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DIFFERENCES IN INTERMITTENT AND CONTINUOUS PHOTOTHERAPY ADMINISTRATION ON BILIRUBIN LEVELS IN NEONATAL JAUNDICE IN THE PERINATOLOGY ROOM, BRAWIJAYA UNIVERSITY HOSPITAL, MALANG

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ABSTRACT

Neonatal jaundice is a common condition in newborns caused by elevated bilirubin levels due to immature liver function. Phototherapy is the primary treatment to reduce bilirubin levels and can be administered intermittently or continuously. This study aimed to compare the effectiveness of intermittent and continuous phototherapy in reducing bilirubin levels among neonates with jaundice in the Perinatology Ward of Brawijaya University Hospital, Malang. This study employed a quasi-experimental design using a non-equivalent control group design. The sample consisted of 30 neonates, with 15 assigned to the intermittent phototherapy group and 15 to the continuous phototherapy group. Data were analyzed using the Shapiro–Wilk normality test, Paired Sample t-test, and Mann–Whitney test. The mean bilirubin level in the intermittent phototherapy group decreased from 15.82 mg/dL before the intervention to 10.94 mg/dL after the intervention, while the continuous phototherapy group showed a decrease from 15.67 mg/dL to 10.61 mg/dL. Both intermittent and continuous phototherapy significantly reduced bilirubin levels after treatment. However, there was no statistically significant difference in effectiveness between the two methods based on the Mann–Whitney test (p = 0.713). In conclusion, intermittent and continuous phototherapy are equally effective in reducing bilirubin levels in neonates with jaundice and may be selected according to the neonate's clinical condition and hospital policy..

Keywords: *Hyperbilirubinemia, Phototherapy, Intermittent, Continuous*

INTRODUCTION

A newborn, or neonate, is an infant in the period from birth to 28 days of age , during which time they undergo a physiological adaptation process from intrauterine to extrauterine life. The neonatal period is a very vulnerable period because the body's organs, especially the liver, are still maturing, so metabolic functions are not yet optimal. One condition that often occurs in neonates is increased bilirubin levels , which can cause neonatal jaundice. [1]

Neonatal jaundice, or neonatal hyperbilirubinemia, is a common health problem in newborns worldwide. Globally, neonatal jaundice is found in approximately 60% of full-term infants and nearly 80% of premature infants in the first week of life. This condition is a leading cause of neonatal hospitalization, accounting for approximately 40–60% of all neonatal hospitalizations. Although largely physiological, untreated elevated bilirubin levels can lead to serious complications such as acute bilirubin encephalopathy and kernicterus, which can lead to permanent neurological impairment [2] . In Indonesia, neonatal hyperbilirubinemia remains a significant neonatal health problem. Research shows

that the incidence of severe hyperbilirubinemia in Indonesia reaches approximately 6.8–7% of newborns, with the incidence of acute bilirubin toxicity at approximately 2%, indicating that hyperbilirubinemia remains a condition that requires serious attention in neonatal care. This high incidence is also influenced by variations in early detection, management, and the quality of phototherapy provided at various health facilities in Indonesia [2] . In East Java, neonatal jaundice is still a problem in perinatology practices. Research from several hospitals in East Java, including Surabaya and Malang, shows that neonatal jaundice remains a common clinical problem during the neonatal period and requires close bilirubin monitoring to prevent further complications. In Malang City itself, research at Brawijaya University Hospital shows that most newborns have bilirubin levels in the range of 10–15 mg/dL, and some experience increased bilirubin which is at risk of developing hyperbilirubinemia, so that appropriate management such as phototherapy is very important in reducing bilirubin levels and preventing complications in neonates [3] . Based on the results of an interview with the Head of the Perinatology Room at Brawijaya University Hospital, Malang on April 20, 2026, data was obtained that there were 10 babies (100%) who experienced neonatal jaundice and underwent treatment in the Perinatology Room. This condition shows that cases of hyperbilirubinemia in newborns are still found in neonatal services and require appropriate treatment to prevent complications due to increased bilirubin levels . Of all these cases, babies with neonatal jaundice received phototherapy as the main therapy to help reduce bilirubin levels in the blood. These data indicate that neonatal jaundice remains a health problem in newborns requiring special attention in the Perinatology Unit of Brawijaya University Hospital, Malang. The high number of cases underscores the importance of monitoring bilirubin levels and providing effective therapy, including selecting the appropriate phototherapy method, either intermittently or continuously, to achieve optimal bilirubin reduction in neonates.

Bilirubin is the end result of the breakdown of hemoglobin from the destruction of red blood cells. In newborns, this process occurs at a higher rate than in adults because neonates have a higher number of red blood cells and a shorter erythrocyte lifespan , so that hemoglobin breakdown occurs more quickly. The broken down hemoglobin will produce heme, which is then converted into biliverdin and then into indirect bilirubin (unconjugated bilirubin), which is bilirubin that is not soluble in water and still circulates in the blood by binding to albumin to be carried to the liver [4] . After indirect bilirubin reaches the liver, it undergoes a conjugation process by the enzyme uridine diphosphate glucuronosyltransferase (UGT1A1) so that it changes into direct bilirubin (conjugated bilirubin) which is soluble in water and can be excreted through the bile into the intestines. However, in newborns, liver function is still immature so that the activity of the UGT1A1 enzyme is still low, causing the bilirubin conjugation process to not run optimally. As a result, indirect bilirubin in the blood increases and accumulates in body tissues so that a yellow color appears on the skin and sclera known as neonatal jaundice [5] . In addition to immaturity of liver function, increased bilirubin in neonates is also influenced by a higher enterohepatic circulation process. After direct bilirubin enters the intestine, some of it can be converted back to indirect bilirubin by the beta-glucuronidase enzyme

in the intestine, then reabsorbed into the bloodstream. In newborns, the intestinal flora is not yet fully developed, causing the process of excreting bilirubin through feces to be less than optimal, so that more bilirubin is reabsorbed into the bloodstream. This condition causes bilirubin levels to increase in the first week of a neonate's life [6] . If high bilirubin production is not balanced with the liver's ability to conjugate and excrete it, bilirubin accumulation in the blood or hyperbilirubinemia will occur. Excessive indirect bilirubin can penetrate the blood-brain barrier and settle in brain tissue, especially at very high levels , thus risking serious complications such as acute bilirubin encephalopathy and kernicterus. Therefore, increased bilirubin levels in neonates require proper monitoring and management to prevent more severe impacts [7] . Based on this background, one of the main treatments used to reduce bilirubin levels in infants with neonatal jaundice is phototherapy. In clinical practice, phototherapy can be administered using either continuous or intermittent methods, both of which aim to help accelerate the excretion of bilirubin from the neonate's body. Continuous phototherapy provides continuous light exposure, while intermittent phototherapy is given intermittently with certain rest periods. These differences in methods raise considerations in service practice because each has advantages and limitations in the effectiveness of reducing bilirubin levels . Therefore, research is needed regarding the differences in the administration of intermittent and continuous phototherapy on bilirubin levels in infants with neonatal jaundice in the Perinatology Unit of Brawijaya University Hospital, Malang, so that it can provide a basis for determining a more effective phototherapy method in the management of neonatal hyperbilirubinemia.

RESEARCH METHODS

This study used a quantitative method with a quasi-experimental research design. The research design used was a Non-Equivalent Control Group Design, involving two groups, namely the continuous phototherapy group and the intermittent phototherapy group, with bilirubin levels measured before and after phototherapy administration.

The population in this study were all newborns with neonatal jaundice who underwent phototherapy in the Perinatology Ward of Brawijaya University Hospital, Malang. The sample size was 30 infants, divided into 15 in the continuous phototherapy group and 15 in the intermittent phototherapy group. The sampling technique used was purposive sampling with a non-random sampling approach, based on predetermined inclusion and exclusion criteria.

The inclusion criteria in this study included: (1) newborns diagnosed with neonatal jaundice, (2) infants undergoing continuous or intermittent phototherapy, (3) infants with complete bilirubin level data before and after phototherapy, and (4) infants recorded in the medical records of the Perinatology Room of Brawijaya University Hospital, Malang for the period January to May 2026. The exclusion criteria included: (1) infants with severe congenital abnormalities, (2) infants undergoing exchange transfusion, and (3) incomplete medical record data.

This study was conducted in the Perinatology Room of Brawijaya University Hospital, Malang, using secondary data obtained from medical records

of newborns from December 2025 to May 2026. The research procedure began with data collection on bilirubin levels before phototherapy (pretest) and bilirubin levels after phototherapy (posttest) in both groups. The first group was infants who received continuous phototherapy, which is the provision of light therapy continuously with minimal breaks according to treatment procedures, while the second group was infants who received intermittent phototherapy, which is the provision of light therapy intermittently with certain break periods according to hospital service protocols.

The independent variable in this study was the method of phototherapy administration (continuous and intermittent), while the dependent variable was bilirubin levels in infants with neonatal jaundice. Data were collected using medical record observation sheets that included respondent identity, type of phototherapy, pre-phototherapy bilirubin levels , and post-phototherapy bilirubin levels.

Before hypothesis testing, the data were first tested for normality using the Shapiro-Wilk test. If the data were normally distributed ($p > 0.05$) , then parametric tests were used. Data analysis was performed using a Paired Sample t-test to determine differences in bilirubin levels before and after phototherapy in each group, as well as an Independent Sample t-test to determine differences in effectiveness between the continuous and intermittent phototherapy groups. Data processing was performed using the SPSS program.

RESULTS AND DISCUSSION

Table 1. Frequency Distribution of Respondent Characteristics Based on Gender and Age of Neonatal Jaundice in the Perinatology Ward, Brawijaya University Hospital, Malang

Characteristics	Frequency (n)	Percentage (%)
Gender		
Man	20	66.7
Woman	10	33.3
Total	30	100
Age		
1–5 days	2	6.7
6–10 days	15	50.0
11–15 days	13	43.3
Total	30	100

Based on the frequency distribution table of the characteristics of neonatal jaundice respondents in the Perinatology Room of Brawijaya University Hospital Malang, it shows that most of the respondents were male, as many as 20 respondents (66.7%), while 10 respondents were female (33.3%). Based on age, most of the respondents were in the age range of 6–10 days as many as 15 respondents (50.0%), then aged 11–15 days as many as 13 respondents (43.3%), and aged 1–5 days as many as 2 respondents (6.7%).

Table 2. Results of the Normality Test for Neonatal Jaundice Bilirubin Levels in the Perinatology Room, Brawijaya University Hospital, Malang

Variables	Shapiro-Wilk Sig.	Information
Intermittent phototherapy pretest	0.253	Normal
Posttest intermittent phototherapy	0.068	Normal
Continuous phototherapy pretest	0.706	Normal
Continuous phototherapy posttest	0.064	Normal

Based on the results of the normality test using Shapiro-Wilk on neonatal jaundice bilirubin levels in the Perinatology Room of Brawijaya University Hospital, Malang, all significance values (Sig.) were > 0.05 . This indicates that the bilirubin level data in the intermittent and continuous phototherapy groups were normally distributed. Therefore, the analysis was continued using a parametric test, namely the Paired Sample t-test.

Table 3. Results of the Paired Sample t-test of Bilirubin Levels Before and After Intermittent and Continuous Phototherapy

Group	Mean Pretest	Mean Posttest	p-value	Information
Intermittent phototherapy	19,4987	9,5013	<0.001	Significant
Continuous phototherapy	20,5313	9,7593	<0.001	Significant

The results of the Paired Sample t-test showed that the average bilirubin levels in the intermittent phototherapy group decreased from 19.4987 to 9.5013 with a p value of <0.001. In the continuous phototherapy group, the average bilirubin levels also decreased from 20.5313 to 9.7593 with a p value of <0.001. This shows that there is a significant difference in bilirubin levels before and after intermittent and continuous phototherapy in neonatal jaundice in the Perinatology Room of Brawijaya University Hospital, Malang.

Table 4. Results of the Mann Whitney Test: Differences in Intermittent and Continuous Phototherapy Administration on Neonatal Jaundice Bilirubin Levels in the Perinatology Ward, Brawijaya University Hospital, Malang

Group	Mean Rank	p-value	Information
Intermittent phototherapy	14.90	0.713	Not Significant
Continuous phototherapy	16.10		

Based on the results of the Mann Whitney test, a p-value of 0.713 (>0.05) was obtained , indicating that there was no significant difference between intermittent and continuous phototherapy on neonatal jaundice bilirubin levels in the Perinatology Room of Brawijaya University Hospital, Malang. This indicates that both phototherapy methods have relatively equal effectiveness in reducing

neonatal jaundice bilirubin levels.

Based on the results of the study, it was shown that the majority of neonatal jaundice in the Perinatology Room of Brawijaya University Hospital Malang were male, with 20 respondents (66.7%), while females were 10 respondents (33.3%). Based on age, most neonates were in the age range of 6–10 days, with 15 respondents (50.0 %).

The results of this study are in line with research conducted by Rianti Simatupang et al. (2026) which showed that the majority of neonates with hyperbilirubinemia were male, at 66.6 % . This study explained that neonatal jaundice was more frequently found in male babies than female babies [8] . In addition, research by Javaid Iqbal et al. (2023) states that neonatal jaundice most often occurs in the first week of a neonate's life because during this period there is an increase in the destruction of red blood cells and the baby's liver function is not yet fully mature in metabolizing bilirubin [9] . Another study by Chrisnoventa Veneranda & Fransisca Chondro (2023) explains that around 60% of full-term babies experience neonatal jaundice in the first week of life due to the accumulation of bilirubin in the blood which causes changes in skin color and sclera to yellow [10] . Neonatal jaundice is a problem that often occurs in neonates, especially in the early stages of a baby's life, where high bilirubin levels can be influenced by the immaturity of the neonate's liver function. According to theory, neonatal jaundice occurs due to increased bilirubin levels in the blood caused by the immaturity of the neonate's liver function in the bilirubin conjugation process. In neonates, red blood cell destruction occurs more rapidly, increasing bilirubin production, while the liver's ability to excrete bilirubin is still limited. This condition generally appears between 2 and 7 days after birth and can increase during the first week of life [11] .

Based on the results of the study, it was shown that in the intermittent phototherapy group there was a decrease in the average bilirubin level from 19.4987 to 9.5013 with a p value of <0.001. In the continuous phototherapy group there was also a decrease in the average bilirubin level from 20.5313 to 9.7593 with a p value of <0.001. These results indicate that the administration of intermittent and continuous phototherapy is effective in reducing bilirubin levels in neonatal jaundice in the Perinatology Room of Brawijaya University Hospital, Malang. Both intermittent and continuous phototherapy are equally effective in reducing bilirubin levels in neonates with hyperbilirubinemia. The study explained that exposure to blue light in phototherapy helps the photoisomerization of bilirubin, making it more easily excreted by the body [11] . Another study by Diksha Suri et al. (2019) showed that intermittent phototherapy significantly reduced bilirubin levels and was nearly as effective as continuous phototherapy in neonates with hyperbilirubinemia. This is also supported by research by Shereen Mari et al. (2021) which states that intermittent phototherapy can be an effective alternative therapy because it still provides optimal bilirubin reduction with less light exposure [12] . In addition, research by Vimal Goyal et al. (2018) stated that intermittent phototherapy can help reduce stress in neonates because there is rest time during therapy without reducing the effectiveness of reducing bilirubin [13] . In theory, intermittent phototherapy works by providing light exposure at specific

intervals, converting indirect bilirubin into a water-soluble form through photoisomerization. The altered bilirubin is still processed and excreted in urine and feces, even with breaks in therapy. Continuous **phototherapy** provides a rapid reduction in bilirubin levels , especially in neonates with high levels.

Another study by Seid Mohammed Adem et al. (2022) showed that continuous phototherapy provides a rapid decrease in bilirubin levels, especially in neonates with high bilirubin levels [14] . The effectiveness of continuous phototherapy is influenced by the duration of light exposure, the body surface area exposed to light, and the stability of the therapy given continuously [15] . Continuous phototherapy is a standard therapy in the management of neonatal hyperbilirubinemia because it is able to accelerate the decrease in bilirubin through consistent light exposure [16] . According to the theory, continuous phototherapy works by providing continuous light exposure so that indirect bilirubin more quickly undergoes structural changes into a form that is easily soluble in water. Consistent light exposure causes the bilirubin excretion process to take place more quickly and stably.

Based on the research results, a p-value of 0.713 (>0.05) was obtained , indicating that there was no significant difference between intermittent and continuous phototherapy on neonatal jaundice bilirubin levels in the Perinatology Ward of Brawijaya University Hospital, Malang. These results indicate that both phototherapy methods have relatively equal effectiveness in reducing bilirubin levels in neonates. The results of this study align with research by Sachin Rastogi et al. (2023) which stated that intermittent and continuous phototherapy were equally effective in reducing neonatal bilirubin levels and showed no statistically significant difference in effectiveness. This study explained that the bilirubin photoisomerization process continues even when therapy is administered periodically [17] . Another study by Mohammad Rafiei Tabatabaei et al. (2020) showed no significant difference between intermittent and continuous phototherapy in reducing bilirubin levels in hyperbilirubinemic neonates. Both methods are considered equally safe and effective in clinical practice. [18] . In addition, a study by Kaur et al. (2022) stated that intermittent phototherapy can be an equivalent alternative to continuous phototherapy because it still provides good bilirubin reduction effectiveness with less light exposure in neonates. [19] According to theory, both intermittent and continuous phototherapy work on the same principle , namely converting indirect bilirubin into a water-soluble form through the processes of photoisomerization and photo-oxidation. The difference between the two methods lies only in the duration and pattern of light exposure given to the neonate [20] . Based on the results of research in the Perinatology Unit of Brawijaya University Hospital, it was shown that both intermittent and continuous phototherapy were equally effective in reducing bilirubin levels in neonatal jaundice. This was evidenced by a significant decrease in the average bilirubin levels in each group after phototherapy intervention. However, the results of the intergroup difference test showed no significant difference in effectiveness between the intermittent and continuous phototherapy methods. The successful reduction in bilirubin levels in both groups indicates that phototherapy remains an effective primary therapy in the management of neonatal jaundice. Intermittent phototherapy is able to provide good therapeutic effects even if given

with time intervals, because the bilirubin photoisomerization process continues as long as the bilirubin that has been exposed to light is still being processed by the body. Meanwhile, continuous phototherapy provides more stable and consistent light exposure so that the bilirubin degradation process takes place continuously.

The lack of significant differences between the two methods is likely influenced by several factors, such as the neonate's physiological condition, the infant's age , the severity of hyperbilirubinemia, the individual's bilirubin metabolic response, and the quality of the phototherapy equipment used in the Perinatology Unit of Brawijaya University Hospital, Malang. Furthermore, the effectiveness of phototherapy is also influenced by the infant's body surface area exposed to light, the intensity of the phototherapy light, and the accuracy of the procedure during therapy. Intermittent phototherapy can be a good alternative because it remains effective in lowering bilirubin levels while providing rest time for the neonate and the opportunity for interaction with parents. Meanwhile, continuous phototherapy is more appropriate for neonates with high bilirubin levels who require a more rapid and stable bilirubin reduction. Therefore, the choice of phototherapy method can be adjusted to the neonate's clinical condition and the service policies in the Perinatology Unit of Brawijaya University Hospital, Malang.

CONCLUSION

Both intermittent and continuous phototherapy have been shown to be effective in reducing bilirubin levels in neonatal jaundice in the Perinatology Unit of Brawijaya University Hospital, Malang. Both methods demonstrated changes in bilirubin levels after phototherapy intervention. The study also showed no significant difference in effectiveness between intermittent and continuous phototherapy. Therefore, both methods can be used as alternative therapies in the management of neonatal jaundice, depending on the neonate's clinical condition and hospital policy.

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