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Impact of Prenatal Physical Activity on Mode of Delivery and Pre-Term Birth: A Cross-Sectional Study

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Abstract

This study utilized a cross-sectional survey design and focused on female patients who were hospitalized to Lady Reading Hospital in Peshawar. A total of 132 patients were included in this survey. Data collection was conducted using the convenience sampling technique. The female patients included in this study were postnatal women who were singletons and above the age of 18, and had no problems linked to pregnancy. Data analysis was conducted using version 22 of SPSS. The Chi-square test was utilized for association. The Objective **was to assess the influence of physical activity (PA) throughout pregnancy on the occurrence of maternal obesity and pre-term delivery**

A total of 132 people, all above the age of 18, took part in this study. The average age of the group was 25 years with a standard deviation of 5.37. The occurrence rates of normal vaginal delivery, caesarean section, and pre-term delivery were 66.5%, 33.3%, and 15.2% respectively. Nevertheless, the occurrence of low, moderate, and strong levels of physical activity were 32 (24.2%), 100 (75.8%), and 0 (0%) respectively. A significant correlation was seen between prenatal physical activity and method of delivery (P-value = 0.00), but no significant correlation was identified between prenatal physical activity and pre-term delivery (P-value = 0.631). Furthermore, a significant correlation was seen between age and manner of delivery (P-value = 0.006), but no significant correlation was discovered between age and pre-term delivery (P-value = 0.157).

The findings of this study indicate that engaging in physical activity during pregnancy has a beneficial effect on the method of delivery, but it does not have any influence on the occurrence of pre-term birth. This study also determined that there is a correlation between age and MOD (mode of delivery), and no correlation was discovered with pre-term delivery.

Key terms: Physical activity, pregnancy, NVD, caesarean delivery and pre-term delivery.

Introduction

The topic of prenatal physical activity (PA) has been the subject of ongoing discussion, as there are worries over its potential adverse impact on fetal development, including reduced fetal growth and premature birth. Nevertheless, there is an increasing body of research that substantiates the beneficial effects of physical activity during pregnancy. Studies have demonstrated that engaging in prenatal activities can effectively decrease excessive weight gain, enhance cardiovascular fitness, and foster mental well-being among expectant mothers. The American College of Obstetricians and Gynecologists (ACOG) and the World Health Organization (WHO) advise that pregnant women should engage in 150 minutes of physical activity each week at a low intensity level. Research has also linked physical activity during pregnancy with an increased probability of giving birth vaginally and a reduced risk of having a cesarean delivery, as well as fewer chances of experiencing gestational complications such as gestational diabetes, hypertension, and postpartum depression[1]. Notwithstanding these discoveries, there is still a high occurrence of physical inactivity during pregnancy, especially in underdeveloped nations like Pakistan, where cultural beliefs and a lack of information may restrict physical activity among women[1-3].

The majority of studies investigating prenatal physical activity have been carried out in countries other than Pakistan, resulting in a scarcity of study on its impacts specifically within the region.[2,3] Due to the cultural and literacy disparities between Western and Pakistani populations, it is not appropriate to immediately apply findings from other locations to Pakistani women[4]. Furthermore, the presence of contradictory information regarding the involvement of PA in pre-term birth underscores the need for additional research. The objective of this study was to investigate the influence of physical activity (PA) on the mode of delivery and pre-term birth rates among women residing in Peshawar, Pakistan[3-7].

Cesarean delivery is a surgical procedure that involves making incisions in the abdomen and uterus. This procedure carries hazards related to the blood supply and anatomical structures involved. The Pfannenstiel incision, which is the most often used kind of cesarean incision, is now frequently substituted with the Joel Cohen incision. This substitution has been proven to decrease blood loss and the duration of the operation. Cesarean delivery is often performed due to several circumstances such as insufficient labor progression, fetal distress, and previous cesarean sections [4,6].

Vaginal delivery, also known as normal vaginal delivery (NVD), is considered the optimal form of childbirth due to its physiological characteristics and the advantages it offers to both the mother and the infant. Although pelvic floor injuries can occur, NVD (normal vaginal delivery) offers benefits compared to cesarean section, such as quicker recovery time and a lower risk of long-term health complications. Performing pelvic floor muscle exercises after childbirth can aid in regaining muscular strength, hence decreasing the likelihood of prolapse and urine incontinence [4,6,8]

Preterm delivery refers to the birth of a baby before 37 weeks of gestation and is a significant contributor to neonatal illness and death on a global scale. Historically, physical activity was seen as a risk factor for pre-term birth because it led to higher levels of catecholamine production and decreased blood flow to the placenta. Recent research indicates that engaging in moderate physical activity (PA) is unlikely to be a factor in pre-term delivery, however having low levels of PA may elevate the risk[10-12].

Physical activity (PA) during pregnancy provides substantial advantages for the health of both the mother and the developing fetus. It mitigates the likelihood of postpartum depression, gestational diabetes, excessive weight gain, and extended labor. Engaging in physical activity is also linked to increased rates of vaginal delivery and decreased chances of cesarean sections and hypertensive diseases. International guidelines recommend engaging in moderate physical activity (3–6 METs) for a total of 150 minutes per week during pregnancy in order to enhance overall well-being. However, it is advisable for pregnant women to refrain from exercising in hot environments as it poses a danger of heat-related injuries. Additionally, there are certain problems, such as uncontrolled vaginal hemorrhage, placenta previa, and multiple gestations, which demand caution and should be avoided[5,8.9.11]

Multiple research studies, including observational studies, randomized controlled trials (RCTs), and meta-analyses, have investigated the connection between physical activity during pregnancy and the outcomes of childbirth. The results suggest that engaging in moderate physical activity is both safe and advantageous, whereas participating in strenuous exercise may be linked to a longer duration of pregnancy and a decreased likelihood of giving birth prematurely. Furthermore, randomized controlled trials (RCTs) indicate that women who engaged in physical activity (PA) had a greater incidence of normal delivery and experienced fewer problems, such as gestational diabetes and hypertension, in comparison to women in control groups [12-13].

The main aim of this study was to examine the impact of prenatal physical activity on the method of birth and premature delivery among women in Peshawar, Pakistan.

In general, engaging in physical exercise during pregnancy has positive effects on the health of both the mother and the fetus. Although cultural disparities and gaps in information may hinder physical activity (PA) involvement in specific areas, raising awareness and promoting moderate PA might enhance pregnancy outcomes by mitigating the likelihood of cesarean birth, gestational diabetes, and hypertension. Additional investigation on Pakistani communities can assist in customizing suggestions for prenatal physical activity in culturally particular circumstances [10-16].

Methodology

This chapter provides a comprehensive explanation of the study's methodology, which includes clear definitions of key terms, the design and location of the study, the criteria for participant eligibility, the procedures for collecting data, the tools used, and the methods employed for analyzing the data.

Physical Activity (PA) was evaluated using the International Physical Activity Questionnaire (IPAQ), which consists of five components.

• Mode of Delivery (MOD): This was classified into three categories: cesarean delivery, normal vaginal delivery (NVD), and instrumental delivery.
Preterm Delivery is defined by the World Health Organization (WHO) as the birth of a baby before 37 weeks of gestation.
The study utilized a cross-sectional design. The survey was carried out in the Gynecology and Obstetrics Ward of Lady Reading Hospital, located in Peshawar. Data was collected using a non-probability sampling technique known as convenience sampling. The sample size of 132 was determined using Raosoft's online sample size calculator. The calculation considered a 5% margin of error, a 95% confidence level, and a 50% response distribution. The population size used for the calculation was 200 [16-21]. The study was carried out for a duration of six months subsequent to the approval of the research proposal.

Criteria for inclusion
• Women who are 18 years of age or older.
• Pregnancies with only one fetus.
• Mentally resilient women who possess the ability to provide informed consent.
• Individuals who willingly provided their signature on a documented consent form.

Criteria for exclusion
• Women who have previously had systemic disorders such as hypertension or type-1 diabetes mellitus.
• Women experiencing difficulties such as premature rupture of membranes, vaginal hemorrhage, placenta previa, cord prolapse, breech presentation, or chorioamnionitis.
Data collection was carried out under the approval of the Advanced Studies and Research Board (ASRB) and the Ethical Review Board of Khyber Medical University. Permission was also obtained by the Director of the Gynecology/Obstetrics Ward. Individuals who met the specified requirements were identified by examining the medical records of the hospital. The researcher administered the IPAQ questionnaire to eligible participants in order to collect data on their physical activity levels. The IPAQ questionnaire, comprising of five sections and 27 items, was the main instrument utilized for data collection. It specifically targeted weekly physical activity. The inquiries encompass topics such as pedestrianism, transit, recreational pursuits, household chores, and horticulture [9,21,22]. The PA levels were classified as low, moderate, or high according to the IPAQ scoring criteria.
The data were analyzed using SPSS version 22. Quantitative data, such as age, were analyzed using descriptive statistics, specifically means and standard deviations. Categorical variables, such as PA classifications, were expressed as frequencies and percentages. The relationship between physical activity (PA), mode of delivery (MOD), and preterm delivery was analyzed using Pearson's chi-square test.
This chapter presents a comprehensive analysis of the study's results, which are presented in the form of tables and figures.

Descriptive Results

Total number of females included in this survey was 132 aged above 18 years. Their mean age was 25 having a standard deviation of ±5.307.

Table 0-1: Frequency and age of the included participants

Total number of participants	Age	Mean	Standard Deviation
132	Above 18 years	25	± 5.37

67 participants, accounting for 50.8% of the total, were under the age of 25. A total of 62 females, accounting for 47% of the group, were between the ages of 26 and 35. The incidence rate of females aged 36 and older was 3, accounting for 2.3% of the total population. The distribution of participants across different age categories is presented in Table 4.1-1. In addition, the distribution of participants across different age groups was shown using a Bar chart, as depicted in figure 4.1-1.

Table 0-2: Frequency and percentages of categorical age

Age	Frequency	Percentage
Age less than 25	67	50.8%
Age between 26 and 35	62	47%
Age above 36	3	2.2%

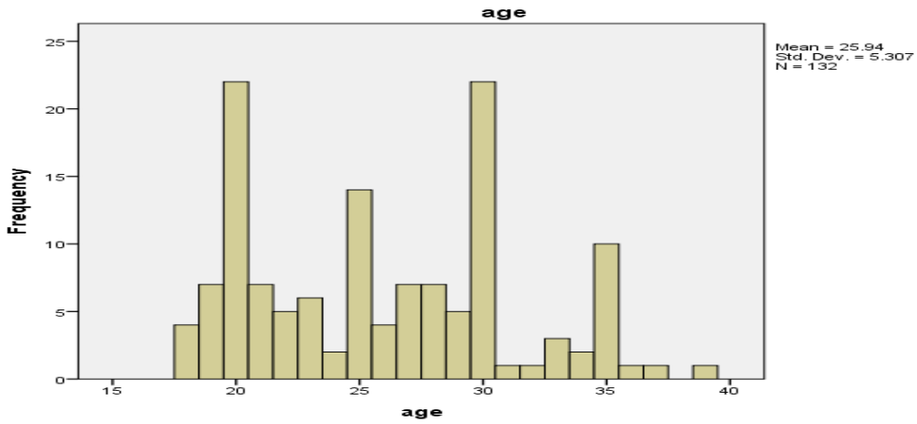

Figure 0-1: Bar chart of age frequencies

The average pre-term delivery among participants was 37, with a standard variation of ±3.406. The average of the participants with NVD is 1.33 with a standard deviation of ± 0.473. The participants who underwent cesarean delivery had an average of 1.67 with a standard deviation of ± 0.470. The average value of the participants' walking MET was 696.61, with a standard deviation of ±564.1. A total of 532 participants utilized MET during the moderate level of physical activity, with a standard deviation of ± 355. The participants who utilized MET during the vigorous degree of physical activity had a mean value of 6.67 with a standard deviation of ± 46.408. The average participants' total MET during physical exercise was 1235.67, with a standard deviation of ± 727.403.

Table 0-3: Mean and standard deviation for pre-term delivery, walking MET, moderate level, and vigorous level Mets

Participants	Mean	Standard deviation
Pre-term delivery	37	± 3.406
Normal Vaginal Delivery	1.33	± 0.473
C-section delivery	1.67	± 0.470
Walking MET	696.61	± 564.1
Moderate level of physical activity MET	532	± 355
Vigorous level of physical activity MET	6.67	± 46.408
Total MET	1235.67	± 727.403

Frequency

Among the 132 participants, 66.7% (88) were females who had a normal vaginal delivery, while 33.3% (44) of the women underwent a cesarean delivery. There were 32 participants who experienced pre-term delivery, which accounted for 15.2% of the total. The prevalence of participants with low physical activity levels during pregnancy was 32, accounting for 24.2% of the total. A total of 100 women, accounting for 75.8% of the sample, experienced moderate levels of physical activity throughout pregnancy. None of the participants in this study had a high degree of physical activity. The table 4.2-2 provides the frequency and percentages of participants who experienced MOD, pre-term delivery, and the amount of physical activity. Table 4.2 2: Frequency and percentages for the method of delivery, premature delivery, and degree of physical activity

Variables		Frequency	Percentages
Mode of delivery	Normal vaginal delivery	88	66.7%
	Cesarean delivery	44	33.3%
Preterm delivery	Preterm delivery	22	15.2%
Level of PA	Low level of PA	32	24.2%
	Moderate level of PA	100	75.8%
	Vigorous level of PA	0	0%

The number of participants who used MET less than 500 was 50 with 37.9%. 57 females used MET in the range of 501 to 1000 with 43.3%. 25 women used walking MET greater than 1001 with 18.9%.

Table 0-1: Frequency and percentages for walking MET categories.

Walking MET categories	Frequency	Percentage
Walking MET used less than 500	50	37.9%
Walking MET used between 501 to 1000	57	43.3%
Walking MET used greater than 1001	25	18.9%

During a moderate level of physical activity, 72 participants, accounting for 54.4%, used less than 500 MET. Additionally, 43 females, representing 32.6%, used MET in the range of 501 to 1000. Furthermore, there were 17 women, making up 12.9%, who used MET during the moderate level of physical activity [22-27.]

Table 0-2: Frequency and percentages for moderate-level METs categories

Moderate-level activity categories	Frequency	Percentages
Less than 500 MET was used during the moderate level of physical activity	72	54.4%
Between 501 to 1000 MET used during the moderate level of physical activity	43	32.6%
Greater than 1001 MET used during the moderate level of physical activity	17	12.9%

There were 44 women who had a total MET (Metabolic Equivalent of Task) value less than 900, which accounted for 33.3% of the total [26-30.] The frequency of participants who utilized MET within the range of 901 to 1800 was 64, accounting for 48.5% of the total. A total of 24 ladies, accounting for 18.2% of the group, had a cumulative MET (metabolic equivalent) value exceeding 1801.

Table 0-3:Frequency and percentages for the categories of total Mets

Total MET category	Frequency	Percentage
MET used less than 900	44	33.3%
MET used between range 901 to 1800	64	48.5%
MET used greater than 1801	24	18.2%

Association

Association with Physical Activity

The objective of this study was to establish a correlation between physical activity during pregnancy and the mode of delivery as well as preterm delivery. To achieve this objective, we utilized the chi-square test [23,27,29] An connection was seen between physical activity (PA) during pregnancy and mode of delivery (MOD), as shown by a p-value of 0.00, which is below the significance threshold of 0.05. The study discovered no significant link between prenatal physical activity and pre-term delivery, as the calculated P value of 0.631 was bigger than the threshold of 0.05.

Table 0-1: Association of the level of PA during pregnancy with the MOD and pre-term delivery

		Level of PA			P-Value
		Low-level PA	Moderate level PA	High-level PA	
MOD	Caesarean delivery	29	15	0	0.00
	NVD	3	85	0	
Pre-term Delivery		4	16	0	0.631

Association with Age

We also observe the correlation between age and both MOD (mode of delivery) and pre-term delivery. In addition, we utilized the chi-square test and found that the p-value was 0.006, indicating a statistically significant correlation between age and MOD, as it was lower than the threshold of 0.05. The p-value for the association between age and pre-term delivery was 0.157, which above the significance level of 0.05. Therefore, there was no significant association between age and pre-term delivery.

Table 0-2: Association of age with the mode of delivery and pre-term delivery

		AGE			P-Value
		25 or less than 25	26-35	36 or greater than 36	
MOD	Caesarean Delivery	15	29	0	0.006
	NVD	52	33	3	
Pre-term Delivery		14	6	0	0.157

Association with Walking MET

In addition, this study also identifies the correlation between walking MET and both the method of delivery and pre-term delivery. The P-value for the link between walking MET and the method of delivery was 0.00, indicating a high correlation. On the other hand, the P-value for the association between walking MET and preterm delivery was 0.631, suggesting no significant correlation [30-33].

Table 0-3: Association of walking METs categories with the mode of delivery and pre-term delivery

		Categories of walking METs			P-Value
		walking MET ≤ 500	walking MET btw 501-1000	Walking MET ≥ 1000	
MOD	Caesarean Delivery	32	9	3	0.00
	NVD	18	48	32	
Pre-term Delivery		4	16	0	0.631

Association with Moderate Level of Physical Activity

Furthermore, there was a significant correlation between moderate level physical activity during pregnancy and the method of delivery, as indicated by a P-value of 0.00. No significant correlation was seen between moderate level physical activity during pregnancy and pre-term delivery, as shown by a P-value of 0.505.

Table 0-4: Association of moderate-level PA categories with the mode of delivery and pre-term delivery

		Categories For Moderate Level Of PA			P-Value
		MET ≤ 500	Mets btw 501-1000	METs≥ 1000	
MOD	Caesarean Delivery	29	15	0	0.00
	NVD	3	85	0	
Pre-term Delivery		9	7	4	0.505

Association with Total MET

Ultimately, we examined the correlation between total MET (Metabolic Equivalent of Task) and the mode of birth. Our analysis revealed a significant link between the level of physical activity throughout pregnancy, as measured by total MET, and the mode of delivery. This was supported by a P-value of 0.00, which is below the threshold of 0.05. The P-value for the association between total physical activity MET and pre-term delivery was 0.307, which exceeded the threshold of 0.05. Therefore, no significant association was observed between total physical activity MET and pre-term delivery [31,34,35.]

Table 0-5: Association of total METs category with the mode of delivery and pre-term delivery

		Categories Of Total MET Used During Physical Activity			P-Value
		MET ≤ 500	Mets btw 901-1800	METs ≥ 1801	
MOD	Caesarean Delivery	32	9	3	0.00

	NVD	12	55	21	
Pre-term Delivery		5	9	6	0.307

Discussion

The objective of this study was to examine the correlation between physical activity during pregnancy and two important obstetric outcomes: the method of delivery and preterm birth. A grand total of 130 ladies who were over the age of 18 took part in the study [30-40].

The findings revealed a noteworthy correlation between increased levels of prenatal physical activity (PA) and the occurrence of normal vaginal delivery (NVD). However, no significant correlation was seen between prenatal PA and pre-term delivery. In addition, the study found a correlation between maternal age and MOD, but no correlation was found between maternal age and pre-term birth [14,27,37].

The results of our study align with previous research indicating that engaging in physical activity during pregnancy reduces the chances of having a cesarean delivery and enhances the possibility of having a normal vaginal delivery. Research conducted by Poyatos et al. (2015) supports these conclusions, indicating that engaging in moderate to high levels of physical activity during pregnancy decreases the likelihood of having a caesarean section, particularly among women who have not given birth before and those with uncomplicated pregnancies. The reason for this consistency can be linked to the commonalities in the study populations and techniques. Both our study and the comprehensive review conducted by Poyatos et al. focused on healthy pregnant women without significant problems. We examined the impact of prenatal physical activity on obstetric outcomes [37-41]

Additional research has also indicated that physical activity (PA) during pregnancy is linked to a decreased likelihood of having a caesarean delivery, especially when PA is continued into the third trimester. Nevertheless, our research findings regarding pre-term delivery are consistent with prior studies that suggest no substantial influence of prenatal physical activity on pre-term birth outcomes. Multiple systematic reviews and meta-analyses have determined that engaging in physical activity during pregnancy, particularly when there are no problems, does not lead to a higher likelihood of giving birth prematurely. Additional evidence was provided by research indicating that physical activity (PA) during leisure time or exercise does not increase the likelihood of pre-term birth in healthy pregnancies with only one fetus [41-46].

The findings of our study align with previous research that emphasizes the correlation between older mother age and higher incidence of cesarean deliveries. According to a study conducted in Denmark, it has been discovered that older moms have a higher likelihood of needing caesarean sections. This pattern was also detected in our own sample. Nevertheless, the pre-term birth rates were not affected by maternal age, which aligns with existing research indicating that unless there are notable maternal health concerns, maternal age alone cannot be used to predict pre-term birth [40,47,48.]

Nevertheless, certain research provide contradictory evidence. Some researchers have contended that prenatal physical activity has no impact on the likelihood of giving birth prematurely, or that it can actually raise this risk. Differences in results may arise due to variances in research methodologies, such as diverse sampling techniques, questionnaires, and the inclusion of pregnancies with multiple fetuses. Previous research utilizing the PRAMS POSTPARTUM questionnaire or including people with multiple births have shown contrasting findings in comparison to our study, which utilized the IPAQ questionnaire and specifically examined pregnancies with only one fetus [23-27].

Additional factors that can influence discrepancies in research results include genetic, cultural, regional, and environmental disparities, as well as variations in diagnostic criteria and methodological methodologies employed in various studies [15-19.]

This study possesses multiple strengths. Initially, we utilized the International Physical Activity Questionnaire (IPAQ), a globally recognized survey, to evaluate physical activity (PA) levels. This approach guarantees that the results may be compared effectively among diverse populations. Furthermore, the study encompassed a range of physical activities, such as those connected to employment, domestic chores, and leisure, thereby offering a thorough evaluation of physical

activity during pregnancy. In addition, we accounted for various confounding variables to improve the internal validity of the study [34-43.]

Limitations and Recommendations

Although this study has notable strengths, it is also subject to many drawbacks. The study had a relatively limited sample size and only collected data from a single hospital, Lady Reading Hospital in Peshawar. This limits the potential to apply the findings to a broader population. Obtaining a larger and more diverse sample from multiple hospitals might yield more reliable and broadly applicable findings. The utilization of a non-probability, convenience sampling technique additionally diminishes the potential to apply the findings to a broader population, as it may introduce a bias in the choosing process.

Another constraint was the timing of data collecting, which occurred after the delivery. The use of a retrospective strategy in this study may lead to recall bias, as individuals were required to remember and report their levels of physical activity during pregnancy. In addition, the study's brief duration restricted our capacity to observe the prolonged impacts of prenatal physical activity on both maternal and newborn outcomes.

To improve the applicability of future research, we suggest conducting larger-scale studies that utilize probability sampling approaches to enhance the capacity to draw general conclusions. Additionally, it is imperative to perform longitudinal studies in order to investigate the enduring impacts of prenatal physical activity on the health of both the mother and the child. Furthermore, future studies should prioritize the incorporation of several hospitals to include the geographical and cultural disparities in physical activity during pregnancy.

Conclusion

Overall, this study showed that engaging in physical activity throughout pregnancy had a notable beneficial effect on the method of childbirth. Specifically, higher levels of physical activity were linked to higher rates of normal vaginal delivery and lower rates of caesarean section. Nevertheless, there was no correlation detected between prenatal physical activity and pre-term delivery. In addition, the study revealed a correlation between maternal age and the method of delivery, although no correlation was identified between maternal age and pre-term birth. Based on these discoveries, it is advisable to motivate pregnant women who are in good health and have no medical reasons to avoid physical activity to participate in moderate levels of physical activity during their pregnancy. By doing so, individuals can decrease their likelihood of undergoing a cesarean delivery and enhance their probability of experiencing a typical vaginal delivery. Future recommendations for prenatal treatment should prioritize the significance of sustaining physical exercise throughout pregnancy to enhance mother and newborn health. Additional investigation is required to examine the enduring consequences of prenatal physical activity and to validate these results in broader and more varied groups.

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