Effect of Stress, Depression and Anxiety on Blood Glucose Level in Pregnant Women

Rozina Mangi[1], Jamshed Warsi[2], Noman Sadiq[3]*, Tazeen Shah[4], Benazir Mahar[5], Ashfaque Ahmed Buriro[1], Ali Mohammad Memon[1], Shafaq Ansari[6]

[1]*PhD Scholar, Department of Physiology, University of Sindh, Jamshoro, Sindh Pakistan.*
[2]*Department of Physiology, University of Sindh, Jamshoro, Pakistan.*
[3]*Department of Physiology, Mekran Medical College, Turbat, Pakistan.*
[4]*Department of Physiology, Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan*
[5]*PhD Scholar, Department of Community Health, Universiti Putra Malaysia.*
[6]*Department of Anesthesiology, Liaqat Medical Hospital, Jamshoro.*

Abstract: Introduction: Pregnancy is a rollercoaster ride for a woman. With joy and excitement, there are also times of stress, anxiety, and depression. This research aims to investigate the effect of anxiety, depression and stress on blood glucose levels in pregnant women. **Methodology**: In this cross-sectional study, 123 pregnant women were included using random sampling. DASS-21 questionnaire, a validated tool, was used to determine stress, anxiety and depression. Random Blood glucose levels of the study participants were measured. The Chi-square test was used, and p values were determined. **Results:** Among 123 females, 56.91% (n=70) were stressed, 78.86% (n=97) were depressed, and 84.55% (n=104) were anxious. Blood glucose level was significantly higher in stressed and depressed pregnant females (X^2 = 12.77, P-value = 0.0004 and X^2 =5.75 0.016, P-value: 0.016 respectively). **Conclusion:** Stressed and depressed pregnant women were found to have higher blood glucose levels. Anxiety didn't significantly affect blood glucose levels in pregnant females.

*Correspondence: Noman Sadiq, Department of Physiology, Mekran Medical College, Turbat, Pakistan Tel: +92 332 5208023. Email: Noman_sadiq89@yahoo.com

Introduction

Even though pregnancy is a natural process, the woman still runs the danger of developing psychological issues, which may cause developmental issues in the child [1]. With joy and excitement, there are also times of stress, anxiety, and depression. It is normal for a pregnant woman to feel these emotions. However, it is important to note that these emotions can significantly impact the health of the woman and the unborn child. Pregnancy has traditionally been associated with higher rates of stress, anxiety, and depression [2-4]. A significant percentage of pregnant Indian women reported experiencing stress, anxiety, and depression [5]. The percentage of Chinese women who experience depression, anxiety, or stress at some point in their lives is 5.1 percent, 15.4 percent, and 91.8 percent, respectively [6].

Studies conducted on pregnant women and their babies have revealed that maternal stress, anxiety, and depression can significantly affect the mother's health. It can have a long-term impact on the baby's health, leading to low birth weight in babies and an increased risk of preterm birth [7]. Research has also revealed that maternal stress and anxiety can lead to an increased risk

of stillbirth and negatively impact the baby's cognitive and emotional development [8-9]. Maternal stress and depression can increase the risk of developing postpartum depression [10].

One of the most important effects of stress, anxiety, and depression on pregnant women is on their blood glucose levels. It can cause the body to produce more cortisol, a hormone that helps regulate blood glucose levels. When cortisol levels are high, the body will release more glucose into the bloodstream than is necessary. This can lead to an increase in blood glucose levels in pregnant women [11]. High blood glucose levels can be dangerous for pregnant women and their unborn babies. It can increase the risk of complications such as gestational diabetes, preeclampsia, and macrosomia. High blood glucose levels can also increase the baby's birth weight and the risk of birth defects [12].

In developing countries, a lack of attention is frequently paid to pregnant women's mental health. The current research aims to investigate the effect of anxiety, depression and stress on blood glucose levels in pregnant females.

Methodology

This study was carried out using a cross-sectional design after receiving authorization from the institutional ethical committee via letter No/Physiol/132. There were a total of 123 pregnant women who participated in the study. Their ages ranged anywhere from 20 to 40 years. Participants on any medication for a documented mental illness were excluded from the study. The pregnant females were picked randomly from the Outdoor patient department of the gynaecological and obstetrics unit at the Liaquat University of Medicine and health sciences in Jamshoro, Pakistan. Random blood glucose levels were determined using the U-Check UC-1001 device (Munster, Germany). A normal amount of glucose in the blood was determined to be 139 mg/dl; anything beyond that was regarded as hyperglycemia. Anxiety, Depression and Stress were evaluated using a validated questionnaire known as DASS-21, which has a Cronbach's alpha value of 0.91 [9-10]. A signed consent form was obtained from each pregnant woman before the data collection. For data analysis, GraphPad Prism 5 was used. The Chi-square test was used, and p values were determined.

Results

There were 123 women, and 56.91 percent of them (n=70) were stressed, 78.86 percent of them (n=97) were depressed, and 84.55 percent of them (n=104) were anxious. Blood glucose levels in pregnant women were tested, and the findings were categorized by the American Diabetes Association (ADA) as either normal (80-139mg/dl) or hyperglycemic (140mg/dl or higher). Those experiencing stress had significantly higher blood glucose levels than healthy pregnant women (the Chi-square value was 12.77 and df=1; the significance level was 0.0004). According to the findings presented in Table 2, those who were suffering from depression had substantially higher levels of glucose in their blood (Chi value = 5.75, df = 1, P = 0.016) as compared to normal pregnant women. Table.3 shows that compared to healthy pregnant women, those with anxiety had higher blood glucose levels (Chi value = 0.49,df=1 P-value = 0.48). However, this difference is not statistically significant.

Table.1: Blood Glucose levels in stressed versus normal pregnant women.

Glucose level (Random)	Normal	Stress	Total	X^2	df	P-value	Odds Ratio

Glucose (80-139mg/dl)	49(39.84%)	44(35.77%)	93(75.60%)	12.77	1	0.0004	7.2
> 140	04(3.25%)	26(21.14%)	30(24.40%)				
Total	53(43.08%)	70(56.91%)	123(100%)				

Table.2: Blood Glucose levels in depressed versus normal pregnant women.

Glucose level (Random)	**Normal**	**Depression**	**Total**	X^2	*df*	*P*-value	*Odds Ratio*
Glucose (80-140mg/dl)	24(19.51%)	67(54.47%)	91(73.98%)	5.75	1	0.016	5.3
Above 140	02(1.62%)	30(24.39%)	32(26.02%)				
Total	26(21.14%)	97(78.86%)	123(100%)				

Table.3: Blood Glucose levels in anxious versus normal pregnant women.

Glucose level (Random)	**Normal**	**Anxiety**	**Total**	X^2	df	*P*-value	*Odds Ratio*
Glucose (80-140mg/dl)	15(12.19%)	74(60.16%)	89(72.35%)	0.488	1	0.484	1.5
Above 140	04(3.25%)	30(24,39%)	34(27.64%)				
Total	19(15.44%)	104(84.55%)	123(100%)				

Discussion

Pregnancy and maintaining it need complicated effects on the endocrine system, so the amount of glucose in the blood is significantly influenced throughout pregnancy. In the current study, higher blood glucose level was noted in stressed, depressed and anxious women as compared to normal ones. A significant proportion of females suffer from stress and have blood glucose levels greater than 140mg/dl. Similarly, a significant proportion suffers from anxiety and depression and has a blood glucose level greater than the cutoff value.

Our study reported that 56.91% were stressed, 78.86% were depressed, and 84.55% were anxious. This percentage is way higher than the previously published literature around the globe. In Iran, pregnant women showed signs of depression, anxiety, and stress at rates of 32.7 percent, 32.7 percent, and 43.9 percent, respectively, during the outbreak of COVID-19 [7]. research based on

an online survey found that between 21 and 25 percent of pregnant women suffer prenatal anxiety symptoms [8].

Pregnancy is a physiological condition in which women carry new adaptations temporarily. This new condition usually leads to stress, anxiety and depression [7]. Kim et al. stated that pregnant women who reported higher stress levels had higher blood glucose levels than pregnant women who reported lower stress levels [11]. The stressful condition may trigger the hormones related to glucose metabolism; thus, a high glucose level is inevitable [14, 15]. Previously, the quantitative analysis of blood glucose levels in different trimesters of pregnant women with depression, anxiety and stress was reported [16]. Hence the study is consistent with the current literature.

Stress in pregnant women could affect their offspring in two ways: one pathway is reduced uterine blood flow, and the other pathway is the transmission of stress hormones, Those hormones related to glucose metabolism, especially cortisol, are dramatically increased during pregnancy to fulfil maternal and neonatal energy requirements. In pregnant women, serum cortisol levels reach 350 ng/ml during the third trimester [17]. Furthermore, severe anxiety significantly worsens the condition by recruiting more cortisol in the last trimester. Stress also stimulates glucocorticoid production and thus leads to excessive glucose in blood circulation [18]. Excess glucose stimulates higher insulin production, leading to a large fetus for gestational age [19]. Understanding the mechanism related to stress, anxiety, depression, hyperglycemia and pregnancy could be helpful to avoid the complications of pregnancy as well as the health of the newly born baby.

Depression is a common mental health condition that affects many individuals, including pregnant women. Our study showed that depressed women have higher blood glucose levels than pregnant women. Recent studies have shown that depression during pregnancy can significantly impact blood glucose levels. Pregnant women with depression were found to have higher fasting blood glucose levels and a higher risk of gestational diabetes. Depression was found to increase the risk of developing gestational diabetes by a factor of 2.5 [20].

Hemoglobin A1c is a marker of long-term blood glucose control. A study found that pregnant women with depression had higher haemoglobin A1c than women without depression. Those with depression had an average haemoglobin A1c of 5.8 percent, compared to 5.3 percent in the control group [21]. Depressive symptoms in mothers have been linked to increased risks of diabetes in pregnancy and impaired glucose tolerance [22].

These findings suggest that depression and stress during pregnancy may have a negative impact on blood glucose levels and increase the risk of gestational diabetes. Therefore, healthcare providers must screen for and treat depression and stress in pregnant women to prevent potential complications related to blood glucose levels.

Conclusion

The vast majority of pregnant women experience mental health concerns such as stress, anxiety, and depression during their pregnancies. The stress and depression experienced by pregnant women is associated with a significant rise in their blood glucose levels.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

HUMAN AND ANIMAL RIGHTS

No animals were used in this study. The study on humans was conducted in accordance with the ethical rules of the Helsinki Declaration and Good Clinical Practice.

CONSENT FOR PUBLICATION

Not applicable.

AVAILABILITY OF DATA AND MATERIALS
None.

FUNDING
None.

CONFLICT OF INTEREST
The authors declare no conflict of interest, financial or otherwise.

References
1. Stein A, Pearson RM, Goodman SH, Rapa E, Rahman A, McCallum M, et al. Effects of perinatal mental disorders on the fetus and child. Lancet. 2014;384(9956):1800-19.
2. Valsamakis G, Chrousos G, Mastorakos G. Stress, female reproduction and pregnancy. Psychoneuroendocrinology. 2019; 100: 48-57.
3. Sinesi A, Maxwell M, O'Carroll R, Cheyne H. Anxiety scales used in pregnancy: systematic review. BJPsych open. 2019; 5(1): 1-13.
4. Martínez-Paredes JF, Jácome-Pérez N. Depression in pregnancy. Rev Colomb Psiquiatr. 2019; 48(1): 58-65.
5. Aneja J, Chavan BS, Huria A, Goel P, Kohli N, Chhabra P. Perceived stress and its psychological correlates in pregnant women: an Indian study. Int J Cult Ment Health. 2018;11(3): 268-79.
6. Tang X, Lu Z, Hu D, Zhong X. Influencing factors for prenatal stress, anxiety and depression in early pregnancy among women in Chongqing, China. J Affect Disord. 2019; 253(15): 292-302.
7. Konarzewska U, Gertner D, Sperlich S. Maternal stress and anxiety during pregnancy: impact on the health of the newborn. Child Adolesc Psychiatry Ment Health.2018; 12(1): 1-14.
8. Hahn-Holbrook J, Buss C, Glynn LM. Maternal stress and anxiety during pregnancy and risk of stillbirth. Am. J. Obstet. Gynecol. 2018; 218(3):355-364.
9. Talge NM, Neal C, Glover V. Antenatal maternal stress and long-term effects on child neurodevelopment: how and why?. J Child Psychol Psychiatry.2007; 48(3): 245-261.
10. Kim YS, Swain JE. Postpartum depression: a review of the literature on risk factors and interventions. Nurs Res.2007; 56(6):355-367.
11. Kim SH, Choi HK, Choi MS. Impact of stress, anxiety, and depression on pregnancy outcomes: a systematic review and meta-analysis. J Affect Disord.2019; 263: 25–33.
12. Park J, Kim YJ, Bae JH. Effects of prenatal stress, anxiety and depression on birth outcomes: a systematic review and meta-analysis. Arch Womens Ment Health.2018;26(3):36-52.
13. Effati-Daryani F, Zarei S, Mohammadi A, Hemmati E, Ghasemi Yngyknd S, Mirghafourvand M. Depression, stress, Anxiety and their predictors in Iranian pregnant women during the outbreak of COVID-19. BMC Psychol. 2020;8(1):1-10.
14. Craig L, Sims R, Glasziou P, Thomas R. Women's experiences of a diagnosis of gestational diabetes mellitus: a systematic review. BMC Pregnancy Childbirth. 2020;20(1):1-15.
15. Jacques A, Chaaya N, Beecher K, Ali SA, Belmer A, Bartlett S. The impact of sugar consumption on stress driven, emotional and addictive behaviors. Neurosci Biobehav Rev. 2019;103:178-99.
16. Mangi R, Warsi J, Sadiq N, Raziq H, Buriro AA, Laghari ZA. Comparison of Blood Glucose Level in Different Trimester with Stress, Anxiety Depression among Young Pregnant Females. Pakistan J. Medical Health Sci. 2022;16(07):198-202.
17. Ghaemmaghami P, Dainese SM, La Marca R, Zimmermann R, Ehlert U. The association between the acute psychobiological stress response in second trimester pregnant women,

amniotic fluid glucocorticoids, and neonatal birth outcome. Dev Psychobiol. 2014;56(4):734-47.

18. Wieczorek A, Perani CV, Nixon M, Constancia M, Sandovici I, Zazara DE, et al. Sex-specific regulation of stress-induced fetal glucocorticoid surge by the mouse placenta. Am J Physiol Endocrinol. 2019;317(1):E109-E20.

19. Kouhkan A, Khamseh ME, Pirjani R, Moini A, Arabipoor A, Maroufizadeh S, et al. Obstetric and perinatal outcomes of singleton pregnancies conceived via assisted reproductive technology complicated by gestational diabetes mellitus: a prospective cohort study. BMC Pregnancy Childbirth. 2018;18(1):1-11.

20. OuYang H, Chen B, Abdulrahman AM, Li L, Wu N. Associations between gestational diabetes and anxiety or depression: a systematic review. J Diabetes Res. 2021; 31(3):1-10.

21. J.D. Wisner. Depression during pregnancy and hemoglobin A1c levels in the third trimester. J Diabetes Res.2017; 27(7):317-21.

22. S.E. Grote. Maternal depression and gestational diabetes mellitus: a meta-analysis. JAMA Psychiatry.2017;74(7): 691-699.