



A STUDY ON THE EFFECT OF PRE-PREGNANCY BMI ON THE PREVALANCE OF GESTATIONAL DIABETES MELLITUS

¹Mrs. MEENA KUMARI

¹HOD Department of Nutrition

²Mrs. UROOJA BIRJIS FATIMA

²Faculty, Department Of Nutrition

³HINA FATIMA

³Department of Nutrition

⁴NIDA SHAREEF

⁴Department of Nutrition

⁵SADIA FATIMA

⁵Department of Nutrition

⁶SAFA OMER AL JABRI

⁶Department of Nutrition

⁷ZEBA AFROZ

⁷Department of Nutrition

ABSTRACT

AIM:- The aim of this study is to know the effect of pre-pregnancy BMI on the prevalence of gestational diabetes mellitus.

OBJECTIVE:- To determine association between prevalence of gestational diabetes mellitus (GDM) in overweight and obese women.

METHODOLOGY:- A pooled study at individual – level was conducted & 50 women diagnosed with GDM were analysed as part of this study.

The pre tested questionnaire was framed consisted of 8 questions and included both open and closed ended questions. From this Questionnaire the anthropometric measurements, obstetric status, diet type of the women were taken. The BMI of the patients was calculated based on the information regarding pre-pregnancy BMI (maternal weight in kilograms/ height in meters²).

RESULTS:- From this review study we can conclude that pre-pregnancy BMI influences GDM. High rates of gestational diabetes mellitus were observed in women whose pre-pregnancy BMI was falling in category of overweight or obese.

INTRODUCTION

Gestational diabetes mellitus (GDM), is defined as glucose intolerance with onset or first recognition during the second or third trimester of pregnancy. [1] The prevalence of GDM varies in different populations or ethnic groups. In the USA, ~7% (ranging from 1 to 14%) of all pregnancies are complicated by GDM (American Diabetes Association, 2004). Native American, Asian, Hispanic and African-American women are at higher risk for GDM than non-Hispanic white women [2] GDM increases risk of adverse pregnancy outcomes and has substantial long-term adverse health impacts on both mothers and their offspring, including a predisposition to obesity, metabolic syndrome and type 2 diabetes mellitus (T2DM) in later life. [3] Weight gain during pregnancy consists of 30% maternal fat accretion, [4] with the second half of a normal pregnancy characterized by progressive insulin resistance.[5] The composition of weight gain also varies by trimester[6,7]: maternal weight gain early in pregnancy is disproportionately fat and could influence subsequent maternal insulin resistance.[6]

In 2009, the Institute of Medicine (IOM) released new recommendations for gestational weight gain, including specific recommendations for rate of weight gain by pre-pregnancy body mass index (BMI) (weight in kilograms divided by height in meters squared).[8]

RISK FACTORS OF GDM

1. AGE

Older maternal age and non-Australian birth increased a woman's risk of developing GDM and this increase was most evident among Asian women. As GDM is associated with adverse maternal and infant outcomes, it is important to explore ways of preventing GDM, and to put in place strategies to effectively manage GDM during pregnancy and to reduce the later risk of developing type 2 diabetes.[9]

2. GESTATIONAL WEIGHT GAIN

Greater gestational weight gain in early pregnancy, particularly during the first trimester, was associated with an increased risk of GDM. Exceeding the 2009 IOM recommendations for gestational weight gain was also associated with an increased risk of developing GDM. the risk of GDM increased with increasing rates of gestational weight gain. Compared with the lowest tertile of rate of gestational weight gain (less than 0.27 kg/week [less than 0.60 lb/wk]), a rate of weight gain from 0.27–0.40 kg/wk (0.60–0.88 lb/wk) and 0.41 kg/wk (0.89 lb/wk) or more, were associated with increased risks of GDM (odds ratio 1.43, 95% confidence interval 0.96–2.14; and odds ratio 1.74, 95% confidence interval 1.16–2.60, respectively). The association between the rate of gestational weight gain and GDM was primarily attributed to increased weight gain in the first trimester. The association was stronger in overweight or obese and nonwhite women. Rapid gestational weight gain in early pregnancy may result in an early increase in insulin resistance that leads to the “exhaustion” of the B cell. This could reduce the capacity of the B cells to secrete adequate levels of insulin to compensate for the insulin resistance induced by the progression of pregnancy and therefore lead to the development of GDM.[10]

3. FAMILY HISTORY

Several studies have examined association between genetic variants and the risk of gestational diabetes mellitus (GDM).Over the past few decades, genetic loci in several genes, responsible for insulin secretion, insulin resistance, lipid and glucose metabolism and other pathways, have been associated with GDM risk.[2]

4. PRE PREGNANCY BMI

The risk of GDM is higher among women who are obese, and the recent dramatic increase in obesity prevalence in the U.S. mirrors a worrisome rise in the prevalence of GDM . Future individual health and societal medical costs could be substantial as obesity and GDM not only increase the risk of adverse pregnancy and infant outcomes, but also are associated with a higher risk of developing type 2 diabetes later in life in both the mother and child.[11] Numerous studies in the U.S. and elsewhere have reported an increased risk of gestational diabetes mellitus (GDM) among women who are overweight or obese compared with lean or normal-weight women. Despite the number and overall consistency of studies reporting a higher risk of GDM with increasing weight or BMI.[11] Compared with women with a normal BMI, the unadjusted pooled odds ratio (OR) of an underweight woman developing GDM was 0.75 (95% confidence interval [CI] 0.69 to 0.82). The OR for overweight, moderately obese and morbidly obese women were 1.97 (95% CI 1.77 to 2.19), 3.01 (95% CI 2.34 to 3.87) and 5.55 (95% CI 4.27 to 7.21) respectively. For every 1 kg⁻² increase in BMI, the prevalence of GDM increased by 0.92% (95% CI 0.73 to 1.10). The risk of GDM is positively associated with pre-pregnancy BMI. This information is important when counseling women planning a pregnancy.[12] The risk of GDM is higher

among women who are obese, and the recent dramatic increase in obesity prevalence in the U.S. mirrors a worrisome rise in the prevalence of GDM . Future individual health and societal medical costs could be substantial as obesity and GDM not only increase the risk of adverse pregnancy and infant outcomes, but also are associated with a higher risk of developing type 2 diabetes later in life in both the mother and child [11].

COMPLICATIONS

Large-for-gestational age prevalence was 5.7% among normal-weight women with adequate gestational weight gain and no GDM and 12.6%, 13.5% and 17.3% among women with BMIs of 25 or higher, excess gestational weight gain, and GDM, respectively. Overweight and obesity, excessive gestational weight gain, and GDM all are associated with LGA; however, preventing excessive gestational weight gain has the greatest potential to reduce LGA risk.[13] Large for gestational age (LGA) describes a neonate who, at birth, weighs at or above the 90th percentile for his or her gestational age. In the United States, approximately 9% of neonates are born LGA annually.[14]For the mother, delivering an LGA neonate increases the risk of prolonged labor, cesarean delivery, shoulder dystocia, and birth trauma. An LGA neonate is more likely to have fetal hypoxia and intrauterine death and to develop diabetes, obesity, metabolic syndrome, asthma, and cancer later in life.[15]

METHODOLOGY

DESCRIPTION

A pooled study at individual – level was conducted & 50 women diagnosed with GDM were analysed as part of this study.

PARTICIPANTS

The study was taken up by 5 students pursuing Post graduate diploma and each one followed 10 diagnosed cases of GDM from one of the reputed Maternity hospitals of Hyderabad. Overall 50 subjects were studied & analyzed.

METHOD

A questionnaire was designed to know the effect of Pre-pregnancy BMI on gestational diabetes mellitus. The questionnaire was framed Consisted of 8 questions and included both open and closed ended questions. From this Questionnaire the anthropometric measurements, obstetric status, diet type of the women were taken.

The BMI of the patients was calculated based on the information obtained from Pre-pregnancy BMI (maternal weight in kilograms/ height in meters²) were calculated using height and pre-pregnancy weight information recorded. Women were classified as underweight (BMI less than 18.5), normal weight (BMI 18.5–24.9), overweight (BMI 25.0–29.9), class I obese (BMI 30.0–34.9), class II obese (BMI 35–39.9), or class III obese (BMI 40.0 or greater). [11]

RESULTS AND DISCUSSION

The survey which was done on women with gestational diabetes, In this survey various factors were considered which includes;

1. AGE
2. PRE PREGNANCY BMI
3. OBSTETRIC STATUS
4. FAMILY HISTORY
5. PLBS &
6. TYPE OF DIET FOLLOWED

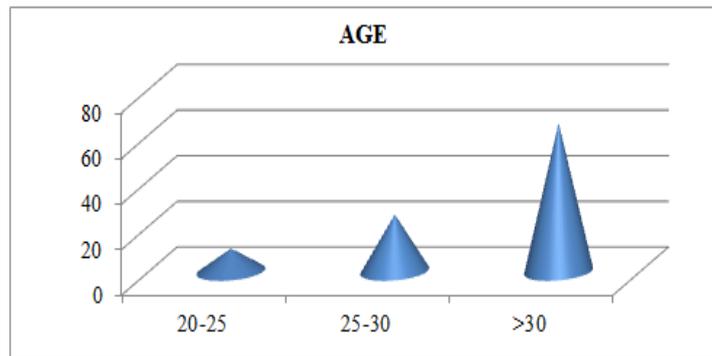
GENERAL CLASSIFICATION

AGE CLASSIFICATION

The age distribution of the patients is shown in table (I)

TABLE (I) AGE CLASSIFICATION

| AGE(years) | NUMBER (n=50) | PERCENTAGE (%) |
|------------|---------------|----------------|
| 20-25 | 5 | 10% |
| 25-30 | 13 | 26% |
| >30 | 32 | 64% |



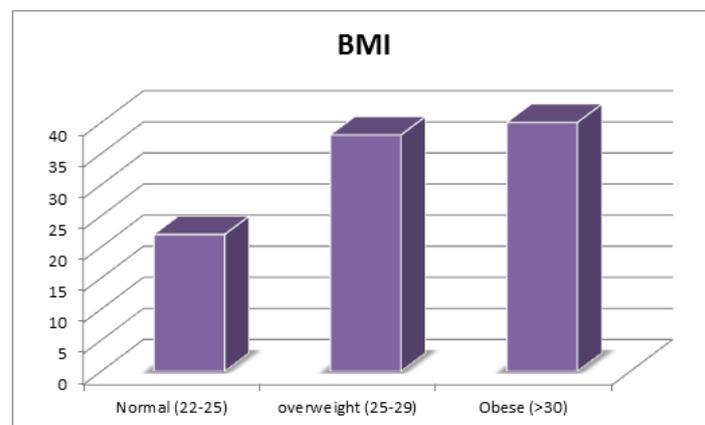
From the above diagram it is clear that most of the patients who were diagnosed with GDM are >30 years of age i.e., 64% & about 10% were between 20-25 years of age & 26% were 25-30 years of age. Older maternal age and non-Australian birth increased a woman's risk of developing GDM and this increase was most evident among Asian women. [9]

PRE PREGNANCY BMI PROFILE

The patients were classified as per BMI TABLE. (II) Shows the detail.

TABLE (II) PRE PREGNANCY BMI

| BMI | NUMBER (n=50) | PERCENTAGE(%) |
|------------|---------------|---------------|
| Normal | 11 | 22% |
| overweight | 19 | 38% |
| Obese | 20 | 40% |



Most of the pregnant women who were diagnosed with GDM had a pre pregnancy BMI more than the normal range. It was found that about 22% of the women fell under the category of normal BMI and 38% of them were overweight and 40% of the women were obese.

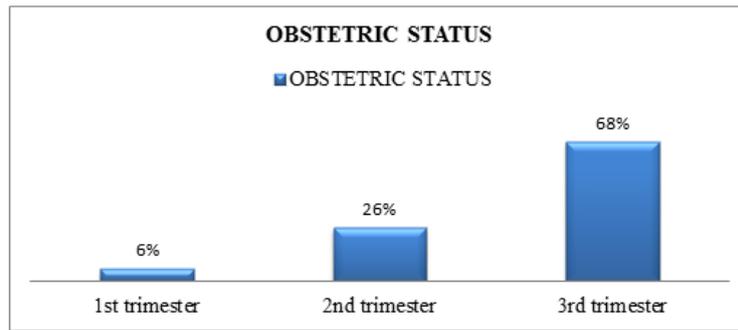
Numerous studies in the U.S. and elsewhere have reported an increased risk of gestational diabetes mellitus (GDM) among women who are overweight or obese compared with lean or normal-weight women. [11]

OBSTETRIC STATUS

The obstetric status of the patients was collected. The details are charter in following table.

TABLE (III) OBSTETRIC STATUS

| OBSTETRIC STATUS | NUMBER (n=50) | PERCENTAGE(%) |
|---------------------------|---------------|---------------|
| 1 st trimester | 3 | 6% |
| 2 nd trimester | 13 | 26% |
| 3 rd trimester | 34 | 68% |



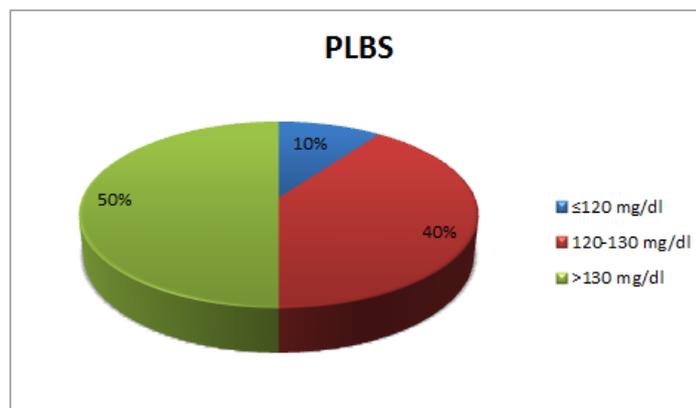
Above diagram illustrates that Most of the pregnant women who were diagnosed with GDM were in their third trimester of pregnancy. From the graph it is analyzed that only 6% of the women were in the first trimester and about 26% in their second trimester and 68% of the women were in there third trimester.

POST PRANDIAL BLOOD SUGARS (On admission)

The post prandial blood sugars of the patients were evaluated and interpreted. The details are charter in following table.

TABLE (IV) PRANDIAL BLOOD SUGARS

| Post Prandial blood sugars | Number (n=50) | Percentage |
|----------------------------|---------------|------------|
| PLBS <120mg/dl | 5 | 10% |
| PLBS 120-130mg/dl | 20 | 40 % |
| PLBS >120mg/dl | 25 | 50% |



During this survey, post lunch blood sugars of 50 GDM cases were checked which is concluded in the above diagram that illustrates that 25 women i.e, 50 % were under normal cut off of 120 mg/dl but 20 women i.e, 40 % were having plbs at higher range of 120-130 mg/dl & 5 women i.e, 10 % were having plbs >130mg/dl.

Stringent glycemic control could be achieved with postprandial monitoring.[16]

DIET HISTORY

The GDM patients were grouped under following type of diet pattern. Vegetarian / non-vegetarian. The following table shows the details of the same.

TABLE (V) DIET TYPE

| Types of Diet | Number (n=50) | Percentage |
|----------------|---------------|------------|
| Vegetarian | 13 | 26% |
| Non-vegetarian | 37 | 74% |



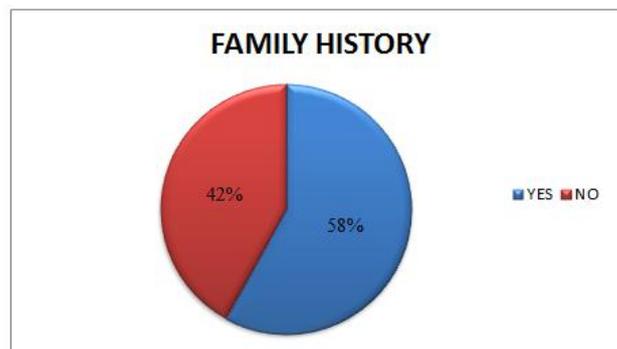
Above diagram illustrates that Most of the GDM patients were non vegetarian i.e., 74% & only about 26% women were vegetarians.

FAMILY HISTORY

The patients were assessed based on their family history of diabetes. The following table shows the details of the same.

TABLE (VI) FAMILY HISTORY

| Family history of diabetes | Number (n=50) | Percentage |
|----------------------------|---------------|------------|
| Yes | 29 | 58% |
| No | 21 | 42% |



Above diagram illustrates that Most of the GDM patients assessed were having a family history of diabetes i.e., 58 % & rest 42 % didn't had any family history.

Several studies have examined association between genetic variants and the risk of gestational diabetes mellitus (GDM). Over the past few decades, genetic loci in several genes, responsible for insulin secretion, insulin resistance, lipid and glucose metabolism and other pathways, have been associated with GDM risk. [2]

SUMMARY & CONCLUSION

It has been found in many studies that women who were falling under the category of overweight & obese before pregnancy were at the higher risk of GDM, in view of this statement the survey was carried out with 50 gestational diabetic women & their pre-pregnancy BMI data was collected & analyzed by using a pretested questionnaire method, which concluded that out of 50 women, 11 women started their pregnancy with normal BMI, 19 were overweight & 20 were obese. So 39 out of 50 GDM women had started their pregnancy with high BMI, hence The association between the pre-pregnancy BMI and GDM was primarily attributed to increased pre-pregnancy BMI.

REFERENCE ARTICLES

- Gestational diabetes mellitus. American Diabetes Association. Diabetes Care. 2000 Jan; 23 Suppl 1():S77-9.
- Genetic variants and the risk of gestational diabetes mellitus: a systematic review Cuilin Zhang Wei Bao Ying Rong Huixia Yang Katherine Bowers Edwina Yeung Michele Kiely (American Diabetes Association, 2004; Bellamy et al., 2009; Reece et al., 2009).

- Institute of Medicine, Subcommittee on Nutritional Status and Weight Gain during Pregnancy. Nutrition during pregnancy. Washington, DC: National Academy of Sciences; 1990.
- Gestational diabetes mellitus. Buchanan TA, Xiang AH. *J Clin Invest*. 2005;115:485–91
- New equations for estimating body fat mass in pregnancy from body density or total body water. van Raaij JM, Peek ME, Vermaat-Miedema SH, Schonk CM, Hautvast JG. *Am J Clin Nutr*. 1988;48:24–9.
- Clinical physiology in obstetrics. Hytten FE, Chamberlain G. Oxford, Boston: Blackwell Scientific Publications; 1980.
- Institute of Medicine (US) and National Research Council (US) Committee to Reexamine IOM Pregnancy Weight Guidelines, Rasmussen KM, Yaktine AL. 2009;
- Maternal age, ethnicity and gestational diabetes mellitus Mary Carolan, PhD (Associate Professor Midwifery) Correspondence information about the author PhD Mary Carolan, Mary-Ann Davey, DPH MEpi (Epidemiologist, Senior research fellow) , Mary Anne Biro, PhD, BA, RN, RM (Senior Lecturer and Midwifery Course Co-ordinator) , Michelle Kealy, PhD (Project Officer, Integrated Maternity Services, Honorary Associate, NHMRC Postdoctoral Researcher
- Gestational Weight Gain and Risk of Gestational Diabetes Mellitus Monique M. Hedderson, PhD, Erica P. Gunderson, PhD, and Assiamira Ferrara, MD, PhD.
- Maternal Obesity and Risk of Gestational Diabetes Mellitus Susan Y. Chu, PHD, MSPH¹, William M. Callaghan, MD, MPH¹, Shin Y. Kim, MPH¹, Christopher H. Schmid, PHD², Joseph Lau, MD², Lucinda J. England, MD, MSPH¹ and Patricia M. Dietz, DRPH¹
- Prepregnancy BMI and the risk of gestational diabetes: a systematic review of the literature with meta-analysis M. R. Torloni ,A. P. Betrán ,B. L. Horta ,M. U. Nakamura ,A. N. Atallah ,A. F. Moron, O. Valente.
- Association of Maternal Body Mass Index, Excessive Weight Gain, and Gestational Diabetes Mellitus With Large-for-Gestational-Age Births Shin Y. Kim, MPH, Andrea J. Sharma, PhD, MPH, William Sappenfield, MD, MPH, Hoyt G. Wilson, PhD, and Hamisu M. Salihu, MD, PhD
- Trends in birth weight and gestational length among singleton term births in the United States: 1990-2005. Donahue SM, Kleinman KP, Gillman MW, Oken E. *Obstet Gynecol*. 2010 Feb; 115(2 Pt 1):357-64.
- Prediction and prevention of the macrosomic fetus. Walsh JM, McAuliffe FM, *Eur J Obstet Gynecol Reprod Biol*. 2012 Jun; 162(2):125-30.
- Postprandial versus Preprandial Blood Glucose Monitoring in Women with Gestational Diabetes Mellitus Requiring Insulin Therapy
- Margarita de Veciana, M.D., Carol A. Major, M.D., Mark A. Morgan, M.D., Tamerou Asrat, M.D., Julianne S. Toohey, M.D., Jean M. Lien, M.D., and Arthur T. Evans, M.D.