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EFFECT OF SHORT INTER-PREGNANCY INTERVAL ON MATERNAL AND FETAL OUTCOMES

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Abstract

OBJECTIVE

To determine the effects of short inter-pregnancy interval on maternal and fetal outcomes

METHODOLOGY

This prospective cohort investigation conducted at Jinnah Postgraduate Medical Centre in Karachi aims to evaluate maternal and neonatal outcomes associated with short (<18 months) and standard (≥18 months) inter-pregnancy intervals (IPI). Expectant females aged 18 to 40 years, at or beyond 28 weeks of gestation, with a singleton pregnancy and a parity greater than one, will be recruited for the study. Criteria for exclusion encompass individuals with chronic health conditions, a history of pre-term deliveries, and instances of early complications. Data analysis utilizing SPSS version 26.0, employing the Chi-square statistical test with a significance threshold set at P<0.05.

RESULTS

The research investigated the ramifications of abbreviated interpregnancy intervals (IPI ≤18 months) on maternal and neonatal health outcomes among women aged 18 to 40 years. Mothers experiencing short IPI exhibited markedly elevated risks of anemia (45.2% compared to 21.4%, RR=2.111, p=0.000), pregnancy-induced hypertension (57.1% versus 43.7%, RR=1.309, p=0.032), and intrauterine growth restriction (68.3% in contrast to 33.3%, RR=2.048, p=0.000). Neonates demonstrated heightened risks of low birth weight (77% against 23%, RR=3.345, p=0.000), admission to the neonatal intensive care unit (NICU) (64.3% as opposed to 35.7%, RR=1.800, p=0.000), and suboptimal Apgar scores (33.3% relative to 21.4%, RR=1.556, p=0.034).

CONCLUSION

This investigation elucidates the potential hazards associated with abbreviated interpregnancy intervals (IPI ≤18 months), demonstrating a definitive association with maternal adversities such as anemia, gestational hypertension, and restricted fetal growth. Neonates resulting from these pregnancies exhibited a higher propensity for low birth weight, necessitated admission to the Neonatal Intensive Care Unit (NICU), and presented with diminished Apgar scores. Proper birth spacing is crucial for maternal and fetal health. Healthcare providers should

promote a 24-month gap between pregnancies, with further research needed on its impact.

INTRODUCTION

The duration between one pregnancy resolving until the next begins is termed the interpregnancy interval (IPI). An increased risk for unfavorable maternal and fetal outcomes has been associated with short interpregnancy intervals (IPI <18 months) such as preterm delivery, low birth weight (LBW), and stillbirth [1]. WHO suggests that spacing subsequent live births a minimum of 24 months from the last may reduce risks as well as waiting a minimum of six months after an abortion [2]. Different factors can play a part in decision-making on ideal spacing between births, including the age of the partners, access to family planning, number of previous pregnancies, sociocultural, religious beliefs, and personal choices [3]. The interval between pregnancies is one of the few well-documented but modifiable risk factors associated with poor pregnancy outcomes as it has major implications [4]. Studies in both high and low middle-income countries report that both short and long intervals between consecutive pregnancies increase the risk of adverse maternal and neonatal outcomes. An increased rate of maternal anemia, gestational hypertension, PROM, placental abruption, placenta previa, and uterine rupture have all been associated with short IPIs, especially in those women with prior cesarean delivery attempting vaginal birth [5]. With the ever-growing awareness of the importance of interpregnancy intervals for perinatal health, many studies have associated short IPI with adverse outcomes such as PROM, placental abruption, placenta previa, uterine rupture and gestational diabetes [6]. The probability of low birth weight (LBW) is strikingly higher (22.8%) in pregnancies characterized by short IPI when juxtaposed with those exhibiting normal intervals (12.1%) [7]. Furthermore, abbreviated IPIs may heighten the risk of preterm birth, presumably due to cervical incompetence and infections, with preterm birth rates documented at 5% to 7% in urban environments. Research indicates that women with an IPI of less than 12 months experience a preterm birth rate of 20.1%, as opposed to 7.7% among those with standard spacing [8]. In low-income nations, the frequency of short interpregnancy intervals fluctuates between 19.4% and 65.9%. In Pakistan, the median birth interval is reported to be 28.2 months, with 37% of births occurring within 24 months of the preceding birth, according to the Pakistan Demographic and Health Survey (PDHS) 2017–2018 [9-10].

A study conducted in Nigeria by Onwuka CC et al. found that short IPI was associated with increased rates of maternal anemia (45.3% vs. 21.6%), preterm delivery (8% vs. 4.5%), PROM (7.3% vs. 8.2%), pregnancy-induced hypertension (7.3% vs. 6%), and birth asphyxia (8.8% vs. 9.7%) [11]. In a similar vein, Shrestha P et al. documented that pregnancies characterized by short IPI presented heightened risks for preterm labor (25% vs. 13.9%), intrauterine growth restriction (IUGR) (8.3% vs. 3.7%), postpartum hemorrhage (PPH) (8.3% vs. 2.6%), low birth
weight (33.3% vs. 17.1%), NICU admissions (16.6% vs. 8.5%), and reduced Apgar scores (<7 at
5 minutes) (8.3% vs. 11.7%) [12].

METHODOLOGY

This prospective cohort investigation will be conducted within the Department of Obstetrics & Gynecology, Ward 8, at the Jinnah Postgraduate Medical Centre in Karachi, employing a non-probability consecutive sampling methodology. The primary focus of this study will be on pregnant individuals aged between 18 and 40 years, who possess a gestational age of no less than 28 weeks, are experiencing singleton pregnancies, and exhibit a parity of greater than one. Inclusion in the study will be limited to those individuals who consent to participate after being fully informed. Participants will be categorized into two distinct cohorts: individuals in the exposed group will have a short inter-pregnancy interval (IPI <18 months), whereas those in the non-exposed group will experience a standard IPI (≥18 months). Specific medical conditions will necessitate exclusion from the study, which includes hypertension (BP >130/90 mmHg), diabetes (BSR >140 mg/dl), chronic conditions such as gestational hypertension, cardiovascular disease, or

anemia (Hb <11 g/dl), previous instances of preterm birth, and complications arising in early pregnancy. Individuals opting not to participate will also be omitted from the study. Upon the acquisition of ethical approval from both the hospital and the College of Physicians and Surgeons of Pakistan, the process of data collection will commence. Eligible participants will be enrolled for delivery through both emergency and outpatient departments. The study aims to evaluate maternal and fetal outcomes predicated on specified clinical criteria. The maternal outcomes to be monitored include anemia (Hb <11 g/dl), preterm delivery (prior to 37 weeks), premature rupture of membranes, pregnancy-induced hypertension, intrauterine growth restriction (as indicated by a fundal height lag of ≥4 cm or fetal weight below the 10th percentile), and postpartum hemorrhage (characterized by blood loss exceeding 500 mL during vaginal delivery or more than 1200 mL during cesarean sections, quantified using a calibrated kidney tray). For neonates, the investigation will monitor low birth weight (under 2.5 kg), admissions to the Neonatal Intensive Care Unit (NICU) (for those necessitating intensive medical intervention), and low Apgar scores (below 7 at five minutes post-delivery). In addition to clinical outcomes, demographic data pertaining to maternal characteristics will be collected, encompassing age, gestational age at delivery, inter-pregnancy interval, parity, socioeconomic status, educational attainment, and occupation. Anthropometric data, which includes height (assessed utilizing a wall-mounted scale), weight (measured with an electronic scale), and body mass index (BMI, calculated using the standard formula: weight in kilograms divided by height in meters squared), will also be documented. Routine laboratory assessments will encompass a complete blood count (CBC) to evaluate red blood cell (RBC) and white blood cell (WBC) counts, platelet counts, and hemoglobin levels. The collected data was entered into and analyzed through SPSS version 26.0. Descriptive statistics were calculated in terms of mean with standard deviation and frequency with percentage. The Chi-square test was applied to compare the both the group at 5% level of significance and relative risk > 1 was considered as significant.

RESULTS

Participants with an interpregnancy interval (IPI) of ≤18 months were slightly older on average than those with IPI >18 months, with a statistically significant difference (p=0.042). This suggests that older participants tend to have shorter IPIs.

Gestational age was significantly higher in participants with IPI ≤18 months, with more participants in the 28-35 weeks category compared to those with IPI >18 months (p=0.013). This indicates a trend towards earlier gestational age in shorter IPIs.

Participants with IPI ≤18 months had a higher average parity compared to those with IPI >18 months, which was statistically significant (p=0.014). This may imply that those with more children tend to have shorter intervals between pregnancies.

Duration of marriage showed a significant difference, with participants having IPI ≤18 months being married longer on average (p=0.013). This could suggest that longer marriages are associated with shorter IPIs. Urban residency was more common among participants with IPI ≤18 months, though not statistically significant (p=0.052). This might indicate a slight urban preference for shorter IPIs. Participants with IPI ≤18 months were more likely to be classified as poor, with a significant difference in social status distribution (p=0.039). This suggests a socioeconomic factor influencing shorter IPIs. Higher education levels were more prevalent among participants with IPI ≤18 months, with significant differences in educational attainment (p=0.029). This could imply that education influences the decision for shorter IPIs. Vaginal delivery was more common in participants with IPI >18 months, with a significant difference in delivery mode (p=0.042). This suggests a preference or trend towards vaginal delivery in longer IPIs. Working women were more prevalent among participants with IPI >18 months, showing a significant difference in occupation (p=0.034). This indicates that employment status may influence the length of IPIs as mentioned in Table I.

Women with an IPI of 18 months or less had a significantly higher prevalence of anemia (45.2%) compared to those with an IPI greater than 18 months (21.4%). The relative risk of developing anemia in the shorter IPI group is 2.111, indicating more than double the risk, with a p-value of 0.000,

which is statistically significant. This suggests that shorter intervals between pregnancies are associated with a higher risk of anemia in mothers. The relative risk for preterm delivery is 1.032, indicating no significant difference between the two groups (p-value = 0.801). This suggests that the IPI does not have a notable impact on the likelihood of preterm delivery A significant association is observed, with 68.3% of mothers with an IPI ≤18 months experiencing IUGR compared to 33.3% in the >18 months group. The relative risk is
2.048 (p-value = 0.000), indicating that shorter IPI is a strong risk factor for IUGR
The risk of developing PIH is higher in the ≤18 months group (57.1%) compared to the >18 months group (43.7%), with a relative risk of 1.309 and a p-value of 0.032, indicating a statistically significant association. The results show no significant difference in the occurrence of PROM between the two groups, with a relative risk of 0.923 and a p-value of 0.529, suggesting that IPI does not significantly affect the risk of PROM. The occurrence of postpartum hemorrhage is low in both groups, with no significant difference (relative risk = 1.400, p-value = 0.384), indicating that IPI does not have a notable impact on this outcome as shown in Table II.
A notable association has been identified, with 77.0% of infants born to mothers experiencing an interpregnancy interval (IPI) of 18 months or less categorized as low birth weight, in contrast to only 23.0% within the cohort exhibiting an IPI exceeding 18 months. The relative risk of 3.345 signifies that a shorter IPI correlates with a risk of low birth weight that is more than threefold, and the p-value of 0.000 corroborates this observation as statistically significant. This finding implies that diminished intervals between pregnancies substantially enhance the probability of low birth weight among infants. The data also shows that 64.3% of the infants born to mothers with an inter-pregnancy interval (IPI) of 18 month or less require admitted to NICU, compare to 35.7% in the group with IPI more than 18 month. The relative risk of 1.800 indicated that one shorter IPI increased the chance of NICU admission nearly doubled with p-value of 0.000, further highlighting shorter IPI and increased NICU admissions. The frequency of low Apgar scores is more pronounced in the group with an IPI of 18 months or less, where 33.3% of infants are affected, relative to 21.4% in the cohort with an IPI exceeding 18 months. The relative risk of 1.556 indicates that shorter IPI is linked to an elevated risk of low Apgar scores, and the p-value of 0.034 denotes that this finding is statistically significant. This suggests that shorter intervals between pregnancies may adversely affect the immediate health status of newborns as assessed by the Apgar score, as delineated in Table III.

DISCUSSION

Short inter pregnancy intervals (IPI ≤18 months) are more detrimental to maternal and fetal health than a normal IPI (>18 months), being associated with a higher occurrence of perinatal and maternal complications. Such observations highlight the need for optimum space between births that can avert some of the preventable maternal and neonatal morbidities and can serve as a protective factor for overall perinatal wellbeing.
Our investigation demonstrated that women who experienced a short interpregnancy interval (IPI) exhibited a higher incidence of complications in comparison to other subjects, as evidenced by the prevalence of anemia (45.2%), intrauterine growth restriction (IUGR) (68.3%), pregnancy-induced hypertension (57.1%), premature rupture of membranes (PROM) (47.6%), and postpartum hemorrhage (PPH) (5.6%). These findings are consistent with prior research, including a study conducted by Onwuka et al., which similarly indicated elevated maternal anemia rates (45.3% versus 21.6%) and postpartum hemorrhage rates (5.8% compared to 4.0%) in pregnancies characterized by short compared to normal IPI [11]. Furthermore, Abozeid et al. reported that mothers with a short interpregnancy interval (IPI) are at an increased risk for hypertensive disorders and preterm delivery [3].
The utilization of shorter interpregnancy intervals (IPI) correlates with a heightened prevalence of complications in pregnancies where maternal recovery time is inadequate, especially regarding the replenishment of essential nutrients such as iron and folate, which likely contributes to the incidence of anemia. Mahfouz et al. similarly identified elevated rates of maternal anemia and adverse pregnancy outcomes among women with closely spaced

pregnancies [2]. In a comparable manner, although our study identified that the short IPI cohort experienced higher occurrences of preterm delivery, PROM, and PPH than the long IPI cohort, the observed differences did not achieve statistical significance, indicating that other maternal health conditions and socio-environmental factors may exert a more substantial influence [6].

The detrimental ramifications of short IPI extended to fetal outcomes, with neonates born to mothers with short IPI exhibiting markedly elevated rates of low birth weight (77%), neonatal intensive care unit (NICU) admissions (64.3%), and low Apgar scores (33.3%) in comparison to those with normal IPI (23%, 35.7%, and 21.4%, respectively). These findings are consistent with those presented by Shrestha et al., who reported increased NICU admissions (64.0% vs. 36.0%) and a higher prevalence of low birth weight (76.47% vs. 23.53%) in pregnancies characterized by short IPI [12].

Our analysis determined a statistically significant correlation between short IPI and pregnancy induced hypertension (OR=1.309, P=0.032), suggesting that insufficient recovery time between pregnancies may elevate the probability of maternal hypertension. Nonetheless, no significant differences were observed in preterm birth rates (P=0.801), premature rupture of membranes (PROM) (P=0.529), or postpartum hemorrhage (PPH) (P=0.384), indicating that these outcomes may be shaped by a more extensive array of obstetric and environmental determinants beyond IPI alone.

Comparative analysis of these findings with prior research indicates that Onwuka et al. similarly reported a lack of significant correlation between short inter-pregnancy interval (IPI) and preterm birth (P=0.236), thereby reinforcing the hypothesis that, although preterm delivery rates may be heightened in closely spaced pregnancies, other maternal and obstetric determinants are likely to exert a greater influence [11]. Correspondingly, their observations regarding premature rupture of membranes (PROM) (P=0.780) and postpartum hemorrhage (PPH) (P=0.421) are congruent with our findings, suggesting that these complications are more contingent upon maternal health status and obstetric management than on IPI alone. Nonetheless, their investigation did not reveal a statistically significant correlation between short IPI and hypertensive disorders (P=0.05), which contrasts with our findings. The differences may be due to differences in the demographics of the study populations, sample sizes or the hypertensive states.

In addition, previous studies documented significant associations of short IPI with maternal iron deficiency (P=0.001, OR=2.091) which supports the hypothesis that inadequate recovery time leads to micronutrient deficits. These findings highlight the complex association between maternal health, interpregnancy interval and perinatal outcomes and more research is needed in different populations [11]. All short IPI has been linked with adverse neonatal events including impaired intrauterine growth and higher premature birth rates [13-15], and the most recent short and inopportune IPI lead to greater neonatal morbidities [16]. High levels of NICU admissions and low birth weight suggests maternal nutritional depletion and placental dysfunction are important factors [17].

Healthcare experts should focus on translate this concept of birth spacing, especially in low- and middle-income settings, whereas iron supplementation and better antenatal care might help relieve its risks [18]. Our data are consistent with the World Health Organization recommendation of a 24-month inter-pregnancy gap to reduce morbidity [5]. The biological mechanisms by which results are significant, as well as maternal child health outcomes in the long-term, warrant further exploration.

In addition to health-related risks, short IPI inflicts financial burdens, especially within low- resource contexts. Public health initiatives that promote optimal birth spacing are likely to enhance outcomes by diminishing the incidences of preterm births and low birth weight, thereby highlighting the necessity to address both health and socioeconomic determinants in reproductive health policies.

CONCLUSION

This investigation elucidates the potential hazards associated with abbreviated interpregnancy intervals (IPI ≤18 months), demonstrating a definitive association with maternal adversities such as anemia, gestational hypertension, and restricted fetal growth. Neonates resulting from these pregnancies exhibited a

higher propensity for low birth weight, necessitated admission to the Neonatal Intensive Care Unit (NICU), and presented with diminished Apgar scores. Proper birth spacing is crucial for maternal and fetal health. Healthcare providers should promote a 24-month gap between pregnancies, with further research needed on its impact.

Table I: Demographic Characteristics of Study Participants (n=252)

Characteristics	**IPI ≤18 Months** (n=126)	**IPI >18 Months** (n=126)	**P-Value**
Age Group (years)	28.61 ± 6.90	26.82 ± 7.04	0.042
18 - 30 years	78 (61.9)	87 (69.0)	0.233
> 30 years	48 (38.1)	39 (31.0)	
Weight (kg)	79.60 ± 12.30	79.37 ± 11.91	0.880
Height (cm)	167.61 ± 8.19	167.90 ± 8.25	0.783
Body Mass Index (kg/m^2)	28.49 ± 4.49	28.31 ± 4.52	0.748
21 - 24 kg/m^2	26 (20.6)	27 (21.4)	0.877
> 24 kg/m^2	100 (79.4)	99 (78.6)	
Gestational Age (weeks)	33.57 ± 3.02	32.58 ± 3.21	0.013
28 - 35 weeks	92 (73.0)	109 (86.5)	0.008
> 35 weeks	34 (27.0)	17 (13.5)	
Parity	3.22 ± 1.08	2.89 ± 1.00	0.014
2 – 4	102 (81.0)	113 (89.7)	0.050
> 4	24 (19.0)	13 (10.3)	
Duration of Marriage (years)	33.57 ± 3.02	32.58 ± 3.21	0.013
2 - 5 years	81 (64.3)	88 (69.8)	0.348
> 5 years	45 (35.7)	38 (30.2)	
Residential Status			
Urban	56 (44.4)	41 (32.5)	0.052
Rural	70 (55.6)	85 (67.5)	
Mode of Admission			
OPD	51 (40.5)	67 (53.2)	0.043
Emergency	75 (59.5)	59 (46.8)	
Social Status			
Poor	71 (56.3)	54 (42.9)	
Middle	43 (34.1)	63 (50.0)	0.039
Upper	12 (9.5)	9 (7.1)	
Educational Status			
Primary	18 (14.3)	25 (19.8)	
Matric	36 (28.6)	46 (36.5)	
Intermediate	31 (24.6)	36 (28.6)	0.029
Graduate	34 (27.0)	16 (12.7)	
Above Graduate	7 (5.6)	3 (2.4)	
Mode of Delivery			
Vaginal	47 (37.3)	63 (50.0)	0.042
C-Section	79 (62.7)	63 (50.0)	
Occupation of Mother			
Working Women	36 (28.6)	52 (41.3)	0.034
Housewife	90 (71.4)	74 (58.7)	

Table II: Effects of Maternal Outcome and Short Inter-Pregnancy Interval (n=252)					
Maternal Outcome, n (%)		**IPI ≤18 Months (n=126)**	**IPI >18 Months (n=126)**	**Relative Risk (95% C. I.)**	**P-Value**
Anemia	Yes	57 (45.2)	27 (21.4)	2.111 (1.436-3.104)	0.000
	No	69 (54.8)	99 (78.6)		
Preterm Delivery	Yes	65 (51.6)	63 (50.0)	1.032 (0.809-1.316)	0.801
	No	61 (48.4)	63 (50.0)		
Intrauterine Growth Restriction	Yes	86 (68.3)	42 (33.3)	2.048 (1.557-2.693)	0.000
	No	40 (31.7)	84 (66.7)		
Pregnancy Induced Hypertension	Yes	72 (57.1)	55 (43.7)	1.309 (1.020-1.680)	0.032
	No	54 (42.9)	71 (56.3)		
Premature Rupture of Membranes	Yes	60 (47.6)	65 (51.6)	0.923 (0.719-1.184)	0.529
	No	66 (52.4)	61 (48.4)		
Postpartum Hemorrhage	Yes	7 (5.6)	5 (4.0)	1.400 (0.456-4.294)	0.384
	No	119 (94.4)	121 (96.0)		

Table III: Effects of Fetal Outcome and Short Inter-Pregnancy Interval (n=252)					
Fetal Outcome, n (%)		**IPI ≤18 Months (n=126)**	**IPI >18 Months (n=126)**	**Relative Risk (95% C. I.)**	**P-Value**
Low Birth Weight	Yes	97 (77.0)	29 (23.0)	3.345 (2.397-4.668)	0.000
	No	29 (23.0)	97 (77.0)		
NICU Admission	Yes	81 (64.3)	45 (35.7)	1.800 (1.377-2.353)	0.000
	No	45 (35.7)	81 (64.3)		
Low Apgar Score	Yes	42 (33.3)	27 (21.4)	1.556 (1.027-2.357)	0.034
	No	84 (66.7)	99 (78.6)		

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