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Original Research Article

An Observational Study of the Effect of Interpregnancy Interval on Fetomaternal Outcome in the Department of Obstetrics and Gynaecology in J.L.N. Medical College Ajmer

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Abstract

Rationale: The duration between a live birth and the subsequent conception, known as interpregnancy internal (IPI) is a critical, yet modifiable, determinant of maternal and fetal health outcomes. IPIs that have been excessively short or much prolonged are known to be linked to increased risks of obstetric complications, yet limited data exists in localized settings to guide optimal birth spacing.

Objectives: This study aims to observe reporting findings of correlation between IPI and fetomaternal health and to identify the interval range with comes with least complexities.

Methods: Department of Obstetrics and Gynaecology, Rajkiya Mahila Chikitsalaya, J.L.N. Medical College, Ajmer undertook this prospective observational study between June 2023 and May 2024. 360 unifetal pregnant women with ≥28 gestations weeks were screened and enrolled into this study. The women were categorised into three groups based on IPI – Group 1: Short (IPI <1.5 Years), Group 2: Optimal (IPI Between 1.5 and 5 years) and Group 3: Long (IPI >5 years). Data on demographic, clinical, maternal, and fetal outcomes were collected and analyzed using Chi-square test and odds ratios Statistical significance was set at $p<0.05$

Results: Group 1: Short (IPI <1.5 years) corresponded with increased incidence of maternal anemia (66.67%), preterm labor (up to 33.33%), fetal growth restriction (FGR, up to 46.67%), and low birth weight. Long IPI (>59 months) showed increased rates of preeclampsia (39.58%), gestational diabetes (18.75%), and placental complications. The lowest complication rates were observed in the optimal IPI group (18–59 months). The association of IPI with FGR, anemia, and hypertensive disorders was statistically significant ($p < 0.0001$).

Conclusion: Both Group 1 (Short) and Group 3 (Long) interpregnancy intervals correlated with extensive maternal and fetal complications. Optimal spacing of 24–59 months was associated with the most favorable outcomes. Counselling on birth spacing and postpartum contraception should be integral to antenatal and postnatal care strategies to improve maternal and neonatal health.

Keywords: Interpregnancy interval, maternal outcome, fetal growth restriction, preterm labor, anemia, birth spacing.

Introduction

The interval between two successive pregnancies, termed the interpregnancy interval (IPI), has emerged as a vital causal factor of fetomaternal health. Pregnancy initiates profound metabolic and physiological changes that extend beyond the gestational period, affecting both maternal and fetal well-being. [1] A significant body of evidence suggests that the timing between pregnancies plays a vital role in optimizing health outcomes for both mother and child, as well as impacting population dynamics and socioeconomic development. [2] The Trends in Maternal Mortality 2000 to 2020 report from World Health Organization (WHO), defines maternal health as not just the health of the mother during pregnancy but also during childbirth and the post-partum period. The global Maternal Mortality Ratio (MMR) has shown a declining trend, from 328 per 100,000 live births in 2000 to 197 in 2023. However, to meet the WHO's 2030 target of an MMR below 70, accelerated improvements are needed. [3] Birth spacing has the potential to contribute significantly to this goal by reducing maternal and neonatal risks. [4] The period between a live birth and the subsequent conception is known as interpregnancy internal (IPI). United States Agency for International

Development (USAID) along with World Health Organisation recommend an IPI of 18 to 24 months to be optimal, cautioning against intervals less than 1.5 years and longer than 5 years. [5] Studies indicate that short IPIs are associated with adverse events such as preterm birth, low birth weight (LBW), small for gestational age (SGA) infants, maternal anemia, uterine rupture, and postpartum complications. [6-10] conversely, prolonged intervals are associated with risks such as preeclampsia and gestational diabetes. [8-11]

The underlying mechanisms may include maternal nutritional depletion, particularly folate deficiency, hormonal imbalances, and incomplete recovery from prior pregnancy. [12,13] These risks are particularly pronounced in low-resource settings where maternal malnutrition is common, yet evidence suggests that even in well-nourished populations, inadequate recovery time can compromise outcomes. [14]

Given that IPI is a modifiable risk factor, understanding its association with fetomaternal outcomes is crucial for developing effective maternal and child health strategies. Numerous global and regional studies have attempted to define the optimal birth interval and examine its impact on both fetomaternal mobidity and mortality. [15-17] However, the variations in healthcare settings, sociodemographic factors, and study methodologies necessitate further localized research.

This study aims to evaluate the correlation between interpregnancy interval and fetomaternal health among pregnant women attending the Obstetrics and Gynecology Department at J.L.N. Medical College, Ajmer. By categorizing IPIs into short, optimal, and long intervals, the study seeks to elucidate their respective contributions to complications such as anemia, preeclampsia, scar dehiscence, preterm labor, and fetal growth restriction.

Methods

This prospective observational study was conducted at Rajkiya Mahila Chikitsalaya within the Obstetrics and Gynecology Department of Jawahar Lal Nehru Medical College, Ajmer, Rajasthan. The study was conducted for a year between 01 June 2023 and 32 May 2024. The sample size was calculated based on previous data suggesting that approximately 26% of pregnancies have an IPI less than 1.5 years. Using 95% confidence level and 5% absolute margin error, minimum required sample size was calculated to be 296. A 20% drop out or lost to follow up was considered brining the sample size to 360 pregnant women. All pregnant women attending the antenatal clinic or admitted to the labor ward during the study duration were screened for eligibility. Women were included if they had a gestational age of 28 weeks or more, were carrying a singleton pregnancy, and provided informed written consent to participate. Women who were primigravida, had multiple gestations, or had known pre-existing medical conditions such as chronic hypertension, heart disease, thyroid disorders, tuberculosis, chronic kidney disease, or liver disorders were excluded.

After obtaining informed consent, detailed demographic information, obstetric and medical history, and clinical examination findings were recorded for each participant. Data collected included age, address, religion, educational and socioeconomic status of the participant and her spouse, gravidity and parity, number of abortions or ectopic pregnancies, mode and outcome of the last delivery, and the date of the last pregnancy. Based on the duration between the previous live birth and the current conception, participants were categorized into three groups: Group 1 : Short (IPI <1.5 Years), Group 2 : Optimal (IPI Between 1.5 and 5 years) and Group 3 : Long (IPI >5 years).

Each participant was followed throughout the antenatal period and intrapartum course, and fetomaternal outcomes were assessed and recorded. Maternal outcomes included anemia, preeclampsia, eclampsia, GDM – Gestational Diabetes Mellitus, PROM – Premature Rupture of Membrane, preterm labour postpartum hemorrhage (PPH), placenta previa, placental abruption, mode of delivery, and caesarean scar dehiscence. Fetal outcomes included birth weight, intrauterine fetal death (IUFD), stillbirth, NICU - neonatal intensive care unit admission, prematurity, fetal growth restriction (FGR), APGAR score, and malpresentation.

All participants underwent routine antenatal investigations including hemogram, blood and Rh typing, routine urine analysis and microscopic examination, fasting blood glucose (FBG), liver function tests (LFT), renal function tests (RFT), prothrombin time (PT), clotting time (CT), international normalized ratio (INR), and screening for HIV, HBsAg, and VDRL. Obstetric ultrasound was performed to assess gestational age, fetal well-being, placental location, and amniotic fluid index (AFI).

Statistical Analysis: The data was compiled using Microsoft Excel and analyzed with Primer statistical software. Categorical variables were defined as frequencies and percentages. Continuous variables were measured as means and standard deviations. Correlation between IPI and various maternal and fetal outcomes were assessed using the Chi-square test. Odds ratios (OR) and 95% confidence intervals (CI) were calculated to

determine the strength and correlation. Statistical significance was set at $p<0.05$

Results

Age Distribution: The majority of participants (48.06%) belonged to the 26–30-year age bracket, with second highest being 30.83% in the 20–25 age range. Only 10.83% were above 35 years of age.

Correlation between IPI and Gestational Age at Time of Delivery: From this study we learnt that gestational age at delivery across different interpregnancy interval (IPI) groups revealed a higher incidence of preterm births with shorter IPI. In the <6 months IPI group, 33.33% of women delivered preterm, compared to 30.56% in the 6–11 months' group. In contrast, the proportion of preterm births decreased significantly in the 12–23 months (11.54%) and 24–59 months (12.10%) groups, which represent the near-optimal and optimal intervals, respectively. Women with IPIs greater than 59 months had a slightly higher preterm birth rate of 16.67%. Term deliveries were most common in the 12–23 months (78.85%) and 24–59 months (77.71%) groups, while post-term deliveries occurred more frequently in the 12–23 months (9.62%) and 24–59 months (10.19%) groups compared to the shorter IPI categories. Although these trends suggest a clear association between IPI and gestational age at delivery, particularly the increased risk of preterm labor with short IPIs, the observed differences did not reach statistical significance ($p = 0.061$).

Distribution of Fetal Outcomes According to IPI: In our study, fetal outcomes across different interpregnancy intervals (IPI) showed a significant correlation between short IPI and adverse neonatal events. The incidence of preterm labor was highest in the <6 months IPI (33.33%) and the 6–11 months IPI (30.56%), compared to significantly lower rates in the 12–23 months (11.54%) and 24–59 months (12.10%) groups.

A slight increase was observed again in the >59 months group (16.67%), with the association reaching statistical significance ($p = 0.012$). Similarly, the occurrence of fetal growth restriction (FGR) was markedly elevated in pregnancies with IPI <6 months (46.67%) and 6–11 months (25.00%), while it was lowest in the 12–23 months (5.77%) and 24–59 months (5.73%) groups. The rate of FGR in the >59 months group was also elevated at 18.75%. This trend was highly statistically significant ($p < 0.0001$), indicating a strong correlation between short or prolonged IPI and FGR. Regarding intrauterine fetal death (IUFD), the highest incidence was observed in the <6 months group (6.67%), followed by 4.17% in the >59 months group. Intermediate rates were noted in other groups, and the association was statistically significant ($p = 0.037$). Premature rupture of membranes (PROM) showed a trend toward higher occurrence in the short IPI groups (26.67% in <6 months, 16.67% in 6–11 months), although this did not prove to be statistical significant ($p = 0.135$). Malpresentation was seen in approximately similar proportions across groups and was not statistically significant ($p = 0.584$). Additionally, NICU admissions were more frequent in the short IPI groups and moderately high in the long IPI group (>59 months), while they were least in the optimal IPI group (24–59 months), suggesting better neonatal outcomes with optimal spacing. Similarly, the rate of low birth weight (<2.5 kg) was elevated in short IPI groups, moderate in >59 months group, and lowest in the 24–59 months category. Although exact p-values were not available for NICU admissions and birth weight, the trend supports the conclusion that short and long IPIs are correlated with adverse fetal outcomes, while optimal spacing leads to more favorable neonatal profiles.

Distribution of Maternal Outcomes According to IPI: In our study, maternal outcomes across varying interpregnancy intervals (IPI) revealed significant associations with multiple complications. Anemia was most prevalent in women with short IPI; it affected 66.67% of participants in both the <6 months and 6–11 months groups. The prevalence dropped markedly in the 12–23 months group (36.54%) and was lowest in the 24–59 months (19.75%) and >59 months (16.67%) groups. This association was statistically significant ($p < 0.0001$), suggesting that shorter intervals between pregnancies may not allow adequate time for the nutritional recovery of the mother. The incidence of preeclampsia was highest in the >59 months group at 39.58%, followed by 10.57% in the 12–23 months group. It was considerably lower in other groups: 6.66% in <6 months, 5.56% in 6–11 months, and 6.4% in 24–59 months, with a highly significant association ($p < 0.0001$). This suggests that both short and especially long IPIs may possibly increase the risk associated with hypertensive disorders in pregnancy. Gestational diabetes mellitus (GDM) was more frequent in the >59 months group (18.75%) and occurred at moderate levels in the 12–23 months (10.58%) and 24–59 months (9.55%) groups. GDM was absent in the <6 months group and occurred in 5.56% of the 6–11 months group. However, this association was not statistically significant ($p = 0.169$). Placental abruption occurred most frequently in women with <6 months (13.33%) and >59 months (12.50%) IPIs, while rates were low in the 12–23 months (1.92%) and 24–59 months (3.18%) groups. The association was statistically significant ($p = 0.018$), indicating a higher risk of abruption with extreme IPI durations.

Similarly, placenta previa showed a slightly increased rate in the <6 months (6.66%) and >59 months (6.25%) groups, but the association was not statistically significant (p = 0.090). Premature rupture of membranes (PROM) and scar dehiscence were also more common in women with shorter IPIs. PROM occurred in 26.67% of the <6 months group and 16.67% of the 6–11 months group, compared to lower rates in the 12–59 months groups.

Although PROM did not reach statistical significance (p = 0.135), scar dehiscence showed a statistically significant association (p = 0.002), with the highest rates in <6 months (13.33%) and 6–11 months (11.11%) groups. Other outcomes such as postpartum hemorrhage (PPH) and prolonged labor occurred more frequently in short and long IPI groups but did not reach statistical significance (p = 0.361 and p = 0.429, respectively). Cesarean section (LSCS) rates were higher in <6 months (26.67%) and >59 months (20.83%) groups compared to the optimal interval group (10.19%), though this trend was not statistically significant (p = 0.121). Likewise, labor induction was more common in long IPI cases (27.08%) but did not show a statistically significant trend (p = 0.177).

Association between Interpregnancy Interval and Fetal Growth Restriction (FGR): A significant association was observed between interpregnancy interval (IPI) and the occurrence of fetal growth restriction (FGR). The highest proportion of FGR was found among women with an IPI of less than 6 months, where 46.67% (7 out of 15) of pregnancies were complicated by growth restriction. This was followed by the 6–11 months group, which had a FGR rate of 25.00% (9 out of 36). In contrast, the incidence of FGR was markedly lower in the 12–23 months (5.77%) and 24–59 months (5.73%) groups, both of which fall within or near the optimal interval window. The rate of FGR increased again in the >59 months group, where 18.75% of pregnancies were affected (9 out of 48).

The statistical analysis demonstrated a highly significant association between IPI and FGR (p < 0.0001), indicating that both very short and prolonged intervals between pregnancies are associated with an increased risk of fetal growth restriction. These findings highlight the importance of maintaining an optimal birth interval of approximately 2 to 5 years to minimize the risk of compromised fetal growth.

Table 1: Age Distribution of Participants

Age Group	Frequency (n=360)	Percentage (%)
20–25 years	111	30.83%
26–30 years	173	48.06%
31–35 years	37	10.28%
>35 years	39	10.83%

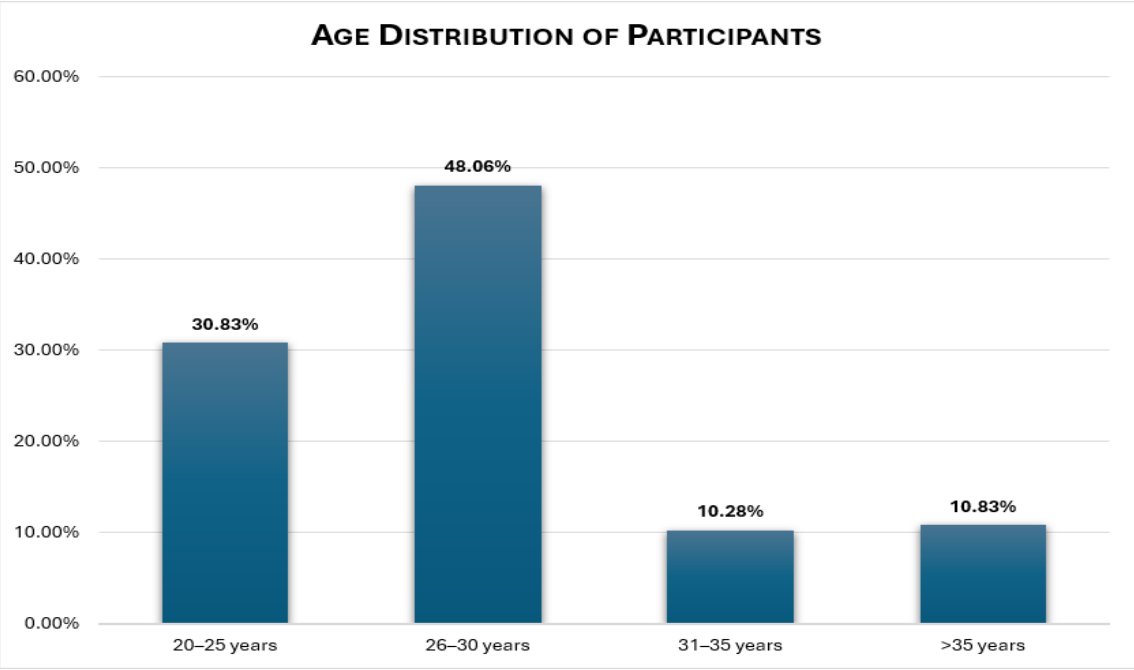

Figure 1: Age Distribution of Participants

Table 2: Association between IPI and Gestational Age at Delivery

IPI Group	Preterm	Term	Post-term	P-value
<6 months	5 (33.33%)	10 (66.67%)	0	0.061
6–11 months	11 (30.56%)	24 (66.67%)	1 (2.78%)	
12–23 months	12 (11.54%)	82 (78.85%)	10 (9.62%)	
24–59 months	19 (12.10%)	122 (77.71%)	16 (10.19%)	
>59 months	8 (16.67%)	36 (75.00%)	4 (8.33%)	

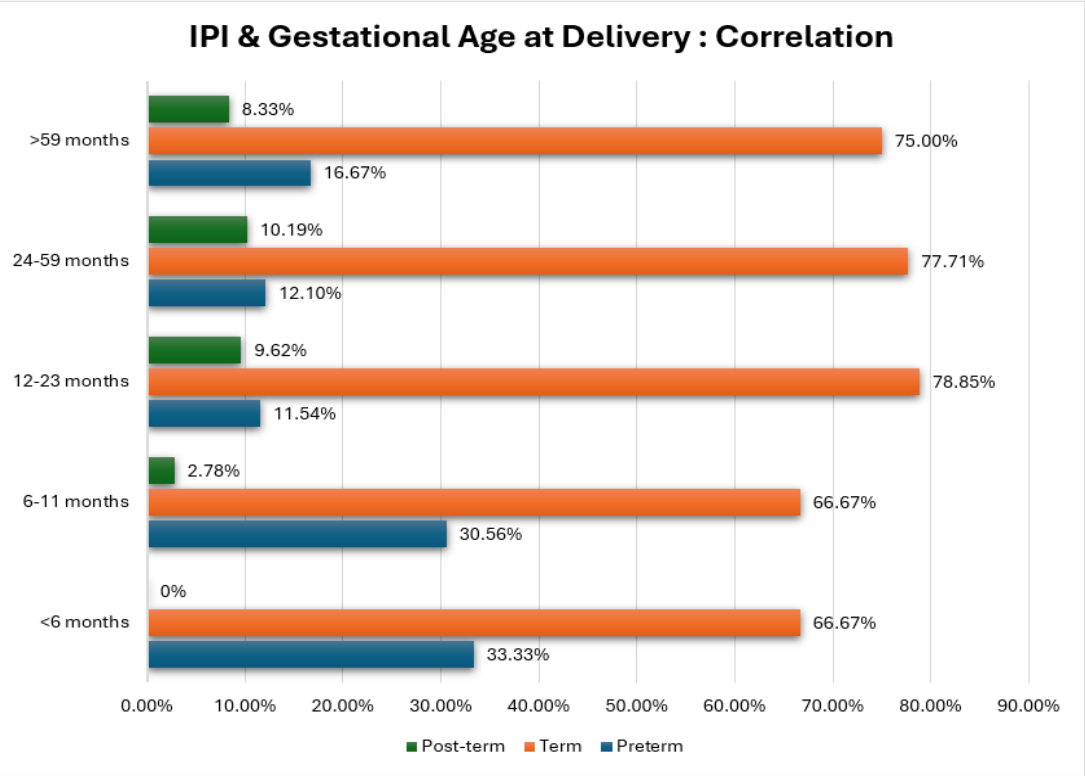

Figure 2: IPI & Gestational Age at Delivery: Correlation

Table 3: Distribution of Fetal Outcomes According to Interpregnancy Interval (IPI)

Fetal Outcome	<6 months (n=15)	6–11 months (n=36)	12–23 months (n=104)	24–59 months (n=157)	>59 months (n=48)	P-value
Preterm Labour	5 (33.33%)	11 (30.56%)	12 (11.54%)	19 (12.10%)	8 (16.67%)	0.012
PROM	4 (26.67%)	6 (16.67%)	8 (7.69%)	15 (9.55%)	7 (14.58%)	0.135
FGR	7 (46.67%)	9 (25.00%)	6 (5.77%)	9 (5.73%)	9 (18.75%)	<0.0001
IUFD	1 (6.67%)	1 (2.78%)	1 (0.96%)	2 (1.27%)	2 (4.17%)	0.037
Malpresentation	2 (13.33%)	5 (13.89%)	8 (7.69%)	10 (6.37%)	4 (8.33%)	0.584
NICU Admission	High	High	Moderate	Low	Moderate	—
Birth Weight <2.5 kg	Elevated	Elevated	Moderate	Low	Moderate	—

Table 4: Distribution of Maternal Outcomes According to Interpregnancy Interval (IPI)

Maternal Outcome	<6 months (n=15)	6–11 months (n=36)	12–23 months (n=104)	24–59 months (n=157)	>59 months (n=48)	P-value
Anemia	10 (66.67%)	24 (66.67%)	38 (36.54%)	31 (19.75%)	8 (16.67%)	<0.0001
Preeclampsia	1 (6.66%)	2 (5.56%)	11 (10.57%)	10 (6.4%)	19 (39.58%)	<0.0001
Gestational Diabetes Mellitus (GDM)	0 (0%)	2 (5.56%)	11 (10.58%)	15 (9.55%)	9 (18.75%)	0.169
Placenta Abruption	2 (13.33%)	3 (8.33%)	2 (1.92%)	5 (3.18%)	6 (12.50%)	0.018
Placenta Previa	1 (6.66%)	0 (0%)	1 (0.96%)	2 (1.27%)	3 (6.25%)	0.090

PROM	4 (26.67%)	6 (16.67%)	8 (7.69%)	15 (9.55%)	7 (14.58%)	0.135
Scar Dehiscence	2 (13.33%)	4 (11.11%)	1 (0.96%)	2 (1.27%)	0 (0%)	0.002
PPH	2 (13.33%)	2 (5.56%)	3 (2.88%)	5 (3.18%)	2 (4.17%)	0.361
Prolonged Labour	2 (13.33%)	3 (8.33%)	15 (14.42%)	28 (17.83%)	11 (22.92%)	0.429
LSCS	4 (26.67%)	7 (19.44%)	12 (11.54%)	16 (10.19%)	10 (20.83%)	0.121
Labour Induction	1 (6.67%)	2 (5.56%)	20 (19.23%)	30 (19.11%)	13 (27.08%)	0.177

Table 5: Association between Interpregnancy Interval and Fetal Growth Restriction (FGR)

Interpregnancy Interval (IPI)	FGR Present	FGR Absent	Total (n)	Percentage with FGR (%)	P-value
<6 months	7	8	15	46.67%	**<0.0001**
6–11 months	9	27	36	25.00%	
12–23 months	6	98	104	5.77%	
24–59 months	9	148	157	5.73%	
>59 months	9	39	48	18.75%	

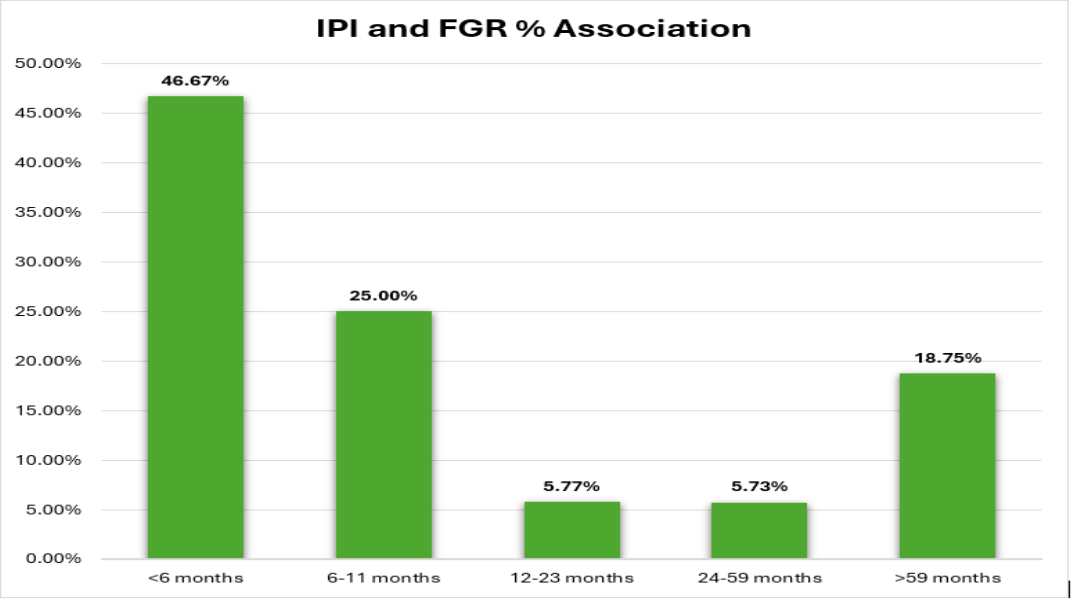

Figure 3: IPI & FGR Association

Discussion

This study evaluated the impact of interpregnancy interval (IPI) on fetomaternal outcomes among 360 pregnant women. The results demonstrated that very short (<6 months) and long (>59 months) IPIs are linked with increased maternal and fetal complications, while optimal spacing (12–59 months) is linked to better outcomes.

Our findings reinforce the World Health Organization's recommendation of a minimum IPI of 24 months to reduce maternal and perinatal risks. [18] Women with IPIs less than 12 months had significantly higher rates of maternal anemia (66.67%), scar dehiscence (13.33%), preterm labor (33.33%), fetal growth restriction (FGR, 46.67%), and low birth weight (LBW, 60%). These findings are consistent with those of Lewis and Mor, who found increased rates of anemia, PROM, scar dehiscence, and LBW in women with short IPIs. [19] Similarly, Jani et al. reported that short IPIs were significantly associated with anemia (p = 0.017) and scar complications. [20]

The increased maternal and neonatal morbidity associated with short IPI may be explained by several mechanisms. According to the maternal depletion hypothesis, closely spaced gestations do not allow adequate time for the mother to restore essential nutrient stores—particularly folate, which is critical for fetal development. Studies show that folate levels remain subnormal for several months postpartum, contributing to increased risks of anemia, FGR, and neural defects. [21]

Fetal outcomes in this study followed a similar trend. FGR and NICU admissions were markedly more common in <6 and 6–11 month groups. These results parallel the findings by Seham et al., who observed significantly higher rates of small for gestational age (SGA, 58%) and preterm labor (58%) in women with IPIs <6 months compared to those with optimal spacing. [22] Likewise, Hanley et al. reported increased odds of preterm birth and

NICU admissions with IPIs <6 months. [23] Conversely, long interpregnancy intervals (>59 months) were associated with increased risks of preeclampsia (39.58%), gestational diabetes (18.75%), and placental abruption (12.50%), aligning with prior literature that links prolonged IPI to maternal age-related risks, uterine aging, and loss of uterine muscle tone. [22,24] In our study, the >59 months group also showed increased rates of preterm labor (16.67%) and low APGAR scores, suggesting that very long gaps between pregnancies may compromise uterine preparedness.

Our study showed the lowest incidence of adverse outcomes in women with an IPI of 24–59 months, affirming that this interval represents an optimal window for maternal recovery and uterine readiness. As noted by Sumayya et al., optimal spacing was correlated with lower rates of anemia, preterm birth, and NICU admissions. [25]

In light of these findings, public health programs must emphasize the importance of pregnancy planning, antenatal counseling, and postpartum contraception. Educating women about the risks of short and prolonged IPIs could play a critical role in reducing preventable fetomaternal morbidity and mortality. Furthermore, this study supports incorporating birth spacing guidance into postnatal care protocols, especially in low-resource settings where nutritional and medical recovery post-pregnancy is often inadequate.

Conclusion

This study demonstrates that the interpregnancy interval (IPI) has a significant impact on both maternal and fetal outcomes. Short IPIs (<1 year) were strongly associated with heightened risks of maternal anemia, preterm labor, fetal growth restriction, low birth weight, and scar-related complications. Conversely, long IPIs (>59 months) were linked to higher rates of hypertensive disorders, gestational diabetes mellitus, and placental complications such as abruption and previa. The lowest incidence of complications was observed in women with optimal IPIs of 24 to 59 months, supporting current recommendations for adequate birth spacing.

These findings emphasize the importance of counseling women on appropriate family planning and postpartum contraception to ensure optimal interpregnancy intervals. Public health strategies should prioritize awareness campaigns and access to reproductive health services to minimize preventable fetomaternal morbidity and mortality. Further research, particularly large-scale multicenter studies, is recommended to reinforce these associations and tailor interventions to different population needs.

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