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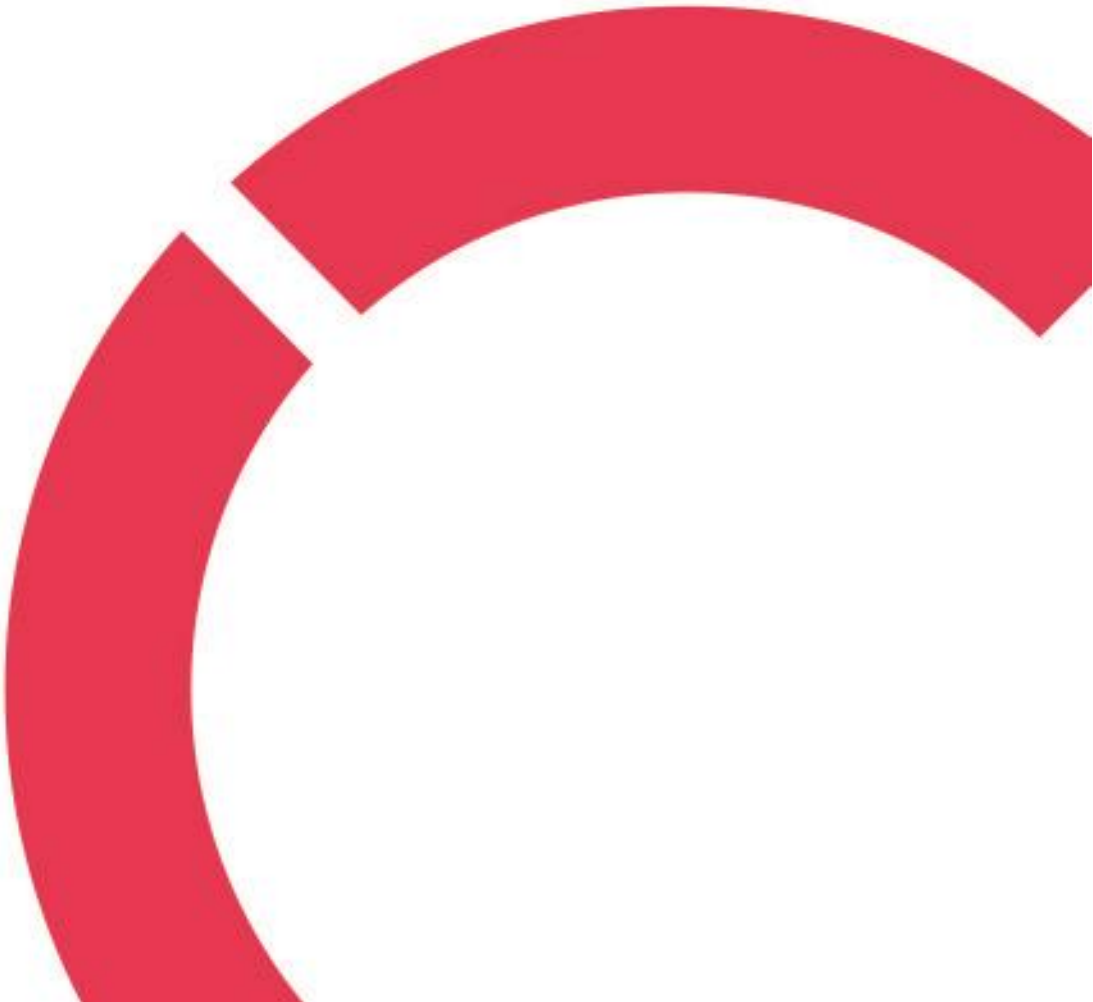
CHECKING BLOOD GLUCOSE ON INFANTS

Production of a learning material for Centria's nursing students

Thesis
CENTRIA UNIVERSITY OF APPLIED SCIENCES
Bachelor of Health Care
May 2024



ABSTRACT

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Degree programme Nursing, Bachelor of health Care		
Name of thesis CHECKING BLOOD GLUCOSE ON INFANTS Learning material for nursing students		
Centria supervisor Soili Vuollo		**Pages** 22+2
Instructor Hanna-Mari Pesonen		

The purpose of this thesis was to develop learning material for Centria's nursing students about infant blood sugar or glucose, how to test infant blood sugar, the risk factors that cause imbalance in infant blood sugar and how nurses manage the imbalance in infant blood sugar. This thesis consists of two parts; the first part is the theoretical part explaining infant blood sugar, when to test an infant for blood sugar imbalance, types of imbalances in infant blood sugar and nursing interventions towards infant blood sugar imbalance, while the second part is the learning material demonstrating the important information's a nurse should know about infant blood sugar.

The objective of this product was to create awareness and educate nursing students about infant blood sugar and to teach them how they can manage infants with blood glucose imbalance. The learning material will also guide the nursing students on ways of ensuring safe management of infant blood sugar imbalance. The topic is important as it prevents complications that comes with infant's blood sugar imbalance like brain injury and improve the quality of nursing care in family and child health.

The learning material was created in coordination with the Centria UAS' nursing teacher which is based on evidence-based articles, journals, papers, and books. The learning material contains importance of checking infants blood sugar, risk factors of infant blood sugar imbalance, blood sugar values, blood glucose test procedure and monitoring time during management.

Key words
Blood glucose, blood glucose value, blood test, hyperglycaemia, hypoglycaemia, infants, neonates, newborn, risk factors

CONCEPT DEFINITIONS

ASA
Appropriate for gestational age

BWS
Beckwith-Wiedemann syndrome

CPT-1
Carnitine palmitoyltransferase 1

ELBW
Early low birth weight

IDMs
Infants of diabetic mothers

IUGR
Intrauterine growth restriction

LGA
Large for gestational age

SGA
Small for gestational age

VLBW
Very low birth weight

ABSRACT

CONCEPT DEFINITIONS

CONTENTS

1 INTRODUCTION

In this thesis, the terms newborn, neonate, and infant are used interchangeably. The target age bracket of infants in our thesis is newborns who are 1 to 72 hours old (about 3 days). This is the first thesis addressing the basic blood sampling topic: Infant blood glucose in Centria UAS nursing.

Testing an infant's blood sample for glucose level is one of the necessary tasks done during the first test. A blood sample is collected by a nurse to assess the blood glucose concentration of the newborn. Blood tests in newborns help provide information for nurses in identifying diseases, treatments, or monitoring an infant's health. (Barbara & Irene 2022.)

Glucose, also known as sugar, is one of the most important resources that provides energy to every cell in the body through blood circulation. With a healthy newborn baby, blood sugar levels are always kept at a normal and safe level by providing adequate energy (National Library of Medicine, 2004). Glucose in the blood plays a significant role in the development of newborns and their imbalance also affects, and causes, many problems such as hypoglycemia, or hyperglycemia in infants (Abramowski, Ward & Hamdan 2023). Hypoglycemia in newborns poses significant risks to the child's long-term development, so it is important to understand and identify associated risk factors (American Academy of Pediatrics 2017).

In maternity and pediatric wards, nurses provide direct care to newborns. Collection of blood samples is also performed by nurses to monitor and assess the newborn's blood sugar levels, which is important for identifying and managing hypoglycemia and hyperglycemia in newborns. Therefore, as nursing students, knowledge, and skills, about blood sugar in newborns need to be fully equipped before direct clinical practice with newborns. This is the motivation to make a valuable contribution to Centria's nursing education materials.

This thesis will help Centria's nursing education by providing nursing students with leaflets containing important knowledge about blood sugar in newborns, blood test procedure, risk factors and effective treatment of hyperglycemia and hypoglycemia newborns.

2 PURPOSE AND OBJECTIVE

In this thesis, the purpose is providing concise learning material for nursing students at Centria university of applied sciences about blood glucose level (hyperglycemia and hypoglycemia) in infants, their screening and management using evidence-based research sources. The aim is to distinguish the main factors contributing to these conditions and increase awareness among Centria nursing students.

3 CHECKING BLOOD GLUCOSE ON INFANTS AND THE TEST PROCEDURE

In this chapter, our discussion will focus on neonatal blood glucose, problems, and the meaning of blood glucose value in newborns. Blood glucose measurement procedures are also mentioned at the end of this chapter. In the section, we will discuss the risk factors such as maternal diabetes, premature birth, low birth weight or perinatal asphyxia, and monitoring and treatment of the baby. Finally, we will describe the step-by-step procedure for performing blood glucose sampling in newborns and some considerations to keep in mind during this process.

3.1 Glucose balance in the infant period

Glucose is an important metabolic substrate for tissue energy production. Normally, adults get nutrients such as glucose, calcium, or fiber from food to provide energy to the body. But newborns cannot get glucose on their own, instead the mother is the main and only source. During pregnancy, the fetus is provided with glucose from the mother's food and metabolized through the placenta and umbilical cord to the fetal body. Part of the glucose will be immediately converted into energy and the rest will be stored by the fetal body to prepare for the birth process. After birth in the first days, thanks to the amount of glucose stored in the body, the newborn has enough energy for the body to be healthy and develop well. Then, usually on the third day of life, milk from breastfeeding will become the main source of sugar for the body by metabolizing the lactose in milk. (Güemes, Rahman & Hussain 2016.)

In healthy full-term babies, glucose levels are normally the lowest in the first 1-2 hours after birth. To adapt to the environment outside the mother's body, the child's body will balance its glucose levels by using previously stored sugar and fat and the body will balance it naturally to the healthy range 3.5-5.5mmol/l. This is also the healthy glucose level for both adults and children. However, due to some problems during childbirth or pregnancy, there can be imbalance in glucose levels in the newborn's blood which can be called hypoglycemia and hyperglycemia. (Narvey & Marks 2019.)

The central nervous system is responsible for the maintenance of glucose homeostasis through glycogenolysis and gluconeogenesis in the early postnatal stage of the infant. For example, in extremely low birth weight infants (VLBW) and preterm infants (infants born less than 37 weeks (about 8 and a half months) of gestational period), the balance is distributed when a small reserve is combined with the infant´s increased energy requirement thereby leading to increased occurrence of hyperglycemia. (Mitanchez Delphine 2007). Hyperglycemia also results when an infant cannot enhance peripheral glucose consumption or reduce endogenous glucose synthesis during parenteral glucose infusion (Rosenfeld Elizabeth, Thornton Paul, Feingold, Anawalt, Blackman, Boyce, Chrousos, Corpas, Herder, Dhatariya, Dungan, Hofland, Kalra, Kaltsas, Kapoor, Koch, Kopp, Korbonits, Kovacs, Kuohung, Laferrère, Levy, McGee, McLachlan, New, Purnell, Sahay, Shah, Singer, Sperling, Stratakis, Trence & Wilson 2023).

3.2 Neonatal Hypoglycemia

Determining neonatal hypoglycemia from a single value is quite challenging (Cornblath & Reisner 1965). Nurses caring for infants continue to encounter hypoglycemia as one of the most prevalent disorders, from the early hours to days following delivery (Aziz, K & Dancey, P 2004).

Hypoglycemia is known as a symptom, not a disease. The term hypoglycemia means ("hypo" means low and "glycemia" is glucose) low blood glucose concentration, and refers to an imbalance between glucose supply and consumption. Low blood sugar is the most common metabolic problem in most newborns in the first 1-2 hours after birth. However, hypoglycemia is a serious health problem when it lasts longer than 48 hours (about 2 days). Hypoglycemia may occur in 50% of infants in the risk group and may occur in 15% of all infants. (Alsweiler, Heather, Harris & McKinlay 2021.)

For premature and low birth weight babies, Intrauterine growth restriction (IUGR) is when the fetus grows less than expected during the weeks (?) of pregnancy, they cannot store enough sugar to increase glucose levels after birth. Besides, the body needs to increase metabolism due to the larger brain size. Infants with low birth weight who less than 1000g, may produce low amounts of glucose due to low levels of enzymes involved in glucose production. In this condition, low blood sugar levels can be severe or even more prolonged. Supplemental feeding

is needed to help balance glucose levels. (Mitchell, Grimbly, Rosolowsky, O'Reilly, Yaskina, Cheung & Schmölzer 2020.)

Gestational diabetes is quite common, and it also affects the baby's hormone imbalance to tolerate or balance glucose levels. In the womb, the baby is provided with glucose directly from the mother, so the fetus's glucose concentration is also proportional to the mother's glucose concentration. Gestational diabetes causes the mother's glucose level to increase for a long time, leading to increased blood sugar in the fetus and stimulating the pancreas to increase insulin production. High insulin levels persist after birth because the amount of glucose provided is no longer large enough to be consumed like it was in the womb, so it causes the baby to have hypoglycemia. And that makes it impossible for the baby to store and increase sugar levels in the initial stages. Some babies have similar problems if they are older than their gestational age or born late. (Kole, Ayala, Clark, Has, Esposito & Werner 2020.)

During childbirth, if the baby experiences perinatal stress such as fetal distress, hypothermia, ischemia, or congenital heart disease, the baby will need more energy to increase metabolism. That puts the baby at risk for hypoglycemia, which can last from days to weeks. Other reasons for hypoglycemia are delay in breastfeeding, medication, or maternal insulin during pregnancy. (Abramowski, Ward & Hamdan 2023.)

If, after the first 48 hours (about 2 days), glucose levels remain below the normal range of 3mmol/L then there is concern for an underlying disorder causing hypoglycemia. Some potential disorders may include congenital hyperinsulinism, congenital syndromes: Beckwith-Wiedemann syndrome (BWS) and endocrine disorders. (Abramowski, Ward & Hamdan 2023.) BWS is a disorder imprinted in the human genome. This disorder leads to phenotypic changes in patients including overgrowth, macroglossia, abdominal wall defects, neonatal hypoglycemia, unilateral overgrowth, and a risk of developing embryonal tumor (Shuman, Kalish & Weksberg 2000).

Infants appropriate for gestational age (AGA) have their blood glucose level fall immediately after birth to as low as 1.8mmol/L at one hour of age but rise on its own to levels greater than 2.0 mmol/l which is kept up for 72 hours. (Diwakar & Sasidhar 2002.)

3.3 Infants at risk of hypoglycemia

Symptomatic infants have the following symptoms tremors, twitching, high pitched sound, jitteriness, irritability, seizures, poor feeding, respiratory distress, temperature instability, exaggerated Moro reflex and coma (Canadian paediatric society 2019).

Asymptomatic infants are infants with a weight less than 10th percentile of Small for gestational age (SGA), Infants with Intrauterine growth restriction (IUGR), Infants with low birth weight of less than 2500 grams, Infants with weight greater than 90th percentile Large for gestational age (LGA), Infants of diabetic mothers (IDMs), Preterm or premature infants which means infants born in less than 37 weeks gestational age (GA), Mothers with Labetalol use (a beta blocker medication for treating high blood pressure), late preterm exposure to antenatal steroids, Infants with perinatal asphyxia (failure to breath at birth), Infants with metabolic conditions like Carnitine palmitoyl transferase 1(CPT-1) deficiency particularly in Inuit infants and Infants with syndromes associated with hypoglycemia, for example Beckwith-Wiedemann. (Canadian paediatric society 2019.)

3.4 Neonatal Hyperglycemia

Hyperglycemia is the opposite symptom of hypoglycemia, and is high blood sugar levels. Compared with hypoglycemia, hyperglycemia in newborns has a lower incidence. Preterm infants are infants born in less than 37 weeks (about 8 and a half months) of gestational age and are more likely than mature infants to have hyperglycemia. There is an inverse relationship between gestation, birth weight and the occurrence of hyperglycemia. The causes of hyperglycemia in preterm infants includes high glucose intake, impaired pancreatic beta cell production of insulin, insulin resistance, immaturity of the glucose transport system, small mass of insulin-responsive tissue, sepsis, pain, medications such as steroids and inotropes, and neonatal diabetes. (Hey, E 2005.)

Hyperglycemia requires immediate attention and treatment because, it can increase mortality and morbidity in newborns. To determine hyperglycemia, a capillary glucose test (test from the heel) result is above 8.3 mmol/l, and a whole blood glucose test result is above 6.9 mmol/l.

Currently, the specific blood sugar level to determine hyperglycemia in newborns is still inconsistent, however, in clinical practice, if the value is above 8.3-10 mmol/l, this should warn about hyperglycemia in newborns. Nursing interventions for hyperglycemia include monitoring blood glucose value and insulin treatment as prescribed by the physician. (Balasundaram P & Dumpa 2023.)

Hyperglycemia is more frequent in preterm infants and low birth weight infants than in appropriate gestational age (AGA) infants. It is important to test for blood glucose in preterm infants. (Besser, Flanagan, Mackay, Temple, Shepherd, Shields, Ellard & Hattersley 2016).

3.4.1 Prevention of hyperglycemia

In the prevention of hyperglycemia, the nurse should be able to set an infusion rate as directed by the doctor. Prevention is done by setting a maximum infusion rate of 12 mg/kg/min for glucose during treatment. A glucose infusion of at least 6 mg/kg/min is necessary for a premature infant. Protein anabolism is aided by an addition of 2-3 mg/kg/min. The maximum glucose oxidative capacity is 12 mg/kg/min, after which glucose is transformed into fat by increasing the production of carbon dioxide and using more oxygen. (Kairamkonda & Khashu 2008). For preterm newborns, it is advised to limit the glucose infusion rate to a maximum of 12 mg/kg/min. Assure a sufficient supply of amino acids. For VLBW newborns, amino acids should be included in the diet regimen early on, with the aim of achieving a daily intake of 3.0-3.5 g/kg of amino acids. A positive protein balance requires at least 1.5g/kg/day of amino acids. (Hay & Thureen 2010.) Even at a minimum glucose infusion rate of 4.2 mg/kg/min, parenteral amino acid supplementation enhances insulin release, aids in glucose homeostasis, and inhibits protein breakdown. Since enteral feeds aid in the pancreatic release of insulin, enteral nutrition should be introduced as soon as possible. The nurses should be aware of the prevention of hyperglycemia, but act according to the doctor's order. (Burattini, Bellagamba, Spagnoli, D'Ascenzo, Mazzoni, Peretti, Cogo & Carnielli 2013.)

3.4.2 Nursing intervention: Blood glucose test

Blood sugar testing is a procedure conducted by nurse, that measures the amount of sugar in the body by placing a few drops of blood into a measuring device called a blood glucose meter. Usually, the nurse also can take it from the heel or earlobe, especially for newborns. (PubMed Central 2004)

Blood glucose testing is a crucial tool for diagnosing and monitoring blood glucose levels. When glucose levels get too low, it can put the baby in a bad condition. The brain can be damaged if blood sugar is not checked promptly and treated properly (Alsweiler, Heather, Harris & McKinlay 2022). During the first few hours after birth, glucose levels will change, and this test is important for newborns who are at risk of hypoglycemia. The causes of the risk of hypoglycemia are diverse, such as premature birth, maternal diabetes, or stress during childbirth. (Abramowski, Ward, Hamdan 2023)

3.4.3 Blood glucose test procedure

For newborn screening and health management, blood glucose testing is important to assess the health status of newborns, especially those at risk of hypoglycemia or hyperglycemia. In pediatrics, there are two places where blood glucose measurements are commonly performed in newborns: the heel and the earlobe. (American Academy of Pediatrics, 2017.)

The Heel stick method is a puncture that involves pricking the infant's heel to take a small amount of blood sample for blood sugar testing. This procedure is often performed in infants due to the ease of access of the heel and the larger blood vessels present in this area. For heel taping, a lancet device is used to puncture the infant's heel and a small drop of blood is placed on the test strip for analysis. (Shah & Ohlsson, 2011.)

The Ear lobe injection method like heel sticking, earlobe pricking involves puncturing a newborn's earlobe to get a blood sample for blood sugar testing. The earlobe may also be preferred in certain cases, such as when repeated blood sampling is required or when the heel of the infants is inaccessible due to medical condition or intervention. (Owida, Al-Nabulsi, Ma'touq, Al-Naami & Alnaimat, 2022.)

3.4.4Blood sugar testing process

Preparation starts with the nurse preparing the necessary equipment, including blood collection equipment, alcohol swabs, gauze pads, sterile gloves, and blood sugar monitoring device. Then insert the test strip into the monitoring device to start the analysis system and ensure the device operates normally. (Osmosis, 2021.)

Positioning of the newborn is placed in a comfortable position, either in the newborn baby's bed or in the mother's arms, to facilitate easy access to the chosen location (heel or earlobe). While the infant is sleeping is a suitable time to do a blood test, because it is easier to get a drop of blood when infant is sleeping peacefully. (Osmosis, 2021.)

Site preparation to begin taking a blood sample, the nurse must make sure to clean the puncture site with an alcohol swab and let it dry naturally because the alcohol in the swab can affect the blood and lead to inaccurate results. Therefore, the nurse must ensure that the alcohol evaporates completely before proceeding to the next step. And remember to wear gloves when performing procedures that involve blood. (Osmosis, 2021.)

Blood collection is using the needles for blood sugar testing are called lancets blood needle device, the nurse gently pokes the selected skin area to take a small blood sample by pressing the needle release button. After the puncture, a drop of blood will flow out. If more blood is needed or the blood is too little, try to gently press the skin next to the puncture site to make more blood flow. (Osmosis, 2021.)

Test by inserting the blood sample into the test strip and the system starts reading immediately. While waiting for results, place a gauze swab on the puncture site and continue to apply pressure until the bleeding stops. Results are usually available within seconds. After getting the results, the nurse can compare it with the blood sugar level on the identification card and give the baby's blood sugar status. And remember to always read the results to the baby's parents and explain the baby's condition to them. (Osmosis, 2021.)

Recording blood sugar results is needed in the child's medical record for further monitoring and management by the nurse. Check and edit test date and time, puncture site, test results and any unusual observations. (Osmosis, 2021.)

3.4.5 Monitoring time

Based on the guidelines for screening and management of postnatal Glucose homeostasis in SGA, premature, full-term infants, IDM and LGA infants are divided into 2 periods from birth to the first 4 hours and 4 to 12 hours and shows changes in glucose values during the first 12 hours of a newborn's life. After monitoring and treatment, infants should achieve a target blood sugar concentration above 2.5 mmol/l before each feeding. (David, H. Adamkin 2011.)

For newborns with symptoms of neonatal hypoglycemia such as seizures, apnea, weak or high-pitched crying, poor feeding, blood sugar below 2.2 mmol/l will be treated with intravenous glucose infusion as prescribed by the doctor. (Hume, R., McGeechan & Burchell 1999.)

Asymptomatic infants from birth to 4 hours should be first fed at 1 hour of age and begin blood glucose screening 30 minutes after the first feeding. If the result is less than 1.4 mmol/l, the infant is fed again and rechecked after 1 hour. With values remaining below 1.4 mmol/l after feeding attempts, treatment with intravenous glucose should be instituted. With values between 1.4 - 2.2 mmol/l, infants are treated with intravenous glucose infusion or refeeding as prescribed by the doctor. (Hume, R., McGeechan & Burchell 1999.)

From 4 to 12 hours, newborns with glucose concentrations below 1.9 mmol/l need to be fed continuously every 2-3 hours and recheck their glucose index needs to be rechecked before and after 1 hour of each feeding. And if the value remains below 1.9 mmol/l after refeeding is attempted, treatment with intravenous glucose should be instituted. With values between 1.9 - 2.5 mmol/l, babies are treated with intravenous glucose infusion or refeeding as prescribed by the doctor. (Hume, R., McGeechan & Burchell 1999.)

In the case of a baby born to a mother with diabetes and the ratio is too high for the gestational age, and the blood sugar level remains above 2.2 mmol/l, monitoring and screening should continue until the baby is 12 hours old. After intravenous treatment, blood sugar still cannot increase more than 2.5 mmol/l after 24 hours. The nurse should consider the possibility of hypoglycemia due to hyperinsulinemia. It is the most common cause of persistent hypoglycemia in newborns. (David, H. Adamkin 2011.)

3.4.6 Blood glucose value in newborn infants

To care for newborns, as a nurse, understanding blood sugar values is important for early detection, correction, and management of blood sugar imbalances. This section will outline the various blood glucose values seen in newborns and explain the clinical significance of the various levels.

3.4.7Normal blood sugar level

During the first few hours after birth, normal blood glucose levels in full-term newborns typically range from 2.5 to 5.5 mmol/l. The concentration may be slightly low and unstable depending on the individual, however, after 24 to 48 hours (about 2 days) the body will change naturally and stably to adapt to the environment outside the mother's body. A range of 3.9 to 5.6 mmol/l indicates a healthy baby due to adequate glucose metabolism needed for cellular energy production and is also a healthy glucose level. for everyone including children, adults, and the elderly. (American Academy of Pediatrics 2017)

3.4.8Transient Hypoglycemia

Transient hypoglycemia, also known as mild hypoglycemia, is defined by blood glucose levels lower than 2.5 to 3.9 mmol/l in newborns. This condition refers to a short-term decrease in blood glucose levels, the time after birth. Mild hypoglycemia does not appear, or clear symptoms are difficult to recognize, so if a child is detected with mild hypoglycemia, it is necessary to monitor and treat it regularly to prevent progression to severe hypoglycemia. Typically, interventions include frequent breastfeeding to keep blood sugar levels stable and monitoring blood sugar levels before and after each meal. (Harris, Weston, & Harding 2020.)

3.4.9Severe hypoglycemia

Hypoglycemia is defined as glucose levels less than 2.5 mmol/l in full-term infants and less than 1.7 mmol/l in preterm infants. Hypoglycemia can lead to the risk of neurological impairment, seizures, and long-term developmental complications if left untreated. The causes of

hypoglycemia are diverse, most commonly due to insufficient glycogen reserves, premature birth, maternal diabetes, sepsis, and difficulty eating. Nursing interventions for hypoglycemia should be immediate and include intravenous administration of dextrose solution, additional feedings, and close monitoring of blood sugar levels. (Stanley, Rozance, Thornton, Leon, Harris, Haymond, Hussain, Levitsky, Murad, Simmons, Sperling, Weinstein, White & Wolfsdorf 2015).

3.4.10 Hyperglycemia

Currently, the specific blood sugar level to determine hyperglycemia in newborns is still inconsistent, however, in clinical practice, a value above 8.3-10 mmol/l should warn about hyperglycemia in newborns. Nursing interventions for hyperglycemia include monitoring for dehydration and insulin treatment as prescribed by the physician. (Balasundaram & Dumpa 2023)

4 PROJECT IMPLEMENTATION PHASES

In this chapter, the entire project development process will be described in terms of the various stages of development from the team's formation until the end. This chapter focuses on the project phase, preparation and identification of need, initiation and planning phase, implementation phase and finally closure phase.

4.1 Project phases

The term project phase describes a series of scheduled actions designed to oversee and regulate the creation of a thesis product. The stages happen in the specified order. Every stage comprises an assigned assignment, the tasks that need completion, and the expectations for the task. Risks and expenses are considered at every stage. (Ngoc 2010.) A project's cycle typically begins during the start phase and ends when all its objectives have been met at the closure phase (Barron & Watt 2022). This project was done to produce learning material for Centria UAS nursing students on infant blood sugar, and the phases are described below. Our thesis organization is Centria University of Applied Sciences and the thesis was intended for nursing students of Centria UAS.

4.2 Preparation and identification of need

The theme was chosen from a list of ideas that Centria's lecturers had suggested, the first version of which was "Basic blood sample testing in children". With the project supervisor's suggestion, it was proposed the topic should be narrowed to a specific subject, the authors are interested in learning about. After discussing with the group, it was decided to choose the topic of blood sugar in newborns. We chose this topic because when practicing in the obstetrics department, nurses will check blood sugar of some newborns, but not all. This is the reason the authors chose this topic. It is important for nursing students to know more about the effects and role of blood sugar in risk factored infants and how nurses handle and monitor blood sugar problems. As for how to proceed, the authors have also considered compiling

learning materials through this thesis for nursing students, because they think many nursing students do not understand the importance of blood sugar in newborns. So, through this thesis learning material, we want to provide knowledge to nursing students, so that they can increase their awareness of the role of blood sugar and become familiar with it before students can directly handle the problems during their practice.

The project managers started gathering data that was supported by evidence and would be included in the thesis by searching for pertinent literature on the subject. The thesis authors organized a team to assure the successful completion of the research. They drafted the thesis strategy, started it, monitored progress, and assigned jobs to team members. The project managers were responsible for following up on each work allocated and ensuring accurate final project reporting. The project launcher decided when to launch the project. The project will begin with an initiation phase that includes a thorough requirements assessment and the development of specific project goals. The planning phase will focus on creating a thorough project plan, including schedules, resource allocation, and risk management techniques.

This thesis was completed to raise readers' awareness and provide information about infant glucose, considering the general danger that has been linked to infant hypoglycemia and hyperglycemia. The project managers and supervisor began working together in May 2023. During this time, the project's goals and purpose were established, and it was decided how and when to launch it. The project launch proposal period was set for April 2024. For potential use during the thesis process, reputable international and local Finnish websites offering scientific data-based research were sought after.

4.3 Initiation and Planning Phase

The project team was formed at this point with the supervisor for the thesis. A meeting was also held to discuss the different duties that each team member would play individually and collectively.

A discussion was then held in January 2024 in Kokkola between the project team members and the supervisor. During the meeting, the thesis's aims and objectives and what was expected from the project were outlined. We planned to officially launch the thesis by April 2024 and produce learning material by April 2024, because the project will be used by the nursing students of Centria UAS as part of their reference material on infant blood glucose. Exploring for resources was part of the planning and initiation phase.

4.4 Implementation Phase

The implementation phase was underway in early 2024. During that time, the project progress was be continuously evaluated by the supervisor, with regular feedback loops and revisions made, as necessary. The intention to achieve our goals by using all available evidence-based materials from Centria-Finna and electronic resources (eResources) appropriate to the thesis topic. Electronic resources used were Cinahl and PubMed. Accumulated reliable sources of information were used to draft the thesis and make study materials through leaflets. The leaflet was designed on A4 paper and divided into 3 x 2 sides to expand the space for content, creating compactness and accessibility for readers. The content in the leaflet contains the most essential information on the topic that has been fully summarized after selecting appropriate and useful content for nurses. The supervisor received the final copy of the thesis and leaflet after the thesis was revised and corrections were made. During the research for this thesis, the authors were unable to locate reputable sources with the actual values of newborns with hypoglycemia and hyperglycemia utilized in Finland.

4.5 Closure Phase

The Closing Phase began immediately after the Implementation Phase in April 2024. This phase includes assessment of the thesis through language and plagiarism checking after the thesis is approved. The copyright of the thesis was transferred to Centria UAS, so that Centria UAS can use the learning materials for teaching purposes to Centria's UAS nursing students. To close the project, a final meeting was held to dissolve the project team.

4.6 Project organization

To ensure the project goes smoothly, a project implementation team was established with two team members, Hue Doan and Chinedu Mgboh, as the project leader and the authors of the thesis. The group members coordinated to carry out the thesis, starting from planning, discussing, and drafting the thesis according to the process schedule established from the beginning. The workload was shared fairly among each team member and committed to completion according to the schedule agreed upon by the whole team. To approve the thesis and monitor the entire project process, a steering group was established with the role of project supervisor, Soili Vuollo, and providing suggestions and guidance for the project.

5 ETHICAL ISSUES AND RELIABILITY

The thesis authors were aware of how crucial it is to consider ethical considerations when working on the thesis. The ethics of this thesis were upheld by examining written reports for plagiarism both before and after the thesis was released. Additionally, consideration was given to the usage of research articles and materials protected by the copyright laws. Ensuring the ethical integrity of the project is critical, and input from trusted sources is critical in creating the project's ethical framework. Compliance with the Arene ethical recommendations for thesis at Finnish higher education institutions (Arene, 2021) and the principles of the Finnish Advisory Board on Research Integrity emphasizes a commitment to ethical research techniques (TENK, 2021). Furthermore, the use of relevant material from the collection of Centria UAS ensures that the research is founded on the ethical standards commonly found in nursing research.

Thorough analysis of current nursing research documents collected from reliable sources available in Centria's library ensures reliability. Thorough documentation and consistent data collection processes add to the project's credibility. Furthermore, adhering to copyright rules and following proper citation procedures will protect us from intellectual property difficulties. The project will seek permission to use copyrighted resources and ensure appropriate acknowledgment while adhering to academic research ethics. An agreement was reached between the supervisor, project managers, and Centria University of Applied Sciences, Kokkola.

6 REFLECTION

Drafting this practice-based thesis was a long procedure that calls for a lot of time, energy, willingness, and study from multiple current scientific sources from other scholars working on the same topic. Producing this learning material and searching for evidence-based materials which helped in the completion of this thesis was an eye opener for the authors.

During the research, the authors realized that different countries have slight differences in the values of hypoglycemia and hyperglycemia in infants. So therefore, it is important for nursing students to know the actual reference value of hypoglycemia and hyperglycemia of infants based on the country where they are studying or practicing after graduation.

It is important for nurses to know the risk factors that lead to either hypoglycemia or hyperglycemia in infants because undetected and untreated glucose imbalance can lead to high mortality and brain injury. This helps the nurses know when to test for blood sugar imbalance. As student nurses, who will someday become nurses, it is imperative for us to know when to take a blood glucose sample, how to take it, the normal values of blood glucose, how to maintain abnormal blood glucose, and finally how to monitor blood glucose during nursing interventions.

The production of this learning material exposed us to up-to-date procedures of maintaining blood glucose in infants. It created awareness on the current studies from scholars on guidelines on the importance of blood glucose tests in infants at elevated risk of developing glucose imbalance.

The authors both participated and made the most of their abilities, thus it was a worthwhile learning experience. The authors also learnt how to work together, which was difficult in the beginning. When they were creating this solution, cooperation and time management were two of the most important components. At times, the authors believed they could not complete the project on time, and at other times, they believed they had done everything cor-

rectly, only to receive feedback and identify some errors. Whenever the authors required assistance, the supervisor was there to guide them. Without a doubt, the entire study procedure comprised performing the research.

It was an interesting and fascinating learning process to hold group Zoom sessions, participate in guidance talks and meetings with Centria library staff and our supervisor, and adhere to the Centria UAS thesis criteria. Both the authors agree that this project was challenging because of the difficulties encountered, but it was also a remarkable success because it allowed the authors to incorporate the theoretical knowledge, learned into a learning material that will be used as study material for future nursing students.

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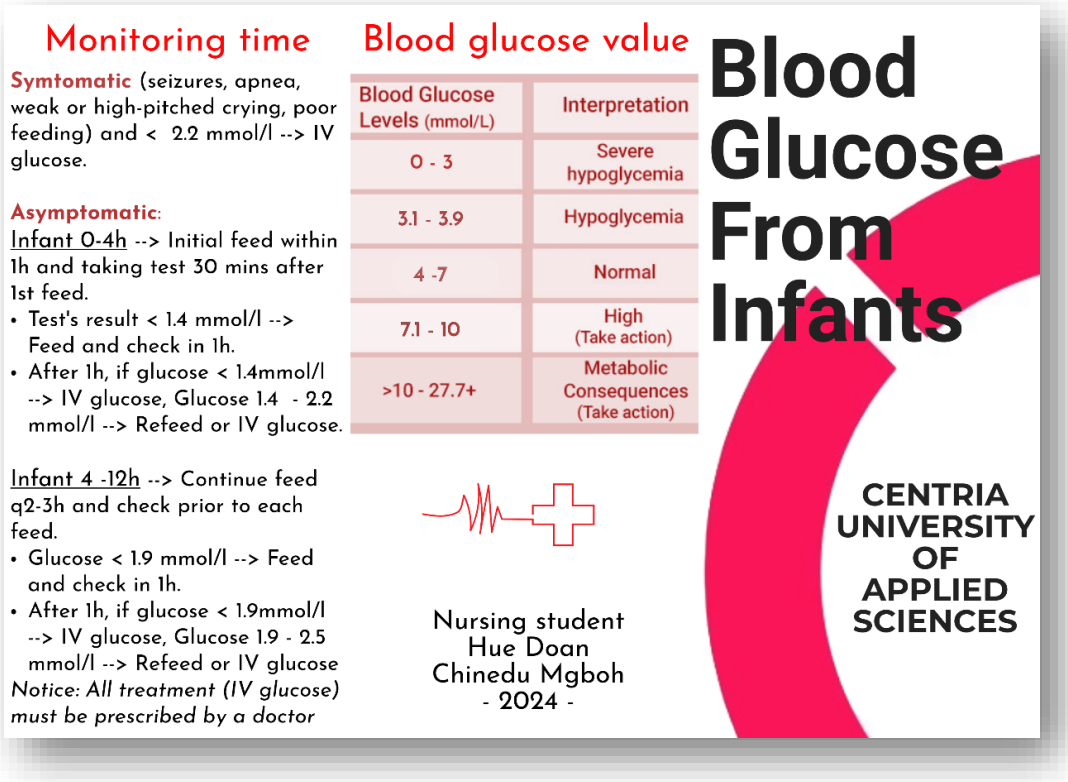
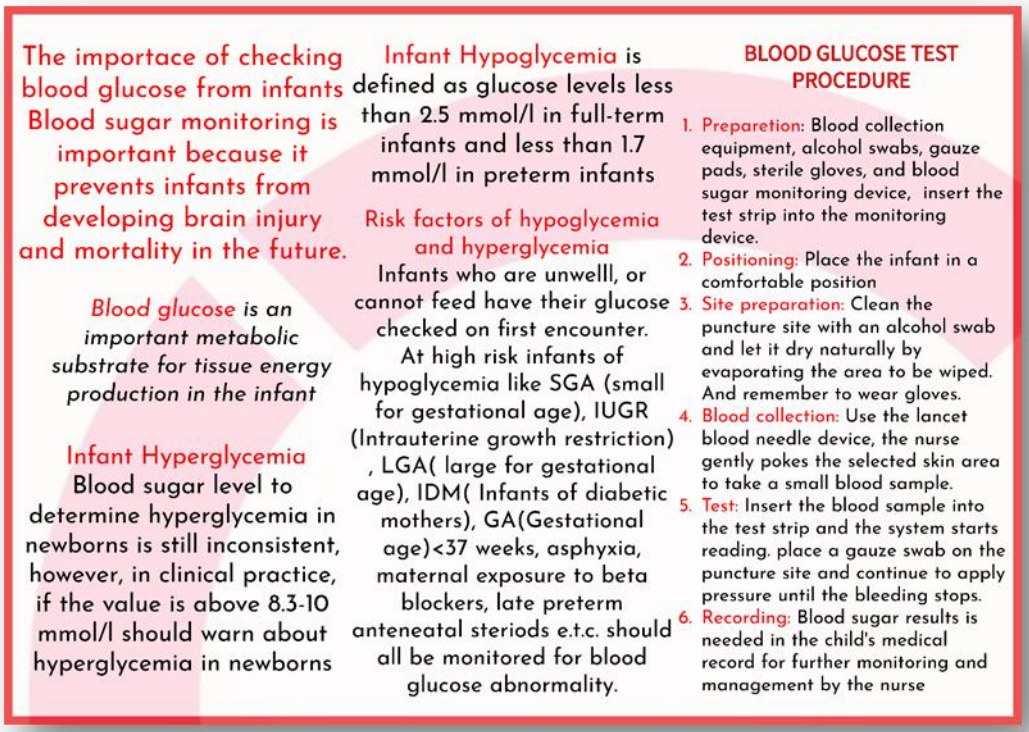
APPENDIX

Learning Material




The importace of checking blood glucose from infants Blood sugar monitoring is important because it prevents infants from developing brain injury and mortality in the future.
Blood glucose is an important metabolic substrate for tissue energy production in the infant
Infant Hyperglycemia
Blood sugar level to determine hyperglycemia in newborns is still inconsistent, however, in clinical practice, if the value is above 8.3-10 mmol/l should warn about hyperglycemia in newborns
Infant Hypoglycemia is defined as glucose levels less than 2.5 mmol/l in full-term infants and less than 1.7 mmol/l in preterm infants
Risk factors of hypoglycemia and hyperglycemia
Infants who are unwelll, or cannot feed have their glucose checked on first encounter. At high risk infants of hypoglycemia like SGA (small for gestational age), IUGR (Intrauterine growth restriction) , LGA(large for gestational age), IDM(Infants of diabetic mothers), GA(Gestational age)<37 weeks, asphyxia, maternal exposure to beta blockers, late preterm anteneatal steriods e.t.c. should all be monitored for blood glucose abnormality.
BLOOD GLUCOSE TEST PROCEDURE
1. Preparetion: Blood collection equipment, alcohol swabs, gauze pads, sterile gloves, and blood sugar monitoring device, insert the test strip into the monitoring device.
2. Positioning: Place the infant in a comfortable position
3. Site preparation: Clean the puncture site with an alcohol swab and let it dry naturally by evaporating the area to be wiped. And remember to wear gloves.
4. Blood collection: Use the lancet blood needle device, the nurse gently pokes the selected skin area to take a small blood sample.
5. Test: Insert the blood sample into the test strip and the system starts reading. place a gauze swab on the puncture site and continue to apply pressure until the bleeding stops.
6. Recording: Blood sugar results is needed in the child's medical record for further monitoring and management by the nurse