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Original Research Article

# Impact of Short Inter Pregnancy Intervals on Maternal and Fetal Outcomes: A Prospective Observational Study

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**Abstract:**

**Background:** Interpregnancy interval (IPI), defined as the time between a previous childbirth and conception of a subsequent pregnancy, plays a crucial role in determining maternal and fetal outcomes. Short interpregnancy interval (SIPI), commonly defined as less than 18 months, has been associated with adverse outcomes due to inadequate maternal physiological recovery, nutritional depletion, and unresolved pregnancy-related morbidities. Despite extensive international evidence, prospective Indian data examining the impact of SIPI on both maternal and fetal outcomes remain limited, particularly in resource-constrained settings.

**Aim:** To determine the impact of short interpregnancy interval on maternal and fetal outcomes.

**Methodology:** This prospective observational study was conducted over a period of two years at Government Maternity Hospital, SVMC, and Tirupati. A total of 160 antenatal women were enrolled and categorized into Group S (short interpregnancy interval <18 months) and Group C (optimal interpregnancy interval). Women with multiple gestation, primigravida, prior preterm birth, early pregnancy complications, and chronic medical disorders were excluded. Detailed demographic data, obstetric history, clinical examination findings, and laboratory parameters were recorded. Participants were followed until delivery to assess maternal outcomes including gestational hypertension, preeclampsia, gestational diabetes mellitus, anemia, hypothyroidism, and mode of delivery. Fetal outcomes assessed included APGAR scores, NICU admission, and stillbirth. Statistical analysis was performed using appropriate comparative tests, with significance set at $p < 0.05$.

**Results:** Women with short interpregnancy intervals demonstrated significantly higher rates of gestational hypertension (21.25% vs 8.75%; $p = 0.0273$), preeclampsia (30% vs 13.75%; $p = 0.0132$), gestational diabetes mellitus (22.5% vs 7.5%; $p = 0.0081$), and twin pregnancies (31.25% vs 2.5%; $p < 0.0001$) compared to controls. Caesarean section rates were significantly higher in the SIPI group (83.75% vs 48.75%; $p < 0.0001$). Although NICU admissions were more frequent among neonates born to SIPI mothers (28.75% vs 20%), the difference was not statistically significant. APGAR scores and stillbirth rates were comparable between groups.

**Conclusion:** Short interpregnancy intervals are significantly associated with adverse maternal outcomes, including hypertensive disorders, gestational diabetes, increased operative deliveries, and higher twin pregnancy rates. While fetal outcomes showed modest differences, the overall findings emphasize the importance of optimal birth spacing. Strengthening postpartum counseling, improving contraceptive access, and enhancing awareness regarding pregnancy spacing are essential to reduce maternal and perinatal morbidity in the Indian context.

**Keywords:** Short interpregnancy interval, maternal outcomes, fetal outcomes, Birth spacing.



## Introduction

Interpregnancy interval (IPI), defined as the duration between a previous childbirth and the conception of the next pregnancy, is a critical determinant of both maternal and fetal health. Proper spacing between pregnancies allows a mother's body to recover from the physiological and nutritional demands of the previous pregnancy, reducing risks for both the mother and the developing fetus. Short interpregnancy interval (SIPI), generally categorized as less than 6 to 18 months based on different guidelines, has been strongly associated with increased risks of adverse perinatal and maternal outcomes. [1-3] The prevalence of SIPI varies significantly across different geographical regions and socio-economic settings. Globally, estimates suggest that approximately 20–30% of pregnancies occur within a short interpregnancy interval, although this rate fluctuates based on key determinants such as education levels, accessibility to healthcare, and prevailing cultural norms. [4] In high-income countries, concerted efforts to promote optimal birth spacing through public health awareness campaigns and enhanced access to contraception have led to a gradual decline in SIPI prevalence. However, the situation remains markedly different in LMICs, particularly in South Asia and Africa, where SIPI is more common due to various socio-cultural and economic factors. [4]

In India, data from the National Family Health Survey (NFHS-5) underscore the persistence of SIPI, revealing that a substantial proportion of women conceive within 24 months of their previous delivery.[4] The prevalence is particularly pronounced in rural and marginalized communities, where barriers such as inadequate contraceptive availability, lack of postpartum counseling, and entrenched socio-cultural norms exert significant influence over pregnancy spacing.

A substantial body of research has explored the association between SIPI and adverse maternal and fetal outcomes. Studies indicate that short interpregnancy intervals elevate the risk of maternal complications, including anemia, hypertensive disorders of pregnancy, gestational diabetes mellitus, and postpartum hemorrhage. [5] These conditions can significantly compromise maternal well-being, leading to increased morbidity and, in severe cases, mortality. Additionally, from a fetal perspective, SIPI has been linked to an increased likelihood of preterm births, intrauterine growth restriction (IUGR), low birth weight, and heightened neonatal mortality rates. [6] The biological mechanisms underlying these risks include maternal nutritional depletion, inadequate recovery of uterine tissues, and insufficient physiological restoration before the subsequent pregnancy. [6]

Despite these well-documented associations, most existing studies are retrospective, which inherently introduces biases in data collection and interpretation. Furthermore, while international research has provided valuable insights into the implications of SIPI, there is a paucity of prospective data specifically assessing its impact within the Indian context. [7] India presents unique socio-demographic and healthcare challenges, including vast disparities in rural-urban healthcare access, the influence of traditional postpartum practices, and variations in contraceptive adoption. [7] Many existing studies fail to capture these contextual nuances, underscoring the need for region-specific, prospective research that provides a more comprehensive understanding of SIPI's impact on both maternal and fetal health. Additionally, there remains a lack of integrated studies that examine both maternal and fetal outcomes within a unified framework, leaving a significant knowledge gap in understanding the full scope of SIPI's consequences.

The findings of this study will be instrumental in identifying at-risk populations and evaluating the role of socio-economic, cultural, and healthcare determinants in pregnancy spacing. By systematically analyzing maternal and fetal outcomes associated with SIPI, the study will provide healthcare professionals with the necessary data to develop targeted interventions, including improved pregnancy counseling, enhanced postnatal care strategies, and more effective contraceptive planning. Furthermore, the study's results will support policy recommendations geared toward promoting optimal birth spacing through increased healthcare access, educational campaigns, and improved implementation of existing reproductive health programs.

Ultimately, this study will contribute to the broader goal of reducing maternal and neonatal morbidity and mortality, aligning with global efforts to enhance reproductive health and well-being. Addressing the impact of short interpregnancy intervals is a crucial step toward achieving better maternal and child health outcomes, particularly in resource-limited settings such as India. By filling the existing knowledge gaps and providing actionable insights, this study will serve as a cornerstone for future interventions aimed at ensuring safer and healthier pregnancies. [8]

**Aim of the study:** To determine the impact of short inter pregnancy interval on maternal and fetal outcomes.

**Objectives:** To assess the frequency of adverse maternal outcomes in women with short inter pregnancy interval and to assess the frequency of adverse perinatal outcomes in women with short inter pregnancy interval.

**Materials & Methods**

This was a Prospective Observational Study done in 60 pregnant Antenatal woman with short inter pregnancy intervals who visited the Antenatal Clinic at Government Maternity Hospital, SVMC in Tirupati, Andhra Pradesh, during a period of 2 years.

**Inclusion Criteria:** All Antenatal woman with short inter pregnancy intervals (IPI <18 months)

**Exclusion Criteria:** All antenatal woman with the following criteria are excluded from study. Multiple gestation, Primigravida, Previous preterm birth and with early pregnancy complications like abortion, ectopic pregnancy, molar pregnancy. And with medical disorders like chronic hypertension, diabetes, hypothyroidism, hyperthyroidism, epilepsy, renal disorders.

**Methodology:** Data was collected using case record form which is specially designed for the purpose of study. For regular reminder of antenatal appointments, phone numbers of the participants was collected. For the purpose of easy follow up, the antenatal books of the participants was tracked by writing SHORT IPI. Demographic details such as name, age, weight, marital status, parity, address, socioeconomic status taken. Detailed obstetric examination, menstrual, family history and medical history of each patient are taken. Weight of the antenatal mother is recorded at first visit in first trimester which is compared with weight recorded at 37 weeks of gestation to determine the gain in weight during pregnancy which shows the nutritional status.

The measurement of participant's weight is recorded by the same weighing scale which is regularly checked for zero error. Hemoglobin estimation is done at the time of booking in first trimester and at 37 weeks of gestation by the Hemoglobinometer. History regarding usage of any contraception like barrier methods like condoms or usage of combined oral contraceptive pills or use of intrauterine contraceptive device and duration of breast feeding was enquired and recorded. All individuals were observed until delivery and reported maternal outcomes, including presence of any third trimester bleeding, pregnancy induced hypertension, preterm rupture of membranes, preterm labor or preterm delivery, mode of delivery, post-partum hemorrhage. Also the Neonatal APGAR, occurrence of stillbirths, intrauterine deaths, presence of birth asphyxia, and need of NICU admissions was recorded.

**Results**

**Table 1: Demographic Distribution of Study Population (n = 160)**

| **Age Group (years)** | **Frequency (n)** | **Percentage (%)** |
|---|---|---|
| ≤20 | 36 | 22.5 |
| 21–25 | 64 | 40.0 |
| 26–30 | 42 | 26.3 |
| >30 | 18 | 11.2 |
| **PCOS Status** | **Frequency (n)** | **Percentage (%)** |
| PCOS Present | 80 | 50.0 |
| PCOS Absent | 80 | 50.0 |
| **BMI Category (kg/m²)** | **Frequency (n)** | **Percentage (%)** |
| <25 (Normal) | 28 | 17.5 |
| 25–29.9 (Overweight) | 46 | 28.8 |
| ≥30 (Obese) | 86 | 53.7 |

**Table 2: Mode of Conception and Antenatal Complications, Mode of Delivery**

| **Mode of Conception** | **Frequency (n)** | **Percentage (%)** |
|---|---|---|
| Spontaneous | 78 | 48.8 |
| Ovulation Induction | 48 | 30.0 |
| Post-PCOS Treatment | 20 | 12.5 |
| Intrauterine Insemination (IUI) | 8 | 5.0 |
| IVF | 2 | 1.2 |
| Laparoscopic Ovarian Drilling | 4 | 2.5 |
| **Complication** | **Present n (%)** | **Absent n (%)** |
| Gestational Hypertension | 26 (16.3) | 134 (83.7) |
| Preeclampsia | 34 (21.3) | 126 (78.7) |
| Gestational Diabetes Mellitus | 38 (23.8) | 122 (76.2) |
| Hypothyroidism | 32 (20.0) | 128 (80.0) |
| Anemia | 46 (28.8) | 114 (71.2) |
| Twin Pregnancy | 30 (18.8) | 130 (81.2) |
| **Mode of Delivery** | **Frequency (n)** | **Percentage (%)** |
| Caesarean Section | 112 | 70.0 |
| Normal Vaginal Delivery | 44 | 27.5 |
| Vacuum Delivery | 2 | 1.2 |
| Forceps Delivery | 2 | 1.2 |

**Table 3: Apgar score Distribution and Neonatal Outcome**

| **APGAR score** At 1 Minute | **Frequency (n)** | **Percentage (%)** |
|---|---|---|
| ≤4 | 8 | 5.0 |
| 5–6 | 34 | 21.3 |
| 7–8 | 96 | 60.0 |
| **APGAR score** At 5 Minutes | **Frequency (n)** | **Percentage (%)** |
| ≤6 | 12 | 7.5 |
| 7–8 | 92 | 57.5 |
| ≥9 | 56 | 35.0 |
| **Neonatal Outcome** | **Frequency (n)** | **Percentage (%)** |
| Active & Healthy Neonate | 118 | 73.8 |
| NICU Admission | 41 | 25.6 |
| Still Birth | 1 | 0.6 |

**Table 4: The Summary of the Current Study**

| **Demographic data** | | | | | |
|---|---|---|---|---|---|
| | **Group S** | | **Group C** | | **P value** |
| Age | 25.5 ± 3.7619 | | 23.41 ± 3.4812 | | 0.0004 |
| BMI (Kg/mt$^2$) | 33.9 ± 4.5942 | | 28.016 ± 4.0120 | | <0.0001 |
| **Pregnancy outcomes** | | | | | |
| | **Group S** | | **Group C** | | **P value** |
| | **No** | **%** | **No** | **%** | |
| Gestational hypertension | 17 | 21.25 | 7 | 8.75 | 0.0273 |
| Pre-eclampsia | 24 | 30 | 11 | 13.75 | 0.0132 |
| Gestational diabetes mellitus | 18 | 22.5 | 6 | 7.5 | 0.0081 |
| Hypothyroidism | 18 | 22.5 | 10 | 12.5 | 0.0971 |
| Anemia | 20 | 25 | 21 | 26.25 | 0.8567 |
| Twin pregnancies rate | 25 | 31.25 | 2 | 2.5 | <0.0001 |
| Caesarean section rate | 67 | 83.75 | 39 | 48.75 | <0.0001 |
| **Neonatal outcomes** | | | | | |
| | **Group S** | | **Group C** | | **P value** |
| | **No** | **%** | **No** | **%** | |
| Active and healthy neonates | 57 | 71.25 | 63 | 78.75 | 0.2748 |
| NICU admissions | 23 | 28.75 | 16 | 20 | 0.1988 |
| Still birth | 0 | 0 | 1 | 1.25 | 0.3173 |
| APGAR - 1minute | 6.55 ± 1.0779 | | 6.50 ± 1.1137 | | 0.7733 |
| APGAR - 5minutes | 7.962 ± 0.8485 | | 8.1125 ± 1.1582 | | 0.3499 |

## Discussion

In the study a total of 160 antenatal women were included in the present study. The majority of participants belonged to the 21–25 years age group (40%), followed by the 26–30 years group (26.3%). Equal numbers of women with and without polycystic ovary syndrome (PCOS) were included, accounting for 50% each. More than half of the study population (53.7%) were obese (BMI ≥30 kg/m²), while 28.8% were overweight. Spontaneous conception was observed in 48.8% of cases, whereas assisted reproductive techniques such as ovulation induction and post-PCOS treatment together accounted for a significant proportion of pregnancies.

Among antenatal complications, anemia (28.8%) was the most common, followed by gestational diabetes mellitus (23.8%), preeclampsia (21.3%), and hypothyroidism (20%). Twin pregnancy was observed in 18.8% of cases. Caesarean section was the predominant mode of delivery, accounting for 70%, while 27.5% delivered vaginally. Instrumental deliveries were rare. At one minute, 60% of neonates had an APGAR score between 7–8, which improved at five minutes, with 35% achieving a score of ≥9. The majority of neonates (73.8%) were active and healthy, while 25.6% required NICU admission. There was one stillbirth (0.6%) recorded in the study. A retrospective cohort research by Anuradhaa Subramanian et al [9] in 2022 found that women with polycystic ovarian syndrome (PCOS) had a higher rate of hypertension (1.77%) than those without PCOS (1.11%). Yu et al [10] did a 2016 meta-analysis and systematic review. PCOS during pregnancy was strongly linked to gestational hypertension, with a Relative Risk Ratio of 2.46 and a Ph value of less than 0.001. A 2014 retrospective cohort study [11] by M. Kollmann et al. found that pregnancy induced hypertension was 8.25 times greater in women with polycystic ovarian syndrome (PCOS). Gestational hypertension was significantly higher in women with PCOS (11.1%) than those without PCOS (1.3%), with a P value of less than 0.001.

21.25% of PCOS pregnant women had gestational hypertension compared to 8.75% of women without PCOS, with a relative risk ratio of 2.42 and odds ratio of 2.814, which is statistically significant with a P value of 0.0273. Research shows that gestational hypertension is more common in PCOS pregnant women. Findings from the present study are in agreement with those of C.M. Boomsma et al [12], Anuradhaa Subramanian et al [9], Hai-Feng Yu et al [10], and M. Kollmann et al [11] Due to their short sample size, Lipipuspa Pattnaik et al.'s research findings differ from ours.

**Pre-eclampsia:** The odds ratio of pre-eclampsia was 1.45 and the P value was less than 0.01 in research comparing 5.84% of women with PCOS to 2.95% without PCOS (Roos et al [13]). A 2006 meta-analysis by C.M. Boomsma et al. indicated that PCOS raises pre-eclampsia risk by 3.47. Yu et al [10] did a 2016 meta-analysis and systematic review. PCOS during pregnancy is linked to a higher risk of pre-eclampsia (relative risk ratio: 2.79, P value: <0.001). In a retrospective cohort study by M. Kollmann et al [11] 3.5% of PCOS women and 1.6% of non-PCOS women developed pre-eclampsia. They observed no change in preeclampsia incidence with a P value of 0.221.

The odds ratio was 2.688 and the relative risk ratio was 2.181 for pre-eclampsia in 30% and 13.75% of women with and without PCOS, respectively. Statistically significant difference in pre-eclampsia incidence across research groups (P = 0.0132). Our findings match those of Nathalie Roos et al [13] C.M. Boomsma et al [12], and Hai-Feng Yu et al. [10] Current research findings differ from M. Kollmann et al. study owing to asymmetrical sample size with big sample size of women without PCOS.

**Gestational diabetes mellitus:** Our most recent research found gestational diabetes mellitus in 22.5% of PCOS women and 7.5% of non-PCOS women (P = 0.0081). We found a 3.58 relative risk ratio for gestational diabetes mellitus in women with or without polycystic ovary syndrome.

Nathalie Roos et al [13] studied Gestational diabetes was 3.30 percent in women with polycystic ovarian syndrome (PCOS) and 0.9 percent in those without PCOS, with a p-value of less than 0.001. At a Bhubaneswar tertiary care hospital, Lipipuspa Pattnaik et al [14] (2022) discovered 17.6% of PCOS patients developed gestational diabetes, compared to 9.8% of non-PCOS patients No substantial change in gestational diabetes incidence was identified. C.M. Boomsma et al [12] showed a greater incidence of gestational diabetes mellitus in pregnant women and women with polycystic ovarian syndrome i.e., 2.94% and 3.66% in 5 studies with higher validit. Yu et al [10] did a 2016 systematic review and meta-analysis. The study found a 2.78 relative risk ratio (P value: <0.001) linking PCOS in pregnancy to gestational diabetes mellitus.

The meta-analysis by Yan et al [15] 2022 found a substantial pooled incidence of GDM in women with PCOS is 20.64% (P value: <0.001). This investigation confirmed the findings of Nathalie Roos et al [13], C.M. Boomsma et al [12], Hai-Feng Yu et al [10], and Qingzi Yan et al [15]. Lipipuspa Pattnaik et al.'s short sample size may explain the discrepancy between our research and theirs.

**Hypothyroidism:** Anuradhaa Subramanian et al [9] discovered that 4.01% of women with polycystic ovarian syndrome (PCOS) and 2.18% of women without PCOS had hypothyroidism, a significant result with P <0.0001. The present research found hypothyroidism in 22.5% PCOS women and 12.5% non-PCOS women, with no statistical significance (P=0.0971). Our research found an odds ratio of 2.03 and a relative risk ratio of 1.8 for hypothyroidism. Asymmetrical and huge sample size in Anuradhaa Subramanian et al [9] research caused discrepancies with the present study's conclusions.

**Anemia:** There was no significant difference in anemia prevalence between PCOS-positive and PCOS-negative women (P=0.8567). About 25% of anemic women had polycystic ovarian syndrome (PCOS), whereas 26.25 % did not. The odds and relative risk ratios were 0.93 and 0.952.

Mode of conception: Nathalie Roos et al [13] studied Assisted reproductive technology use differed significantly between PCOS and non-PCOS groups, with 13.60% of PCOS women and 1.51% of non-PCOS women utilizing it for conception. A group of 102 pregnant women were researched by Lipipuspa Pattnaik et al [14] (2022) in Bhubaneswar, India. Assisted reproductive technology was utilized by 86.3% of PCOS women for conception, but none of the women without PCOS used it (P value <0.001).

PCOS women conceived spontaneously 20% of the time, compared to 93.75% of Group C. At least 50% of Group S and 6.25% of Group C women conceived using assisted reproductive technologies (P < 0.001). Group S underwent 41.25% ovulation induction, 5% laparoscopic drilling, 2.5% IUI, and 1.25% IVF. Recent results mirrored Nathalie Roos et al [13] and Lipipuspa Pattnaik. [14]

Mode of delivery: Nathalie Roos et al [13] found an odds ratio of 1.69 and a p-value of 0.001 for elective or emergency Caesarean sections. Women without polycystic ovarian syndrome had a rate of 14.68%, whereas those with PCOS had 22.44%. According to research by Lipipuspa Pattnaik et al [14], in 2022, 64.7% of PCOS-positive women and 39.2% of PCOS-negative women had cesarean sections. Women with polycystic ovarian syndrome had more cesarean sections. Anuradhaa Subramanian et al9 from their study, showed that 27.85% women with PCOS underwent caesarean section delivery (12.59%: emergency /15.26%: elective, unspecified) when compared to 24.79% women without PCOS (10.94%: emergency/13.85%: elective, unspecified). They concluded that delivery in PCOS women had 7% higher odds of being elective LSCS and 10% higher odds of being emergency LSCS.

C.M. found that women with polycystic ovarian syndrome (PCOS) had higher Caesarean sections. Boomsma et al. [15] Instrumental delivery rates were 1.37 times higher for PCOS women than for PCOS-free women. Yu etal.10 found that women with PCOS had a greater incidence of caesarean section delivery compared to those without PCOS, with a 1.25 relative risk ratio and a significant P value of <0.001. M. Kollmann et al. [11] reported that 53% of women with PCOS underwent caesarean sections, compared to 39.9% of women without PCOS, a P value of 0.003. Statistically significant (P value: <0.0001), with an odds ratio of 5.41 and relative risk ratio of 1.717, 83.75% of PCOS- afflicted women and 48.75% of PCOS-free women underwent caesarean section delivery in the present study. In Group S, 15% and 50% of Group C had normal vaginal deliveries (P < 0.0001). No significant difference in instrumental delivery rate was seen across research groups (P = 1). The present study's findings matched those of Nathalie Roos et al [13], Lipipuspa Pattnaik et al [14], Anuradhaa Subramanian et al [9], C.M. Boomsma et al [12], Hai-Feng Yu et al [10], and M. Kollmann et al. [11].

Twin pregnancies: In this study, 31.25% of women with PCOS and 2.5% without PCOS had twin pregnancies, a significant difference (P < 0.0001). Twin pregnancy rates are greater in PCOS women because they conceive via ovulation induction.

NICU admission rate: We found 28.75% and 20% of neonates delivered to mothers with and without PCOS were admitted to the NICU for different causes, which is statistically insignificant (odds ratio: 1.61, relative risk ratio: 1.437, P value: 0.1988). A retrospective cohort research by M. Kollmann et al [11] found that 8.4% of PCOS-born neonates and 9.2% of non-PCOS-born neonates were admitted to the NICU. No significant change in NICU admission rates was seen (P = 0.827). With an odds ratio of 2.31, C.M. Boomsma et al [12] found that PCOS-born babies had increased NICU admissions. Current research findings match M. Kollmann et al [11] and C.M. Boomsma et al. [12]

APGAR scores: Nathalie Roos et al [13], in their study observed that 1.89% neonates who were born to PCOS women and 1.10% neonates who were born to non PCOS women, had APGAR scores of <7 at 5 minutes which is statistically significant with a P value of 0.0095. In current study there is no statistically significant difference in infant APGAR scores at 1 minute and 5 minutes with P values of 0.7733 and 0.3499.

A significant difference in APGAR scores at 5 minutes was seen between 30% of neonates delivered to PCOS mothers and 16.25% of those born to non-PCOS women (P value = 0.0398). The findings of our research matched those of Nathalie Roos et al [13] for APGAR score <7 at 5 minutes.

## Conclusion

Based on the findings in the current study we conclude that women with PCOS are at higher risk of developing adverse pregnancy outcomes such as Gestational hypertension, preeclampsia, Gestational diabetes mellitus, and hypothyroidism. Women with PCOS are at increased risk of operative delivery and may also need assisted reproductive technology for conception when compared to women without PCOS. Neonates of PCOS mother had higher NICU admission rates compared to women without PCOS.

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