

Effects of Cycled Versus Constant Lighting on Weight Gain, Physiological Parameter and Duration of Stay among Premature Babies in Neonatal Intensive Care Unit Literature Review

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Abstract: Preterm neonates generally spend weeks in the neonatal intensive care unit where environmental lighting can potentially affect weight gain, physiological parameters and the length of stay in Neonatal Intensive Care Unit (NICU). **Objectives:** The aim of this review is to compare the effects of cycle light and constant light on premature neonates' physiological parameters, weight gain, and the duration of hospital stay in NICU. **Methods:** The researcher searched for previously conducted research and relevant documents for this review using free web databases.

Keywords: Length of stay, cycle light, constant light, Neonatal, Intensive Care Unit, Premature, NICU environment, Weight gain.

I. INTRODUCTION

Premature neonates have five subsystems, including the autonomic and motor subsystems, that show stress or adaptation responses when exposed to environmental stimuli such as variable or high-intensity light in the NICU. Furthermore, nurses in the NICU should adjust the light to improve preterm infants' environmental adaptability and reduce improper stress responses. Implementing lighting management measures would have the impact of facilitating preterm baby adaption through enhanced physiological stability and lower levels of motor activity. This literature review may help to understand the effects of cycled lighting and constant lighting on weight gain, physiological parameters, and duration of stay among premature babies who are admitted to Neonatal Intensive Care Unit. Following the PICOT method of formulating a question, we asked "what are the effects of cycled lighting and constant lighting on weight gain, physiological parameter and duration of stay among premature babies in Neonatal Intensive Care Unit?" The relevant literature has been thematically analyzed and sorted into categories: the cycled light, constant light, weight gain, physiological parameters, preterm babies, duration of stay, and nursing role.

Premature babies:

Each year, it is estimated that 1 in 10 births worldwide, or 15 million children, are born prematurely (WHO, 2022). A premature baby is one who is born too early, before 37 weeks of pregnancy (Kelsey & Nagtalon-Ramos, 2018). Premature babies may not be fully developed at birth and may have more health problems and need to stay in the hospital longer than babies born fully term. Furthermore, comprehensive caring during antenatal period for the pregnant mother allows the survival of these increasingly immature preterm babies with low birth weights, resulting in an increasingly long hospitalization period (Sánchez-Sánchez et al., 2022). On the other side, the earlier in pregnancy a baby is born, the more

likely he is to have health problems. Babies born before 34 weeks of pregnancy are mostly likely to have health problems, but babies born between 34 and 37 weeks of pregnancy are also at increased risk of having health problems related to premature birth (Kelsey & Nagtalon-Ramos, 2018).

Cycled light:

Premature babies are sensitive to the light and the sensitivity to light is higher with more premature babies. As most of preterm infants spend many weeks in the neonatal intensive care unit, they expose to light intensity which lead to physiological instability and increased motor activity in these infants (Lebel et al., 2017).

Cycled lighting is defined as the process in which the lights in the room are illuminated to a certain level for 12 hours during the day and then dimmed for the next 12 hours. It is important for premature babies because cycled lighting is consistent with naturally occurring circadian rhythms in all babies, even as early as 32 weeks gestation, providing benefits to their long term (Brandon et al., 2017).

The intensity of the cycled light is also important. Too much light can be harmful, but too little light can also disrupt the circadian rhythm (Hazelhoff et al., 2021). The ideal intensity of light for preterm infants is still being studied, but most studies suggest that a range of 200-600 lux is suitable for the health of premature babies (Morag & Ohlsson, 2016; Brandon et al. 2017; Lebel et al., 2017). Overall, the evidence suggests that day-night cycled light is a safe and effective way to improve the health outcomes of preterm babies (Hazelhoff et al., 2021).

Constant light:

Generally, Neonatal Intensive Care Units (NICUs) are often maintained under 24-hour constant bright light (CBL) conditions, without significant variations in light intensity (Farahani et al., 2018). So, these infants are mainly exposed to the signals of chaotic temporal without cyclic variations in terms of sounds and light. On the other hand, the level of light to which premature babies are exposed represents an accessible environmental variable that can be easily controlled (Sánchez-Sánchez et al., 2022). Most of premature babies are maintained under CBL conditions for prolonged intervals which affecting their growth and development (Lebel et al., 2017).

Weight gain:

Neonates in NICU Exposing to the environment in the NICU such as lighting is considered as a major factor that lead to poor weight gain and prolonged stay in NICU (Farahani et al., 2018). Neonates in NICU are almost constantly exposed to harsh lighting, which can make them highly susceptible to growth and sleep disorders, and altered circadian rhythms. Altered circadian rhythms, in turn, decrease arterial oxygen saturation, reduce weight gain, and impair normal metabolism. All these complications can prolong NICU stay. Therefore, appropriate lighting is of paramount importance to neonates' weight gain, growth and development, and NICU stay (Farahani et al., 2018).

Physiological parameter:

In the last decades, it is noted that preterm neonatal care shows significant improvement in preterm neonates' growth and development and reduces neonatal mortality rate worldwide (Esmailizadeh et al., 2016). Therefore, creating a healthy condition is absolutely necessary for improving preterm neonates' physical and neural growth and minimizing the risk of developing serious complications (Reddy et al., 2019). Care services for enhancing the quality of preterm neonates' nutrition and sleep are of serious importance to their health (Mony et al., 2018).

A study carried out to compare the effectiveness of cycled lighting (CL) or continuous near darkness (CND) on physiological parameters of preterm infants revealed that anthropometric parameters and mean rectal temperatures of groups were not different at 35 weeks postmenstrual age and there were no differences among the groups in duration of full enteral feeding time, duration of mechanical ventilation, and anthropometric parameters (Arayici et al., 2022).

Most preterm babies are exposed to an incubator environment for a long time which affects their position and alignment of the body and may lead to sensory deprivation, over-stimulation, and/or harmful, uncomfortable, or inappropriate stimulation with direct consequences on brain maturation of the preterm newborn (Séassau et al., 2023).

Duration of stay:

Hospitalization of preterm babies in the NICUs is considered a major concern for Neonatologists due to their early exposure to intense and unpredictable lighting. In these units, neonates are almost constantly exposed to continuous lighting which has been associated with adverse clinical outcomes: less weight gain, behavioral and sleep disturbances, in addition to stress in preterm (Sánchez-Sánchez et al., 2022).

Neonatal Intensive Care Unit (NICU):

A neonatal intensive care unit (NICU) is an intensive care place which specializes in the care of ill or premature newborns. It is divided into three areas, including a critical care area for babies who require close monitoring and intervention, an intermediate care area for infants who are stable but still require specialized care, and a step-down unit where babies who are ready to leave the hospital can receive additional care before being discharged (Kelsey & Nagtalon-Ramos, 2018).

Although neonatal intensive care units provide highly specialized medical care, they do not necessarily offer an ideal environment for the development of newborn infants. The physical environment (light, temperature, sound, radiation) in the NICU is a critical issue, which can affect the normal development of a newborn infant (Williams et al., 2018).

II. CONCLUSION

light is an important aspect in neonatal growth and adequate presence of constant bright light of high lux value reduces the retinal growth of the neonates and hampers the overall recovery progress of the neonates. Maintaining light is an effective approach in neonatal care that helps in improving the rate of neonatal care and helps in improving the overall growth rate.

This strategy helps in improving the overall level of patient's growth and helps in improving the overall level of neonatal recovery process by reducing the mortality rate. It has been observed that the presence of cycled lighting also helps in maintaining and improving the birth weight of the preterm neonates. This strategy reduces the overall amount of hospital stay duration of the preterm neonates.

REFERENCES

- [1] Arayici, S., Simsek, G. K., Uras, N., Oncel, M. Y., Canpolat, F. E., & Oguz, S. S. (2022). Cycled Lighting Versus Continuous Near Darkness in Preterm Infants: A Randomized Controlled Trial. *Zyklische Beleuchtung versus kontinuierliche Dunkelheit bei Frühgeborenen: Eine randomisierte kontrollierte Studie. Klinische Padiatrie*, 234(2), 74–80. <https://doi.org/10.1055/a-1554-5699>
- [2] Brandon, D. H., Silva, S. G., Park, J., Malcolm, W., Kamhawy, H., & Holditch-Davis, D. (2017). Timing for the introduction of cycled light for extremely preterm infants: a randomized controlled trial. *Research in nursing & health*, 40(4), 294-310. doi:10.1002/nur.21797
- [3] Esmaeilzadeh, M., Shoja, M., Shoja, E., Shoja, M.M., Nejat, H., & Oudi, D. (2016). Comparing the Effects of Continuous and Cyclical Lightings on Weight Gain and Length of Hospital Stay Among Preterm Neonates. *Modern Care Journal*, 13 (1), e8951.
- [4] Farahani, E.A., Nourian, M., Ahmadi, F., & Kazemian, M. (2018). Comparing the Effects of Cycled and Constant Lighting on Weight Gain and Length of Stay in Neonatal Intensive Care Unit among Premature Neonates: A Two-Group Randomized Controlled Clinical Trial. *Nursing and Midwifery Studies*, 7(3), 93-99. doi: 10.4103/nms.nms_7_17
- [5] Hazelhoff, E. M., Dudink, J., Meijer, J. H., & Kervezee, L. (2021, March 18). Beginning to See the Light: Lessons Learned From the Development of the Circadian System for Optimizing Light Conditions in the Neonatal Intensive Care Unit. *Frontiers in Neuroscience*, 15. <https://doi.org/10.3389/fnins.2021.634034>
- [6] Kelsey, BM. & Nagtalon-Ramos, J. (2018). *Midwifery & Women's Health Nurse Practitioner Certification Review Guide*. Hardcover, Kelsey Beth M. Jones and Bartlett Publishers, Inc. 4th Edition,
- [7] Lebel, V., Aita, M., Johnston, C., Héon, M., & Dupuis, F. (2017). Effects of Cycled Lighting Versus Continuous Near Darkness on Physiological Stability and Motor Activity Level in Preterm Infants. *Advances in neonatal care : official journal of the National Association of Neonatal Nurses*, 17(4), 282–291. <https://doi.org/10.1097/ANC.0000000000000372>

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- [8] Mony, K.S., Selvam, V., Diwakar, K.K., & Vijayaraghavan, R. (2018). Effect of nesting on sleep pattern among preterm infants admitted in NICU. *Biomedical Research-tokyo*, 29, 1994-1997.
- [9] Morag, I., & Ohlsson, A. (2016). Cycled light in the intensive care unit for preterm and low birth weight infants. *The Cochrane database of systematic reviews*, 2016(8), CD006982. <https://doi.org/10.1002/14651858.CD006982.pub4>
- [10] Reddy, Y.S., Syed, A.M., & Belavadi, G.B. (2019). Changes in the physiological parameters of newborns in the first one hour of life. *International Journal of Contemporary Pediatrics*.
- [11] Sánchez-Sánchez, M., García, T. L., Heredia, D., Reséndiz, I., Cruz, L., Santiago, J., Rojas-Granados, A., Ubaldo-Reyes, L., et al., (2022). Effect of a light-darkness cycle on the body weight gain of preterm infants admitted to the neonatal intensive care unit. *Scientific reports*, 12(1), 17569. <https://doi.org/10.1038/s41598-022-22533-1>
- [12] Williams, K. G., Patel, K. T., Stausmire, J. M., Bridges, C., Mathis, M. W., & Barkin, J. L. (2018). The Neonatal Intensive Care Unit: Environmental Stressors and Supports. *International journal of environmental research and public health*, 15(1), 60. <https://doi.org/10.3390/ijerph15010060>
- [13] World Health Organization (WHO). (2022). Available online: <https://www.who.int/fr/news/item/15-11-2022-who-advises-immediate-skin-to-skin-care-for-survival-of-small-and-preterm-babies> (accessed on 22 May 2023).