GENERAL MEDICINE
ISSN:1311-1817

ISSN: 1311-1817
Volume 26, Issue 06, June, 2024

Association of Maternal Habitual Short Sleep Duration in Early Pregnancy and Glucose Concentration in Later Pregnancy: Increased Risk of Gestational Diabetes Mellitus

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ABSTRACT— The purpose of this study is to determine whether habitually low sleep duration by mothers in the early stages of pregnancy is associated with higher blood glucose concentration later in pregnancy and a higher risk of gestational diabetes mellitus. A study involving 106 women from gynecology and obstetrics departments at Muhammad College of Medicine/Muhammad Teaching Hospital in Peshawar and Gujranwala Medical College Teaching Hospital in Gujranwala, Pakistan. The study categorized participants based on sleep duration and snoring frequency. Data analysis identified possible confounders and adjusted for mother's age. A practical sampling technique was used to determine the sample size. Just 106 ladies took part in the analysis study during November 2023 to March 2024. 51.5% of the respondents were older than 35 and had average sleep length with a substantial p-value (0.002), while the majority of respondents (58%) were younger than 35 and had short sleep duration. The majority of the females had pre-pregnancy BMI (kg/m2) and were overweight, with 72% having normal sleep duration and 67% having short sleep duration (p-value < 0.001). The risk of GDM was statistically significantly (p-value = 0.003) higher in women who were overweight and snorers. It is determined that pregnant women over the median age of 35 who are multiparous are more likely to have shorter sleep intervals than 4.5% of expecting moms who have short sleep durations during the first month of their pregnancy.

KEYWORDS: maternal habitual short sleep duration, early pregnancy, glucose concentration, later pregnancy, risk, gestational diabetes mellitus

1. Introduction

In most cases, pregnant women are the ones who are affected by diabetes mellitus during pregnancy, which is also referred to as gestational diabetes mellitus (GDM). It is the defining characteristic of this illness for pregnant women that they either develop or initially realise that they are unable to tolerate glucose when they

are pregnant [1]. The condition is associated with long-term consequences such as overweight and obesity in infants and type 2 diabetes in children [2], [3]. In addition to an increased risk of short-term complications for both the mother and the foetus, such as spontaneous abortion, foetal anomalies, preeclampsia, foetal demise, macrosomia, neonatal hypoglycemia, and neonatal hyperbilirubinaemia, the condition results in an increased risk of these complications. It is of the utmost importance to detect and treat gestational diabetes mellitus (GDM) at an early stage in order to protect the health and safety of expecting mothers and their newborn children through early identification and treatment [4], [5]. This is due to the fact that the condition is growing more widespread and has the potential to generate complications that are not appealing. Over the course of a pregnancy, it is not uncommon for a woman to experience problems sleeping. A lack of quality sleep during pregnancy has been linked to an increased risk of a range of poor outcomes, including but not limited to preterm birth, low Apgar scores, caesarean sections, gestational hypertension, and other unfavourable outcomes [6- 8]. All of these outcomes are related with an increased risk of adverse outcomes. There is evidence that proves this, and it has been presented by epidemiological studies in the past. According to the findings of a number of studies, pregnant women who had trouble sleeping were more likely to face poor effects that would last for a longer period of time. The presence of attention-deficit/hyperactivity disorder inattentive scores [10], [11], low reading test scores in children aged 7–9, and hospital admissions of children aged less than 6 [12] were all evidences from which this was established. The duration of time spent sleeping is a crucial component in determining the quality of sleep. This is due to the fact that it is simple to measure and evaluate in clinical settings. An excessive amount of sleep duration has been connected with harmful consequences on the health of both the mother and the foetus, including the occurrence of premature birth [13- 17]. Furthermore, it was not a common practice to study and take into consideration relevant variables associated to GDM whenever multivariable models were being used [18- 23]. Consumption of food and physical exercise are examples of these variables. In point of fact, none of the previous research that has been conducted in mainland China has looked into the relationship between the amount of sleep that is received during the first trimester and the risk of developing gestational diabetes mellitus with prospective cohort studies. The reality is that this is the case even after taking into account all of the significant confounding factors. Those findings were the result of epidemiological study as well as studies that were carried out on animals. There is a correlation between the risk of getting diabetes and the duration of sleep that is short, as indicated by the findings of a number of epidemiological studies to which this correlation was found. The findings of these research indicate that those who report having trouble falling asleep or who have a limited amount of sleep on a daily basis have a much increased likelihood of developing the illness [24- 26]. Further, a growing number of studies have established a connection between regular mumbling and sleep apnea, both of which are classified as rest-related respiratory disorders, and cardiometabolic issues such as high blood pressure, dyslipidemia, overweight and obesity, high blood sugar, glucose resistance, and the development of type 2 diabetes [27], [28]. Both of these conditions are classified as respiratory disorders that occur during periods of rest. Changes are brought about by a combination of circumstances, including sleep disruption and insufficient rest, according to the findings of clinical research. For the time being, there is a lack of thorough comprehension regarding the specific mechanisms that are responsible for these interactions [29], [30]. Additionally, research that was carried out in the laboratory on both humans and animals [31- 33] demonstrated that intermittent hypoxia, a condition that is linked to sleep apnea, has a detrimental effect on the breakdown of glucose in the body. The connection between insufficient sleep and respiratory problems during pregnancy, as well as the increased risk of pregnancy-related disorders such as gestational diabetes mellitus (GDM), is not well understood with regard to the relationship between the two. Because pregnant women have been omitted from the majority of sleep study, this is the reason why this is the case. To the best of our knowledge, there have been no studies conducted on the effect that a woman's snoring or the amount of time she sleeps has on the metabolism of glucose while she is pregnant when she is carrying a child. During the course of this research, we looked into the links that exist between snoring and glucose intolerance, as

ISSN: 1311-1817
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well as the correlations that exist between snoring and a later diagnosis of gestational diabetes mellitus. To be more specific, we investigated the connections between snoring throughout the early stages of pregnancy and the length of sleep that the mother himself or herself reported having. The purpose of this research is to determine whether or not mothers who have a pattern of short-term sleep during the early stages of pregnancy are associated with higher blood glucose concentrations later on in pregnancy, as well as an increased likelihood of pregnant women developing gestational diabetes mellitus. This is the question that will be investigated in this study.

2. RESEARCH METHODOLOGY

First, the women who were enrolled in the gynaecology and obstetrics departments at Muhammad College of Medicine/ Muhammad Teaching Hospital in Peshawar, Pakistan, and Gujranwala Medical College Teaching Hospital in Gujranwala, Pakistan, gave their ethical approval before the cross-sectional study could be carried out. Both of these hospitals are located in Pakistan. The country of Pakistan is home to both of these medical facilities. Women were considered eligible for the programme if they met the following criteria: they were at least 18 years old, they were able to read and speak Urdu, they intended to give birth at either of the two hospitals, and they began receiving prenatal care prior to the 20th week of their pregnancy according to the qualifying circumstances. The people who participated in the structured interview that took place at 14 weeks of gestation reported their sociodemographic variables on average. The staff of the study obtained data from the medical records of the participants' labour and delivery facilities as well as clinic records after the delivery of the babies of the study. Over the course of the period beginning in November 2023 and ending in March 2024, a number of female participants gave their permission to take part in the research endeavour. Utilising a sampling technique that is feasible, we were able to ascertain the size of the sample. Of the total number of participants in the analytical investigation, just 106 were female. Each individual who participated in the study was required to get written informed permission. A knowledgeable interviewer gave a structured questionnaire that lasted between forty-five and sixty minutes to be filled out by participants at the time of enrolling in the study. The average number of hours of sleep that a woman obtains before and during the early stages of pregnancy was one of the sociodemographic and lifestyle factors that we gathered. We also collected information on medical and reproductive histories during this time period. We wanted to get an idea of the normal amount of sleep that a mother gets each night while she is carrying her child, so we asked her, "Since you became pregnant, how many hours do you sleep each night?" in order to get an estimate of how much sleep she gets. An investigation of a similar nature was carried out with regard to the quantity of sleep that was obtained prior to reaching the point of pregnancy. In the form of whole numbers, the responses were represented in the presentation. For the aim of conducting a bivariate analysis, we divided the individuals into four distinct categories, which were distinguishable based on the duration of their sleep. These categories were as follows: ≤ 4, 5-8, 9, and ≥ 10 hours, respectively. There were earlier classifications from investigations that served as the basis for the thresholds [34]. In light of the fact that it is well-known that pregnant women, particularly those who are in the first trimester of their pregnancy, require thirty to forty-five minutes more sleep per night than their counterparts who are not pregnant [35], [36], we made the assumption that the reference group would consist of women who reported sleeping nine hours per night. Research has shown that the frequency with which pregnant women snore during their index pregnancy may be a factor in determining the degree to which they experience sleep-disturbed breathing during their pregnancy. The inquiry that was directed towards them in regard to their sleeping patterns was something along the lines of, "To the best of your knowledge, have you snorred when you are asleep since you became pregnant?" The responses were as follows: (i) never, (ii) most of the time, (iii) very occasionally, (iv) very occasionally, and (v) very occasionally as the most common. Those participants who admitted to snoring the majority of the time were classified as snorers, while the remaining ladies were classified as non-snorers. Snoring was a factor in the participants' classification. The information that was handed along served as the foundation for this classification.

Furthermore, the respondents' self-reports were the basis for determining their height and weight before to becoming pregnant. Before getting pregnant, one can calculate their body mass index (BMI) by using the formula that involves dividing their weight in kilogrammes by their height in metres squared. The oral glucose challenge test consisted of fifty grammes and lasted for one hour. It was given to each and every pregnant lady who took part in our research study between the ages of twenty-four and twenty-eight weeks of gestation. Patients who did not pass this screening test (with a glucose level of 140 mg/dl or more) were then given an oral glucose tolerance test (OGTT) in 100 grammes, which was administered over the course of one to two weeks. This test was administered in a manner that was stretched out over a period of time. Following the completion of the 50-gram glucose challenge test for a duration of one hour and the 100-gram OGTT diagnostic test for a duration of three hours, we made an abstract of the results obtained from both testing procedures. By exceeding two or more of the following glucose levels on the 100-gram oral glucose tolerance test (OGTT), a woman was diagnosed with gestational diabetes mellitus (GDM). These glucose levels are as follows: fasting glucose levels of 95 mg/dl or higher; glucose levels of 180 mg/dl or higher after one hour; glucose levels of 155 mg/dl or higher after two hours; and glucose levels of 140 mg/dl or higher after three hours. A consideration was given to using SPSS 24 when carrying out the analysis of the data. We compared and contrasted the sociodemographic, lifestyle, behavioural, and medical history aspects of the subjects based on the diagnosis status of glycosylated diabetes (GDM) among the respondents. We evaluated the findings of the oral glucose screening test that lasted for one hour in order to determine whether or not the individual had a glucose intolerance. Over the course of one hour, we were able to determine the mean glucose concentrations of mothers by utilising linear regression approaches. These techniques took into consideration potentially confounding aspects such as the age of the mother and the race or ethnicity of the mother. In order to evaluate the relative risk (RR) and the confidence intervals (95% CIs) of the connections between the length of time spent sleeping and the factors that contribute to snoring with insulin resistance and the likelihood of developing type 2 diabetes, we fitted generalised linear models with a log-link function. This would allow us to determine the relative risk (RR) and the confidence intervals (95% CIs). The length of time spent sleeping and the amount of snoring were both measured using different models. On the basis of a number of maternal traits, we conducted an investigation into the phenomena of bewilderment. In previous research including males and females who were not pregnant, we were able to find potential confounding factors by using a list of variables that satisfied the criteria for confounding and were connected with both the length of sleep and snoring. By doing so, we were able to identify potential confounding factors. Given these factors, we made modifications to take into consideration the mother's age in order to accommodate for it. Due to the fact that estimates of association may be spuriously attenuated when components along the chain of causality are taken into consideration, this distinction is particularly essential. For each and every published p-value, two-tailed p-values are utilised.

3. RESULTS AND DISCUSSION

The 106 women included in the present study. Characteristics of all the included participants are presented in Table 1. Most of the participants (58%) were in <35 years of age with short sleep duration and 51.5% were from ≥35 years of age in normal sleep duration with significant p-value (0.002). Most of the females were overweight in pre-pregnancy BMI (Kg/m2) as 72% with normal sleep duration and 67% in short sleep duration with significant p-value (<0.001). More details have given below in Table 1.

Table 1: Frequency of Demographic characteristics and all covariates (N = 106)

Variables	Short sleep duration, %	Normal sleep duration, %	Adjusted risk ratio (95% CI)	p-value
Maternal Age at Interview				
<35 years	58%	48.5%	1.31 (1.05-1.62)	0.002
≥35 years	42%	51.5%	1.40 (0.48-4.42)	
Pre-pregnancy BMI (kg/m^2)				

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Lean (<18.5)	03%	2.02%	1.28 (1.02-1.68)	<0.001
Normal (18.5-24.9)	10%	14.1%	1.42 (1.26-1.62)	
Overweight (25.30)	67%	72.0%	1.48 (1.08-2.01)	
Obese (≥30)	20%	11.88%	1.32 (1.06-1.68)	
Gestational Diabetes Mellitus history				
Yes	57%	87%	0.44 (0.08-2.81)	0.783
No	43%	13%	1.46 (1.08-2.41)	
Family history of Diabetes				
Yes	62%	58.1%	1.47 (0.99-1.98)	0.662
No	38%	41.9%	1.62 (1.16-2.22)	
Gestational Weight Gain				
Insufficient	24%	18.8%	1.44 (1.08-2.41)	0.428
Moderate	48.6%	46.2%	1.00 (0.66-1.52)	
Excessive	27.4%	35.0%	1.36 (0.94-1.93)	

***Adjusted risk ratio = 1.33 (1.06-1.63); BMI = body mass index*

Following a 50-gram oral glucose challenge during weeks 24-28 of pregnancy, an upward trend was observed throughout levels of the usual nightly duration of sleep for the mother's mean-1-hour plasma glucose concentration (Figure 1). After adjusting for age, the mean 1-hour plasma glucose levels of mothers were determined to be greatest in those who claimed to rest a standard of ≤ 4 hours per night throughout their early pregnancy, and lower in those who slept an average of 9 hours per night.

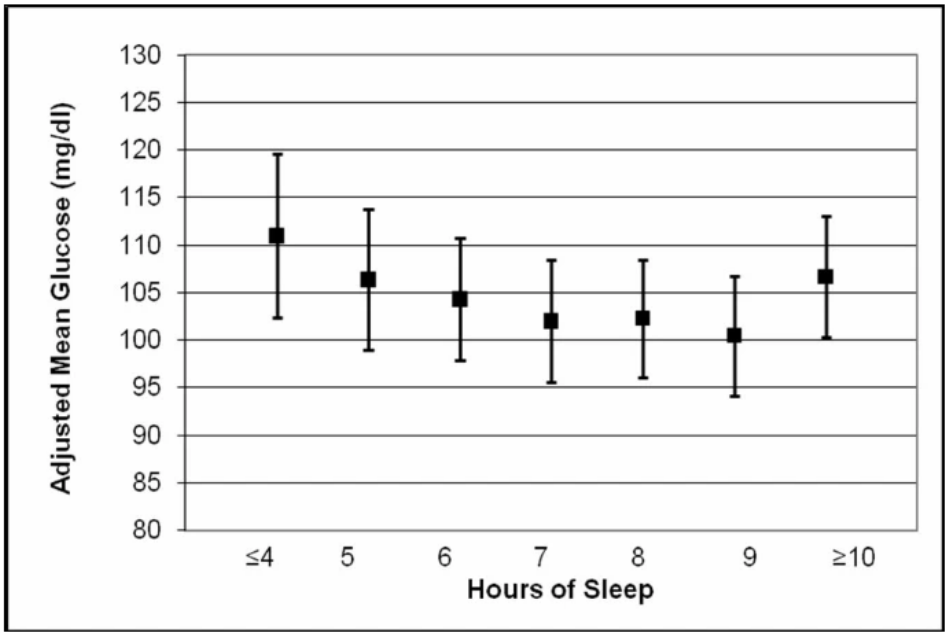

Table 1: Maternal mean plasma glucose concentrations after a 50-g glucose challenge

Table 2 shows the relationship between the amount of sleep and gestational diabetes mellitus. Even after controlling for maternal age, early pregnancy women who slept less than 4 hours per night were more likely to develop gestational diabetes mellitus (GDM) than those who slept 9 hours (p-value = 0.000). Mothers' pre-pregnancy BMI remained good. We also found considerable connections between short sleep duration and GDM in overweight women (Table 2). To assess the risk of GDM, we modelled maternal sleep duration as a continuous variable, focusing on women who slept ≥10 hours. Evidence suggests a U-shaped relationship between sleep duration and GDM risk, with higher risks for short and long sleep durations, and a linear trend for sleep durations ranging from ≤ 4 to 5–9 hours. The connection between pregnancy-related and reported sleep duration was high (p = 0.000). Again utilising the mother's nightly sleep duration before pregnancy, the results were similar (Table 2).

Table 2: Correlation between Gestational Diabetes Mellitus & Sleep Duration (N= 106)

Variables	Gestational Diabetes Mellitus		*p*-value
	Yes (n = 86), %	No (n = 20), %	
Sleep duration during pregnancy			
≤ 4 hours	29.9%	7.0%	0.000
5-9 hours	42.2%	70%	
≥10 hours	27.9%	23%	
Snoring in pregnancy			
Yes	29.7%	36.2%	0.001
No	44.2%	41.0%	
Don't know	26.10%	22.8%	

Women who were pregnant and overweight and who also reported snoring during their pregnancy had a greater likelihood of acquiring gestational diabetes mellitus. When compared to lean women who did not snore, women who were overweight and reported snoring had a statistically significant (p-value = 0.003) higher chance of developing gestational diabetes (Table 3).

Table 3: Snoring during early and pre-pregnancy over weight

Variables	Gestational Diabetes Mellitus		*p*-value
	Yes (n = 84), %	No (n = 22), %	
Snore status & Overweight	36.9%	42.4%	0.003
Non-snorer & Lean	2.3%	1.9%	
Snorer & Lean	21.4%	24.6%	
Non-snorer & Overweight	23.8%	29.3%	
Snorer & Overweight	15.4%	1.8%	

With the help of data on snoring and length of sleep, which were collected early on in the pregnancy, we were able to establish connections between sleep patterns and maternal plasma glucose levels when a 50-gram oral glucose challenge screening test was administered later in the pregnancy. Furthermore, the glucose concentrations were statistically significantly higher among women who snorted during pregnancy. Furthermore, the relative risk of gestational diabetes mellitus (GDM) was significantly greater among overweight women who snorted in comparison to their counterparts who did not snort and those who were physically fit. Glucose homeostasis in pregnancy is susceptible to maternal habitual short sleep duration and snoring throughout pregnancy, according to the data collected from the study, which provides evidence that is consistent with the existence of the hypothesis. The only study that we are aware of that investigates the connection between plasma glucose levels, the risk of gestational diabetes mellitus, and sleep variables (such as snoring and regular sleep length) during pregnancy is the one that examined this relationship. Inadequate sleep hinders glucose metabolism and increases the chance of developing type 2 diabetes, according to a considerable body of research [32- 35], which focuses primarily on males and women who are not pregnant. Researchers conducted a survey of 740 Canadians, consisting of 323 men and 417 women, and found that a prolonged sleep duration of less than seven hours was associated with a high prevalence of type 2 diabetes [36- 39]. This was the case even after the researchers had adjusted for confounding variables. In conclusion, there is data that suggests that snoring on a regular basis may be connected with abnormal glucose metabolism. Through the establishment of a connection between snoring and decreased glucose tolerance as well as gestational diabetes mellitus during pregnancy, our study contributes important preliminary evidence to the current body of literature. The current research has a great deal of significant advantages. Therefore, the reporting of maternal sleep duration and snoring was not contingent on the outcomes of the pregnancy or the signs and symptoms of gestational diabetes mellitus (GDM). Initially, our evaluation of these factors was based on reports made early on in the pregnancy. Snoring and a regular short or lengthy sleep duration are both factors that appear to precede the clinical diagnosis of type 2 diabetes, according to our findings. Second,

ISSN: 1311-1817
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the presence of a high follow-up rate (more than 95%) removed any possibility of selection bias. Nevertheless, there are a few negatives that are worth discussing and taking into consideration before moving on. The duration of the mother's usual sleep and the snoring were both obtained through self-reporting, and as a result, they are likely to be subject to misclassification [40]. As a method for identifying sleep-disordered breathing, the use of revealed snoring is a technique that is well-known. In large epidemiologic studies, snoring that is either infrequent or not performed on a regular basis does not serve as a useful screening tool for sleep-disordered breathing [41], [42]. It was therefore necessary for our study to differentiate between people who snore frequently and those who snore less frequently. Further limitations of our pilot study were the relatively limited number of cases of GDM that were included in the sample, as well as the imprecision of relative risk calculations, which was demonstrated by the broad confidence intervals that were calculated for 95% of the total [43- 46]. For women in our cohort who reported having short or long sleep durations and snoring, the positive relationship between later pregnancy hyperglycemia and the chance of developing GDM was significant. This was the case despite the fact that the mechanisms involved are unknown. There was a significant increase in the risks among women who were overweight and had these sleep issues.

4. CONCLUSION

In order to assist medical services endeavours in preventing and managing GDM, it is important to place an emphasis on healthy sleeping habits. Women who are pregnant and have little or no sleep are more likely to develop gestational diabetes mellitus (GDM), which is a type of diabetes that affects pregnant women. In addition, recent studies have demonstrated that 4.5% of women who are expecting have short sleep durations during the first month of their pregnancy. Furthermore, research has shown that multiparous women who are pregnant and are over the median age of 35 are more likely to have shorter sleep intervals. These preliminary findings suggest that there may be connections between snoring and glucose intolerance and GDM, as well as short sleep duration. Even if our findings are consistent with those of study conducted on males and women who are not pregnant, it is necessary to conduct additional research projects in the future that are on a larger scale and include reliable measures of the amount of time spent sleeping, the settings under which one sleeps, and the breathing patterns that occur throughout pregnancy. As a result of a better understanding of the potential biochemical effects of sleep disruptions during pregnancy, it is anticipated that there will be major therapeutic ramifications for the prevention and treatment of impaired tolerance to glucose and gestational diabetes mellitus in pregnant women.

5. REFERENCES

[1] Xu, Y. H., Shi, L., Bao, Y. P., Chen, S. J., Shi, J., Zhang, R. L., & Lu, L. (2018). Association between sleep duration during pregnancy and gestational diabetes mellitus: a meta-analysis. Sleep medicine, 52, 67-74.

[2] Facco, F. L., Grobman, W. A., Reid, K. J., Parker, C. B., Hunter, S. M., Silver, R. M., ... & Zee, P. C. (2017). Objectively measured short sleep duration and later sleep midpoint in pregnancy are associated with a higher risk of gestational diabetes. American journal of obstetrics and gynecology, 217(4), 447-e1.

[3] Du, M., Liu, J., Han, N. A., Zhao, Z., Luo, S., & Wang, H. (2021). Association between sleep duration in early pregnancy and risk of gestational diabetes mellitus: a prospective cohort study. Diabetes & Metabolism, 47(5), 101217.

[4] Cai, S., Tan, S., Gluckman, P. D., Godfrey, K. M., Saw, S. M., Teoh, O. H., ... & GUSTO Study Group. (2017). Sleep quality and nocturnal sleep duration in pregnancy and risk of gestational diabetes mellitus. Sleep, 40(2), zsw058.

[5] Wang, W., Li, M., Huang, T., Fu, Q., Zou, L., Song, B., ... & Guo, P. (2021). Effect of nighttime sleep duration and midday napping in early pregnancy on gestational diabetes mellitus. Sleep and Breathing, 25, 487-492.

[6] Qiu, C., Lawrence, W., Gelaye, B., Stoner, L., Frederick, I. O., Enquobahrie, D. A., ... & Williams, M. A. (2017). Risk of glucose intolerance and gestational diabetes mellitus in relation to maternal habitual snoring during early pregnancy. PLoS One, 12(9), e0184966.

[7] Nicolì, F., Prete, A., Citro, F., Bertolotto, A., Battini, L., de Gennaro, G., ... & Bianchi, C. (2022). Short sleep duration and risk of gestational diabetes. Gynecological Endocrinology, 38(8), 672-675.

[8] Wang, H., Leng, J., Li, W., Wang, L., Zhang, C., Li, W., ... & Yang, X. (2017). Sleep duration and quality, and risk of gestational diabetes mellitus in pregnant Chinese women. Diabetic medicine, 34(1), 44-50.

[9] Lai, Y., Wang, C., Ouyang, J., Wu, L., Wang, Y., Wu, P., ... & Pan, X. F. (2024). Association between nighttime sleep duration, midday napping, and sleep quality during early pregnancy and risk of gestational diabetes mellitus: A prospective cohort study in China. Sleep Medicine, 119, 164-171.

[10] Du, M., Liu, J., Han, N. A., Zhao, Z., Luo, S., & Wang, H. (2021). Association between sleep duration in early pregnancy and risk of gestational diabetes mellitus: a prospective cohort study. Diabetes & Metabolism, 47(5), 101217.

[11] Kim, M., Facco, F. L., Braun, R. I., Wolf, M. S., Garcia-Canga, B., Grobman, W. A., ... & Reid, K. J. (2023). The association between light exposure before bedtime in pregnancy and the risk of developing gestational diabetes mellitus. American journal of obstetrics & gynecology MFM, 5(8), 100922.

[12] Zhang, X., Zhang, R., Cheng, L., Wang, Y., Ding, X., Fu, J., ... & Li, R. (2020). The effect of sleep impairment on gestational diabetes mellitus: a systematic review and meta-analysis of cohort studies. Sleep medicine, 74, 267-277.

[13] Sohel Mahmud, Sharmin Ara Yasmin, Nahal Mostak Khan, Soheb Ahmed Robin & Lutfullahil Khabir (2024). Demographic Profile & Associated Risk Factors of Patients with Retinal Vein Occlusion in a Tertiary Eye Hospital. Dinkum Journal of Medical Innovations, 3(01):64-71.

[14] Surachhya Sharma (2024). Knowledge, Attitude and Practices of Hormonal Contraceptives and Incidences of ADR among Users. Dinkum Journal of Medical Innovations, 3(02):199-213.

[15] Dr. Shovit Dutta (2024). Knowledge & Practice about Personal Hygiene among Primary School Students in Rural Chattogram, Bangladesh . Dinkum Journal of Medical Innovations, 3(02):72-88.

[16] Dr. Anupama Sharma, Dr. Himanshu Shah & Dr. Vandana Mourya (2024). The evaluation of maternal morbidity and perinatal morbidity & mortality in Breech Delivery and Its Comparison with Mode of Delivery. Dinkum Journal of Medical Innovations, 3(02):89-101.

[17] Dr. Md. Hasan Moshiur Shawon & Prof. Dr. Shanjoy Kumar Paul (2024). Risk Factors of Urinary Tract Infection Caused by Extended-Spectrum Beta-Lactamases-Producing Bacteria in Children . Dinkum

Journal of Medical Innovations, 3(02):102-117.

[18] Muhammad Abdullah Al Amin, Abdul Mumin, A.K.M Shahariar Kabir, Rifat Ara Noor, Md Atiqur Rahman, Urmi Rahman & Fatema Marzia Nur (2024). Role of Dexamethasone in the Management of Acute Ischaemic Stroke in a Tertiary Hospital: A Randomized Clinical Study . Dinkum Journal of Medical Innovations, 3(02):118-131.

[19] Dr. Nabin Kumar Sinjali Magar, Dr. Dhruba Gaire & Dr. Prasanna Bahadur Amatya (2024). Evaluation of Pulmonary Hypertension in Chronic Obstructive Pulmonary Disease (COPD) by assessment of Chest X- Ray, ECG and Echocardiography. Dinkum Journal of Medical Innovations, 3(02):132-144.

[20] Dr. Rosina Paudel, Dr. Dhan Keshar Khadka & Dr. Arpana Rijal (2024). Clinico-epidemiological Profile of Adult Acne and factors Associated with Adult Acne . Dinkum Journal of Medical Innovations, 3(02):145-164.

[21] Dr. Sangam Pokharel, Dr. Rajesh Yadav, Dr. Anima Pradhan & Dr. Ashmita Paudel (2024). Comparative Study of Bupivacaine 0.5% and Ropivacaine 0.75% Epidurally In Lower Limb Orthopedic Surgeries. Dinkum Journal of Medical Innovations, 3(02):165-173.

[22] Ms. Saroja Poudel & Dr. Rajesh Niraula (2024). Comprehensive study of Placenta Previa & Its Psychological Consequences. Dinkum Journal of Medical Innovations, 3(02):174-187.

[23] Dr. Sujan Pradhan, Dr. Sabi Rana, Dr. Property Bhandari, Dr. Ozone Shrestha & Dr. Pranjal Shrestha (2024). The Correlation of Hearing Loss with Site & Size in Tympanic Membrane Perforation. Dinkum Journal of Medical Innovations, 3(02):188-198.

[24] Abdul Mumin, Abdullah Al Amin, A.K.M. Shahriar Kabir, Rifat Ara Noor & Urmi Rahman (2024). Role of C- Reactive Protein (CRP) and Neutrophil Lymphocyte Ratio (NLR) in detecting severity & Predicting outcome of Acute Pancreatitis patients. Dinkum Journal of Medical Innovations, 3(01):01-12.

[25] Dr. Prabin Kumar Jha, Dr. Bindu Laxmi Shah, Dr. Shruti Kumari Thakur & Dr. Avinash Thakur (2024). Effectiveness of Dexamethasone as an Adjuvant to Bupivacaine in Supraclavicular Brachial Plexus Block. Dinkum Journal of Medical Innovations, 3(01):13-25.

[26] Nahal Mostak Khan, Soheb Ahmed Robin, Lutfullahil Khabir & Sohel Mahmud (2024). Role of Vitamin C in Development of Age Related Cataract. Dinkum Journal of Medical Innovations, 3(01):26-34.

[27] Tariq Mahmood khan, Omair khan, Salma Shazia, Nadia Munir, Asad Mahmood, Aftab Tanoli, Rabia Zulfiqar, & Haq Nawaz. (2024). KNOWLEDGE OF FORENSIC ODONOTOLOGY AMONG DIFFERENT GENERAL HEALTH AND DENTAL PROFESSIONALS AS NEWLY EMERGING FIELD: A CROSS-SECTIONAL STUDY. Journal of Population Therapeutics and Clinical Pharmacology, 31(5), 1087–1094. https://doi.org/10.53555/jptcp.v31i5.6273

[28] Nistha Thapa, Puja Gartaula & Pushpa Chand Thakuri (2024). Knowledge of hygienic food-handling Practices among street Food vendors in Dhading Besi, District Dhading, Nepal. Dinkum Journal of Medical Innovations, 3(01):35-51.

[29] Muhammad Abdullah Al Amin, Abdul Mumin, A.K.M Shahariar Kabir, Rifat Ara Noor, Md Atiqur Rahman, Urmi Rahman & Fatema Marzia Nur (2024). Role of Dexamethasone in the Management of Acute Ischaemic Stroke in a Tertiary Hospital: A Randomized Clinical Study . Dinkum Journal of Medical Innovations, 3(02):118-131.

[30] Dr. Nabin Kumar Sinjali Magar, Dr. Dhruba Gaire & Dr. Prasanna Bahadur Amatya (2024). Evaluation of Pulmonary Hypertension in Chronic Obstructive Pulmonary Disease (COPD) by assessment of Chest X- Ray, ECG and Echocardiography. Dinkum Journal of Medical Innovations, 3(02):132-144.

[31] Dr. Rosina Paudel, Dr. Dhan Keshar Khadka & Dr. Arpana Rijal (2024). Clinico-epidemiological Profile of Adult Acne and factors Associated with Adult Acne . Dinkum Journal of Medical Innovations, 3(02):145-164.

[32] Dr. Sangam Pokharel, Dr. Rajesh Yadav, Dr. Anima Pradhan & Dr. Ashmita Paudel (2024). Comparative Study of Bupivacaine 0.5% and Ropivacaine 0.75% Epidurally In Lower Limb Orthopedic Surgeries. Dinkum Journal of Medical Innovations, 3(02):165-173.

[33] Dr. Md. Salah Uddin (2024). Correlation between Duration of Preoperative Motor Deficit and Early Postoperative Motor Functional Recovery in Patients with Intradural Extramedullary Spinal Tumor. Dinkum Journal of Medical Innovations, 3(01):52-63.

[34] Shekh Mohammad Mostafa, Sejuti Sarker Tinny, Meshari Attar, Sandra Rumi Madhu, Kamrun Nahar, Md. Allama Iqbal, & Rabia Zulfiqar. (2024). COMPUTERIZED IDENTIFICATION OF THE PHASES OF LIVER FIBROSIS BY ULTRASONOGRAPHY: QUANTITATIVE STUDY OF DEEP CONVOLUTIONAL NEURAL NETWORK. Journal of Population Therapeutics and Clinical Pharmacology, 31(6), 604–611. https://doi.org/10.53555/jptcp.v31i6.6526

[35] Mst.Dil Afroz Bhuiyan, Md. Abul Hossain, Shekh Mohammad Mostafa, Anirudha Biswas, Mohammed Samiullah, Gul Mehnaz, Fozan Ahmad, Arooj Saeed, Arif Ahmed, & Rabia Zulfiqar. (2024). The QUANTITATIVE ANALYSIS OF HAZARDS OF HEAVY METALS ON HUMAN HEALTH AND AGRICULTURAL PRODUCTION. Journal of Population Therapeutics and Clinical Pharmacology, 31(2), 2820–2829. https://doi.org/10.53555/jptcp.v31i2.4543

[36] Zhang, X., Zhang, R., Cheng, L., Wang, Y., Ding, X., Fu, J., ... & Li, R. (2020). The effect of sleep impairment on gestational diabetes mellitus: a systematic review and meta-analysis of cohort studies. Sleep medicine, 74, 267-277.

[37] Kim, M., Facco, F. L., Braun, R. I., Wolf, M. S., Garcia-Canga, B., Grobman, W. A., ... & Reid, K. J. (2023). The association between light exposure before bedtime in pregnancy and the risk of developing gestational diabetes mellitus. American journal of obstetrics & gynecology MFM, 5(8), 100922.

[38] Sanapo, L., Bublitz, M. H., Bai, A., Mehta, N., Messerlian, G. M., Catalano, P., & Bourjeily, G. (2022). Association between sleep disordered breathing in early pregnancy and glucose metabolism. Sleep, 45(4), zsab281.

[39] Song, Y., Wang, L., Zheng, D., Zeng, L., & Wang, Y. (2022). Sleep disturbances before pregnancy and subsequent risk of gestational diabetes mellitus. Nature and Science of Sleep, 1165-1174.

ISSN: 1311-1817
Volume 26, Issue 06, June, 2024

[40] Zhou, X., Hong, X., Huang, K., Ding, X., Yu, H., Zhao, J., ... & Wang, B. (2023). Poor sleep quality in early pregnancy increases the risk of developing gestational diabetes mellitus: a propensity score matching analysis. Sleep and Breathing, 27(4), 1557-1565.

[41] Tariq Mahmood khan, Omair khan, Salma Shazia, Nadia Munir, Asad Mahmood, Aftab Tanoli, Rabia Zulfiqar, & Haq Nawaz. (2024). KNOWLEDGE OF FORENSIC ODONOTOLOGY AMONG DIFFERENT GENERAL HEALTH AND DENTAL PROFESSIONALS AS NEWLY EMERGING FIELD: A CROSS-SECTIONAL STUDY. Journal of Population Therapeutics and Clinical Pharmacology, 31(5), 1087–1094. https://doi.org/10.53555/jptcp.v31i5.6273

[42] Katz, J., Sanapo, L., Bublitz, M. H., Guillen, M., Avalos, A., Aldana, A., ... & Bourjeily, G. (2024). Longitudinally assessed maternal sleep position, measures of breathing during sleep, and fetal growth in high-risk pregnancies. Sleep, 47(2), zsad315.

[43] Silveira, N. C., Balieiro, L. C. T., Gontijo, C. A., Teixeira, G. P., Fahmy, W. M., de Paiva Maia, Y. C., & Crispim, C. A. (2024). Association between sleep duration and quality with food intake, chrononutrition patterns, and weight gain during pregnancy. British Journal of Nutrition, 131(8), 1413-1420.

[44] Gao, H., Miao, C., Liu, W., Sun, Y., Li, H., Wu, Z., ... & Zhu, Y. (2024). Association of sleep duration and sleep quality with gestational diabetes mellitus in pregnant women after treatment with assisted reproductive technology: A birth cohort study. Journal of Sleep Research, e14191.

[45] Xintong, L., Rongrong, B., Ruimin, C., Yingying, G., Yide, H., Lingling, C., & Dongmei, X. (2024). Effect of sleep in the third trimester of gestational diabetes mellitus on maternal and infant outcomes.

[46] Akbari, M., EsmaeilzadehSaeieh, S., Farid, M., Shafiee, A., Bakhtiyari, M., Bahrami Babaheidari, T., & Yazdkhasti, M. (2024). Association between sleep quality with maternal and neonatal outcomes during the covid-19 pandemic. BMC Pregnancy and Childbirth, 24(1), 294.