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THE ASSOCIATION OF GESTATIONAL DIABETES MELLITUS (GDM) WITH PRE-PREGNANCY OBESITY OF WOMEN AT FAUJI FOUNDATION HOSPITAL RAWALPINDI

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ABSTRACT

Gestational diabetes mellitus (GDM) is a global condition where pregnant women experience high blood sugar levels. It poses risks to both maternal and fetal health. Identifying modifiable risk factors, such as pre pregnancy obesity, is crucial in managing GDM and its complications. It is important to determine the modifiable risk factors associated with GDM. Pre Pregnancy Obesity, a well-established risk factor for various pregnancy complications, has been suggested to be closely linked with the development of GDM. Objective of this study was to determine the association of GDM with pre pregnancy obesity of women. This cross-sectional study was conducted at Fauji Foundation Hospital Rawalpindi from March, 2023 to June, 2023. 100 pregnant women, aged 19-39 years with gestational age more than 20 weeks were included. Fifty women with GDM were taken in group A while 50 non-GDM women in group B. OGTT (oral glucose tolerance test) were used to diagnose the GDM. Data was collected by using a self-designed questionnaire including anthropometric measurements. Data was analyzed through an appropriate study design. In GDM group BMI ranges from 21.1 to 41.3. Obese were 38%, overweight found 46% while within normal BMI were about 16%. While in Non GDM group the BMI values range from 18.1 to 30.6, in which majority 56%falls in normal BMI, 26% falls in overweight, 14% were in obese category while 4% were found in underweight prepregnancy BMI. Study findings also revealed a statistically significant association (P≤0.05) between pre pregnancy obesity and GDM. Women with higher pre-pregnancy BMI were at a heightened risk of developing GDM.

Keywords: *Gestational Diabetes Mellitus, Pre Pregnancy Obesity, Risk Factors.*

INTRODUCTION

The World Health Organization (WHO) initially characterized Gestational Diabetes Mellitus (GDM) in 1965 as "diabetic-level hyperglycemia occurring during gestation period." Historically, this definition encompassed all forms of maternal hyperglycemia, including pre-existing diabetes and hyperglycemia first identified during pregnancy. In 1979, the National Diabetes Data Group (NDDG) refined this definition to "glucose intolerance with onset or recognition during pregnancy." This definition underwent further revision in 1985 at the Second International Workshop-Conference on

Gestational Diabetes, describing GDM as "variable-severity hyperglycemia resulting from carbohydrate intolerance, first recognized or onset during pregnancy." This definition remained the standard until recent updates (Sweety et al., 2022).
Gestational Diabetes Mellitus (GDM) emerges as a concern during pregnancy, typically in the second or third trimester, when varying levels of glucose intolerance become apparent. Revised American Diabetes Association (ADA) criteria for the diagnosis of diabetes now identify cases of previously unrecognized diabetes identified in the first or second trimester, apart from overt diabetes. This group includes 1.1% to 14.3% of pregnant women assays vary by maternal ethnicity and the clinical characteristics of the subjects evaluated and any diagnostic method used. A broader category, hyperglycemia in pregnancy, affects about 16.9% of pregnant individual's worldwide (Jahan et al., 2018).
Remarkably, data from the United States National Longitudinal Survey of Youth reveals that pregnant women are 3 to 4 times more likely to experience obesity within 5 years after childbirth compared to their non-pregnant counterparts. The vulnerabilities of young women to both short-term and long-term complications stemming from pregnancy-related obesity, diabetes mellitus, and hypertension are noteworthy (Khalid et al., 2015).
Pregnancy affected women in the United States have GDM in the range of 1-25% and GDM incidence in India is 5-6% and the increasing rate of GDM was 7.1%.1%. The rates of prevalence are not constant throughout the world and have differences depending on tribal associations, national, cultural, lineage backgrounds and location consistent with type 2 diabetes prevalence.The increasing rates of GDM may therefore vary for several reasons; population characteristics such as age and BMI, the screening or diagnostics procedures done to pregnant women, charge in testing methods, or variations in the definition of diagnosis of GDM (Wagan et al.,2021).
Background Accumulated weight gain throughout pregnancy has no prediction with the presence of gestational diabetes mellitus (GDM). Furthermore, only pre-pregnancy body mass index (BMI) appears as a risk factor for all four low birth weight subgroups of at-risk infants and adolescents: Gestational diabetes mellitus complicated by preeclampsia[17] Preterm delivery,[18][19][20](Gestational hypertension), [21](fetal macrosomia).
It is important to acknowledge that the prevention of GDM is a complex issue and requires a multifaceted approach. A holistic approach balanced healthy diet, regular walk or physical activity, and the healthy weight or normal body mass index are all dominant factors in preventing GDM. Before planning about to conceive or becoming pregnant and are overweight, the chances of getting GDM are more significant. By losing extra weight and increasing physical activity become pregnant. Taking these few steps can be beneficial how the body utilize the insulin and help the blood glucose levels stay within accepted range. Clinical, biochemical, social and environmental attributes could affect GDM prevention through behavioral and physiological trajectories (Lim, S et al., 2023).
Recent researches advocates for a paradigm shift, prioritizing the inclusion of complex, low-to-medium glycemic index carbohydrates and adequate fiber intake through targeted increases in fruit, vegetable, and whole grain consumption. Meta-analyses and comparative studies have consistently demonstrated the absence of a single superior diet or dietary protocol, highlighting the necessity for tailored nutrition interventions that accommodate individual patient needs and circumstance (Kapur.K et al., 2021).

REVIEW OF LITERATURE

A systematic literature search was conducted by Al-Rifia et al (2000-2019) identified eligible studies reporting GDM prevalence in the MENA region. Random-effects meta-analysis was employed to pool study estimates and derives weighted prevalence rates at regional, sub regional and national levels. The review encompassed 102 research articles, comprising 279,202 pregnant women screened for GDM across 16 MENA countries. Iran and Saudi Arabia contributed 36.3% and 21.6% of the included studies, respectively. Meta-regression analysis was performed to explore sources of heterogeneity, while the National Heart, Lung, and Blood Institute's tool evaluated the risk of bias in included studies.

As the research landscape evolves, investigations into the mechanisms underlying the association between GDM and Pre-Pregnancy Obesity are essential. With Fauji Foundation Hospital Rawalpindi as the study setting, this research seeks to contribute to the incremental growth of scientific understandings by examining the specific dynamics of this association within a distinct healthcare context.

By elucidating the relationship between GDM and Pre-Pregnancy Obesity, this study endeavors to inform clinical practices and preventive strategies for improved maternal and fetal outcomes. Non communicable chronic diseases pose a significant global health burden, necessitating urgent attention. As chronic diseases are huge burden on healthcare system in developing countries, diabetes mellitus has a significant contribution in this regard. Diabetes is the most crucial metabolic disorder, which is usually asymptomatic in early stage that damages the body organs while elevating the blood sugar levels. The studies included in this literature are taken from all around the world including Pakistan. Research designs of most of the studies are cross-sectional in nature.

Gestational Weight Gain

Pre Pregnancy Obesity has implications beyond just maternal health; it affects fetal outcomes as well. A study by Chu et al. Adverse perianal outcome in offspring of obese mothers with GDM (2018) The association between pre-pregnancy obesity and Gestational Diabetes Mellitus (GDM) is well documented based on empirical data from multiple studies. Catalano et al. A groundbreaking study by Yessoufou (2015) showed that pre-pregnancy BMI was significantly positively associated with the risk of GDM; in particular, individuals who were obese had an extremely increased risk.

Taken together, these results indicate that it is important to recruit pregnant women with Pre Pregnancy Obesity as the target intervention group during pregnancy in order to reduce GDM. Although previous studies have provided some insights into this problem but received controversial conclusions and so it prompts us toward more carefully designed trials on exploring possible causal relations which can further be used for clinical focus while designing full fledged interventions.

Types of Obesity

General Obesity

Peripheral, or general obesity, which is also termed simple obesity, is a phenomenon that concerns society in general. Generalized obesity, also described as pathological or android obesity, does not have a regional preference and tends is a uniform deposition and distribution of excess adipose tissue. As for the assessment of this condition, there is the Body Mass Index (BMI), an easily replicable validated anthropometric measurement. In quantitative terms, BMI is the weight in kg divided by the square of the height in meters (kg/m^2), meaning this is a dimensionless index widely used for comparison across different populations (World Health Organization, 2021). This definition brings out the largely general aspect of obesity more so in the sense that it does not always differentiate between male and female, young and old or black and white. However, it is useful in that regard as it recreates an objective benchmark for overweight people, those whose total body mass is higher than should be expected from their height. General obesity can have far-reaching implications Obesity is a multifaceted risk factor for various chronic diseases, conferring an increased susceptibility to: It positively correlates with cardiovascular morbidity such as coronary artery disease and heart failure, metabolic disorders including insulin resistance and type 2 diabetes, neoplastic diseases including colorectal, breast and endometrial cancers, and musculoskeletal disorders including osteoarthritis, degenerative disc disease and other joint conditions (Suara, Slyne, Morris, & Parise, 2020).

Abdominal Obesity

Abdominal obesity or visceral obesity tends to manifest an absolutely different and potentially deleterious pattern of fat deposition characterized by an augmented adipose tissue mass in the abdominal cavity. The mentioned form of obesity is quite peculiar thanks to the rather strong link with increased risks of multiple health issues, such as metabolic syndrome, insulin resistance, and different cardiovascular disorders. While assessing the abdominal obesity, the three central obesity

measurements using waist girth has been embraced widely as a relevant tool (Cameron et al., 2014). Central or abdominal obesity more specifically known as visceral obesity is however a different ball game in terms of health risk because of the link with metabolic complications and cardiovascular diseases. WC is one of the simplest and most effective tools for diagnosing and managing this form of obesity. Understanding the dangers associated with the storage of abdominal fat and its effects on health intensifies the need for early identifying of the potential risks , assessment of the impacts of obesity and implementing early interventions aimed at minimizing the detrimental effects of bad health implications that are likely to occur in future (Cameron et al., 2014).

Pre-Pregnancy Obesity

Pre-Pregnancy Obesity is one particular sub-topos of Obesity, that is targeted at women within child-bearing age, who start pregnancy with a BMI of 30 and over. This unique type of obesity is of great interest because its manifestation influences the condition of pregnant partners and offspring greatly. In 2013, the American College of Obstetricians and Gynecologists (ACOG) acknowledges Pre Pregnancy Obesity as a factor affecting pregnancy. On a final note, women in this BMI range are at a higher risk of complications throughout pregnancy (ACOG, 2013). Lastly and consequently, Pre Pregnancy Obesity can be perceived as a specific type of obesity that has specific consequences for the Overall Health of pregnant counterpart and their unborn child during a gestational period. By recognising this category as proposed by the American College of Obstetricians and Gynecologists in 2013, there is the need to embrace proactive care strategies among women in the category due to the risks associated with it. With proper observance and optimal strategies, healthcare personnel should try their best to improve the pregnancy outcomes and reduce the adverse events that occurring in pregnancy to increase the maternal and fetal wellbeing (Mistry et al., 2021).

Epidemiology of Pre Pregnancy Obesity

The current global trend over the past few decades, suggests a gradually increasing rate of Pre Pregnancy Obesity. Such a trend remains prevalent in completely different populations without limiting itself to one country and at varying levels of economic development. For example, in United States for example where trend initiators are usually sourced; about a quarter of expectant mothers today are categorized as obese (Poston et al., 2016). Therefore, global increase in Pre Pregnancy Obesity is alarming and appreciated across the regions and economic status. The statistics as the problem of obesity expands from developed countries including United States to the low- and middle-income countries assert the importance of this problem. Analyzing and covering the aspects of the main concerns associated with pre gestational obesity, health care personnel and researchers can contribute to the protection of the current as well as future pregnant woman and future offspring.

The Impact of Pregnancy on Obesity

The subject review demonstrates that excessive gestational weight gains have adverse pregnancy complications to the mother and newborn such as hypertensive disorders, fetal macrosomia and increased cesarean section rate. ACOG recommends that advice about GWG should be personalized depending on a woman's BMI before pregnancy. It is not, however, a local restricted phenomenon; this intricate interplay impacts the world at large. Global obesity prevalence is rising for women of child bearing age mirroring the global obesity epidemic for all age groups. The effects are enormous, assuming the health of mothers and the generation of the future. The concepts identified for the target Pre Pregnancy Obesity - 'Gestational Diabetes Mellitus; 'Pre Eclampsia' ; 'CS Delivery' are all established in literature and are adverse pregnancy outcomes. These complications do not only have short term risks for the mother and the baby, yet predict future health problems for both (McDowell et al., 2019).

GDM on the Global Stage

The disease of gestational diabetes mellitus (GDM) is a global problem that does not have any restrictions by states or countries, endangering the health of pregnant individuals by worsening the levels of blood glucose. It is shown that GDM has potential consequences of affecting the health of women during their pregnancy and their fetuses. In

a developing country like Pakistan where the health system and its challenges are different for maternal and child care, the impact on both mother and child due to GDM is of much more importance (Riaz et al., 2019).The complications that occur due to the high blood sugar level for a longer duration affect all the organs and cause dysfunction to organs. These include the eyes, kidneys, nervous system, heart, and blood vessels through the research studies by Law and Zhang, (2017). Thus we see that the management of GDM is not just considering the welfare of mother but is in fact an issue of primary health concern in both mother and child.

The Pivotal Trimesters and Beyond

Another absolute type of diabetes is GDM which is diagnosed at the second or third trimester of pregnancy and has different symptoms and risk factors than type 1 or type 2 diabetes (Association, 2014). Like most other forms of diabetes, the development if GDM is precipitated by peripheral insulin resistance, which results in high blood sugar levels. The development of insulin resistance in GDM is influenced by various factors, including: hormonal changes:, estrogens and progesterone, increased secretion of human placental lactogen and cortisol causes increased insulin resistance. Beta-cell dysfunction, reduced insulin secretion and beta-cell dysfunction aggravate hyperglycemic condition.

The Persistence of GDM

The key feature of the GDM is the persistent demonstration of glucose intolerance that leads to adverse maternal-fetal consequences. Gestational Diabetes mellitus also known as a condition that arises due to inadequate levels of secretion of insulin by the pancreatic beta cells to adequately address the body needs. Data shows that the β-cell dysfunction in GDM is associated with factors similar to those occurring in the general background of hyperglycemia, including autoimmune, monogenic, and insulin resistance factors (Buchanan et al., 2017). Therefore, it is clear that pathogenesis of GDM is very complex ranging from β-cell dysfunction to insulin resistance and pre gestational obesity. It seems that GDM is not only a childbirth phenomenon, hence there is a need for preventive-effacing lifespan approach that aligns perinatal treatment with continuous health enhancing and disease prevention for mothers and their babies (Bellamy et al., 2009). Gestational Diabetes Mellitus Diabetes occurring during pregnancy is referred to as gestational diabetes mellitus (GDM) – diabetes induced by inadequate activity of pancreatic β-cells to provide the necessary amount of insulin during pregnancy. Several scholarly studies suggest that abnormalities of β-cell function encountered in GDM are due to an abuse of processes underlying hyperglycemic state in general, including autoimmune factors, monogenic factors, and insulin resistance (Buchanan et al., 2007). Therefore, GDM may be viewed as a multifactorial disorder, characterized by impaired β-cell function and insulin sensitivity, as well as by Pre Pregnancy Obesity. GDM is not only relegated to gestation, but instead requires a life-cycle framework, wherein encompassing not only the immediate perinatal vulnerability of maladies of both the mother and child but also delayed health maladies source (Bellamy et al., 2009). Etiology and risk factors The complexity of history interacting with etiology of GDM includes first blood relations with diabetes, family history of diabetes, education, socio-demographic, geographic, pre pregnancy BMI, screening GDM and other mechanistic and epidemiological studies by Jhons et al., (2018). The cross sectional hospital observational research was shown in Tehran by Etminan et al. (2020) and they have determined that the prevalence of GDM is approx 11.5% and the factors involved are BMI, history of prior GDM and family history of diabetes. Kanwal and Bashir (2022) with a quantitative research design having a cross-sectional approach, conducted a research study at Department of Physiology, University of Health Sciences Lahore that helped in identifying the risk factors of GDM. Spanning from February 2019 to March 2020, this research aimed to elucidate associated GDM risk factors. The study sample comprised ninety pregnant women in their third trimester, equally divided into those diagnosed with gestational diabetes and those without. The investigators employed ELISA for serum vitamin B12 measurements and the glucose oxidase method for fasting blood glucose (FBG) analysis.

Hypothesis

H_1=There is association of GDM with pre pregnancy Obesity of pregnant women

H_0= There is no significant association of GDM with pre pregnancy Obesity of pregnant women

Rationale

There are not enough researches on this topic in Pakistan. This study has significant implication for public health by identifying the association of GDM with Pre-Pregnancy Obesity of women, which may contribute to improve pregnancy outcomes in a healthy way and play a notably role to delay the development or even prevention of DM type 2 by nutritional management.

Objective of the study

The objective of this study was:

1. To determine the association of Gestational Diabetes Mellitus (GDM) with Pre pregnancy obesity of women.

MATERIAL AND METHODS

A carefully planned study design was employed to analyze any possible links among pre pregnancy obesity and Gestational Diabetes Mellitus (GDM). This study allowed only a cross-sectional observational study design that hopefully provided a glimpse into the status quo for the perinatal counterparts attending the antenatal department at Fauji Foundation Hospital, Rawalpindi. This design enabled the evaluation GDM as well as pre pregnancy obesity in a single time point and therefore created the basis to investigate the relationship between these factors. The cross-sectional study design ensured that data on both GDM and pre pregnancy obesity could be obtained at the same time and differences, tendencies and association between these variables could be determined. In capturing the participants at different gestational stages it was possible to conduct a comprehensive exploratory study to establish the prevalence of GDM and Pre Pregnancy Obesity within this population in regard to the potential relationship between the two conditions. This is due to the fact that the sample size was required to ensure that the study has good levels of internal and external validity besides having good levels of statistical reliability. In case of the sample size, it was determined on the assumptions of 5% margin of error and 95% confidence level. Given the fact that both GDM and Pre Pregnancy Obesity are common especially in similar centres, we deemed that recruiting 100 pregnant women (both GDM positive and negative) to be sufficient for the study. This made an effort of instituting a large sample size that was deemed capable of providing the researchers with a mere snapshot of the population under study so that the possibility of a relationship between GDM and Pre Pregnancy Obesity at Fauji Foundation Hospital Rawalpindi could be determined. Hence, by employing a sufficiently large and appropriately calculated sample size, this study sought to add some useful understanding of these two significant maternal factors.

Case Study of In-Vivo Study Design with Oral Glucose Tolerance Test (OGTT):

In-vivo design based on OGTT included the evaluation of socio demographic and obstetrics characteristics of pregnant women attending the antenatal clinic at Fauji Foundation Hospital Rawalpindi. Patients had achieved consent and went through the process that involved ingestion of a glucose concentrated solution with a subsequent measurement of glucose in the blood stream at set time periods. This method offered an incredibly useful view of participants glucose response which is vitally important for investigation of GDM onset and its relation to Pre Pregnancy Obesity. By using OGTT within the in-vivo design, the researcher found out how pregnant women metabolize glucose under normal circumstances. This not only helped the identification of GDM but also allowed examination of any association between Pre gestation obesity and abnormal glucose metabolism. Due to the longitudinal nature of OGTT the ability to analyze responses of glucose concentration over the period of time brought additional valuable insights into the course of GDM (O'Malley et al., 2020).

Recruitments and Selection of Participants

The data acquisition process collection was initiated by including pregnant women attending antenatal clinic in Fauji Foundation Hospital Rawalpindi. To this end, a purposive sampling approach was adopted, whereby only participants who met the specified criteria and inclusion

characteristics were recruited to the study across the different stages of gestation and other demographics. They confirmed by volunteering to participate in the research for the objectives and method explained alongside the backward and prospects that we outlined before getting their consent, and as we assured them of their freedom to walk out at any one time as and when they preferred.

Oral Glucose Tolerance Test, often known as OGGT

The basic tool of the collecting of data is the OGTT (Oral Glucose Tolerance Test). This long-standing method that has enormous significance for screening for GDM is based on the following principle. For members of in-vivo study group, the Oral Glucose Tolerance Test (OGTT) was conducted as described earlier. The participants received a standardized 75g glucose concentrated solution after approximately twelve hours of fasting and samples were collected at specific time points (fasting, 1-hour and 2-hour). Such dynamic approach to data collection enabled not only monitoring of the patterns of glucose metabolism and detection of GDM candidates (O'Malley et al., 2020).

Questionnaire and Data Analysis

The questionnaire is used in a broad sense as many considerations that go into it are refined and fitted to capture different aspects of a research study. Structured self administered questionnaire was employed in this study which consists of the following sections: Demographic Data, Anthropometric Measurements, History of GDM and Family History of DM, Food Frequency Questionnaire (FFQ). Descriptive studies that employ data management and analysis to describe the study population characteristics. Mean and standard deviation, median, and mode were the basic statistical measures used in the study. The collected data had comprehensive deviations, frequencies, and percentages calculated in SPSS version 23.0 for the variables as the maternal age, BMI, fasting blood glucose results, and postprandial blood sugar results. Analytic statistical methodologies were used to investigate a relationship between GDM and Pre Pregnancy Obesity.

Data Analysis and Results

Descriptive statistical analysis of Sample

VARIABLE	MEAN	MEDIAN	STD DEV	MIN	MAX
AGE (Y)	31.58	30.50	6.02	21.00	39.00
HEIGHT (Inch)	5.25	5.30	0.26	4.80	5.70
WEIGHT(kg)	63.62	62.50	16.45	31.20	96.00
BMI(kg/m2)	26.03	25.75	5.00	18.10	41.30
OGTT(mm/dl)	9.96	9.70	1.16	8.80	13.2

Table 1: Descriptive statistical Analysis of Sample Population

In table 1, the descriptive statistics for the variables in the dataset are as follows. The mean age of the individuals is approximately 31.58 years, with a median age of 30.50 years. The standard deviation of age indicates a variability of about 6.02 years around the mean. The age ranges from a minimum of 21.00 years to a maximum of 39.00 years. Regarding height, the mean height is around 5.25 inches, with a median height of 5.30 inches. The standard deviation for height is approximately 0.26 inches, reflecting a relatively low variability in this measurement. Heights in the dataset range from a minimum of 4.80 inches to a maximum of 5.70 inches.

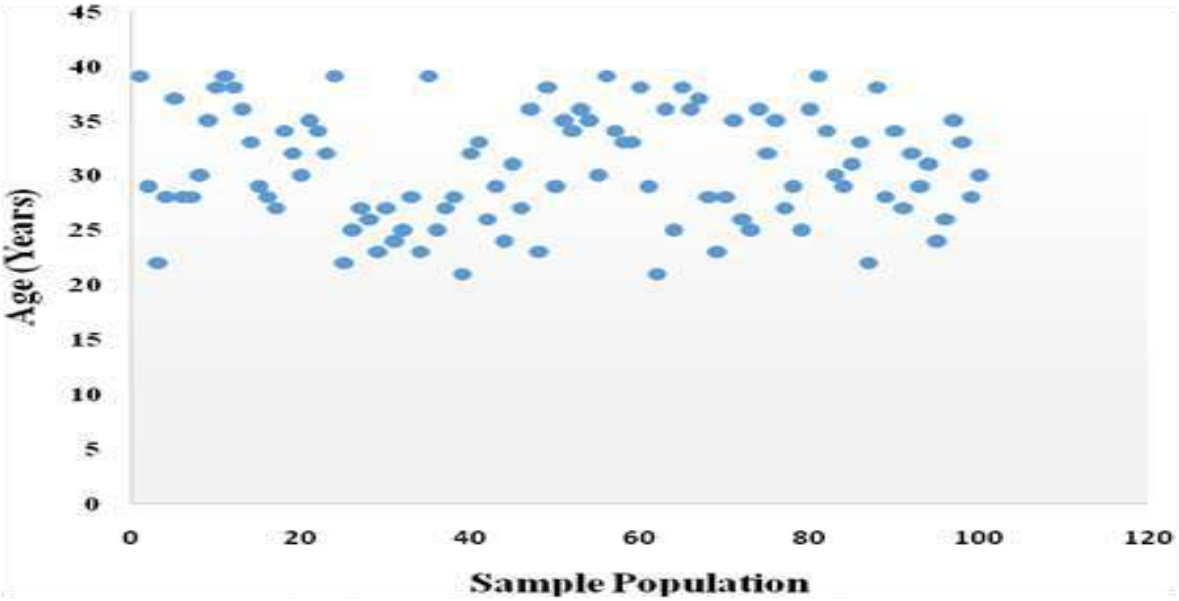
For weight, the mean weight is about 63.62 units, and the median weight is 62.50 units. The standard deviation of weight stands at 16.45 units, indicating a noticeable spread around the mean. Weights in the dataset vary between a minimum of 31.20 units and a maximum of 96.00 units. Lastly, the mean Body Mass Index (BMI) computed from the provided data is approximately 26.03. The median BMI is slightly lower at 25.75. The standard deviation for BMI is 5.00, pointing to a

moderate amount of variability in BMI values. The range of BMI in the dataset spans from a minimum of 18.10 to a maximum of 41.30.

The Oral Glucose Tolerance Test (OGTT) analysis the values from the dataset of 100 counterparts revealed several key descriptive statistics. The average OGTT value among the women was approximately 9.96, indicating the overall mean glucose tolerance level. The median value, at 9.70, aligns closely with the mean, demonstrating that the data is relatively symmetrically distributed. The standard deviation of 1.16 suggests a moderate degree of variability among the OGTT values, reflecting how individual measurements deviated from the mean. As it was described in the methodology section, the OGTT were at their lowest with 8.80 and highest with 13.2, further emphasizing the obvious variance of glucose tolerance in this data set.

Sample Distribution according to age:

Fig 1: Age Distribution of sample population



The paper analyzes a dataset including such attributes of 100 people. Regarding the age of these participants, We have participants aged 21years to 39 years. The age distribution of the data comes from a wide age bracket and most of the data set focus on the age group of 28-35. This distribution makes it possible to have a chance to look for the patterns and correlations with the age of the population in general. The wide ages range of the dataset gives an opportunity to investigate other factors with age and get more views on the further analysis.

Sample Distribution according to BMI:

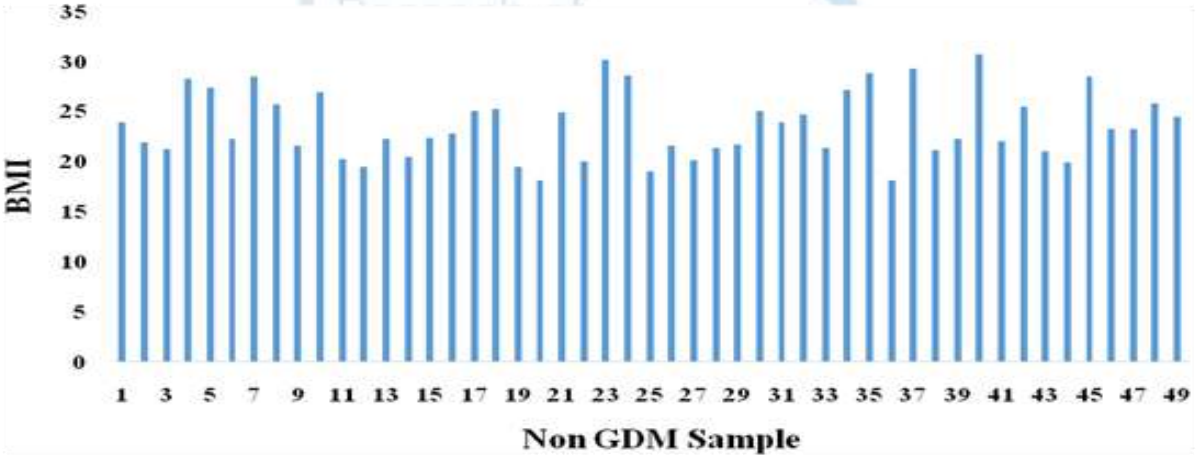
Fig 2: BMI Distribution of sample population



A general distribution table of the Body Mass Index (BMI) of the surveyed individuals is also presented and shows that the sample is heterogeneous. The sample includes people with the BMI scores between 21.1 and 41.3, the average being 28.4. As depicted from the numerous numbers of participants with BMI greater than 25mg/m2, more than two- third of the participants are overweight to obese. Such findings indicate a possible issue: the increase of weight in the population as a common phenomenon. However, it should be pointed out that the sample also consists of normal-weight people, but their prevalence is slightly lower than that of overweight and obese subjects.

Sample Distribution of Non-GDM Women BMI:

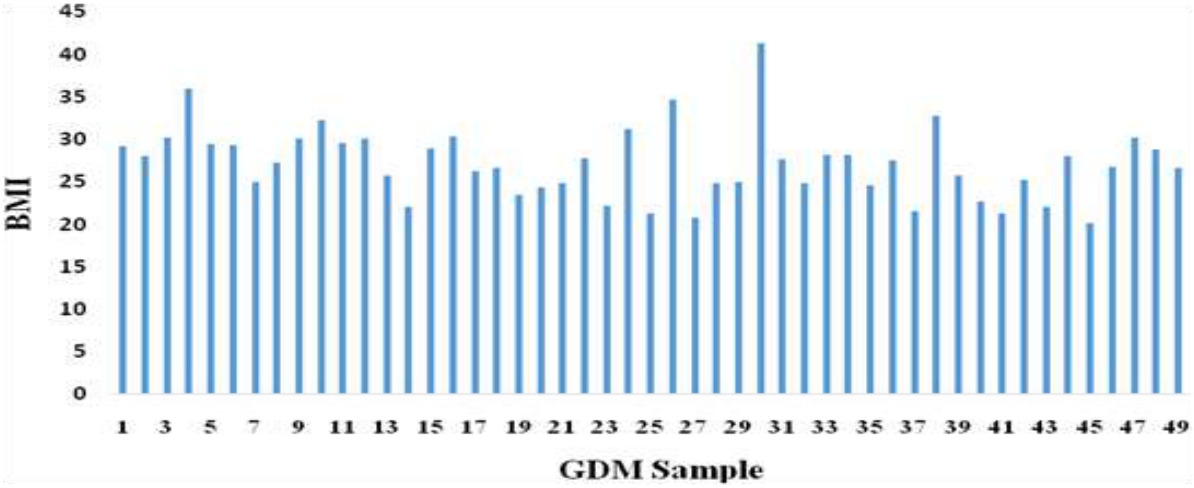
Fig 3: Non-GDM & BMI Distribution of sample population



When it comes to the analysis of BMI values in this study sample of Non-Gestational Diabetic women, Non-GDM, the authors observed the wide range of BMI Freight. The distribution presents the range of weight statuses for the Non-GDM women participants. These non-GDM women across the sample had a range of BMI of 18.1–30.6 with a mean of 24.7. This range is typical for the heterogeneity of weight status present among the subjects in the Non-GDM subgroup.

Sample Distribution of GDM Women BMI:

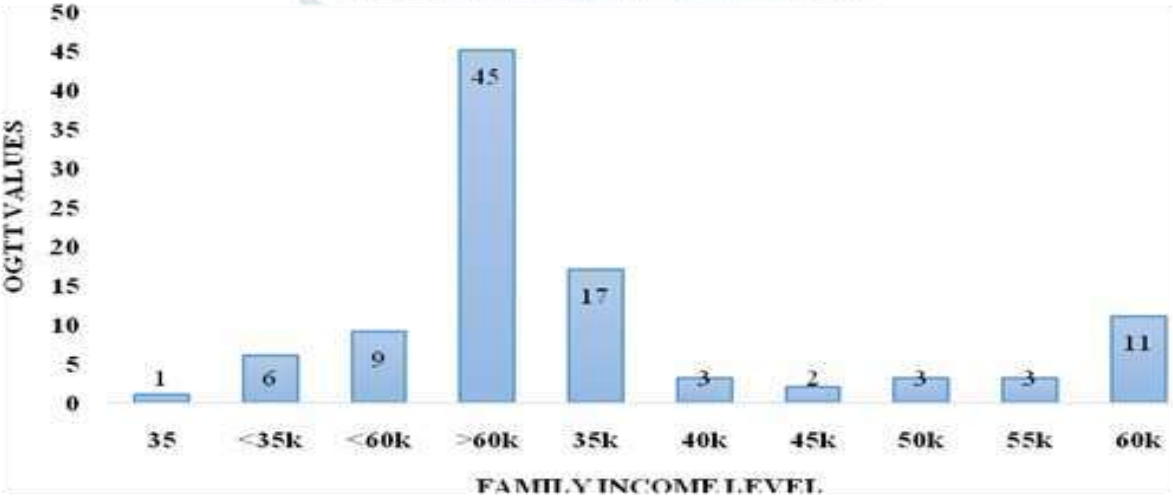
Fig 4: GDM BMI Distribution of sample population



Analyzing BMI rates within the GDM subgroup it was found out that they have a wide range with BMI constituting from 20.1 up to 41.3 marks and an average of 28.5 marks. The range of the BMI values presented above indicates rather large variability in body weights in GDM women in the sample, which may be due to the interdependency of the BMI and gestational diabetes. Such outcomes underscore the need for increased weight and metabolic control in women with GDM pregnancies. This begs the question of the quality of the relationship between BMI at first antenatal booking and GDM management with maternal and fetal health outcomes. This could be very informative if an endeavor is made to optimize the care of the GDM women and their infants.

OGTT and Family Social Status

Fig 5: OGTT and Family Social Status



In order to study the relationship between the income level and OGTT outcomes, for the present study, various parameters including number of subject=100 was considered with different characteristics like age, height, weight, education level, employment status, parity, history of diabetes, and OGTT results. Among these factors, we selected the investigating of the correlation

between the income levels and OGTT results. The dataset revealed a diverse range of income levels, with the majority falling into the ">60k" category (urban: 60k and rural: >60k). Other income groups were '35k+' Both Urban and Rural, '50k+' Both Urban and Rural, '40k+' Both Urban and Rural and '<35k' Both Urban and Rural. The OGTT values differed these income level, ranging from 8.8 - 13.2. Closely, the complete dataset was inclusive of the OGTT values and related income levels of all the participants.

Discussion

OGTT level association with Weight:

In this segment of our dataset, we have paired the participants' weights with the corresponding findings of the Oral Glucose Tolerance Test (OGTT). The results are instrumental in determining the presence or absence of Gestational Diabetes Mellitus (GDM) among the pregnant counterparts at Fauji Foundation Hospital Rawalpindi. The majority of our study participants, as indicated by the paired weight and OGTT results found negative association between non GDM and their BMI because most of non GDM women were having average BMI of 24.7, so these fall under the category of "Non GDM." These individuals exhibit glucose tolerance within the expected range for pregnant women, reassuringly indicating the absence of GDM. This group represents the vast majority of our participants, reaffirming the importance of understanding factors that contribute to healthy pregnancies.

Association between BMI and GDM, Non-GDM Women of Sample Population:

The research findings provide valuable insights into the association among Body Mass Index (BMI) and the presence of Gestational Diabetes Mellitus (GDM) among the surveyed women. The results showed a substantial difference of BMI distributions in counterparts with recorded GDM and those with no GDM. As for Non-GDM women the average BMI was about 24.7, thus revealing quite stable BMI distribution with moderate SD. The understanding of relationship of BMI and GDM could be advanced by including aspects like gestational weight gain and glycemic control as a means of determining the contribution to gestational diabetes risk. It might help in designing intervention and prenatal care measures to reduce the risks posed by GDM to such women especially those with higher than normal BMI scores improving the maternal and fetal health. The results explained the non-linear association between BMI and GDM, in relation to the surveyed women. Overall, therefore this study has filled the gap in the existing literature by documenting the relationship between BMI and the development of GDM among women. The results of the work support the necessity of focusing on maternal weight status during antenatal care, especially among women with increased body mass indexes.

Correlation Analysis of Parameters in the Research:

In the current study, the anthropometric and clinical measurements of 100 women were compared against each other and with their actual scores on an instrument to determine the nature of the associations and correlation coefficients between different parameters regarding maternal health, socioeconomic status, and medical history. Attributes like age, height, weight, BMI, education level, occupation, family income, place of residence, gravidity, gestational age, diabetes history, and the OGTT results have been used in constructing the dataset.

Maternal Age, BMI, and OGTT Values:

A positive relationship ($P \leq 0.04$) was established between the age of the mother and the BMI level, so the BMI rises as the age. This could suggest more lifespan declines metabolic or somatic composition alterations. Surprisingly, no relationship was established between maternal age and OGTT values. This consequently suggests that the maternal age might not affect the glucose tolerance in the together sampled population.

Educational Background and Occupation:

The female respondents had higher education, and the participants' jobs reflected the level of education they had achieved. According to the survey, many people with post graduate degrees worked for the government or in private sector. This trend reflects the importance of educational attainment in influencing career choices.

Income Level and Place of Residence:
A clear correlation (P≤0.05) emerged between family income levels and the place of residence. Women with higher family incomes predominantly resided in urban areas, while those with lower incomes were more likely to live in rural settings. This association underscores the socioeconomic disparities between rural and urban populations.

Diabetes History and OGTT Values:
Women with a history of diabetes in their family, particularly from their mothers, exhibited higher OGTT values. This highlights the potential hereditary influence on glucose tolerance. However, the correlation (P≤0.05) between gestational diabetes history and OGTT values suggesting that factors beyond family history could also contribute to glucose tolerance levels during pregnancy.

Gestational Age and OGTT Values:
A noteworthy correlation (P≤0.05) was observed between gestational age and OGTT values. As gestational age increased, there was a tendency for OGTT values to rise as well. Such a trend may suggest small changes in glucose tolerance throughout pregnancy, which becomes important as pregnancy advances.

Parity and OGTT Values:
Therefore, there was no correlation between gravidity (parity) and OGTT values as follows; This implies that perhaps, the ability to measure maternal experiences in pregnancies might not be effective in determining glucose tolerance. The correlations indicated in this study also highlighted the complex system of interconnections associated with different aspects of maternal health and glucose tolerance. Some were foreseeably related, for example the link between past history of diabetes and OGTT results; others were quite enlightening on the subject interactions. In the forthcoming discussion section, we proceed towards eagerly and ceaselessly undertaking a scholarly analysis of the ramifications and importance of the discovery made during the course of investigating the relationship between Gestational Diabetes Mellitus (GDM) and Pre Pregnancy Obesity in pregnant women in Fauji Foundation Hospital Rawalpindi. This section can be considered as a turning point in our research process since it allows exploring diverse layers of our project. These observations pale a cord when compared to the research conducted at a global level; Kim et al which in fact supports the frequency of abnormally high BMI in gestational diabetes. Their study performed on various populations reasserts that high BMI among the maternal lineage increases the risk of gestational diabetes. The global patterns are consistent with the current study finding of higher BMI in GDM women and drives home the point that the relationship holds across all the regions globally. The discussion proceeds by locating our study alongside maternal well-being, gestational diabetes mellitus, and the urgent problem of Pre Pregnancy Obesity. Explicit linkages can be made from the results we obtain with regards to previously established knowledge, thus helping the assessment of the originality and usefulness of further research to the field. In essence, this discussion section is not simply a restatement of our results; it is a virtual flyover through the soul of our research and its application, expanding upon the exploration of the importance of our study. It is our aim to help to see the way ahead where our data may help to make a difference in clinical practice, epidemiology and research in the areas pertinent to Pre Pregnancy Obesity and Gestational Diabetes Mellitus to enhance quality of life of pregnant women who continue to face multiple substantial challenges. So before pregnancy obesity is not a simple process which develops independently but rather it is a condition that emerges as interstructure interwoven genetic, metabolic, and environmental factors. Still, within this multifactorial approach, we identify the roots of a pressing health issue. Pregnancy overweight may trigger a series of metabolic conditions. This poses awareness of insulin resistance, a dysfunction in glucose homeostasis, and inflammation marked differently—each acknowledged to be risk factors for GDM. These mechanistic pathways are, as we described in this study, gloriously confirmed by this study. They afford an identifiable index of the obstetrics and complications that Pre Pregnancy Obesity brings during pregnanct. Not only does this research highlight the need for early and specialised interventional strategies, but it also supports the expansive knowledge of the role of

Pre Pregnancy Obesity in the advancement of GDM.

Implications of this study

Clinical Implications

These results have important clinical implications. OB/GYN and endocrinology practitioners should consider Pre Pregnancy Obesity as a lust influential factor GDM. This calls for change in antenatal care where more focus will be placed on screening, teach and discuss, and manage counterpart(s) of pregnancy who are overweight. This implies that there is need for timed intervention and management of Pre Pregnancy Obesity, weight management programs, nutritional consult and close follow up of glucose levels in order to prevent Development of Gestational Diabetes Mellitus and complications.

Public Health Implications

Consequently, the findings of this study are significant in terms of community health perspective. It also highlights the importance of multicomponent interventions which include the knowledge of healthy living activities within women who are of child bearing age group. As programmes focused on obesity, food intake, exercise and learning significantly decrease the occurrence of obesity, they can also significantly decrease the chances of GDM. These public health initiations have the ability to provide significant returns on the health of these matrilines and their offspring.

Limitations and Future Directions

Although the present analysis helps additively to our knowledge concerning the connection between GDM and Pre Pregnancy Obesity, it imperative to state the limitations of the study. Some of them may include; relative small sample, mode of data collection, or exclusion of some factors that could influence the result in the analysis. Further research in this study should endeavor to overcome these aforementioned limitations.

Future studies could include large sample size and more diverse populations to enhance the generalizability of the findings. Additionally, investigating the hidden dynamics of the association among Pre Pregnancy Obesity and GDM at a molecular and cellular level could provide deeper insights into preventive and therapeutic interventions.

Conclusions

The research establishes a clear and notable association between maternal pre pregnancy obesity and the incidence of Gestational Diabetes Mellitus (GDM) among pregnant sample population undergoing care at Fauji Foundation Hospital Rawalpindi. Early detection and proper treatment of GDM are essential due to the detrimental long- and short-term effects on women and their children, particularly in Asian populations and low- and middle-income nations. Research on identifying GDM predicting factors in these populations is warranted.

Mounting pre-pregnancy body mass index (BMI) is directly linked to a greater risk of developing GDM during gestation, underscoring Pre Pregnancy Obesity as key risk precursors for this condition. Targeted healthcare approaches should prioritize early screening, vigilant monitoring, and tailored interventions for pregnant women with elevated BMIs to effectively manage and mitigate the risk of GDM. Preconception care gains critical importance in addressing Pre Pregnancy Obesity, as proactive weight management before pregnancy emerges as a crucial strategy to diminish the likelihood of GDM and amplify overall matrilineal and fetal health consequences.

Recommendations

1. Managing pre pregnancy obesity and GDM require several important measures by operating at multiple levels of endeavour.
2. Initial preconception health promotion campaigns should focus on issues such as ideal weight before conception and inform women of the effects that Pre Pregnancy Obesity has on GDM. Specific treatment to diets as well as exercise regimens as well as weight control strategies need to be designed for pregnant women of a higher body mass index.
3. Work with the registered dietitians for overall nutrition plan, full support for structured life style changes and initiating health awareness campaigns regarding effects of Pre Pregnancy Obesity.

To address these challenges: interdisciplinary cooperation is required among health care

providers; more extensive studies are needed to establish the mechanisms through which GDM affects the mother and infant; and follow-up programs have to be designed for both the mothers and infants that were affected by GDM.

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