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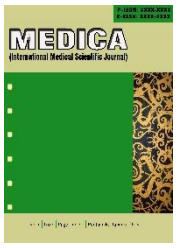

## Factors Associated with Hyperbilirubinemia in Newborns at Tanjungpura University Hospital, Pontianak


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**Abstract**

In Indonesia, neonatal death is often caused by low birth weight, asphyxia, birth trauma, hyperbilirubinemia, infections, and congenital abnormalities. Hyperbilirubinemia in neonates generally occurs due to the immaturity of organs in processing bilirubin, with phototherapy as the primary treatment. Recent studies have shown an increase in cases of hyperbilirubinemia at Tanjungpura University Hospital in Pontianak, highlighting the need for further research on the factors influencing this condition. The aim of this study is to analyze the factors associated with hyperbilirubinemia in newborns at Tanjungpura University Hospital in Pontianak. This research used an analytical observational design with a cross-sectional approach. The sample consisted of 67 respondents selected through total sampling. The distribution of maternal gestational age showed 49.3% preterm and 50.7% term. Of the respondents, 50.7% had ABO incompatibility, while 49.3% did not. A total of 58.2% of the newborns had normal birth weight, while 41.8% did not. Regarding delivery type, 67.5% were delivered by cesarean section (C-section), and 34.3% by normal delivery. The results of the Chi-Square Continuity Correction test showed p=0.038 for gestational age, p=0.018 for ABO incompatibility, p=0.001 for birth weight, and p=0.202 for delivery type. In conclusion, there is a significant relationship between gestational age, ABO incompatibility, and birth weight with the occurrence of hyperbilirubinemia, but no significant relationship with the type of delivery.





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## 1. INTRODUCTION

In advancing the social, economic, and cultural progress of a nation, health is an essential need (Al-Hanawi, Khan, & Al-Borie, 2019). Furthermore, substantial investment in the health sector is necessary to improve human resources (HR). The Maternal Mortality Rate (MMR) and Infant Mortality Rate (IMR) in a region of a country reflect the impact on the development of health (Kementerian Kesehatan Republik Indonesia, 2022). According to Asnidar and Asdinar (2017), a newborn or infant is a developing human who has experienced birth trauma and has the ability to adapt from life in the womb to life outside. From birth until the end of the first month, the baby is considered a newborn (Koizer, 2011). Approximately 2.3 million babies are expected to die worldwide in 2022 (WHO, 2024). Currently, in Indonesia, around 185 newborns die each day, with an infant mortality rate (IMR) of 15 per 1,000 live births. The highest infant mortality occurs during the first week, when the infant is 0-6 days old, and about 40 babies die within the first 24 hours. The main causes of death in low birth weight infants are stillbirth, birth trauma, hyperbilirubinemia, infections, and congenital defects.

Hyperbilirubinemia is a common condition in newborns, caused by the immaturity of the baby's intestines in filtering bilirubin and the decreased transport of bilirubin within the body (Santosa et al., 2020). The causes of this condition are diverse, including low birth weight. Studies have shown that low birth weight is associated with a higher risk of hyperbilirubinemia in newborns (Yasadipura et al., 2020; Gerungan et al., 2022). For infants with hyperbilirubinemia, appropriate therapy is necessary to avoid severe consequences, including permanent brain damage (kernicterus). Phototherapy has been proven to be an effective treatment for newborns with hyperbilirubinemia (Widhiastuti, 2024). The yellowish color of the skin and/or sclera of a baby caused by the deposition of bilirubin in tissues is known as neonatal jaundice. In Asia, especially Southeast Asia, pregnancy-related variables, pregnancy problems (such as ABO and Rh blood group incompatibility with diabetes), and the type of delivery are risk factors for neonatal jaundice. Other factors include poor breastfeeding rates, low birth weight (LBW), gender, medication use, neonatal deaths (perinatal), infant mortality, disease, stillbirth, and others (Bhutani et al., 2016). Jaundice becomes clinically evident in newborns when bilirubin levels in the blood range between 5 and 7 mg/dL. The global incidence rate of jaundice increased from 7.5% (2 million births) to 8.6% (2.2 million births) during the previous period. Premature infants are also at risk of hyperbilirubinemia, and premature birth can pose challenges for both the mother and the infant.

In Indonesia, low birth weight (LBW) contributes to 26% of neonatal deaths, followed by jaundice (9%), hypoglycemia (0.8%), and stillbirth (1.8%). Neonatal jaundice is the second leading cause of death in infants aged 0 to 6 days in Indonesia; however, jaundice is a condition that develops during infancy and can be prevented through measures such as regular newborn screenings. Approximately 60% of newborns die, and full-term infants face a mortality risk 80% higher than that of preterm infants (Kementerian Kesehatan Republik Indonesia, 2022). A study by Lamdayani et al. (2022) found that the use of oxytocin injections, pregnancy complications, ABO incompatibility, and breastfeeding practices are some variables that may contribute to the development of hyperbilirubinemia. Other factors such as illness, disease progression, hypoglycemia, previous disease history, and birth weight also play a role. Based on data from Tanjungpura University Hospital in Pontianak, from October to December 2023, the average age of newborns was 58 years, with 18 of them diagnosed with hyperbilirubinemia. In October, 15 out of 51 newborns were affected by hyperbilirubinemia. Given this increasing trend in hyperbilirubinemia cases at Tanjungpura University Hospital, further research is needed to investigate the causes of

hyperbilirubinemia in newborns at the hospital. The aim of this study is to investigate the factors that contribute to the development of hyperbilirubinemia in newborns at Tanjungpura University Hospital in Pontianak.

## 2. METHOD

The research utilises a cross-sectional design and methodology. This design allows for the collection of data from a specific point in time, providing a snapshot of the factors influencing hyperbilirubinemia in newborns. The study population consists of newborns at Tanjungpura University Hospital in Pontianak, with the sample being all neonates born between June and July 2024. A total bilirubin test is performed on these newborns on the second day after birth to assess the presence of hyperbilirubinemia. Penelitian This study employs an analytical approach where the researcher aims to identify the causative factors and their relationships. The focus of the study is to understand the various factors contributing to hyperbilirubinemia in newborns, particularly about variables such as birth weight, ABO compatibility, gestational age, and the type of delivery. By examining these factors, the research intends to uncover any significant associations between them and the occurrence of hyperbilirubinemia, providing insight into the underlying causes of this condition.

Data used in this research include both primary and secondary data. Primary data is obtained through direct data collection in the field and through repeated observations of newborns at Tanjungpura University Hospital. These observations help gather information on various factors such as the baby's health status, birth characteristics, and immediate postnatal conditions. Secondary data, on the other hand, is gathered from Tanjungpura University Hospital's records, which provide information on the number of cases of hyperbilirubinemia, as well as details such as birth weight, age at birth, blood type, and delivery method.

The data collected will be analyzed using univariate and bivariate analyses. Univariate analysis will help describe the distribution of individual variables, such as the frequency of hyperbilirubinemia, birth weight categories, and gestational age. Bivariate analysis will then be used to examine the relationships between different variables and their potential impact on the occurrence of hyperbilirubinemia. Data analysis using chi-square test (X2) test with 95% confidence level and 5% significance level. This analysis will allow the researchers to identify significant correlations and determine which factors are most strongly associated with the condition. This research has received ethical approval from the Ethics Commission of the Poltekkes Kemenkes Pontianak with Number: 276/KEPK-PK.PKP/V/2024.

## 3. RESULTS AND DISCUSSION

**Table 1**. Distribution of Respondents Based on Gestational Age, ABO Incompatibility, Birth Weight, and Delivery Type in Relation to Bilirubin Levels in Newborns

| Variable | Category | Bilirubin Levels | | Total (N=67) |
|---|---|---|---|---|
| | | High Bilirubin Level (N=29) | Normal Bilirubin Level (N=38) | |
| Gestational Age | Preterm | 19 (28.4%) | 14 (20.9%) | 33 (49.3%) |
| | Aterm | 10 (14.9%) | 24 (35.8%) | 34 (50.7%) |
| ABO Incompatibility | Yes | 20 (29.9%) | 14 (20.9%) | 34 (50.8%) |
| | No | 9 (13.4%) | 24 (35.8%) | 33 (49.2%) |

| | | | | |
|---|---|---|---|---|
| Birth Weight | Normal | 4 (6.0%) | 24 (35.8%) | 28 (41.8%) |
| | Abnormal | 25 (37.3%) | 14 (20.9%) | 39 (58.2%) |
| Delivery Type | Cesarean Section (SC) | 22 (32.8%) | 22 (32.8%) | 44 (65.7%) |
| | Normal | 7 (10.5%) | 16 (23.9%) | 23 (34.3%) |

Table 1 shows the relationship between several factors and bilirubin levels in newborns. Of the 67 newborns studied, those born preterm were more likely to have high bilirubin levels (28.4%) compared to those born at term (14.9%). ABO incompatibility was also linked to higher bilirubin levels, with 29.9% of babies with ABO incompatibility having high bilirubin levels, while only 13.4% of babies without ABO incompatibility had high bilirubin levels. Additionally, babies with abnormal birth weights were more likely to have high bilirubin levels (37.3%) compared to those with normal birth weights (6.0%). However, the type of delivery did not show significant differences, as the proportion of babies with high or low bilirubin levels was similar for both cesarean section and normal deliveries. Overall, gestational age, ABO incompatibility, and birth weight appeared to be associated with higher bilirubin levels in newborns.

**Table 2.** Factors Associated with the Occurrence of Hyperbilirubinemia in Newborns

| **Variables** | **Total Bilirubin** | **Total** | **Total** | **p-value** | **OR** |
|---|---|---|---|---|---|
| | **High** | **Not High** | | | |
| Gestational Age | | | | | |
| Preterm | 19 | 14 | 34 | 0.038 | 5.488 |
| Term | 10 | 24 | 33 | | |
| ABO Incompatibility | | | | | |
| Yes | 20 | 14 | 34 | 0.018 | 6.927 |
| No | 9 | 24 | 33 | | |
| Birth Weight | | | | | |
| Abnormal | 25 | 14 | 39 | < 0.001 | 17.728 |
| Normal | 4 | 24 | 28 | | |
| Delivery Type | | | | | |
| Cesarean | 22 | 22 | 44 | 0.202 | No risk |
| Normal | 7 | 16 | 23 | | |

## DISCUSSION

In this study, maternal gestational age was divided into two categories: preterm and term. Of the 67 respondents, 33 were in the preterm category, and 34 were in the term category. The distribution indicates that the proportion of mothers with preterm and term pregnancies was nearly balanced, with only a slight difference between the two groups. This distribution suggests that preterm and term births occurred almost equally in the studied population. It also emphasizes the importance of monitoring and providing appropriate interventions for mothers before pregnancy, as childbirth is often associated with higher rates of maternal and neonatal mortality. On the other hand, full-term mothers must also ensure that the delivery process runs smoothly. Research by Pratiwi & Kusumaningtiar (2021) highlighted a significant relationship between neonatal hyperbilirubinemia and factors such as breastfeeding, ABO incompatibility, type of birth, low birth weight, and term gestation. This suggests that gestational age plays a key role in neonatal hyperbilirubinemia. Similar findings were supported by the study of Khotimah

& Subagio (2021), which found a significant relationship between gestational age and hyperbilirubinemia. Further, a study by Fanni & Andriani in 2017 emphasized that gestational age is related to hemoglobin levels during the third trimester, which in turn affects birth weight. This indicates that gestational age not only impacts neonatal hyperbilirubinemia but also birth weight through its effect on hemoglobin levels (Fanni & Andriani, 2017). Additionally, this study underscores the importance of considering gestational age and birth weight in the context of various neonatal health outcomes, as gestational age plays a pivotal role in understanding the health of newborns. Based on the data from this study, where 49.3% of mothers were in the preterm gestational age category and 50.7% in the term category, the researcher assumes that this nearly balanced distribution reflects a similar prevalence in the studied population. Previous research that found a significant relationship between gestational age and neonatal hyperbilirubinemia supports this view. These findings are further reinforced by studies linking gestational age to hemoglobin levels and birth weight, as well as the importance of gestational age and birth weight in neonatal health outcomes. Therefore, the researcher argues that gestational age plays a crucial role not only in the occurrence of neonatal hyperbilirubinemia but also in birth weight and overall neonatal health. This highlights the need for proper monitoring and intervention for both preterm and term mothers to ensure optimal health outcomes for newborns.

In this study, ABO incompatibility was divided into two categories: Yes and No. Of the 67 respondents, 34 had ABO incompatibility, while 33 did not. The distribution indicates that the proportion of respondents with and without ABO incompatibility was nearly balanced, with only a slight difference between the two groups. This suggests that in the studied population, ABO incompatibility occurred at nearly the same rate as no incompatibility. Research has shown that ABO incompatibility can occur in some pregnancies, though only a small number of cases result in severe hemolysis. Nevertheless, ABO incompatibility remains identified as a contributing factor to hyperbilirubinemia in newborns (Akbar et al., 2019). Other studies explain that ABO incompatibility occurs when a mother has blood type O and the baby has blood type A or B. This is due to anti-A and anti-B antibodies naturally present in the circulation of mothers with blood type O, which can trigger an immune response in babies with different blood types. The researcher argues that ABO incompatibility in pregnancy can influence the occurrence of hyperbilirubinemia in newborns. With nearly balanced proportions between respondents with and without ABO incompatibility, this study suggests that although ABO incompatibility does not typically cause severe hemolysis in most cases, it can contribute to the risk of hyperbilirubinemia. This indicates the importance of considering this factor in neonatal monitoring and care to reduce the risks associated with high bilirubin levels in newborns.

Of the 67 respondents in this study, the distribution of birth weight shows that 39 had a normal birth weight, and 28 had an abnormal birth weight. This percentage indicates that, while 25% of respondents deviated from the expected standard, nearly two-thirds of the study population had birth weight within the normal range. These findings have significant implications for the monitoring of neonatal health because abnormal birth weight may be a sign of increased health risks for the baby. Babies with higher-than-average birth weight may require appropriate care and close observation to maximize their health during the post-delivery phase. According to Widadi et al. (2023), babies weighing less than 2500 grams are classified as low birth weight (LBW). In this study, LBW is identified as a predictor of the likelihood that a newborn will develop hyperbilirubinemia. Understanding LBW in the context of hyperbilirubinemia is crucial for neonatal health. Research indicates that babies born with low birth weight (LBW) are 6.4 times more likely

to develop hyperbilirubinemia compared to babies with normal birth weight (Widadi et al., 2023). In Indonesia, research at RSUD Drajat Prawiranegara found that gestational age, parity, and preeclampsia were associated with the occurrence of LBW (Khotimah & Sasmita, 2020). The occurrence of low birth weight (LBW) has also been linked to maternal nutritional status, as shown by other research. Pregnant women with low nutritional status are more likely to give birth to babies with low birth weight (LBW), according to a study at RSUD Abdoel Wahab Sjahranie Samarinda (Aldina et al., 2022). Furthermore, maternal age and parity are factors that affect LBW prevalence. Maternal age under 20 or over 35 years is associated with an increased risk of LBW, according to a study conducted in Palembang (Indriyani & Alvianti, 2021). The researcher argues that birth weight (BW) is an important indicator in predicting the risk of hyperbilirubinemia in newborns. Based on the data, the proportion of babies with normal birth weight was higher than those with abnormal birth weight, but low birth weight (LBW) remains a significant health issue. The researcher also argues that factors such as gestational age, parity, preeclampsia, and a history of hypertension during pregnancy play a role in the occurrence of LBW. Additionally, maternal nutritional status and age, particularly under 20 or over 35 years, also influence the risk of LBW. Therefore, intensive monitoring and proper care are essential for babies with abnormal birth weights to optimize their health after birth.

In this study, the distribution of delivery types shows that of the total 67 respondents, 44 underwent a cesarean section (C-section), while 23 had a normal delivery. This proportion indicates that most mothers in this study opted for or required a cesarean section over a normal delivery. This aligns with the research by Putri (2017), which found no significant relationship between the type of delivery and cases of hyperbilirubinemia in newborns. The study showed that neither normal nor cesarean deliveries were significantly associated with hyperbilirubinemia in babies. These results suggest that other factors may contribute more significantly to cases of hyperbilirubinemia in newborns than the type of delivery itself, one of which is the successful initiation of breastfeeding (IMD), which can be influenced by the type of delivery. The method of delivery, such as cesarean section, can impact IMD. However, there are studies that suggest that the type of delivery may influence the occurrence of hyperbilirubinemia in newborns. Research by Khotimah and Subagio at RSUD dr. Drajat Prawiranegara found that cesarean delivery can increase the risk of hyperbilirubinemia. Factors such as delays in post-C-section breastfeeding initiation also contribute to this risk (Khotimah & Subagio, 2021). Another study by Pratiwi and Kusumaningtiar emphasized the importance of factors such as breastfeeding, ABO incompatibility, LBW, and gestational age in determining the risk of hyperbilirubinemia in newborns (Pratiwi & Kusumaningtiar, 2021). This highlights the complexity of the relationship between delivery type and hyperbilirubinemia, where other factors should also be considered in a comprehensive understanding of the condition. The researcher argues that although most mothers in this study underwent cesarean delivery (C-section), delivery type did not play a significant role in cases of hyperbilirubinemia in newborns. This is supported by data analysis using SPSS software, which showed a p-value of 0.202, indicating that delivery type, whether normal or cesarean, was not significantly associated with hyperbilirubinemia occurrence. The researcher also argues that other factors likely contributed more significantly to hyperbilirubinemia in newborns than the delivery type itself. One such factor is the successful initiation of breastfeeding (IMD), which can be influenced by delivery type, as cesarean delivery may affect IMD. This may be the case because, in the location where the study was conducted, other factors such as IMD practices or neonatal care management were well controlled or played a more dominant role in determining hyperbilirubinemia occurrence in newborns. Moreover, it is likely that post-delivery management, such as monitoring and medical intervention, was also closely

managed, resulting in no significant relationship between delivery type and hyperbilirubinemia in this study.

## 4. CONCLUSION

In conclusion, there is a significant relationship between gestational age, ABO incompatibility, and birth weight with the occurrence of hyperbilirubinemia, but no significant relationship with the type of delivery. Future studies should consider a larger and more diverse population to validate the findings on risk factors for neonatal hyperbilirubinemia. Additionally, prospective cohort studies are recommended to better understand causal relationships and the progression of hyperbilirubinemia in relation to gestational age, ABO incompatibility, and birth weight. Research on genetic predispositions, maternal health conditions, and the effectiveness of early screening and intervention protocols could also provide deeper insights for improving neonatal outcomes and reducing the incidence of hyperbilirubinemia.

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