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Nutrition care in baby with low birth weight

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Abstract
Low Birth Weight (LBW) refers to infants born with a birth weight of less than 2.500 grams. Low weight can affect the nutritional status of the infant. Providing adequate nutrition to premature LBW infants plays an essential role in helping them reach growth and developmental milestones similar to those of full-term infants and ensuring a better quality of life in the future. The most important aspect of early LBW care is providing optimal and adequate nutrition to increase weight gain, thereby supporting brain growth and development through rapid postnatal high-protein nutrition. This can be achieved through breast milk and Total Parenteral Nutrition (TPN), which helps prevent extrauterine growth restriction and promotes post-term growth due to the immaturity of the gastrointestinal tract. Additional support, such as Kangaroo Mother Care (KMC), is beneficial for temperature stabilization, allowing the infant to improve their sucking reflex. This study was conducted on LBW infants with moderate asphyxia. The results showed an improvement in nutrition following gradual nutritional management, including parenteral and enteral therapy and KMC over five days, as evidenced by weight gain, increased breastfeeding frequency, and more frequent bowel movements.

Keywords: Nutrition care; hospital care; low birth weight; kangaroo mother care; nursing intervention

Introduction
Low Birth Weight (LBW) is defined by the World Health Organization (2018) as infants born with a birth weight of less than 2.500 grams (Cutland et al., 2017). According to the 2021 Indonesia Demographic and Health Survey, the perinatal mortality rate in Indonesia is 26 deaths per 1.000 pregnancies, with 30.3% of neonatal deaths attributed to low birth weight (Thapa et al., 2022). Infants with LBW have a 20 times higher risk of death compared to infants with normal birth weight. Mortality in LBW cases is often due to neonatal complications such as asphyxia, infection, aspiration, pneumonia, intracranial haemorrhage, hypoglycaemia, hypothermia, and difficulties with nutritional intake. LBW in preterm births generally presents risks for poor feeding, nutrient deficiencies, and growth restrictions (Basel & Singh, 2020). In addition to increasing perinatal mortality and complications, LBW infants, especially Very Low Birth Weight (VLBW) infants, are at risk for congenital abnormalities, behavioural issues, growth and developmental delays, and neurodevelopmental disorders in the future. The following data was obtained from birth records at Soerojo Hospital, Magelang, on low-birth-weight infants from July 2023 to September 2023. In July 2023, there were 8 (11.2%) LBW infants, in August 2023, there were 10 (22.7%), and in September 2023, there were 12 (18.8%).

Weight gain is a crucial aspect of LBW management, in addition to preventing complications. The process of weight gain in infants occurs gradually according to the infant's age. Infancy, from 0 to 12 months, is characterized by rapid physical growth and nutritional changes. Newborns may experience up to a 10% weight loss below their birth weight in the first week due to excessive extravascular fluid excretion and insufficient nutrient intake (Devaguru et al., 2023). LBW management should begin as early as possible. The most important aspect of early care for LBW infants is providing optimal and adequate nutrition to support brain growth and development, achieved through rapid postnatal high-protein nutrition, which can be obtained from breast milk, LBW formula, and Total Parenteral Nutrition (TPN). TPN helps limit extrauterine growth restriction and supports post-term growth due to gastrointestinal immaturity (Yu, James, Hendry, & MacMahon, 1979). Nutrition for LBW infants consists of parenteral and enteral nutrition. In cases where the infant's condition is unstable, nutrition can be provided parenterally (Shen, Ritz, Li, Sangild, & Jiang, 2024). Parenteral nutrition, administered via the central vein, includes fluids and TPN, which contains glucose, protein, fats, vitamins, and minerals. Recommended fluid intake is 80–90 ml/kg/day on the first day, increasing daily to 160–180 ml/kg/day. Caloric intake increases gradually by 25–30 kcal/kg/day until total adequacy of 90–100 kcal/kg/day is achieved.

Supportive management to improve nutritional status includes the Kangaroo Mother Care (KMC) method, which helps maintain body temperature and prevent hypothermia. Hypothermia can lead to hypoglycemia. The implementation of KMC helps keep the infant’s weight stable, allowing them to sleep soundly and strengthening their

sucking reflex, which improves nutrition and contributes to weight gain. Given the ongoing cases of LBW infants at Soerojo Hospital, Magelang, who are at risk of nutritional deficits due to underdeveloped organs and difficulties with enteral feeding, with some infants requiring parenteral therapy, this study focuses on the topic "Overview of Nutritional Support for Low Birth Weight (LBW) Infants at Soerojo Hospital.". The study aimed to evaluate the giving of nutritional care in baby with low birth weight.

Case Description

Assessment was conducted on October 28, 2023, at 11:00 a.m. WIB for a 2-day-old baby. The baby showed chest retractions, tachypnea with a respiratory rate of 84 breaths per minute, thin skin, and was using CPAP with PEEP 7, FiO2 30%, and flow 9. The sucking and swallowing reflexes were still weak, making optimal intake of ASIP (expressed breast milk) challenging. The baby had an OGT tube in place and was receiving parenteral nutrition. The extremities felt cold, and the baby was being cared for in an incubator with a D5 1/4 NS IV drip at 5 ml/hour via UVC (Umbilical Venous Catheter). The baby appeared jaundiced on the body and sclera. Vital signs showed a heart rate of 148 beats per minute, respiratory rate of 86 breaths per minute, temperature of 35.7 °C, and SpO2 of 88%. The baby was born on October 26, 2023, at 9:05 a.m. WIB at Soerojo Hospital, Magelang, through spontaneous delivery, with G2P1A0 at 36 weeks + 4 days of gestation, due to premature rupture of membranes (PROM). At birth, the baby did not cry immediately, appeared pale, had cold extremities, chest retractions, and tachypnea. APGAR scores were 3 at the first minute, 5 at the fifth minute, and 6 at the tenth minute. Birth weight was 2.145 grams, length 44 cm, head circumference 28 cm, chest circumference 28 cm, and amniotic fluid was cloudy. Initial resuscitation was performed with T-Piece Neopuff with PEEP 7, FiO2 up to 30%, followed by CPAP (Continuous Positive Airway Pressure) with PEEP 7, FiO2 40%, and flow 9. Laboratory results on October 28, 2023, showed direct bilirubin at 0.48 mg/dL and indirect bilirubin at 5.05 mg/dL. HGB was 11.4 g/dL, HCT 31% (both below normal), PLT 138 x 10^3/uL (below normal), GDS 68 mg/dL (below normal), and leukocytes 19.4 x 10^3/uL (above normal). The baby received an infusion of D5 1/4 NS at 5 ml/hour, injections of Ampicillin Sulbactam 40 mg/kg/12 hours, Gentamicin 4 mg/kg/24 hours, Aminophylline 1.6 mg/8 hours, vitamin K 1 mg/24 hours, and parenteral nutrition with daily dosage adjustments.

Physical examination showed thin skin, weak sucking and swallowing reflexes, brownish regurgitation, and suboptimal ASIP intake, so parenteral nutrition was added. The skin appeared pale, and the nursing diagnosis was Nutritional Deficit related to Inability to Swallow Food (D.0019) (SDKI, 2018). Nursing interventions included observing bowel and urinary elimination patterns for quantity, frequency, and consistency to detect abnormalities and administer appropriate care. Weight, skin dryness, pigmentation changes, skin turgor, and oral mucosa were monitored to assess dehydration levels, and fluid balance was maintained by monitoring intake and output. Adequate breastfeeding was encouraged. Due to weak sucking and swallowing reflexes and the need for respiratory support, nutrition was provided via OGT for ASIP intake, with parenteral nutrition administered for three days. Parenteral nutrition details included: Day 1: Amino acids 1.6 grams/day = 26 ml with Aminosteril 6%, IL 0.8 grams/day = 4 ml with IL 20%, Na 1.636 meq/day = 3.2 ml with NaCl 3%, K 0.818 meq/day = 0.8 ml with KCL 7.4%, Ca 0.818 meq/day = 0.8 ml with Calcium Gluconate 10%, remaining fluid with Dextrose 66 ml at 12.5%, parenteral nutrition rate of 2.55 ml/hour. Day 2: Amino acids 1.6 grams/day = 40.9 ml with Aminosteril 6%, Na 1.636 meq/day = 3.2 ml with NaCl 3%, K 0.818 meq/day = 0.8 ml with KCL 7.4%, Ca 0.818 meq/day = 0.8 ml with Calcium Gluconate 10%, remaining fluid with Dextrose 68.82 ml at 12.5%, parenteral nutrition rate of 4.8 ml/hour. Day 3: Amino acids 3.2 grams/day = 54.5 ml with Aminosteril 6%, Na 1.636 meq/day = 3.2 ml with NaCl 3%, K 0.818 meq/day = 0.8 ml with KCL 7.4%, Ca 0.818 meq/day = 0.8 ml with Calcium Gluconate 10%, remaining fluid with Dextrose 55.22 ml at 12.5%, parenteral nutrition rate of 5.4 ml/hour. No intolerance to TPN was observed.

ASIP was administered via OGT, starting with 4 cc every 2 hours and gradually increasing to 10 cc, 20 cc, and 30 cc every 2 hours. Once stable, the baby received Kangaroo Mother Care (KMC) and gradually practiced breastfeeding, starting with 2 sessions per day for 1 hour, increasing to 3 sessions per day for 1–2 hours, and eventually increasing frequency and duration. The baby's body temperature stabilized without signs of hypothermia, weight increased from an initial 2.145 grams to 2.278 grams, urine output exceeded 8 times per day, skin turgor improved, and the baby was active. By day 7, the baby was ready for rooming-in and home care preparation.

Discussion

The observations conducted over five days with the provision of enteral and parenteral nutrition resulted in an increase in body weight from an initial 2135 grams to 2278 grams, with an average weight of 2204 grams. The administration of breast milk through enteral feeding started at 4 cc every 2 hours and gradually increased to 30 cc every 2 hours, averaging 12.8 cc per hour. During the first two days, the baby was unable to breastfeed due to instability, but by day three, when the baby's condition stabilized, breastfeeding was gradually initiated twice a day, increasing to six times a day by day five, averaging 2.4 times a day. The frequency of urination also improved from three diaper changes per day to eight, averaging 5.4 changes per day. This data concludes that the baby responded well to nutritional intake. The initial intervention for nutritional fulfilment involved oral administration of breast milk at 2 cc every 2 hours; however, the baby was unable to digest breast milk properly, as evidenced by brownish vomiting, indicating possible

gastrointestinal bleeding and necrotizing enterocolitis (NEC). Consequently, an orogastric tube (OGT) was inserted for decompression, and the baby was temporarily fasting. For nutritional needs, TPN was administered via umbilical venous catheter (UVC) due to the inability to provide oral or enteral nutrition. TPN was given for three days, with dosages tailored to the baby's needs. After receiving vitamin K (1 mg for three days), the baby stopped vomiting black, and was prepared to receive breast milk through OGT, starting gradually from 4 cc to 30 cc every 2 hours. Once the baby was stable, kangaroo mother care (KMC) was gradually introduced, beginning with two sessions a day for one hour, increasing to three sessions a day for 1-2 hours, and subsequently more frequently for durations exceeding two hours.

Weak sucking and swallowing reflexes, reduced bowel motility, slow gastric emptying, decreased absorption of fat-soluble vitamins, lactase enzyme deficiency in intestinal villi, decreased reserves of calcium, phosphorus, protein, and iron, increased risk of NEC, and the condition of a low-birth-weight baby with hypothermia can all contribute to inadequate nutrition and weight loss. Hypoglycemia may occur as a response to hypothermia, with norepinephrine release causing pulmonary constriction and reduced blood oxygen levels. This condition inhibits glucose metabolism and leads to anaerobic glycolysis, resulting in greater glycogen loss, thereby diverting nutrients away from metabolism to meet the baby's basic metabolic needs. Breast milk is the best nutrition for infants. It is an emulsion of fats in a solution of protein, lactose, and organic salts secreted from maternal glands, providing optimal nutritional support for infant growth (Dror & Allen, 2018). Breast milk offers many benefits, including containing colostrum as a natural antibody, higher lactose levels compared to formula milk, inhibiting the growth of pathogenic bacteria, and facilitating calcium, mineral, and magnesium absorption. Additionally, it contains antibodies like immunoglobulin, lysozyme, lactobacillus, lactoferrin, and promotes psychological bonding between mother and baby (Martin, Ling, & Blackburn, 2016). Breastfeeding can be initiated shortly after birth through Early Initiation of Breastfeeding (IMD), followed by on-demand feeding. If oral feeding is not feasible due to the condition of the mother or baby, expressed breast milk can be administered via nasogastric (NGT) or orogastric (OGT) tubes. In the case of baby M, due to instability, respiratory distress, and poor sucking/swallowing reflexes, oral and enteral nutrition were not viable. Therefore, parenteral nutrition was initiated, known as TPN, which is an intravenous method of delivering nutrients and energy to meet carbohydrate, protein, fat, vitamin, and mineral needs for newborns with severe clinical problems preventing enteral feeding (Lapillonne, Fellous, Mokthari, & Kermorvant-Duchemin, 2009). TPN was indicated for babies weighing over 1800 grams whose enteral requirements were unmet, with respiratory or gastrointestinal tract disturbances (Riskin, Hartman, & Shamir, 2015). Baby Ny M received TPN based on these indications due to difficulties in swallowing and nutrient absorption, as well as brownish vomiting, with TPN administered for three days at adjusted dosages.

TPN includes fluids and electrolytes, carbohydrates, proteins, amino acids, glucose, fats, vitamins, and minerals. TPN is more rapidly absorbed by the body, thereby preventing nutrient deficiencies. Monitoring during TPN administration is essential to identify potential complications such as arrhythmias, pulmonary embolism, pleural effusion, jugular vein thrombosis, and a high risk of bacterial infection, as well as metabolic issues such as hyperglycemia and hyperbilirubinemia (Dutta et al., 2019). This monitoring includes tracking temperature, anthropometric measurements (weight, length, head circumference, chest circumference), metabolic status, electrolytes, and urine output. During the TPN treatment of baby Ny M, no complications were noted, and the TPN was effectively absorbed, indicated by improved metabolic condition, decreased infection rates, balanced urine production, and weight gain. This is supported by a study where 24 low birth weight infants receiving gradual TPN showed that 16 infants gained weight more quickly (Ibrahim, Jeroudi, Baier, Dhanireddy, & Krouskop, 2004). The accompanying intervention was kangaroo mother care, initiated when the baby's condition stabilized and they were ready for breastfeeding training. For baby Ny M, KMC commenced after the baby was off respiratory support, beginning with two sessions daily and increasing to three as stability improved. KMC helps maintain stable body temperature, facilitating comfort and deep sleep, while also enhancing sweating and encouraging stronger sucking and swallowing reflexes, thus improving breast milk intake and weight gain (Jiménez-Jiménez et al., 2023). KMC can enhance body temperature, regulate breathing patterns, stabilize heart rate, increase blood glucose levels, and optimize energy use, promoting better metabolism and weight gain. The benefits of KMC for mothers include facilitating breastfeeding, boosting confidence in caregiving, and providing psychological calmness (Dhage, Rannaware, & Choudhari, 2023).

KMC is a specific care approach for low-birth-weight infants that involves direct skin-to-skin contact between the mother and baby, promoting infant health development through improved temperature regulation, breastfeeding, infection prevention, and maternal-infant bonding (WHO Immediate KMC Study Group et al., 2021). Before initiating KMC, the infant's vital signs are monitored, and their reactions in the incubator are assessed; frequently observed signs of discomfort include restlessness, crying, and disturbed sleep. In contrast, when KMC is performed, the infant appears comfortable and calm. Nutritional enhancement programs can continue at home, and family members have been trained in KMC during hospital stays, ensuring that family members can perform KMC as an alternative to maintain the infant's temperature stability, which positively influences weight gain and reflects the baby's nutritional status.

Conclusion

It can be concluded that low birth weight infants (LBW) are those with a birth weight of less than 2500 grams, regardless of gestational age, and several organ functions are not fully developed, leading to frequent bodily function disturbances, especially in thermoregulation, respiration, and nutrition. The primary effort to meet nutritional needs for these infants is through breast milk, preferably by direct breastfeeding (oral). If that is not feasible, breast milk can be provided enterally using a syringe or nasogastric/orogastric tube (NGT/OGT). When oral (enteral) nutrition is not possible, total parenteral nutrition (TPN) is administered. Supportive interventions that can enhance nutritional intake include kangaroo mother care (KMC), which stabilizes body temperature and improves the infant's sucking reflex. The management of nutrition for LBW infants focuses on breast milk as the main food source, which is administered gradually alongside TPN and KMC. These interventions have been implemented, resulting in improved conditions for several infants, allowing them to be cared for together with their mothers. Future researchers could investigate the impact of nutritional management with a larger sample size to determine its effect on the nutritional status of LBW infants.

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