and hyperbilirubinaemia, which is supported by the findings of the study done by Hod M, et al which proved that GDM is associated with increased risk

characterized by macrosomia hyperbilirubinaemia, respiratory distress syndrome. [42] The review also showed the higher mean birth weight of 3043 gms but which is less when compared to previously reported studies. [41], [43]

## 5. Conclusion

The prevalence of gestation diabetes is high among Saudi women and increased maternal age, higher body weight high BMI and previous history of GDM and macrosomia were the most important predisposing factors for gestational diabetes. The GDM mothers were more likely to deliver the baby by cesarean section and the infants born to GDM mothers were at higher risk of developing hypoglycemia and macrosomia.

There is a need for early detection of gestational diabetes in order to reduce the maternal and fetal complications. There is a need for more elaborate research on gestational diabetes covering all the geographical areas of Saudi Arabia to know the current trend and also for having a better understanding.

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