

**PRETERM INFANT FEEDING KNOWLEDGE, ATTITUDES, AND PRACTICES
AMONGST HEALTH PRACTITIONERS AT TERTIARY HOSPITALS IN
CAPRICORN DISTRICT, LIMPOPO PROVINCE, SOUTH AFRICA**

by

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DISSERTATION

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I. DEDICATION

I dedicate my dissertation work to my family, many friends, and colleagues. A special feeling of gratitude to my loving wife Linda, and daughter Tumisho; my parents Mogale and Mosibudi Ralebapa; my siblings, Agnes, Sello, Dikeledi, Abigail and Katlego Ralebepa's, with special dedication to my late sister, Molatelo Paulinah Ralebapa (deputy mother). Their present in my life gives me enough courage to continue working hard to become the best I can possibly be.

I also dedicate this dissertation to my many colleagues in the field of Dietetic across the Limpopo province, with special dedication to Mankweng Dietetic Department, who have supported me throughout the process. I appreciate the work done by Department of Human Nutrition and Dietetics, University of Limpopo, especially my supervisor Mrs Rabodiba, co-supervisor Dr Mphasha, Mrs Bopape, Mr Makwela, and my classmates Masters group of 2021, Dr Masoga the postgraduate coordinator and my friend for encouragement.

II. DECLARATION

I declare that Preterm infant feeding knowledge, attitudes, and practices amongst health practitioners at tertiary hospitals in Capricorn District, Limpopo Province, South Africa, is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references and that this work has not been submitted before for any other degree at any other institution.

Ralebapa Khomotso

26 February 2024

Signature

Date

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IV. ABSTRACT

Introduction: Preterm infant feeding is the cornerstone for growth and development, and yet not prioritized by health practitioners.

Aim: This study aims to determine preterm infant feeding, knowledge, attitudes, and practices amongst health practitioners at tertiary hospitals in Limpopo province, South Africa.

Methodology: The study was conducted among 40 health practitioners working at the neonatal unit at Mankweng Tertiary Hospital. The sample size was calculated using the Morgan and Krejci formula, however due to the small sample size, the total population sample methodology was employed. The sample included 16 Medical practitioners and 24 registered nurses. The study complied to all ethical considerations. Data on the knowledge, attitudes and practice amongst health practitioners was collected using a structured self-administered questionnaire.

Data analysis: Statistical Package for the Social Sciences (SPSS) version 29 was used to analyse the data. Continuous variables were presented using minimum, maximum, mean and standard deviation. Categorical variables were presented with frequencies and percentages. Knowledge and practice questions were allocated one point for every correct answer and zero for a wrong answer. The overall knowledge and practice were interpreted using Bloom cut-off, and presented as maximum, minimum, mean and standard deviation. The attitudes questions were analysed using the attitudes score, and the overall attitudes score was calculated and presented as maximum, minimum, mean and standard deviation. The relationship between the socio-demography of health practitioners and the knowledge, attitudes and practice (KAP) was analysed using Pearson chi-square. The strength of the relationship was determined using Pearson's correlation coefficient. P-value of less than 0.05 was considered as significant.

Results of the study: The majority (77%) of health practitioners had moderate knowledge, mean knowledge score of 48%, 88% of health practitioners had a positive attitude, with the mean attitudes score of 89.9%, and 58% of health practitioners obtained a moderate practice, mean score of 64.7%, on preterm infant feeding. There was a significant relationship between registered nurses and knowledge of preterm infant feeding ($p=0.003$), and years of experience of registered nurses and knowledge ($p=0.046$). Additionally, there was a significant relationship ($p=0.031$) between registered nurses' years of working with preterm infant and their knowledge on preterm infant feeding. There was no statistically significant association between socio-demographic characteristics and the overall KAP variables.

Conclusion: Health practitioners at tertiary hospitals in Limpopo obtained a moderate score on knowledge, positive attitudes, and a moderate score on practice on preterm infant feeding, and there was no association between sociodemographic and KAP variables.

Keywords: Preterm, Knowledge, Attitudes, Practice

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V. ABBREVIATIONS

AAP	American Academy for paediatrics
BPD	Broncho Pulmonary Dysplasia
BMB	Breast Milk Bank
CDC	Centre for Disease Control
COVID	Coronavirus
CPAP	Continuous Pulmonary Airway Pressure
DBM	Donor Expressed Breast Milk.
DHM	Donor Human Milk.
EBM	Expressed Breast Milk.
ELBW	Extremely Low Birth Weight
EN	Enteral Nutrition
ESPGHAN	European Society for Paediatric Gastroenterology Hepatology and Nutrition.
FAO	Food and Agriculture Organization
GA	Gestation Age
GIT	Gastrointestinal Tract
GIR	Glucose Infusion Rate
GRV	Gastric Residual Volume
HGT	Hourly Blood Glucose
HP	Health Practitioner
HRLY	Hourly
IQ	Intelligence Quotient
KAP	Knowledge Attitudes and Practice
KMC	Kangaroo Mother Care
LBW	Low Birth Weight
LGA	Large for Gestational Age
LP	Limpopo Province
MAS	Meconium Aspiration Syndrome
MBFHI	Mother Baby Friendly Hospital Initiative
MEN	Minimal Enteral Nutrition
MO	Medical Officer

MOM	Mother's Own Milk
NEC	Necrotizing Enterocolitis
Neo-BFHI	Baby-Friendly Hospital Initiative for Neonatal ward
NICE	National Institute for Health and Care Excellent
NICU	Neonatal Intensive Care Unit
NW	Neonatal Ward
PFM	Preterm Formula Milk
PN	Parenteral Nutrition
PNALD	Parenteral nutrition–associated liver disease
PTD	Pre-Term Delivery
PTI	Preterm Infant
RDS	Respiratory Distress Syndrome
SA	South Africa
SARSCoVID	Severe acute respiratory syndrome coronavirus
SGA	Small for Gestational Age
sIgA	Secretory immunoglobulin A
SOP	Standard operating procedure
SPN	Supplemental Parenteral Nutrition
SPSS	Statistical Package for the Social Science
TPB	Theory of Planned Behaviour
TOF	Tracheoesophageal Fistula
TPN	Total Parenteral Nutrition
TREC	Turfloop Research and Ethics Committee
UNICEF	United Nation Children's Fund
WHO	World Health Organization

VI. DEFINITION OF TERMS

Adherence – The degree to which the person's behaviour corresponds with the agreed recommendations (WHO, 2019). In this study, it refers to the following: preterm infant feeding guidelines and recommendations.

Attitudes - refers to a tendency to react in a particular way to a situation; to see and interpret events according to certain pre-dispositions, or to organize opinions into coherent and interrelated structures (WHO, 2018). In this study, an attitude refers to the reaction of health practitioners towards feeding preterm infant.

Enteral feeding - Administration of nutrition via the gut, either sucked by the infant or given through a feeding tube inserted through the nose or the mouth into the stomach or small intestine (Altebäumer, Mader, Pfeil, Carnielli, Koletzko et al., 2021). In this study enteral feeding refers to administration of feed via nasogastric, orogastric and enterally.

Extremely preterm neonate – refer to an infant born before 28 weeks of gestation (WHO, 2018).

Health practitioners – refer to any practitioners for which a professional board has been established in terms of section 15 and include any category or group of persons provided for by such a board (Health Professional Council of South Africa, 2007). In this study, it refers to medical practitioners and registered nurses.

Knowledge - is the capacity to acquire, retain and use information; a mixture of comprehension, experience, discernment, and skill (WHO, 2018). This study refers to the understanding regarding the feeding of preterm infant by health practitioners.

Parenteral nutrition - Administration of nutrition through the veins directly into the bloodstream, bypassing the digestive tract (Altebäumer et al., 2019). In this study refers to the administration of nutrients via the peripheral of central vein.

Practice - mean the application of rules and knowledge that leads to action (WHO, 2018). In this study it refers to how health practitioners feed preterm infant.

Preterm infant – an infant that is born alive before 37 weeks of gestation is completed (WHO, 2018). In this context, the definition will be used as it is.

Tertiary hospital - specialized facility that offers health care service to those referred from secondary health care for diagnosis or treatment, and which is not available in primary or secondary care (Department of Health, South Africa, 2014). In this study, it refers to Mankweng Hospital.

CHAPTER ONE: INTRODUCTION AND BACKGROUND

1.1. Introduction and background

Globally, about 15 million infants are born preterm, representing 10.6% of 139.95 million live infants (Lincetto & Banerjee, 2020; WHO, 2018). In 2014, North Africa accounted for 13.4%, Asia and Sub-Saharan African countries accounted for 81.1%, and Europe for 8.7% of preterm birth globally (Lincetto & Banerjee, 2020). The prevalence is higher in middle- and low-income countries, with a prevalence of 12% and 9% respectively (WHO, 2018). According to the WHO (2018), the top 10 countries with the greatest number of preterm births in 2016 were India, China, Nigeria, Pakistan, Indonesia, the United State of America, Bangladesh, Philippines, Democratic Republic of Congo, and Brazil. More than 60% of preterm births occur in Africa and South Asia (WHO, 2018). Furthermore, the incidence of preterm birth in sub-Saharan Africa varied from 3.4% to 49.4% (Mabrouk, Abubakar, Too, Chongwo & Adetifa, 2022; Nisar & Yoshida, 2022). In South Africa (SA), approximately 84,000 births are preterm, and the prevalence of preterm birth is 14.17% (Fouché, Kritzinger & Le Roux, 2018; WHO, 2018). Moreover, the United Nation International Children,s Fund (UNICEF)-WHO Low birth weight estimates (2019) estimates that worldwide, 14.2% of infants are born low birth weight, which account for one hundred and sixty-seven thousand and one hundred (167100). There is a lack of data about preterm live births in Limpopo Province. However, the assumption is that the prevalence can be high, deduced from the number of infants born prematurely in SA.

Preterm birth is a global problem, with the prevalence showing to be increasing globally (World Health Organisation (WHO), 2018). Possible causes of preterm birth include multiple pregnancies, genetics, infections and chronic conditions such as diabetes and high blood pressure (Alamneh, Teshale, Worku, Tessema, Yeshaw et al., 2021; WHO, 2018). Preterm infant feeding is therefore important for growth and development; hence knowledge, attitudes and practices of health practitioners are crucial for effective feeding of preterm infant, and support of mothers with preterm infant. It is recommended that feeding of preterm infant

commence within the first 24 hours of life (WHO, 2022; Kumar, Singhal, Vaidya, Banerjee, Anwar et al., 2017). In South Africa (SA), preterm feeding is started after 24 hours of life (Raban, Joolay, Horn & Harrison, 2013). Preterm infant feeding is solely dependent on health practitioners' knowledge, attitudes, and practices of preterm infant feeding. The study aimed to understand health practitioners' knowledge, attitudes, and practices regarding preterm infant feeding, identify training needs and gaps with the aim of improving preterm infant feeding knowledge.

Mothers own expressed breast milk is the recommended as the first feed of choice for preterm infant (WHO, 2022). The second feed of choice in cases where mothers own milk is not available, donor human milk is the recommended, and the third feed of choice where MOM and donor human milk is not available, preterm infant formula may be used as the feed of choice (WHO, 2022). The feeding practices of preterm infant differ based on the country and the guidelines followed by the hospital. In the USA, about 66.7% of the preterm infants were given commercially available milk/formula milk when the mother was unable to breastfeed (Rodriguez, Affuso, Azuero, Downs, Turner-Henson et al., 2018). A study conducted in the United Kingdom on feeding practices of preterm infant between 30-33 weeks of gestation, found that 53% of infant received maternal breastmilk, 3% donated breastmilk, and 40% infant formula as their first feeds within 11-43 hours of birth (Kwok, Dorling & Ojha, 2017). A South African study conducted in Cape Town by Raban et al. (2013) indicated that the rate of enteral feeding in the first 24hours was lower in extremely preterm neonates whereas 65% of neonates of 28-31 weeks of gestational age are fed within 24 hours using breastmilk. Preterm infant of less than 33 weeks of gestation should be enterally fed through an orogastric or nasogastric tube. While those greater than 33 weeks of gestation should be cup-fed or breastfed (Lapillonne, Bronsky, Campoy, Embleton, Fewtrell et al., 2019).

A study conducted in China reported that health practitioners have insufficient knowledge regarding breastfeeding to be able to support breastfeeding mothers

(Yang, Li, Wang, Huang & Lu, 2018). Health practitioners showed to have more information about the usefulness of breastmilk but less information about the composition and the benefits of feeding preterm infant' breastmilk (Yang et al., 2018). The Brazilian systematic review indicated that breastfeeding education provided by health practitioners to lactating mothers resulted in improved self-confidence in the importance of breastfeeding and milk expression (Fonseca, Milagres, Franceschini & Henriques, 2021). A Swedish study showed that education by health practitioners to mothers about breastfeeding composition and knowledge improved a mother's confidence towards breastfeeding (Ericson, Flacking, Westas & Eriksson, 2016).

Health practitioners in Jordan were reportedly having poor attitudes towards supporting breastfeeding (Shattnawi, 2017). This poor attitudes towards breastfeeding were blamed on lack of staff as well as lack of time to enrich or educate mothers on the superiority and the importance of breastfeeding (Ericson et al., 2016). An Italian study found that the influence from professional opinions such as medical officers towards the mothers of breastfeeding preterm infant leads to a decreased feeling of discomfort or embarrassment towards breastfeeding (DeMaria, Ramos-Ortiz & Basilec, 2020). A study conducted amongst final year and intern medical students in India showed a positive attitude towards breastfeeding support, and initiation within the first twelve hours of life (Sudarsanan, Sanchana, VipanchiKamepalli & Kumutha, 2021). This study will, therefore, determine the preterm knowledge, attitudes, and practices among health care workers.

Feeding preterm infant with breastmilk may results in good gut tolerance, leading to less incidence of feed stoppage, and less time to reach maximum feeding volume (WHO, 2018). Furthermore, it can result in reduced risk of necrotising enterocolitis (NEC), sepsis, retinopathy of prematurity (WHO, 2018). Breastmilk can improve gut microbiota ecosystem. Long term benefits in preterm infant include reduction in risk of bronchopulmonary dysplasia and metabolic syndrome.

These benefits may lead to reduced incidence of infections, improved growth and development and reduced hospital stay (WHO, 2018).

1.2. PROBLEM STATEMENT

Breastfeeding and the use of expressed human milk are the normative standards for all infant, especially for preterm infant (Wang, Briere, Xu & Cong, 2019). Mother's own milk (MOM) is the standard for feeding premature infant providing both short- and long-term health benefits (WHO, 2022; Ruys, Van de Lagemaat, Rotteveel, Finken & Lafeber, 2021; Banait, Basu, Desai, Dutta, Kumar et al., 2020; Kumar et al., 2017; Kim, 2016). In cases where MOM is unavailable, pasteurized donor human milk is recommended, instead of formula milk. Furthermore, organizations such as the WHO, American Academy of Pediatrics (AAP), UNICEF recommends that MOM, either fresh or frozen, should be the primary diet for premature infant. The standard practice in neonatal units should be to promote the MOM as the food of choice for all premature and low birth weights (LBW) infant. However, a study by Sepeng (2015) showed that the use of preterm formula milk and mixed feeding is a common practice in the hospitals around Johannesburg, SA. Additionally, the researcher observed the feeding practices in the government hospital, wherein MOM is not prioritised, feeding is usually delayed to after 24 hours after birth, extreme preterm may sometimes be kept nil per oz for up to three days. This observation prompted the researcher to understand the rationale behind this practice by conducting a study on the knowledge, attitudes, and practices of health care workers about preterm infant feeding in a tertiary hospital of Limpopo Province, South Africa.

1.3. PURPOSE OF THE STUDY

1.3.1. Aim

This study aimed to determine the knowledge, attitudes, and practices of health practitioners regarding preterm infant feeding at tertiary hospitals in the Capricorn District, Limpopo Province, South Africa.

1.3.2. Objectives

This study assessed the knowledge of health practitioners regarding preterm infant feeding at tertiary hospitals in the Capricorn District, Limpopo Province, South Africa.

The study described the attitudes of health practitioners regarding preterm infant feeding at tertiary hospitals in the Capricorn District, Limpopo Province, South Africa.

The study described the practice of health practitioners regarding preterm infant feeding at tertiary hospitals in the Capricorn District, Limpopo Province, South Africa

The study determined the relationship between knowledge, attitudes, practices, and socio-demographic data of health practitioners regarding preterm infant feeding at tertiary hospitals in Capricorn District, Limpopo Province, South Africa.

1.3.3. Research questions.

What is the health practitioners' knowledge about preterm infant feeding at a tertiary hospital in the Capricorn District, Limpopo Province, South Africa?

What are the attitudes of health practitioners regarding preterm infant feeding at a tertiary hospital in the Capricorn District, Limpopo Province, South Africa?

What is the practice of health practitioner regarding preterm infant feeding at a tertiary hospital in the Capricorn District, Limpopo Province, South Africa?

1.4. Conclusion of introduction and background

Studies regarding preterm infant feeding studies in Limpopo Province and in SA are limited. Most studies were about breast feeding, and the health practitioners' need for caring for in hospital preterm infant. The findings of this study will help in the development of training for health professionals regarding preterm infant.

1.5. Outline of thesis

Chapter one – introduction and background about prevalence of preterm delivery and outline of aim, objectives, problem statement, and significance of the study

Chapter two – chapter introduction, overview of preterm infant feeding guidelines and practices, including when to start feeding, recommended feeding volumes. Feed of choice, monitoring of feed tolerance, total parenteral nutrition, kangaroo mother care, mixed feeding, and theoretical framework. Available literature about preterm infant feeding KAP studies, and lastly conclusion of the chapter.

Chapter three – covers research design and methods, study area, population, sample determination, and data collection and analysis methods in the study, and chapter conclusion.

Chapter four – chapter introduction, presentation, interpretation and discussions of results findings and conclusion of the chapter.

Chapter five – recommendation and conclusion of the research.

Chapter six – summary and conclusions of the study.

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

The literature review was conducted using original articles, systematic reviews, books, and documents focusing on preterm infant feeding, including nutritional requirements, start of enteral feeding, total parenteral nutrition, monitoring of feed tolerance and monitoring of preterm infant growth. Literature review was sourced using difference database such as PubMed, Google scholar, Science direct, WHO, Science Direct, Sage publications, South African government repositories, Cochrane libraries, and EBSCOhost. Words used through the search engines include preterm feeding recommendations, preterm feeding attitudes, practice, and knowledge by health professionals, and nutrition in preterm and low birth weights.

2.2. Feeding of preterm infant

Preterm infant feeding is highly nutritionally demanding compared to term infant, and their requirements for physiological growth are four times higher (Wiechers, Bernhard, Goelz, Poets & Franz, 2021). Therefore, the primary goal of preterm infant nutrition is to provide nutrients to meet growth and development similar to a healthy infant with the same developmental outcomes (Wiechers et al., 2021; Hay, 2018). Growth failure resulting from increased nutritional requirements due to external environment and the need for a mechanical incubator is very common in preterm infant, which increases morbidity and impairs neurocognitive outcomes (Wiechers et al., 2021). Feeding should be initiated within 6 to 24 hours after birth with the mothers' own milk (Gao, Shen, Wu, Mao, Liu et al., 2023; Mustapha, Wilson & Barr, 2021). The use of enteral feeding among preterm infant has several advantages, which include physiological gastrointestinal growth and maturation, prevention of atrophy and intestinal permeability, and promoting microbial health and immunity (Thoene et al., 2021; Wiechers et al., 2021). Moreover, early initiation of enteral feeds in preterm infant is associated with the

release of trophic endogenous agents, inhibition of inflammatory mediators and cytokine release (Gao et al., 2023).

Feeding should be started and advanced by 30 – 40 ml/kg/day, with proper monitoring of feeding tolerance for preterm infant weighing > 750 grams and for preterm infant weighing < 750 grams, start feeding with 15 – 20 ml/kg/day and maintain trophic feeding for 72 hours and not more than 5 days and increase feed rate by 15 – 20 ml/kg/day (Thoene et al., 2021). Minimum target feed should be 150 to 160ml/kg/day in all preterm infant, to a maximum of 180 ml/kg/day for well-growing preterm infant (Meiliana, Alexander, Bloomfield, Cormack, Harding et al., 2023; Embleton, Jennifer Moltu, Lapillonne, Van Den Akker, Carnielli et al., 2022; Koletzko et al., 2021). Poorly growing preterm infant feeds should be advanced to a maximum of 220 ml/kg/day (Embleton et al., 2022; Mustapha et al., 2021; Thoene et al., 2021). Nutritional requirements for enteral feeding are shown in Table 2.1. Trophic feeds are recommended in all preterm infant within the first day of life, with a volume of < 24ml/kg/day (Mustapha et al., 2021). Feeding volume can be advanced by 30-40 ml / kg / day (WHO, 2022). Additionally, an increased weight gain, shorter hospital stays, shorter time to full enteral feeds and a reduced incidence of late-onset sepsis without increasing the risk of NEC was observed with an advance of 30 - 40 ml / kg / day (Akindolire, Talbert, Sinha, Embleton & Allen, 2020). Early feed progression was found to be associated with less days to reach full enteral feeding, reduced use of parenteral nutrition and reduced need for central venous access in extreme preterm infant without reducing postnatal growth (Salas, Li, Parks, Lal, Martin et al., 2018).

Table 2.1 Enteral nutrition requirements

	Koletzko, 2019	ESPGHAN, 2022 Recommendation
Fluid (ml/kg/day)	135-200	150-180 (135-200)
Energy (kcal/kg/day)	110-130	115-140 (-160)
Protein (g/kg/day)	3.5-4.0 (4.5)	3.5-4.0 (-4.5)
Fat (g/kg/day)	4.1-7.4	4.8-8.1
Carbohydrate (g/kg/day)	11-13	11-15 (-17)

Preterm infant less than 33 weeks and critically ill require feeding through naso- or oro-gastric feeding (Badran, Hashish, Ali, Shokeir, & Shabaan, 2021). Nasogastric feeding tubes can increase nasal airway resistance, especially in preterm infant less than 1000g, may accelerate breathing work and cause collapse of the pharyngeal airway (Mustapha et al., 2021). Overall enteral feeding has a positive effect on glycaemic control through incretins, which stimulate insulin secretion (Beardsall, Thomson, Guy, Iglesias-Platas, van Weissenbruch et al., 2021).

2.2.1. Feeding frequency in preterm infant

Bolus feeding is the delivery of enteral nutrition volume multiple times per day (Mustapha et al., 2021). Bolus feeding is considered optimal for preterm infant (Mustapha et al., 2021). The advantages of bolus feeding include bowel opening, bile duct contraction, thus resulting in feeding tolerance and improved weight gain associated with feeding tolerance, compared with continuous feeding (Embleton et al., 2022). Bolus feeding promotes physiological feeding-fasting increase of hormonal levels compared to continuous feeding and may promote gastrointestinal tract development and improves protein deposition, reduces the time to reach full enteral feeds, reduces feeding intolerance, and improves weight gain (Thoene et al., 2021; Bozzetti & Tagliabue, 2017). Furthermore, bolus feeding increases splanchnic perfusion and may increase energy expenditure compared to continuous feeding. However, the disadvantages of bolus feeding include affecting lung function and may cause greater gastric distension (Thoene et al., 2021; Bozzetti et al., 2017). Furthermore, bolus feeding can increase respiratory instability, airflow, and make it difficult for the immature gastrointestinal tract to handle this kind of nutrition resulting in increased feeding intolerance and feeding-related apnoea (Thoene et al., 2021; Bozzetti et al., 2017).

The benefits of continuous nasogastric feeding include the improvement of energy efficiency by increasing the amount of energy absorbed and decreasing the amount of energy expenditure (Bozzetti et al., 2017). Additionally, glycaemic

stability, reduced feeding intolerance, improved nutrient absorption, duodenal motor function, growth, and weight gain are observed with continuous feeding (Musso, Panfoli, Battaglini, Brigati, Minghetti et al., 2022; Bozzetti et al., 2017). Furthermore, continuous feeding may be beneficial in preterm with post intestinal resection, severe gastro oesophageal reflux, and high-output stoma due to reduced luminal capacity of the jejunum (Yavanoglu Atay, Bozkurt, Sahin, Bidev, Sari et al., 2023; Mustapha et al., 2021). However, continuous feeding is associated with a higher number of prolonged hypoxic episodes related to apnoea, and loss of nutrients (fats attach to the tube surface) associated with the feed delivery system (Yavanoglu Ataye et al., 2023; Thoene et al., 2021). Both feeding frequencies may be beneficial for preterm infant. However, bolus feeding confers greater benefits.

Preterm infant is at increased risk of experiencing feeding difficulties, more especially those born before 30 weeks of gestation. (Fadlalmola & Mohammed, 2020). Feeding difficulties include impaired lip and jaw motion, swallowing, buccal food navigation, breast suckling, bottle sucking, and lack of oral motor skills (Fadlalmola et al., 2020). Risk factors for feeding difficulties include bronchopulmonary dysplasia, eosinophilic esophagitis, gastroesophageal reflux, hypoxic ischemic encephalopathy, intrauterine growth restriction, intraventricular haemorrhage, low birth weight, NEC, periventricular leukomalacia, respiratory distress syndrome (Kamity, Kapavarapu, & Chandel, 2021).

Lactate is a product of anaerobic metabolic activity, which can indicate inadequate oxygenation or oxygen supply to body organs (Lei, Zhang, Wang & Chen, 2016). Plasma lactate level is an indicator of normal metabolism of intestinal flora (El-Abd Ahme, Hassan, Abo-Halawa, Abdel-Razik, Moubarak et al., 2020). Clinical elevation of D-lactate serves as an indicator of sepsis and trauma, especially in intestinal ischemia, which may be indicative of NEC (Lei et al., 2016). Lactate clearance in preterm infant is set to cut off within the first six hours of life (Chen Liu & Li, 2020). Feeding in stable preterm infant should be initiated within 6 hours to 24 hours of life.

2.2.2. Transition from tube feeding to oral (breast or cup) feeding.

Infant oral feeding requires coordination of sucking, swallowing, breathing, and oesophageal transport, but may be affected by factors such as milk availability, NICU environment, and caregiver feeding approach (Embleton et al., 2022). Establishing oral feeding may be more challenging in high-risk infant, e.g., those with bronchopulmonary dysplasia (DPD) where micro aspirations may further compromise respiratory capacity (Rocha, Guimarães & Pereira-da-Silva, 2021). Introducing oral feeds to infant on continuous pulmonary airway pressure (CPAP) appears clinically safe. Moreover, it can decrease time to full oral feed, and feeding infant receiving high flow oxygen through nasal cannula is possible, although swallowing dysfunction and risk of aspiration are important (Embleton et al., 2022).

2.3. Type of feed for preterm infant.

Mother's milk is the preferred source of nutrition for premature babies (WHO, 2022). It offers numerous short- and long-term health benefits, which include late-onset sepsis, protection against NEC, and bronchopulmonary dysplasia (BPD), and improved neurodevelopment (WHO, 2022). Additionally, early oral administration of colostrum provides immunological components, probably stimulating the immune system and protecting against harmful bacteria (Maffei, Brewer, Codipilly, Weinberger & Schanler, 2020). Furthermore, expressed breast milk contains high numbers of myeloid-derived suppressor cells, which can prevent excessive inflammatory reactions and improve tolerance to food antigens (Wiechers et al., 2021).

The advantages of feeding breast milk include better feeding tolerance, lower risk of sepsis, lower incidence of NEC, reduced length of hospital stay and hospitalization, prevention of retinopathy of prematurity, lower risk of cardiovascular disease in life, significantly improved bone mineralization, improved intelligent quotient (IQ) later in life, improved brain, and cognitive functions (Arglu, Boquien, King, Lamireau, Tonetto et al., 2019; Boquien, 2018;

Kumar et al., 2017). These benefits are related to the presentation of IgA, lactoferrin, lysozyme, bile salt-stimulating lipase, growth factors, stem cells, and prebiotics (including human milk oligosaccharides) and probiotics in human breast milk (Arslanoglu, Boquien, King, Lamireau, Tonetto et al., 2019). Although the superiority of breast milk is unquestionable, the high nutritional demands of preterm infant require that breast milk be fortified with human milk fortifier, to meet the nutritional requirements for growth and development (WHO, 2022; Arslanoglu et al., 2019). There is a reason for the above benefits conferred by breastmilk that is recommended as the first feed of choice for new-borns, including preterm infant, by different societies, including European Society for Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN), American Academy of Paediatrics (AAP), UNICEF, and WHO.

However, mothers of preterm infant face various risk factors related to breast feeding and breast milk expression (Ericson, 2018). This challenge includes emotional stress caused by giving birth to a preterm infant, inability of breast stimulation by preterm infant within the first hour of life as recommended by the mother-baby friendly hospital initiative (MBFHI), inadequate milk production coupled with increased demand for breast milk required for feeding 2 to 3 hours per hour in the neonatal unit (Palmér & Ericson, 2019). Preterm infant requires up to 500 millilitres per day of breast milk (WHO, 2020; Wiechers et al., 2021). To reduce the pressure on mothers, prenatal, postnatal preterm infant care and feeding counselling must be provided by the neonatal staff (including doctors, dietitians, and nurses) that are well informed about preterm infant care (Wiechers et al., 2021).

Fortification increases nutrient concentration and enables to meet nutritional needs which are not met by breast milk alone, and it can be done with single-nutrient or multi-nutrient formulation (WHO, 2022; Arslanoglu et al., 2019; Picaud, 2019). The purpose of fortification is to improve the concentration of nutrients to levels that are at the recommended feeding volumes of 135–200 ml/kg/d (Fabrizio, Trzaski, Brownell, Esposito, Lainwala et al., 2020). Nutrient

requirements of preterm infant are defined by Arslanoglu et al. (2019), as intakes that enable the infant to grow at the same rate as a foetus. The use of multi-nutrient or single nutrients fortifier is recommended in preterm infant (Arslanoglu et al., 2019). Indication includes preterm infant born <1,800 g of weight, preterm infant with extrauterine growth restriction, small preterm infant who have not completed catch-up growth, preterm infant with limited fluid intake due to disease conditions, and preterm infant with early poor growth after discharge (WHO, 2022; Gu, Shi, Zhang, Zhou, Gai et al., 2021). Moreover, preterm infant born less than 32 weeks of gestation or weighing less than 1500 grams fed on mothers' own milk or donor human milk (WHO, 2022). Gu et al. (2021) and Thoene et al. (2021) recommends fortification when preterm infant reach 50 to 60ml/kg/day of enteral nutrition. Commercially available human milk fortifiers in SA are FM85, S26 human milk fortifier, and single-nutrient supplement MCT oil. Insufficient nutritional intake in preterm infant has been one of the important causes of EUGR in preterm infant, which can negatively affect the development of the nervous system, kidney, and bone (Gu et al., 2021).

The second feeding of choice in preterm infant is pasteurized donor human milk (WHO, 2022). The indications of pasteurized donor human milk include, mother is absent due to separation, abandonment, illness, death, with double mastectomy (Tran, Nguyen & Mathisen, 2020). Mothers who require medications that are contraindicated in breastfeeding such as amiodarone, Ebola virus disease or breast cancer, chemotherapeutic or antineoplastic agents, retinoids, radioactive pharmaceuticals, chloramphenicol, ergotamine, gold salts, radioactive pharmaceuticals, retinoids, tetracyclines (use for more than 3 weeks), and certain psychotropic medications (Tran et al., 2020). Mothers who use phenindione, phencyclidine, cocaine, and cannabis can be candidates out of concern for long-term neurobehavioral development in infant. Members who belong to LGBTI such as lesbian, gay, bisexual and transgender couples, adoptive or other parents without lactating capacity, and mothers who do not have enough breast milk during the first days after birth despite lactation support (Picaud, 2022; WHO, 2022; Gu et al., 2021).

Pasteurized donor human milk provides nutritional and immunologic benefits like breast milk and reduces infectious complications, reduces the risk of NEC, sepsis, incidences of bronchopulmonary dysplasia and promotes with better tolerance of feed compared to preterm formula milk (Gu et al., 2021; Mustapha et al., 2021; WHO, 2022). Pasteurization alters the nutritional composition of breast milk and may require fortification to support proper growth and development (Arslanoglu et al., 2019). Table 2.2 compares the nutritional composition (macronutrients) of preterm infant milk, mature human milk, and pasteurized donor human milk. Tran et al., (2020) found that the use of pasteurized donor human milk was associated with 46% reduction in episodes of NEC, 19% reduction in the risk of developing sepsis compared to those fed preterm infant formula milk. Among those supplemented with donor human milk, there was a 22% lower incidence of bronchopulmonary dysplasia (Tran et al., 2020). In addition, preterm infant required almost three fewer days of ventilator support than preterm infant who were supplemented with preterm formula.

Table 2.2 Nutritional composition of preterm expressed breastmilk, mature expressed breastmilk, and pasteurized donor human milk.

Nutrient	Preterm expressed milk	Mature human milk	Pasteurized donor human milk
Energy (kcal/100ml)	77 kcal	67kcal	65kcal
Fat (g/100ml)	4.5g	3.5g	3.2g
Protein (g/100ml)	2.1g	0.9g	1.2g
Carbohydrates (g/100ml)	7.5g	7g	7.8g

Source: Ballard & Morrow, 2013. Human milk composition.

The third choice of food for preterm infant is formula milk (Mustapha et al., 2021; WHO, 2022). Preterm infant formula should be used when both MOM and donor human milk is not available. Preterm formula milk should contain all essential nutrients that are designed to meet the need for preterm infant, and low osmolality (WHO, 2022). Preterm formula milk has been shown to increase rapid weight gain and head circumference compared to expressed human milk and donor human milk and increases the incidence of NEC and BPD (Moreira-Monteagudo,

Leirós-Rodríguez & Marqués-Sánchez, 2022). Careful monitoring and calculation of nutritional requirements is necessary, as this will help ensure appropriate weight gain and growth, as rapid weight gain increases body fat content and not muscle mass in preterm infant.

2.4. Total parental nutrition

Parental nutrition is described as the administration of nutrition through the veins directly into the bloodstream, bypassing the digestive tract (Altebäumer et al., 2019). Indications for parental nutrition include preterm infant less than 31 weeks of gestation, birth weight less than 1250g, preterm infant not able to make sufficient progress with enteral nutrition within 3 –5 days, preterm infant with congenital gut abnormalities such as gastroschisis, omphalocele, surgical condition like gut perforation, NEC or critical illness (Mustapha et al., 2021; Wiechers et al., 2021).

Parental nutrition may prevent nutritional compromise after delivery when nutrition through the placenta is abruptly stopped (Mustapha et al., 2021; Silva, Pissarra, Alexandrino, Malheiro, Macedo et al., 2019). Parental nutrition in the first days of life is used to complement and bridge the period until full enteral nutrition is reached (Mustapha et al., 2021). Nutritional requirements for parenteral nutrition are shown in Table 2.3.

Table 2.3 Total parenteral nutrition requirements

	ESPGHAN, 2018	NICE, 2020	Portuguese Neonatal Society, 2019
Energy	90 – 120kcal/kg/day	75 – 120 kcal/kg/day	90-120 kcal/kg/day
Proteins	2.5 – 3.5 g/kg/day	3 to 4 g/kg/day	1.5 – 3.5 g/kg/day
Fats	≤ 4g/kg/day	3 to 4 g/kg/day	1 – 4 g/kg/day
Carbohydrates	4 - 12 mg/kg/day	9 to 16 g/kg/day	4 - 12 mg/kg/day
Fluids			160-180 ml/kg/day

Monitoring of preterm infant with parenteral nutrition should include serum glucose 6 hours a day and 3 – 4 hours for infant experiencing hyperglycaemia and hypoglycaemia, weekly serum creatinine, urea, calcium, sodium, phosphate, magnesium, triglycerides, liver function test such as conjugated bilirubin and

monthly zinc, selenium, copper, ferritin, and vitamin D (Mustapha et al., 2021; Silva et al., 2019). The glucose infusion rate (GIR) is determined if there is glucose intolerance (Reynolds, 2023). The normal GIR range is 4 – 8mg/kg/min in neonates. VLBW infant can tolerate a lower range of 4 – 6mg/kg/min in the first few days of life (Reynolds, 2023). Therefore, it is important to monitor blood glucose in preterm infant receiving parenteral nutrition, in the event of either hypoglycaemia or hyperglycaemia, the glucose delivery rate should be calculated together with total carbohydrates requirements, and necessary adjustments need to be made to maintain euglycemia.

Preterm infants are susceptible to sepsis, which can result in insulin resistance due to the release of counterregulatory hormones (that is, catecholamines and cortisol), causing hyperglycaemia, hypertriglyceridemia, and decreased lipase activity (Orellana & Coss-Bu, 2021). Sepsis increases catabolism, and according to Silva et al. (2019), the amino acid need remains the same as for stable preterm infant. Hyperglycaemia greater than 8.1 mmol/l will require a reduction in glucose to 4mg/kg/min. reduction of lipids to 1g/kg/day in hypertriglyceridemia of more than 2.99 mmol/l to avoid essential fatty acid deficiency. Daily intake of at least 60 kcal/kg and 2.5 g/kg of amino acids is necessary in the acute phase of sepsis (Silva et al., 2019).

Cholestasis is also a common complication associated with total parenteral nutrition in preterm infant, mainly associated with long-term duration of parenteral nutrition and high doses of glucose, and not lipids or amino acids (Silva et al., 2019). To prevent cholestasis (conjugated bilirubin > 2 mg / dL), the glucose supply level should be reduced to levels that do not exceed the oxidative capacity of preterm infant, progress in enteral nutrition in efforts to prevent early stoppage of parenteral nutrition (Silva et al., 2019).

Parenteral nutrition–associated liver disease (PNALD) is prevalent in preterm infant who require long term parenteral nutrition and is a major cause of morbidity,

liver transplantation, and death (Crill, Herrera, Stuart & Christensen, 2020; Sorrell, Moreira, Green, Jacob, Tragus et al., 2017). Parenteral nutrition-associated liver disease is associated with phytosterols and v-6 fatty acids in the parenteral nutrition bag and has been shown to have pro-inflammatory and cholestatic effects (Sorrell et al., 2017). Parenteral nutrition-associated liver disease is defined as direct bilirubin 2 mg / dL without any other cause of liver disease. Parenteral nutrition–associated liver disease has the potential to progress to more serious liver complications, including liver fibrosis, cirrhosis, fulminant liver failure, and death (Crill et al., 2020).

2.5. Growth of preterm infant

Growth is assessed by measuring gain in weight, length, and head circumference, but also using measures of body composition (Embleton et al., 2022). Growth in infancy depends on the intrauterine environment, maternal nutritional status, and genetics. Preterm infants lose approximately 7–15% of their body weight in the first 10 to 14 days of life, this is due to physiological loss of body fluids in the new-born infant, and the weight is regained in the 10th to the 21st day of life (Ndembo, Naburi, Kisenge, Leyna & Moshiro, 2021). The growth chart specifically designed for preterm infant should be used until the infant reach a term-corrected age; the standard growth chart can be used (WHO, 2018). In the utero, an average foetal weight gain of 20-23 g/kg/d during 23-25 weeks of gestation, decreasing to 17-20 g/kg/d during weeks 26-29, 13-17 g/kg/d during weeks 30-34 and 10-13 g/kg/d during weeks 35-37 (Embleton et al., 2022). Weight gain of 15 g/kg/day and 20ng/kg/day to 30g/kg/day is desired for infant < 2kg and > 2kg respectively, length gain of 1cm and head circumference of 0.5cm is desirable per week (Ndembo et al., 2021). The head circumference of more than 1.25 cm per week should be evaluated for hydrocephalus (Embleton et al., 2022; Ndembo et al., 2021). Suboptimal and overweight-against infant should be evaluated for nutritional adequacy and inadequacy (Embleton et al., 2022). Overweight gain above the standards results in accumulation of body fat and delaying brain development in preterm infant and is associated with increased risk of cardiovascular and metabolic disease in later life, more especially when it

is weight gain alone (Embleton et al., 2022; Ou-Yang, Sun, Liebowitz, Chen, Fang et al., 2020).

Growth faltering describes a preterm infant whose growth slows compared to available standards, is more common in sick infant, and associations with poor neurodevelopment (Embleton et al., 2022). Efforts should be made to avoid severe weight loss, stabilise growth, avoid growth faltering, approximately grow along a target growth parameter, and adjust nutrient intakes gradually (Embleton et al., 2022).

Oluwafemi and Abiodun (2018) evaluated growth patterns of preterm infant in an indigenous African population, the results showed an average growth rate of 17.35g / kg / day, with very low birth weight (Oluwafemi et al., 2018). Factors that influence preterm infant postnatal growth include the extent of prematurity (i.e., gestational age), nutritional status at birth (adequate/small for gestational age and intrauterine growth restriction), clinical evolution during neonatal hospitalization including feeding practices, and postnatal nutritional practices (Silveira & Procianoy, 2019).

2.6. Monitoring of feeding tolerance in preterm infant

Feeding intolerance in premature infant is common and may be due to immature gastrointestinal tract or intestinal function disorders (Yuan, Yan, Wen, Deng, Li & Su, 2019). It is estimated that 16 to 29% of premature infant admitted to NICUs develop a feeding intolerance (Elia, Ciarcià, Miselli, Bertini & Dani, 2022). An infant experiencing feeding intolerance presents with the following: Vomiting more than three times during any 24 h period, any episode of bile or blood-stained vomiting, increased abdominal girth increase >2 cm (measured at umbilicus - prefeed), abdominal wall erythema or tenderness, and gross or occult blood in stools (Nangia, Bishnoi, Goel, Mandal, Tiwari et al., 2018). Feeding intolerance may result in poor nutrition, postnatal growth restriction, and several adverse

effects on normal development, which threatens the survival of preterm infant. Furthermore, the delay in progress in attaining enteral feeding caused by feeding intolerance constantly leads to long term use of parenteral nutrition with an increased risk of nosocomial infections and delays in hospital discharge (Yaun et al., 2019).

Gastric residual volume is a measure of milk volume along with gastrointestinal secretions that remains in the stomach after a time interval, it is common in preterm infant due to the immaturity of the gastrointestinal tract with respect to decreased length, immature motility patterns, and inadequate digestive and absorptive capacity (Elia et al., 2022). Negative pressure created by repeated aspiration of gastric contents could damage the fragile gastric mucosa and removing the gastric contents results in loss of gastric enzymes and gastric acid in preterm infant (Elia et al., 2022; Singh, Rochow, Chessell, Wilson, Cunningham et al., 2018). Monitoring pre-feed gastric residual volume to detect feeding intolerance is controversial. Moreover, it has been correlated with an overestimation of feeding intolerance, increasing the number of feeding interruptions and the time taken to reach full feeds (Elia et al., 2022). The gastric residual volume is no longer routinely recommended as a measure of feeding intolerance, and naso-gastric free drainage is recommended for preterm infant who develop abdominal distention and emesis.

2.7. Preterm infant feeding and Novel coronavirus.

Severe acute respiratory syndrome coronavirus (SARSCoV-2) poses a serious health challenge, for preterm infant as well. Due to the nature of transmission through droplets, it is uncertain if the virus can be transmitted to the child from the infected mother via breastmilk (Minckas, Medvedev, Adejuyigbe, Brotherton, Chellani et al., 2021). A study by Babata, Yeo, Chan, Mazzarella, Adhikari et al. (2020) indicated there is a presence of coronavirus (COVID) antibodies (secretory immunoglobulin A (sIgA) in the breastmilk of mothers who tested positive for covid was found. As a result, it is recommended that mothers

of preterm infant continue to express breastmilk for feeding their preterm infant. Minckas et al. (2021) reported few incidents of the presence of a new nucleic acid coronavirus (SARS COVID) present in breast milk, with no incidence of transmission to babies, which may be due to the presence of COVID immunoglobulin M (IgM) antibodies in the infant born to COVID positive mothers. Fear of SARS COVID transmission also decreased the practice of kangaroo mother care (KMC) records by half from 20% to 10%, due to separation of infant from their mothers, among preterm infant born less than 2000g of birth weight (Minckas et al., 2021).

Kebede, Taye, Wondie, Tiguh, Eriku et al. (2021) evaluated the awareness of healthcare professionals of breastfeeding practice recommendations during the COVID-19 pandemic and associated factors in northwest Ethiopia and found that about 40% healthcare providers were aware of breastfeeding practice recommendations during the COVID-19 pandemic and related to information on accessibility information on COVID-19. Coutts, Neille and Louw (2022) conducted a study to evaluate feeding practices in neonatal intensive care units of public hospitals and found that social distancing was a challenge resulting in restricted access for mothers and healthcare workers, and limited the ability to provide adequate feeding practices, thus resulting in anxiety for mothers and mental health challenges for healthcare workers when feeding these at-risk babies.

2.8. Kangaroo mother care in preterm infant.

Kangaroo mother care is the process of preterm infant carried skin-to-skin with the mother (Cristóbal-Cañadas, Parrón-Carreño & Nievas-Soriano, 2022). It involves early, continuous, and prolonged skin-to-skin contact between the mother and the baby. Exclusive breastfeeding is initiated in hospital and can be continued at home. Preterm infant can be discharged early, mothers at home require adequate support and follow-up, it is effective method that avoids the agitation routinely experienced in a busy ward with preterm infant (Cristóbal-Cañadas et al., 2022). Kangaroo mother care is viewed as the most effective way to maintain body temperature, stimulate the senses, promote growth and

development through restricted movement, and provide maternal love (Lord, Harding, Crowther & Lin, 2023). Kangaroo mother care can be practiced intermittently in the neonatal ICU in more stable infant and continuously for well-growing infant who require less medical care (Cristóbal-Caadas et al., 2022; WHO, 2022).

Kangaroo mother care helps the mother form strong emotional bonds with her baby, the mother feels more confident in handling her baby, the mother feels good about herself and the care she can give her baby (WHO, 2022). Moreover, the mother feels less stressed during KMC, the mother is more likely to exclusively breastfeed her baby, with all the family involved, the small baby is more likely to have continuous skin-to-skin care and to have a stable temperature, the mother can interact with her infant and observe progress, this is motivating for the mother and family members (WHO, 2022; Cristóbal-Caadas et al., 2022).

Pratomo, Amelia, Nurlin and Adisasmita (2020) evaluated the knowledge and perception of health care providers of kangaroo mother care and found that most health care providers knew about the benefits of KMC, including stabilizing temperatures, weight gain, and mother and baby bonding and reducing costs. They were also aware of which preterm were eligible for KMC. Their knowledge was mainly gained from observation or obtained from paediatricians and other healthcare professionals. They believed that a preterm infant in an incubator could not be treated with KMC and that it could only be practiced if a special gown was used when holding the baby. Adisasmita, Izati, Choirunisa, Pratomo, and Adriyanti (2021) found that 46.2% of the nursing staff had good knowledge about KMC, 98.5% had good knowledge of KMC benefits, and 100% had a positive attitude toward KMC, in a study conducted in Portugal. Nurses in perinatal wards were found to have minimum experience assisting and implementing KMC. Some observations made among nursing staff included lack of knowledge about the eligible infant weight for KMC and weight gain of infant receiving KMC, lack of education/training about KMC, and concerns about the necessary equipment in the KMC wards (Adisasmita et al., 2021).

2.9. Mixed feeding in preterm infant

Mixed feeding is giving an infant's breastmilk or expressed breastmilk in combination with commercial formula milk or animal milk (Al Sabbah, Assaddf, Taha, Qasrawi & Radwan, 2022; Papadopoulos, Balan, van der Merwe, Pang, Michaelis et al., 2022). In preterm infant, it refers to giving breast milk and preterm formula milk at the same time (Menezes, Steinberg & Nóbrega, 2018). Mixed feeding is used in cases where the breast milk is insufficient from the mother, as an addition to the breast milk. Due to the high concentration of nutrients in preterm formula milk, when administered in combination with breastmilk, it can give a greater weight gain compared to breastmilk alone and a little lower compared to giving only formula milk (Menezes et al., 2018). However, WHO (2022) recommend the use of commercial preterm infant' formula, when mothers own milk or donor human mil is unavailable.

Moreover, in infant exposed to immune deficiency syndrome, HIV can penetrate the integrity of the gut mucosa and cause HIV infection in preterm infant, and alter the gut microbiota, and mixed feeding is not recommended there (WHO, 2018). Preterm infant not exposed to immune deficiency syndrome may also not be mixed fed as it may increase susceptibility to pathogenic infection (WHO, 2018). Mixed feeding is associated with increased risk for the development of NEC (WHO, 2022). The decision on feed can be either from expressed breastmilk or preterm formula milk.

2.10. Theoretical framework

The study will use the Theory of Planned Behaviour (TPB), which was developed by Ajzen (1991). Theory of Planned Behaviour (TPB) predicts an individual's intended behaviour and further explains the ability to exert self-control over people. The key component of the model is the behavioural intention, which is influenced by attitudes, of the likelihood that the behaviour will have the expected outcome and the subjective evaluation of the risks and benefits of that outcome. The theory has been used to predict and explain a wide range of behaviour and intentions, which includes smoking, drinking, health service utilization,

breastfeeding, and substance abuse. It further states that behavioural achievements depend on intention and behavioural control. It differentiates between three types of beliefs Figure 2.1, as behaviour, normative, and control (Sanne & Wiese, 2018).

2.10.1. Components of the Theory of Planned Behaviour

Behavioural Beliefs and Attitudes toward Behaviours - This refers to the degree to which a person has a favourable or unfavourable evaluation of the behaviour of interest. Attitudes develop for the beliefs which people have about the situation or object and plays a role in influencing the behavioural beliefs. It entails a consideration of the outcomes of performing the behaviour (Sanne & Wiese, 2018). The attitudes of health practitioners with regards to preterm infant feeding is very important in influencing the practice, and it is influenced by the expected outcome from behaviour or even a practice. It is therefore important to use attitudes and the component of planned behaviour to evaluate the attitudes of health practitioners with regards to preterm infant feeding.

Normative Beliefs and Subjective Norms - This denotes to the belief about whether most people approve or disapprove of the behaviour. It relates to a person's beliefs about whether peers and people of importance to the person think he or she should engage in the behaviour (Sanne & Wiese, 2018). Institutions develop standards operating policies (SOP) and procedures to guide the professional practice within the institution, furthermore, there are professional organizations that develop recommendations to be adopted for procedure and policy development, and these guidelines are used throughout the world. Therefore, the development of literature for this research documents are based on the guidelines for feeding preterm, and the questionnaire will be used to evaluate the subjective norms and guidelines related to infant feeding.

Control Beliefs and Perceived Behavioural Control - This refers to a person's perception of the ease or difficulty of performing the behaviour of interest. Control beliefs may be influenced by experience with the behaviour and can be influenced

by second-hand information about the behaviour, by the experiences of co-workers and friends, and by other factors that increase or reduce the perceived difficulty of performing the behaviour in question (Bosnjak, Ajzen & Schmidt, 2020). Perceived behavioural control varies across situations and actions, which results in a person having varying perceptions of behavioural control depending on the situation (Sanne & Wiese, 2018). The behaviour of interest is an important determinant of attitudes and situation, the measure of behavioural control will be used to evaluate knowledge and attitudes and practice of health practitioners towards preterm infant feeding.

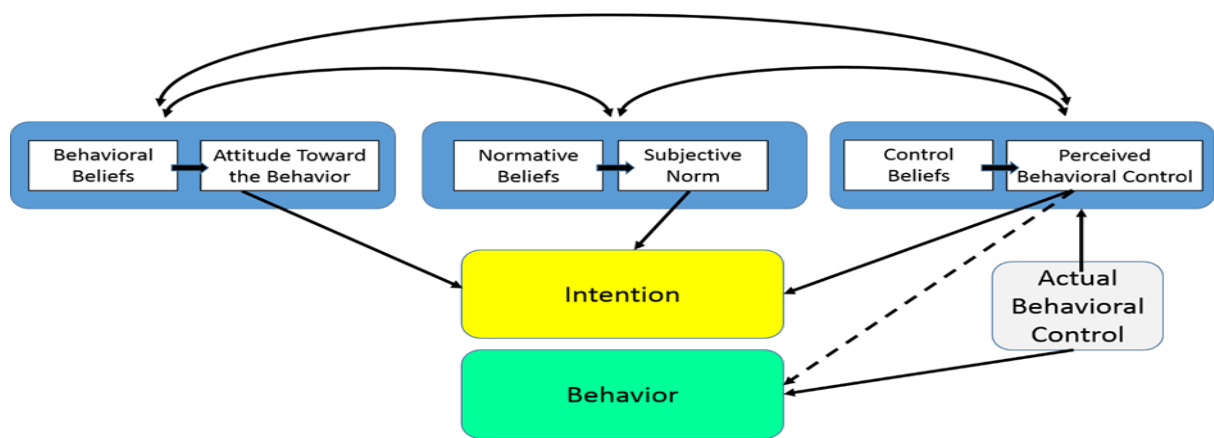


Figure 2.1 The Theory of Planned Behaviour (Ajzen 2019)

Knowledge attitudes and practice of preterm infant feeding amongst health practitioners may be affected by factors such as profession, age, race and years or service. Figure 2.2 outline the conceptual framework of preterm infant feeding.

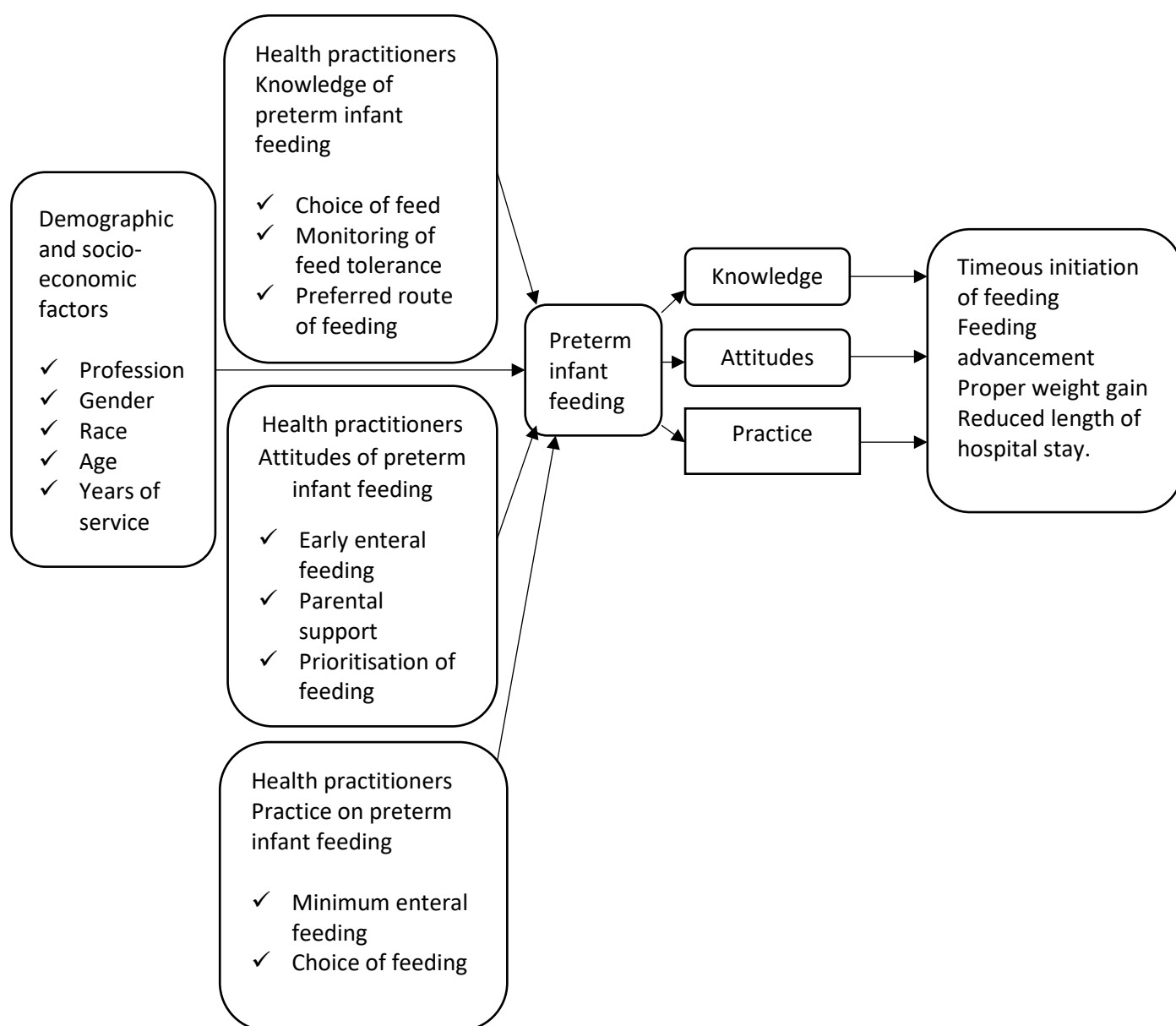


Figure 2.2 Conceptual framework on knowledge, attitudes, and practice of preterm infant feeding (adapted from Amolo, 2019).

2.11. Knowledge of preterm infant feeding

A study by Yang et al. (2018), recommend that it is important for health practitioners to have knowledge regarding preterm infant's breastfeeding, both for support and the management of breastfeeding problems. They should also know the characteristics and properties of preterm human milk to better support breastfeeding mothers. Thoene et al. (2018) emphasizes how nutrition therapy is crucial in the neonatal ICU. Health practitioners must know the timing of

nutritional therapy, how soon feed is to be initiated and increased as mentioned in the above recommendation.

Fonseca et al. (2021) recommend that nurses should have enough knowledge enabling them to support mothers carrying for preterm infant, including early breastmilk expression which allows feeding to be initiated within the 1st day of life, storage of expressed breast milk, encourage early skin-to-skin contact, kangaroo mother care (including benefits), tube and cup feeding (Mörelus, Sahlén Helmer, Hellgren & Alehagen örelus et al., 2022). Mahwasane, Maputle, Simane-Netshisaulu and Malwela (2020) conducted a study to evaluate provision of care to preterm infant at resource limited health facilities of Mopani District, SA, and found there is a need to conduct training with regards to neonatal care including feeding amongst mid wife nurses, as they lacked information with regards to neonatal care. Fadlalmola et al. (2020) conducted a study Nurse's Knowledge and Practice on the Care in Sudan and found nurses to have poor knowledge of preterm infant's care, which was due to lack of experience (less than 6 months) in the neonatal care unit of Preterm Infant at Khartoum State.

Hashim (2021) assessed the knowledge of nurses working in premature section about the ideal nursing care at Kerbala paediatric teaching hospital in Iraq, which found that have higher knowledge regarding preterm infant's care. Helmy, Abdesemie and Awad (2022) conducted the study to evaluate Nurses' Knowledge, Perception and Practices Regarding Kangaroo Care for Preterm Infant and found, less than half of studied nurses to have average knowledge. Pratomo et al. (2020) study conducted in Indonesia, found that most health care workers have knowledge about the benefits of KMC, which including stabilizing temperatures, weight gain, and maternal-infant bonding and reducing human resources and labour costs, the also aware of which preterm infant for eligible for kangaroo mother care. Of which the knowledge was attained from observation from paediatricians and personal experience (Maastrup, Rom, Walloee, Sandfeld & Kronborg, 2021). French study found that nurse's education on breast feeding significantly increase the exclusive breastfeeding rate in preterm infant. However,

in India the study by Sudarsanan et al. (2021) found there is an average knowledge with regards to PTI, feeding practices amongst medical students. Singh, Mishra and Gupta (2018) found that knowledge regarding kangaroo mother care and its benefits amongst health practitioners was poor and recommend regular training of health practitioners to increase knowledge. Moreover, Roba, Binoy, and Naganuri (2017) reported that it is important for health practitioners to have adequate knowledge about KMC, as this directly enhances the transfer of knowledge from health practitioners to the preterm infant's mothers and results in increased KMC practice post-discharge. Adisasmita et al. (2021) found that 46.2% of the nursing staff had good knowledge about KMC, 98.5% had good knowledge of KMC benefits.

2.12. Attitudes of preterm infant feeding

Health practitioners are required to have a positive attitude towards preterm infant feeding. a positive attitude will translate to a priority given to the mother's education by health practitioners to encourage breastmilk expression as soon as possible after birth and early within 24hours of initiation of feeding after delivery (Kim, 2016). Feeding should not only be one profession but all caring for preterm, more especially for medical practitioners who are the primary contacts after birth. Sudarsanan et al. (2021) found that medical students are in support of breastfeeding and breastmilk as the feed of choice in PTI, moreover that PTI formula should not be mixed as supplementary to breastmilk. Ericson et al. (2016) found that there is a positive correlation between positive attitudes of health practitioners and education given to the mothers and breastfeeding in PTI post-hospital discharge. There is a lack of studies evaluating PTI feeding attitudes towards HCPs. Attitudes regarding KMC amongst health practitioners in India was reported to be negative (Singh et al., 2018).

Cultural exposures have an influence in the attitudes of health practitioners. Buys and Gerber (2021) found that the influence of traditional and religious beliefs, the importance of the cultural education of medical staff members, and a support system to improve maternal experience are important for carrying preterm

mother. In South African, vulnerable groups (Mörelus et al., 2022) found that nurses have positive attitudes towards preterm infant feeding and provided guide and support to mothers. A study by Makela, Axelin, Kolari, Kuivalainen and Niela-Vilén (2021) found that after the Baby-Friendly Hospital Initiative and Baby-Friendly Hospital Initiative for neonatal wards (Neo-BFHI) interventions were implemented, there was a significant improvement in the breastfeeding attitudes of healthcare professionals and in breastfeeding-related care practices. Morelius et al. (2022) conducted a study to aim of this study was to explore nurses' experiences of the oral feeding process in the NICU when the infant is born extremely or very preterm in Australia, the experience of nurses towards oral feeding process when the infant is born extremely or very preterm (born from 28 weeks to less than 32 weeks of gestation) was described as complex and required collaboration, provided support to mothers through practical and emotional support. Three fifth of nurses were found to have negative attitudes about kangaroo mother care (Helmy et al., 2022). Health care workers believed that low-birth-weight infant in an incubator should not practice kangaroo mother care (KMC) and KMC could only be done in a special gown was used when holding the baby. These attitudes could be due to lack of formal KMC training, leading to misunderstanding of its aspects (Pratomo et al., 2020). Adisasmita et al. (2021) found that 100% of nurses had good attitudes about kangaroo mother care.

2.13. Practice of preterm infant feeding

A Swedish study reported a reduction of breastfeeding in preterm infant, especially in extremely preterm, this was contributed by lack of support in the neonatal unit by health practitioners (Ericson et al., 2016). Singh et al. (2018), depicted that practice regarding KMC amongst health practitioners is poor, which includes kangaroo feeding of preterm infant. Kumar et al. (2017) established that preterm infant less than 1,5kg, were intimated feeding within the 1st day of life using trophic feeds of 10ml/kg/day, and feed increments of 20ml/kg/day. Mustapha et al. (2020) found a feed increment of 30ml/kg/day for all categories of the preterm infant. The preferred feed on choice in the PTI is mothers expressed breastmilk followed by pasteurized donor breast milk and preterm

formula milk. Raban et al. (2013) found that feeding is initiated at a rate of 0.5 - 1ml/kg/day to a maximum of 20ml/kg/day, with the same volume being maintained for 4 – 5 days. Infant less than 25 weeks received feed via nasogastric tube continuously, and PTI greater than 25, feeds were increased daily.

Recommended feeding for preterm infant is through nasogastric feeding, using expressed mothers' own milk or pasteurised donor human milk if mothers' own milk is unavailable. Starting rate of 10 – 20ml/kg/day, with daily increment of 10 – 20ml/kg/day and target maximum feeds of 160 – 180ml/kg/day (Embleton et al., 2022). A survey conducted in Nigeria and Kenya showed a very varied practices withing and between the two countries, with regards to initiation of feeding within the 1st 24 hours and the availability of preterm infant feeding protocol (Tongo, Olwala, Talbert, Nabwera, Akindolire et al., 2022). Expressed breast milk is used to initiate feeding withing the two countries amongst very low birth weights in secondary and tertiary health care centres (Tongo et al., 2022), and feeding was initiated within the first 24 hours and some not until after 72 hours. Donor human milk is not accessible in both countries as such formula milk is used as an alternative source of nutrition (Tongo et al., 2022). Nakubulwa, Musiime, Namiiro, Tumwine, Hongella et al. (2022) evaluated the factors associated with post-natal growth failure in preterm infant in rural hospitals of Uganda. They found that 73% where below the 10th centile weight on discharge, this was associated with delayed initiation of enteral feeds after 48 hours, which was 3.7 times more compared to when feeds were started within the first 48 h of life.

In South Africa, a study conducted in Charlotte Maxeke Johannesburg Academic Hospital to evaluate growth of extremely low birth weights, found there was an association between poor growth and poor feeding practices (Mabhandi, Ramdin & Ballot, 2019). Alexander, Meyer, Harding, Alsweiler, Jiang et al. (2022) revealed that health practitioners prefer using formula milk in very low birth weights and low birth weights as compared to extremely low birth weights infant, in a study conducted in Auckland, New Zealand. A study conducted in Ethiopia by Gidi, Mekasha, Nigussie, Goldenberg, McClure et al. (2020) found that the use

of preterm formula amongst preterm was higher in Addis-Ababa compared to other regions of Ethiopia, and parenteral and milk fortification was not used. Regarding kangaroo mother care fewer of studied nurses had poor practice (Helmy et al., 2022).

2.14. Preterm infant feeding protocol

Preterm infant feeding and nutrition is an important for survival of preterm infant. Timeous initiation and advancement of nutrition plays a pivotal role in growth and development of preterm infant (WHO, 2022). Availability of preterm infant feeding protocol standardises the practice of feeding across all health practitioners, moreover it promotes early initiation of feed, and reduces the time to reach maximum feeding volume (Sreekumar, Baracho, Bhoomkar, & Joshi, (2023).

2.15. Summary of literature

The goal of nutritional support in preterm infant is to achieve growth like in utero. Nutritional requirements in preterm are heightened due to several factors, including hypothermia, infections and sepsis, immature organs and the need for mechanical ventilation and incubation. Feeding is recommended within the first 24 hours life in stable preterm infant with the rate of 30 to 40 ml/kg/day. Total parenteral nutrition and supplemental parenteral nutrition is recommended for preterm infant born on or before 32 weeks of gestation, infant with congenital gastrointestinal abnormalities and infant undergoing gastrointestinal surgery. Mothers own milk is the preferred first choice of feed in preterm infant, followed by donor human milk and lastly preterm infant' formula. Multi – nutrients fortifier can be used in preterm who are not gaining the appropriate weight. Weight gain of approximately 15 g/kg/day is expected in preterm infant, and head circumference and length of 1 cm per week is also expected.

Knowledge of health practitioners regarding preterm infant feeding, including feeding initiation and progression, monitoring of feed tolerance, total feed volume, feed of choice is essential in optimising nutrition for preterm infant. Attitudes of

health practitioners plays an important role in preterm infant feeding; it can be influenced by the knowledge health practitioners have on preterm infant feeding and by the support of the available structures for example the availability of feeding protocol. Practice of preterm infant feeding may be influenced by both the knowledge and attitudes of health practitioners. For health practitioner to practice relevant guidelines, they also need to be supported by the availability of feeding protocol. Health practitioners need to be continuously empowered with the latest guidelines regarding preterm infant feeding.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1. Introduction

“Research Methodology aims to describe and analyse methods, throw light on their limitations and resources, clarify their limitations and resources, clarify their presuppositions and consequences, relating their potentialities to the twilight zone at the frontiers of knowledge” (Patel & Patel, 2019:48). In this chapter research approach, design, study site, study population, inclusion and exclusion criteria, sampling methods, data collection and data analysis were outlined.

3.2. Research approach

The study employed quantitative research methodology. The quantitative method deals with numbers and measurable data to investigate a relationship between measurable variables (Abuhamda, Ismail & Bsharat, 2021). The study quantified the responses on the assessment of preterm infant feeding knowledge, attitudes, and practice amongst health practitioners at a tertiary hospital in Capricorn District, Limpopo Province, South Africa.

3.3. Research design

The study was a cross-sectional descriptive design. A descriptive study is defined by Aggarwal and Ranganathan (2019), as designed to describe the distribution of one or more variables. The variables that were described include the knowledge, attitudes, and practices amongst health practitioners working in the tertiary hospital. The study used a cross-sectional design, which involves the collection of present data of one or more variables of interest that exist in a setting at one point in time. A cross-sectional study presents a snapshot of the behaviour of a population at a point in time (Aggarwal & Ranganathan, 2019).

3.4. Study site

Limpopo Province has two tertiary hospitals within the Capricorn District, namely Mankweng and Pietersburg. Mankweng hospital serves as a referral for

specialized treatment for high-risk pregnancies and as a referral for high-risk preterm infant from all hospitals (regional and district) across the Limpopo Province. Mankweng hospital was selected as a study site because it was the only hospital that serves as a referral and treatment site for high-risk preterm infant in all hospitals of Limpopo Province. The Neonatal ward is a specialised unit for treatment and care of preterm infant. The Neonatal ward in Mankweng hospital has nine ICU beds (including 1 isolation), nine High care beds (including 1 high care isolation), 32 general neonatal beds, eight neonatal surgical beds, six isolation beds for neonates with severe infections, and seven kangaroo mother care (KMC) beds. Mankweng hospital is located 30Km East of Polokwane Town, figure 3.1.

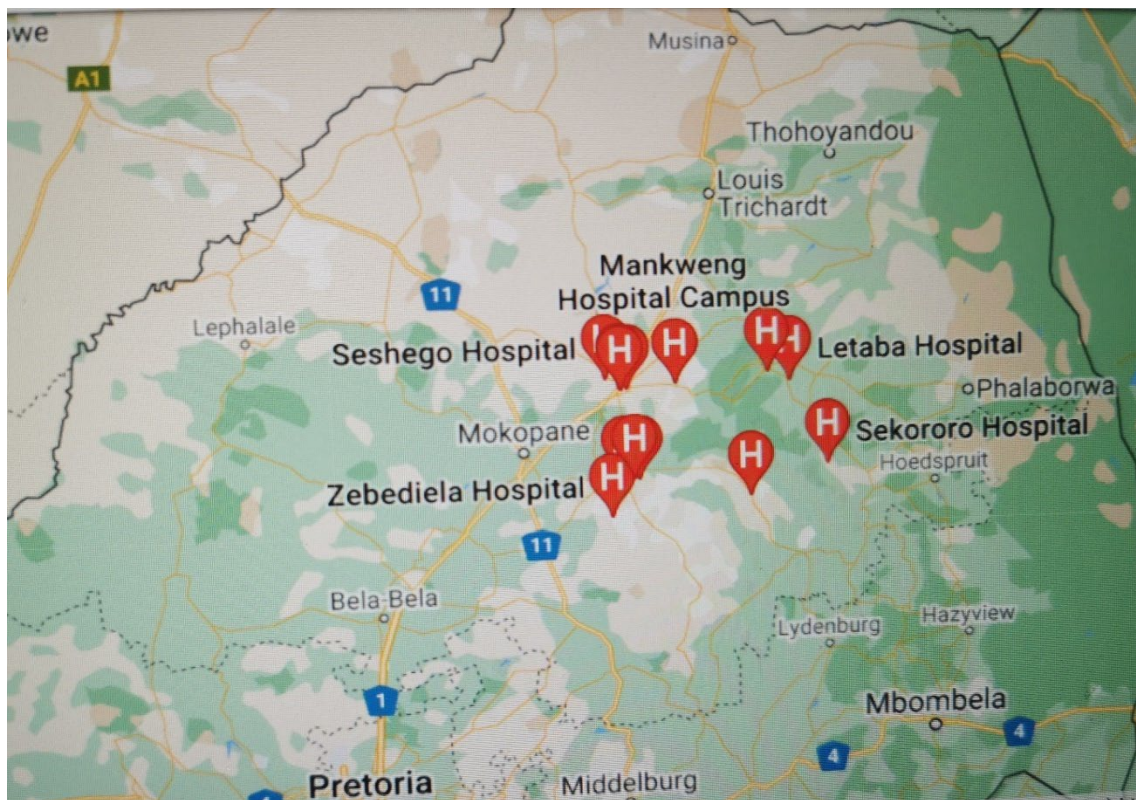


Figure 3.1. Map showing Mankweng hospital.
(<https://mapcarta.com/W432100730/Map>)

3.5. Study population

The population is the total number of persons, case records, events, or other sampling units which concern the research problem (Fouche, Strydom &

Roestenburg, 2021). Neonatal wards employ highly specialized health practitioners including nursing, medical practitioners, dietitians, physiotherapists, and speech therapists. The population in this study was medical practitioners and registered nurses working in the Neonatal ward. The Neonatal ward operate with 21 medical officers comprising of four paediatricians, one neonatologist, one paediatric pulmonologist, two medical officers, 13 paediatric registrars and 32 registered nurses, three dietitians, two physiotherapists and one speech and language therapist. Therefore, the total population in this study was 59 health practitioners.

3.6. Inclusion criteria

Inclusion criteria is defined as the main characteristics of the target population that the researcher will use to reply to their research questions (Patino & Ferreira, 2018). All medical practitioners and registered nurses working in the neonatal unit during the period of this study were included. The medical practitioners and registered nurses are involved directly with feeding of preterm infant.

3.7. Exclusion criteria

Exclusion criteria are describing the structures of the potential study subjects who meet the inclusion criteria, however, presents with additional features that could impairs the success of the study or increase the risk of adverse outcome (Patino & Ferreira, 2018). The study excluded internship medical practitioners because they conduct rotational work in different departments within the hospital and work under supervision. All medical practitioners and registered nurses who took part in the pilot study were excluded from the main study. The physiotherapist and speech therapist were excluded from the study because they do not work with feeding of preterm infant directly, although the speech therapist stimulate sucking in preterm infant. Dietitians were excluded from the study because they formed part of the pilot study.

3.8. Sampling and sampling procedure

Sampling is defined as the process of selecting several subjects from all the subjects in a particular group, or the universe (Bhardwaj, 2019). In this study, a convenience sampling procedure was used to select medical practitioners and registered nurses. Convenience sampling means that the researchers utilize a sample which is readily available, and they have access to (Golzar, Noor, & Tajik, 2022). This method allowed the use of health practitioners who were available. The participants were sampled using convenient sampling method. Questionnaires were presented manually to the participants, until the sample size was reached.

In this study, the sample size was one person less than the population size of 59 health practitioners. All registered nurses who were on duty were given questionnaires and the study project was explained during the morning 7H00 am meeting and were asked to complete the questionnaire. The completed questionnaires were collected at 07H00 pm. The night duty nurses were given a questionnaire at 7H00 pm, when they knock into the shift, and complete questionnaires were collected the following morning at 7H00 am. The same process was repeated on Thursday when the shift was changing for the registered nurses. For medical practitioners their superiors were approached, it was not easy to get medical practitioners collectively. So medical officers were approached individually, and the aim of the study explained. Questionnaires were handed out, and complete questionnaires were collected the following day.

3.8.1. Sample size.

A sample is defined as a selected subcategory of a population (Andrade, 2020). Krejcie and Morgan's formula was used to calculate the sample size (Krejcie & Morgan, 1970).

➤ Sample calculator formula

$$s = X^2 NP(1 - P) \div d^2(N - 1) + X^2 P(1 - P)$$

Where:

s = indicates the required sample size.

X^2 = indicates the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841).

N = indicates the population size (59).

P = indicates the population proportion (assumed to be .50 since this would provide the maximum sample size).

d = indicates the degree of accuracy expressed as a proportion (.05)

➤ Sample size calculation

$$s = X^2 NP(1 - P) \div d^2(N - 1) + X^2 P(1 - P)$$

$$\begin{aligned} s &= [(3.841) (59) (0.50) (1 - 0.5)] \div [(0.05 \times 0.05) (59-1) + (3.841) (0.5) (1-0.5)] \\ &= 56.65 \div 1.1 \\ &= 52 \end{aligned}$$

Requires sample size is 52 +(10% of 59) = 58

$$52+6=58$$

Where 10% is included to cover attrition rate. Attrition due to possible lack of return of questionnaires. The total number of sampled participants was 58.

The number of questionnaires issued to health practitioners was 58, and the number of returned questionnaires was 40. Five (5) health practitioners (3 registered nurses and 2 Medical practitioners) participated in the pilot study and therefore not considered for the main study. Four (4) of the health practitioners refused to participate in the study.

Respond rate (RR) = (questionnaire returned ÷ questionnaire issued) × 100

$$RR = (40 \div 58) \times 100$$

$$RR = 0.689 \times 100$$

$$RR = 69\%$$

The researcher was satisfied with the response rate of 69 % from health practitioners in the study. This is higher than the response rate of 58.2 % amongst health practitioners in the study by Rispel, Ditlopo, White and Blaauw (2021) and 53% in a study by Meyer, Benjamens, El Moumni, Lange and Pol (2022).

3.9. Data collection

3.9.1. Data collection tool

Quantitative data were collected from participants using a questionnaire. The questionnaire was adapted from the Food and Agricultural Organization (FAO) on the guidelines for assessing nutrition related knowledge, attitudes, and practices (FAO, 2014), as well as the available literature on preterm infant feeding (Marías & Glasauer, 2014). Section 1 of the questionnaire (Annexure 3) was on health professional's demographics, section 2 was addressing the knowledge of health practitioners regarding the feeding of preterm infant, section 3 was addressing the attitudes of health practitioners with regards to feeding of preterm infant, and section 4 was addressing the feeding practice by health practitioners in preterm infant. True or false questions were used in section 2, Likert scale was used in sections 3, and multiple-choice questions were used in section 4, of which the aim was to assess health practitioners' preterm infant feeding knowledge, attitudes, and practice. The response time was adopted from guideline by Sharma (2022), who stipulate how short or long should be a questionnaire for any research. Data was collected once from health practitioners from November 2022 until December 2022 when the total sample size was reached.

3.10. Data analysis

Data on socio demographic information was analysed using the Statistical Package for the Social Sciences (SPSS) version 29. Independent variables in our study were profession, gender, race, age, years of service, years of experience working with preterm infant and availability of protocol. Dependent variables were knowledge, attitudes, and practice. Descriptive statistics was summarized using

frequency and percentage. Continuous data was presented using mean and standard deviation.

Knowledge questionnaire had multiple choice questions either yes or no and true or false. The responses were analysed by giving a point to each correct answer, a yes/true=1 point and a no/false=0 (Feleke, Wale & Yirsaw, 2021). The percentage of correct responses were calculated by dividing the total number of correct answers by the total number of questions and multiplying that result by 100. The results for overall knowledge were analysed based on Bloom's cut-off point of 80-100% being good score, 50 -79% being moderate score and less than 50% and below for poor score (Seid & Hussen. 2018). Overall knowledge percentage was analysed as continuous variable and presented a maximum, minimum, mean and standard deviation.

Attitudes was determined using a three-point Likert scale agree, neutral and disagree. Each question was analysed using a scores. An agreement range score of 3 to 1 was used. A score of 3 was allocated agree, 2 to neutral and 1 to disagree (FAO, 2014). The attitudes score per question was determined by dividing the sum of the scores per question by the total number of response per question (FAO, 2014). The score was analysed and interpreted using 3-point Likert scale interval. The score interval for negative, neutral, and positive attitudes were determined as follows: -

The score interval = highest score (3) – lowest score (1) = 2

Then the difference 2 divided by highest score (2/3) = 0.66 (difference)

The interval for negative attitudes score = lowest score 1 to 1.66 (add the difference to the lowest score).

The interval for neutral attitudes score = 1.67 (Obtained 1.66 + 0.01 is the value to avoid interval overlap) to 2.33 (add the difference to lowest interval of neutral)

The interval for positive attitudes score = 2.34 (2.33+0.01) to 3 (2.34+0.66)

The score interval is presented in Table 3.1. The score was analysed and interpreted using three-point scale interval, where in the interval score between 1.00 – 1.66 indicates negative attitudes, score interval between 1.67 – 2.33 indicates neutral, and the score than falls between 2.34 – 3.00 indicates positive attitudes (Pimentel & Pimentel. 2019). For overall attitudes, each highest score was multiplied by the number of participants, then divided by the total score. The dividend multiplied by 100. All the percentages were added together, and the sum divided by the number of questions to determine the overall score. The percentage was analysed based on Bloom's cut-off point of 80 - 100% being good score, 60 - 79% being moderate score and less than 60% and below for poor score (Seid & Hussen. 2018). Overall attitudes percentage was analysed as continuous variable and presented a maximum, minimum, mean and standard deviation.

Table 3.1 Three scale point interval for interpretation of attitudes

Likert scale	Interval	Difference	Description
1	1.00 – 1.66	0.66	Negative attitudes
2	1.67 – 2.33	0.66	Neutral attitudes
3	2.34 – 3.00	0.66	Positive attitudes

Practice questionnaires had multiple- choice questions, each correct answer was given the value of one, and every incorrect answer was given a zero (Feleke et al., 2021). The percentage of correct answers was calculated by dividing the total number of correct answers by the total number of questions and multiplying that result by 100. The results for overall practice were analysed based on Bloom's cut-off point of 80-100% being good score, 50 -79% being moderate score and less than 50% and below for poor score (Seid & Hussen, 2018). Overall knowledge percentage was analysed as continuous variable and presented a maximum, minimum, mean and standard deviation.

Pearson's Chi-Square test was used to determine the relationship between sociodemographic data and KAP. The level of significance was established using

the Pearson's Chi-square, p-value was set at 0.05, the confidence interval of 95% and a 5% margin of error (Sil, Betkerur & Das, 2019). The variables were considered significant if the value is equal or less than 0.05 (Sil et al., 2019). The correlation coefficient(r) was used to determine the strength of the relationship between socio-demographic data and KAP. The correlation coefficients (r) of 0.00 – 0.10 indicated a negligible correlation, 0.10 – 0.39 indicated a weak correlation, 0.40 – 0.69 indicated a moderate correlation, 0.70 – 0.89 indicated a strong correlation and 0.90 – 1.00 indicates a very strong correlation (Schober, Boer & Schwarte, 2018).

3.11. Validity

Validity denotes to whether the measuring tool measures the behaviour or value intended to be measured and is a measure of how well the instrument performs its function (Surucu & Maslakci, 2020). A validated questionnaire was adapted for preterm infant feeding knowledge and attitudes from Bogonko (2013), and for preterm infant feeding practice from Bradfield (2017). The adapted questionnaire was sent to the supervisors who are experts in neonatal nutrition since they have experience of working in the neonatal unit for content validity. It was also sent to the other health practitioners working in the neonatal unit such as the dietitian. External validity was ensured by using a simple random sampling method.

3.12. Reliability

Reliability refers to the constancy of the measuring tool used and its ability of produce the same results over time. Reliability is the ability to measure instruments to give similar results when applied at different times (Surucu & Maslakci, 2020). The pilot study was conducted to test if the study produces the required results.

3.12.1. Pilot study

The pilot study was conducted from the 21st to the 24th of November 2022. The questionnaires were issued to two medical practitioners, three registered nurses

and three dietitians. The nurses and the medical officers who were working in the neonatal unit, and the dietitians were used to validate the data collection tool. They were asked to comment on the time it takes to complete the questionnaire, relevancy of the questionnaire and questions, and where they suggested that alterations should be made. They were requested to bring back the questionnaire the following day. And the feedback was as follows.

- ✓ Time it takes to complete the questionnaire – the minimum time it takes to fill the questionnaire was 20 minutes and a maximum of 35 minutes. The average time it takes for response to the questionnaire is 28 minutes.
- ✓ Question 1.5 plus was removed as part of age category.
- ✓ Question 2.11 present was changed to presence.
- ✓ Question 2.15 it was added between feeding and nasogastric.
- ✓ Question 2.17 NEC was advised to be written in full for consistency throughout the questionnaire.
- ✓ Question 2.19 if was corrected to is, and kilogram changed to gram.
- ✓ Question 2.22 kilogram was changed to gram.
- ✓ Question 2.23, 2.24 and 2.25 option was changed to be less than 150, 150 – 180, and greater than 180 ml/kg/day.
- ✓ Question 2.9 breastfeeding was changed to breast milk.
- ✓ Question 3.9 (is the), was removed to change a question to a statement.
- ✓ Registrar was added as an alternative to medical officer as majority of medical officers in the neonatal department are registrars.
- ✓ Question 4.8 between born and later, not was added so the statements mean between later than 30 – 31 weeks gestation.
- ✓ The option 2.26, 3.11 and 4.23 was added to be used to analyse the data as poor knowledge less than 50 % as poor knowledge, attitudes, practice, 50 to 75 % as good knowledge, attitudes, practice, and greater than 75 % as excellent knowledge, attitudes, practice.

3.12.2. Pilot Results

The pilot data were captured and analysed on SPSS version 29. The pilot results show knowledge score at 75%, excellent knowledge at 90% and good practice at 67.4%. Average per profession medical officer had excellent knowledge and practice at 80 and 85 % respectively, and good practice at 54.5%. Registered nurses had good knowledge at 65%, excellent practice at 83%, and poor practice at 46.5%, while dietitians had excellent knowledge and attitudes at 81% and 100% respectively, and good practice at 71.2%. The pilot results did not form part of the main study.

To overcome bias based on questionnaire that were returned overnight, an observation questionnaire on the practice was developed to validate the practice and knowledge on the questionnaire.

3.13. Bias

Bias is the process that can at any stage of the research affects the results or conclusions that can differ systematically from the fact, can contaminate the whole field of research, including its analysis, design, interpretation, and reporting (Yarborough, 2021). The study was subjected to the following unavoidable bias:

3.13.1. Selection/ participants bias

Selection bias occurs when the researcher uses unsuitable procedures for selecting a sample population, but it can also happen because of factors that influence the participants to continue with the study (Jager, Tripepi, Chesnaye, Dekker, Zoccali & Stel, 2019). Selection bias in this research was unavoidable for Mankweng Hospital as the study site. The study was aimed at health practitioners who are involved in feeding preterm infant, and Mankweng Hospital is the only hospital in Limpopo Province which has this expertise. Selection bias was minimized by using a simple random sampling method, which gave every

health professional involved in feeding preterm infant an equal chance of participating, reducing the risk of selection bias.

3.13.2. *Data collection bias*

Data collection bias occurs when the investigator's personal beliefs affect the way data is collected (Smith & Noble, 2014). Participants received the questionnaire, with questions that will be the same for every participant. The questionnaire was self-administered and similar in all aspects. This might have helped to reduce data collection bias.

3.13.3. *Response bias*

Response bias is the styles that imitate a difference use of the response choice irrespective of the item's content and response biases that reflect a tendency to change responses to support them with contextual demands or one's self-concept such as the tendency to give socially wanted answers (Wetzel & Brown, 2015). The questionnaire was multiple-choice, True, or False and Likert scale format, and this will help minimize response bias.

3.14. ETHICAL CONSIDERATIONS

Ethical considerations' adherence and consideration of ethical standards in the research project are required research principles. Ethical norms help to ensure a healthy, trustworthy relationship between the researcher and the participant (De Vos, 2005).

3.14.1. *Ethical clearance*

The researcher obtained ethical clearance from the Turfloop Research Ethics Committee (TREC) at the University of Limpopo (Annexure 5). Project number: TREC/347/2022:PG

3.14.2. *Permission to conduct the study.*

Prior to the commencement of the study, approval was obtained from the Human Nutrition and Dietetics Department (University of Limpopo), School of Health Care Sciences, Faculty of Health Sciences, ref_2022-09-007 (annexure 4), and then from TREC (TREC/347/2022:PG) (annexure 5). And lastly, permission from the Limpopo Provincial Department of Health (annexure 6), and the CEO from Mankweng Hospital, Ref:55/3/1/2 (annexure 7).

3.15. Confidentiality

Confidentiality refers to what is done with the data once it is in the investigator's possession, and specifically the extent to which it is revealed to others (Sim & Waterfield, 2019). Data collected in this study was strictly treated as confidential, and not shared amongst either participants or non-participants. After analysis, the data was locked in a code-encrypted zip folder and would be kept for a period of 5 years.

3.16. Anonymity

Anonymity is concerned with the attribution of information, that is, will the participant be identified through the information relating to them from the data provided (Sim & Waterfield, 2019)? The questionnaire was coded for anonymity. The code represented health practitioners' category to be used for analysis.

3.17. Privacy

Data collected were locked under code protected zip folder after analysis to ensure the privacy of the participants, printed questionnaire were kept in a locked cupboard where the researcher and the supervisor were the only ones who had

access. The coded questionnaire which did not require names was added as an additional tool to protect the privacy of the participants.

3.18. Informed consent

The participants were requested to sign an informed consent which outlined the aim and objectives of the study, and volunteerism. A signed consent form (annexure 2) that protected the participants from physical or emotional harm, were signed a minimum of two weeks before data collection, in compliance with the Helsinki Declaration. The study participants were informed that participation was voluntary, and nineteen (19) health practitioners chose not to participate in the study. An informed consent form was attached as annexure 1.

3.19. Harm

Harm is defined as to annoy, humiliate, offend, and or cause discomfort (Motloba, 2019). This research project involved minimal harm, and that was explained to the participants before completion of a questionnaire. Reputational harm was minimized through confidentiality and anonymity. However, harm may result in the event the findings of the study are linked with participants, which may cause discomfort. Hence, in this study, such harm was minimized through confidentiality, privacy, and anonymity.

3.20. Time frames

Table 3 2 Time frames

Activity	Time frame
Research proposal	March to September 2021
Submission to the department	October 2021
Submission to school	March 2022
Submission to faculty	April 2022
Submission to TREC	August 2022
Submission to Department of Health	September 2022
Data collection	November 2022
Data analysis	February 2023
Write-up	April 2023
Submission for editing	January 2024
Submission for external assessment	January 2024
Finalization of the study	January 2024
Graduation	April 2024

3.21. Budget

Table 3.3 Budget

Activity	Budget
Tuition fee	R50000
Laptop	R6000
Internet bundles (24 months)	R12000 (R500 per month)
Traveling	R2000
Printing	R500
Total	R70500

3.20. Conclusion

Descriptive cross-sectional design was used in this study. Data was collected from health practitioners about knowledge attitudes and practice with regards to preterm feeding, in the neonatal unit, Mankweng tertiary and academic hospital, Capricorn District, Limpopo Province, SA. Total of 40 health practitioners participated in the study. Structured questionnaire was used as a data collection tool, and ethical clearance and permissions were sought before data collection. Privacy and confidentiality were maintained throughout the study.

CHAPTER FOUR: PRESENTATION, INTERPRETATION AND DISCUSSION OF RESULTS

4.1. Introduction

This chapter presents the results, interpretation and discussion of a study that was conducted among 40 health practitioners at Mankweng hospital. The study participants were 16 medical practitioners and 24 registered nurses. The purpose of the study was to assess preterm infant feeding knowledge, attitudes, and practices (KAP) amongst health practitioners. The results of the study are presented, interpreted, discussed, and compared with other studies.

4.2. Demographic information of health practitioners

4.2.1. Health professional category

The professional category of health practitioners is presented in Figure 4.1. The results show that majority of health practitioners in Mankweng Hospital, neonatal unit are registered nurses. The hospital had no sub-specialities such as neonatologist, paediatric surgeon. The study had a limitation of not classifying the specialities within the registered nurses.

The result of our study concurs with the workforce of the Limpopo Department of Health, where about 66% of the employees are registered nurses, while only 15% are medical officers (Limpopo Province Department of Health, 2021/2022). However, this result differs from the those of a study by Coutts et al. (2022), conducted in Gauteng, SA, among health care workers such as dietitians, physiotherapists, speech & language therapists, and medical practitioners, where registered nurses were the majority with 26%. Most studies evaluating the feeding of preterm infant by health professionals are conducted among nurses (Galal, Tantawi & Hegazy, 2023; Coutts et al., 2022; Mörelius et al., 2022).

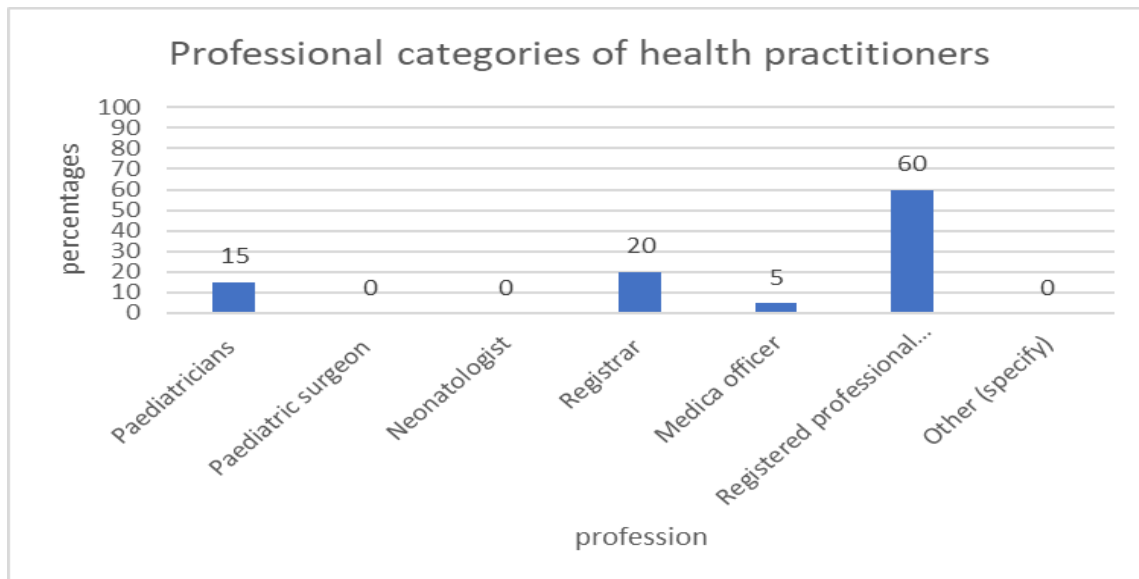


Figure 4.1 Professional category of health practitioners

4.2.2. Gender of health practitioners

The gender was designed to represent the inclusivity and respect of every health practitioner. The results are presented in Figure 4.2. The results indicate that most health practitioners in the Mankweng Hospital, neonatal unit were females (87.5 %).

The result of the current study corroborates with the workforce at the South African National Department of Health, where about 64% of employees are female (National department of health, 2020; 2021). Furthermore, the Mankweng Hospital has more female employees at approximately 73% (Mankweng Hospital Information Department, 2023). Additionally, these results are supported by registrations with South African Nursing Council (SANC, 2021), where most of the nurses registered were females with approximately 86%. The results of our study are further supported by Bulozze (2021), where females dominated by about 83%. However, the result of this study contradicts the registrations of the South African Health Professional Council (HPCSA), where male-dominated medical practitioners registered with approximately 59 % (Tiwari, Wildschut-February, Nkonki, English, Karangwa et al., 2021). The results of gender inclusivity covered all aspects of gender in our study and did not favour any gender or discriminate any gender.

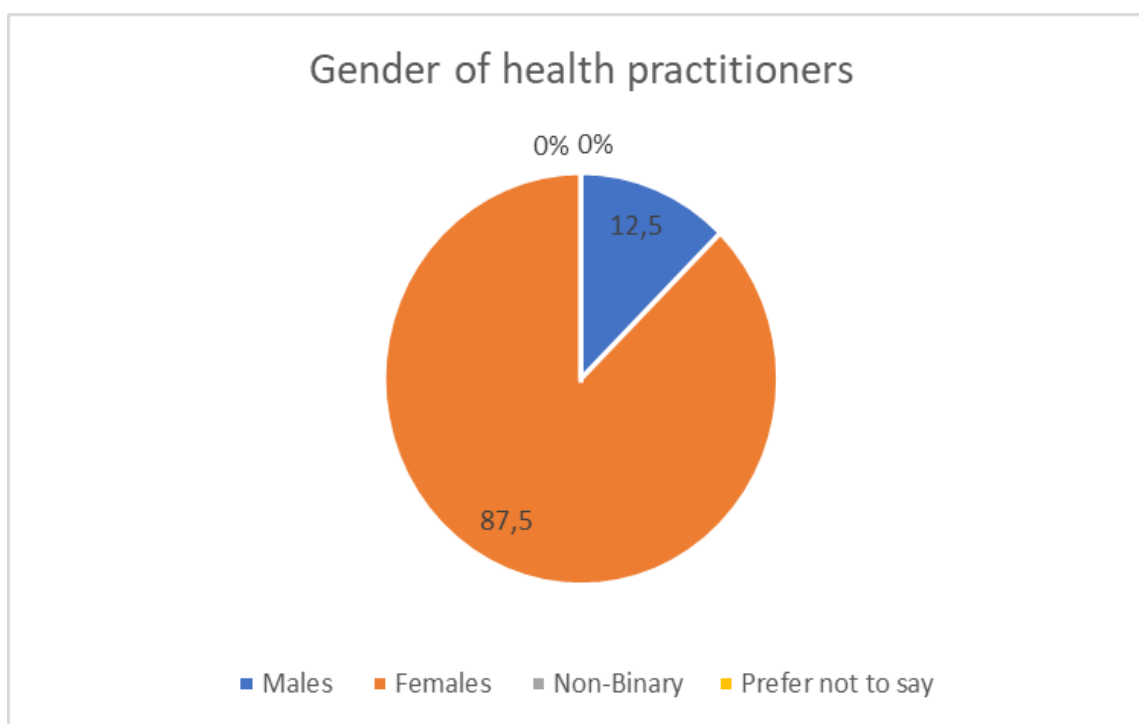


Figure 4.1 Gender of health practitioners

4.2.3. *Race of health practitioners*

The results of the study indicate that all the health practitioners who participated in the study were black.

The study was carried out at Mankweng Hospital in Capricorn District in Limpopo Province. According to Statistics SA, blacks dominate the South African population with 82 % (STATS SA, 2022). Furthermore, approximately 97% of the population in Limpopo Province are Black people, followed by whites at 2.4% and coloured at 0.2 % and Asians/ Indians at 0.1% (STATS SA, 2022). The race of the participants in this study are a true reflection of the population in the province because are in the absolute majority in the Limpopo Province.

4.2.4. *Age of health practitioners.*

The results are presented with minimum, maximum, mean, and standard deviation in Table 4.4. The results of the study indicate that the youngest age of health practitioners was 25 years old while the oldest was 59 with the mean age

of 40.6 years. These results reflect that most health practitioners in the study were middle aged adults. Middle aged adults are between 40 and 54 years old (Espí-Sanchis, Leibbrandt & Ranchhod, 2022).

The age of the health practitioners in our study agrees with the study conducted by Mörelius et al. (2022), where the mean age was 41.5 years. Similarly, a study conducted in Rwanda indicated that the mean age was 43 years (Buloze, 2021). On the contrary, Galal et al. (2023), found that the mean age was 31.3 years. The results on the age of the participants in our study are supported by the Basic Condition of Employment Act no 75, 1997. According to this act, it is a crime to employ children under 15 years of age, except for performing arts with permission from the Department of Labour. Furthermore, Children 15 to 18 years of age may also not be employed for age or for work inappropriate for their age or work at a place that puts them at risk (ACT no 75, 1997). The health professionals undergo tertiary education training of 4 to 6 years depending on the profession. The maximum age of the health professional in our study is supported by the retirement age as per Public Service Act (PSA), 1994, is 60 years for both males and females.

4.2.5. Years of service of health practitioners

The results are presented with minimum, maximum, mean, and standard deviation in Table 4.4. The average years of experience (mean) was 13.9, with standard deviation of 8.1. Most health practitioners had more years of experience which might translate to more knowledge about preterm infant.

The results on mean years of experience in our study differ with those in a study conducted by Abo El Magd Fathi, Elsayed Ouda and Ali Kunswa (2022) which was 3 years. Additionally, the years of experience in our study also differs with the years of experience in a study conducted by Buloze (2021), which was between 5 to 15 years. The difference in these years may be due to tertiary trainings in different countries; for instance- in SA and Rwanda training of medical officers requires six years of university training. While in Egypt medical practitioner training requires seven years of university. Years of service of

experience could influence the knowledge, attitudes, and practice of health practitioners (Weisz & Nannestad, 2021). With more years of experience, health practitioners acquire more knowledge and skills through observation and trainings, this knowledge might result in a positive experience and moreover good practice of preterm infant feeding.

4.2.6. Health practitioners' years of working with preterm infant.

The results are presented with minimum, maximum, mean, and standard deviation in Table 4.1. The results for years working with preterm infant indicate that the average years working with preterm infant (mean) was 7.68. Meaning the majority of health practitioners had more years of experience of working with preterm infant.

These results differ from the study conducted by Mörelius et al. (2022), where the years of working with preterm infant were between 3 and 30 years, and the mean was 11.8 years. Furthermore, the years of working with preterm infant in this study differ from the results by Buloze (2021), where 1 and 10 years were observed as years of experience working with preterm infant. A longer duration of working with preterm infant may improve knowledge, and practice of preterm infant feeding among health practitioners, and may have a positive effect on preterm infant' attitudes. Therefore, the more years that health professionals work with preterm infant, the more knowledge and experience they might acquire.

Table 4.1. Minimum, maximum, mean, and standard deviation for years working with preterm infant (n = 40).

	Minimum	Maximum	Mean	Standard deviation
Age of health practitioners	25	59	40.6 ±9.9	9.95
Years of experience of health practitioners	3	31	13.95±8.15	8.15
Years working with preterm infant	1	22	7.68±5.8	5.84

4.2.7. Availability of feeding protocol in the neonatal unit.

The protocol for feeding preterm infant within the neonatal units ensures standardised and stepwise approach to achieving good nutrition of preterm infant

(Rossholt, Bratlie, Wendel, Aas & Gunnarsdottir et al., 2023). Figure 4.4, present the availability of the feeding protocol. The results indicate that majority of health practitioners (87.5% (n=35) were aware of the feeding protocol in the neonatal unit and the protocol was implemented.

This result of the study concurs with findings by Coutts et al. (2022), who indicated that the preterm feeding protocol in two tertiary hospitals, in Gauteng Province were implemented. Additionally, Rossholt et al. (2023) agreed that a standardized feeding protocol promotes nutrient intake and growth, which were close to the nutritional recommendations. As much as a feeding protocol is found to be beneficial, there are other studies that showed that the use of a feeding protocol led to partial adherence to the enteral feeding and total fluid, and this was reported to be conservative and limiting. Moreover, the feeding protocol is viewed as rigid and does not allow diversity of individualised treatment of preterm infant feeding (De Cloet, Simal, Benoot & Goossens, 2023; Dekker, van Brakel, van den Akker & Plotz, 2023; Fu, Arhin, Schulz, Ward & Chapman et al., 2023). Indeed, our study showed that there was an available and used protocol for feeding preterm infant. Surprisingly, there are health practitioners who did not know about the availability of that feeding protocol, although they worked in the neonatal unit, possibly because it was used mainly by medical officers as nurses follow medical officers' orders. The availability of a feeding protocol in a neonatal unit may be beneficial in ensuring that feeding is done the same in all preterm infant (Fenin, Newman & Taylor, 2020). However, the protocol might, if not well implemented, hinder patient individualization, as well as prevent health practitioners to be optimistic and explore their knowledge in preterm infant feeding.

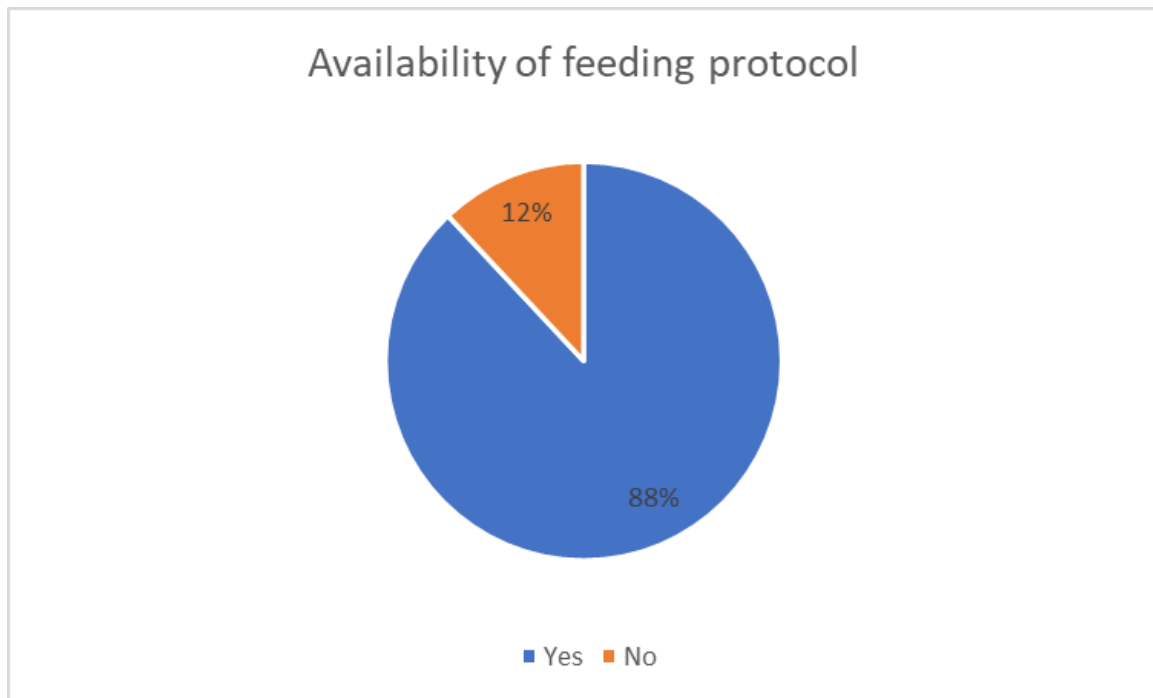


Figure 4.2 Availability of feeding protocol.

4.3. Knowledge of a healthcare practitioners about feeding preterm infant

Knowledge of preterm infant feeding among health practitioners was tested using a 29-item questionnaire. The questionnaire was adapted from the Food and Agricultural Organization (FAO) on the guidelines for assessing nutrition-related knowledge, attitudes, and practices (FAO, 2014) as well as the available literature on preterm infant feeding. There were 29 True or False knowledge questions in the questionnaire. For presentation and interpretation of the result, the questions were formulated into seven (7) categories. The first category, Table 4.2 consists of two (2) items and presents the knowledge regarding classification of preterm infant. The second category, Table 4.3 consists of four (4) items, presenting knowledge on mixed feeding. The third category, Table 4.4 consists of two (2) items, presenting knowledge on kangaroo mother care. The fourth category, Table 4.5 consists of nine (9) items, presenting knowledge on enteral and parenteral nutrition. The fifth category, Table 4.6 consists of three (3) items, presenting knowledge on target enteral feeding volume. The sixth category, Table 4.7 consists of three (3) items, presenting knowledge on feed of choice.

The seventh category, Table 4.8 consists of six (6) items, presenting knowledge on monitoring of feeding tolerance.

4.3.1. Knowledge of the health practitioners regarding classification of preterm infant.

The WHO defines preterm infant as an infant born before 37 weeks of gestation. Prematurity is classified by gestational age and birth weight (WHO, 2018). Health practitioners were asked about the definition and classification of preterm infant. The results in Table 4.2 depicts that an equal number of health practitioners (97.5 % (n=39) knew that preterm infant is infant born before 37 weeks of gestation and the classification of preterm infant by gestational age and birth weight.

The result of our study differs from the study conducted by Fadlalmola and Mohammed (2020), wherein 44% of health practitioners had poor knowledge of definition of preterm infant, including classification of preterm infant. However, Petty, Whiting, Fowler, Green and Mosenthal (2022), had similar results as ours, where in health practitioners had good knowledge about the definition and classification of preterm infant.

Table 4.2 Knowledge of health practitioners on classification of preterm infant (n = 40).

Statements	True	False
1. Preterm infant are infant born before 37 weeks of gestation.	39 (97.5 %)	1 (2.5%)
2. Preterm infant are classified according to gestational age and birth weight	39 (97.5%)	1 (2.5%)

4.3.2. Knowledge of health practitioners regarding mixed feeding.

Mixed feeding is defined as giving preterm infant expressed breast milk and preterm formula milk simultaneously (Moreira-Monteagudo et al., 2022; Papadopoulos et al., 2022; Brown, Lin, Embleton, Harding & McGuire, 2020; WHO, 2018). Health practitioners were asked about mixed feeding in preterm infant. The results in Table 4.3 show that almost all health practitioners (95%; n= 38) indicated that mixed feeding is giving preterm infant expressed breast milk and preterm formula milk.

The results of our study agree with the systematic review by Nieuwoudt and Manderson (2018), where health practitioners were able to define mixed feeding. Additionally, Peng, Zhou, Luo, Qi and Qi et al. (2021) found that health practitioners can define mixed feeding. The results of mixed feeding definition may be due to years of experience when working with preterm infant, with in-service training conducted to health practitioners.

The World Health Organization (2022) recommends the use of mothers' own milk as the first feed of choice in preterm infant, donor human milk as the second feed of choice, and preterm formula milk as the third feed of choice in preterm infant. The results of this study also reflect that the majority of health practitioners (77.5 %; n=31) indicated that mixed feeding can be used when mothers' own milk is insufficient. This showed that they had poor knowledge of the current recommendations and contradicted the WHO (2022), recommendation of not mixed feeding in preterm infant. The WHO recommends that preterm formula milk only be used when MOM and donor human milk are not available.

Mixed feeding can result in an increased risk of developing NEC (WHO, 2022). Mixed feeding in preterm infant is possibly due to the inaccessibility of the donor human in the breast milk bank, due to its eligibility criteria.

The WHO (2022), recommends MOM, to be used as the preferred feed of choice, followed by donor human milk when MOM is not available, and preterm infant formula to be used as the last option for feeding preterm infant. About 82.5% (n=33) of the health practitioners knew that feeding a preterm infant is a combination of mother's milk and donor human milk is not mixed feeding. Additionally, most health practitioners (77.5 %; n=31) indicated that the addition of breast milk fortifier to breastmilk is not considered mixed feeding. This result of our study agrees with the findings by Quigley, Embleton and McGuire (2019), where health practitioners knew that giving a combination of donor milk and expressed breastmilk is not considered mixed feeding. Supplementation of expressed breast milk with donor human milk is not considered mixed feeding and, while adding breastmilk fortifier to breast milk, is also not considered mixed feeding (Brown et al., 2020). Breastmilk fortifier enriches the nutrient content of

breastmilk to support the increased nutrients required for the growth and development of preterm infant (Arslanoglu et al., 2019). However, routine fortification of human milk is not recommended for all preterm infant and can only be considered in preterm infant less than 1500 gram (or less than 32 weeks of gestation).

The WHO (2022) recommends for the care of preterm or low birth weight infant, nutrient-enriched preterm formula milk to be used when mothers' own milk and donor human milk are not available. According to the WHO 's recommendation, commercial preterm formula milk can be used when mothers' own milk and donor human milk is unavailable.

Table 4.3 Knowledge of health practitioners on mixed feeding (n = 40).

Statements	True	False
1. Mixed feeding is giving a preterm infant expressed breast milk and preterm formula milk.	38 (95%)	2 (5%)
2. Mixed feeding can be used when mothers own milk is insufficient.	31 (77.5%)	9 (22.5%)
3. Mixed feeding is giving a preterm infant mother's own milk and donor human milk.	7 (17.5%)	33 (82.5%)
4. Addition of breastmilk fortifier to breastmilk is regarded as mixed feeding.	9 (22.5%)	31 (77.5%)

4.3.3. Knowledge of health practitioners regarding kangaroo mother care.

The WHO (2022) recommended KMC as one of the management strategies for the care for preterm infant. The benefits of KMC include improved weight gain in preterm infant, temperature regulation, breast feeding, regulation of heart and breathing rates, growth and development, and bonding with the mother. Furthermore, Lord, Harding, Crowther and Lin (2023) reported a benefit of the reduction in incidence of neonatal hypoglycaemia. Our results in Table 4.4 show that all health practitioners (100% (n=40) indicated that kangaroo mother care improves weight gain. Furthermore, many health practitioners (77.5 % (n=31) indicated that the benefits of kangaroo mother care include temperature regulation, breast feeding, and bonding with the mother. This shows that most health practitioners are knowledgeable about the concept of KMC.

The results of our study are consistent with the findings of Adisasmita et al. (2021), that 98.5% of health practitioners had good knowledge of KMC benefits. Additionally, Pratomo et al. (2020) found that most health practitioners knew about the benefits of KMC, including stabilizing temperatures, weight gain, and mother-baby bonding and reducing costs. The findings in our study on kangaroo mother care are possibly due to the number of years of experience of working with preterm infant. The number of years of experience of health practitioners have a positive effect on the knowledge of KMC (Adisasmita et al., 2021).

Table 4.4 Knowledge of health practitioners on kangaroo mother care (n = 40).

Knowledge question	True	False
1. Kangaroo mother care improves weight gain preterm infant.	40 (100%)	0 (0 %)
2. Benefits of kangaroo mother care exclude preterm infant temperature regulation, breast feeding, and bonding with the mother.	9 (22.5%)	31 (77.5%)

4.3.4. Knowledge of health practitioners on enteral and parenteral nutrition.

Enteral nutrition is the administration of nutrition through the gastro-intestinal tract, sucked by the infant through the breast, or administered through a feeding tube inserted naso- or oro-gastrically or pass through the Ligament of Treitz (Altebäumer et al., 2019). Health practitioners' knowledge about enteral and parenteral nutrition was assessed and the results are depicted in Table 4.5. The results showed that all health practitioners (100 %; n=40) knew the definition of enteral nutrition.

The results of our study agree with the study by Gomaa, Ahmed and Aboelmagd (2022), where 66% health practitioner where able to define enteral nutrition. The health practitioners in this study were able to define enteral nutrition in preterm infant as defined by Altebäumer et al. (2019).

The nasogastric feeding tube is indicated in preterm infant of greater than 1000g, however, in preterm infant less than 1000g nasogastric tube can increase airway resistance (Mustapha et al., 2021). Our study shows that most health

practitioners, 97.5% (n = 39), indicated that the nasogastric feeding is the preferred route of choice in preterm infant less than 1250 grams of weight. On the other hand, most health practitioners, 65% (n=25), did not know that the route of preterm feeding greater than 1250 grams is nasogastric.

The results of our study contradict Badran et al. (2021), who recommend that all preterm infant without respiratory support received bolus nasogastric tube feeding, as they achieve full enteral feeding sooner compared to those receiving bolus orogastric tube feeding. The added advantage of bolus nasogastric tube feeding was a lower risk of aspiration, tube displacement, and faster regaining of birthweight compared to those who received orogastric feeding (Badran et al., 2021; Bozzetti et al., 2017). To achieve full enteral nutrition early, preterm without respiratory support should be fed through a nasogastric tube. The findings on route of feeding in our study are possibly due to years of experience working with preterm infant.

Parenteral nutrition is the administration of nutrition through the veins directly into the bloodstream, bypassing the digestive tract (Altebäumer et al., 2019). Most health practitioners (95% (n=38) were able to define parenteral nutrition.

The WHO (2022) recommends the initiation of enteral feeding within the first twenty-four hours of life. The result of our study shows that all health practitioners 100% (n = 40), indicated that the early initiation of enteral nutrition in preterm infant is within the first 24 hours of life.

These results agree with the recommendations of Banait et al. (2020), trophic feeding is recommended in all preterm infant within the first day of life. The recommended volume of < 24ml/kg/day, without increasing the risk of NEC, is recommended in all preterm infant (WHO, 2022; Mustapha et al., 2021).

The WHO (2022) encourages that the feed should be increased by up to 30ml/kg/day, additionally fast advancement is increasing feeds by greater than

30ml/kg/day (WHO,2022). All health practitioners (100 %; n=40) agreed that rapid progression of enteral feeds is increasing by greater than 30ml/kg/day. These results reflect that the health practitioners had good knowledge about the fast progression of enteral feed.

Fast advancement of enteral feed by 30 to 35ml/kg/day have been reported to reduce the days it takes to full enteral feeding, reducing the need for intravenous access, and promote growth and development (Perez, Valentine, Nangia, Burrin & Maheshwari et al. 2022).

Mustapha et al. (2019) recommend bolus feeding for preterm infant greater than 1000g. the equal number of health practitioners (67.5% (n = 27), indicated that continuous feeding is preferred for preterm infant under 1000 grams. and that bolus feeding is preferred over continuous feeding in preterm infant greater than 1000 grams.

Contrary to the results of our study, Wang, Zhu and Luo (2020) found that the time to achieve full feed in continuous feed takes longer compared to intermittent feed low birth weight infant. On the contrary, Ye, Chen and Zhang (2020) found that in terms of weight gain continuous feeding is more superior than intermittent feeding; however, continuous feeding was associated with hinger stoppage of feed duration, increased risk of jaundice, and higher gastric residual volume. Preterm infant should be fed by bolus feeding compared to continuous feeding, to achieve good tolerance to feeding and growth and development (Embleton et al., 2022; Mustapha et al., 2021; Thoene et al., 2021; Bozzetti et al., 2017). Bolus feeding is preferred and is mostly practiced among all preterm infant in Mankweng hospital.

Table 4.5 Knowledge of health practitioners on enteral and parenteral nutrition (n = 40).

Knowledge questions	True	false
1. Enteral nutrition is administration of nutrition via the gut, either sucked by the infant or given through a feeding tube inserted through the nose or the mouth into the stomach or small intestine.	40 (100%)	0 (0%)
2. Parenteral nutrition is administration of nutrition through the veins directly into the bloodstream, bypassing the digestive tract.	38 (95%)	2 (5%)
3. For preterm Infant less than 1250g, the preferred route of feeding is nasogastric.	39 (97.5%)	1 (2.5%)
4. For preterm greater than 1250g, the preferred route of feeding nasogastric.	14 (35%)	25 (65%)
5. Minimal enteral (trophic) feeding in preterm is defined as feeding with small volumes i.e., 0.5-1 ml/kg/d up to a maximum of 20 ml/kg/d.	35 (87.5%)	4 (10%)
6. Early initiation of feed is feeding with the 1st 24 hours of life.	40 (100%)	0 (0%)
7. Continuous feeding is preferred over bolus feeding in preterm infant born less than 1000g.	27 (67.5%)	11 (27.5%)
8. Fast progression of feed is increasing feeds by greater than 30 ml/kg/day.	40 (100%)	0 (0%)
9. Bolus feeding is preferred over continuous feeding in preterm infant between 1000g to 1500g.	27 (67.5%)	13 (32.5%)

4.3.5. Knowledge of health practitioners regarding target enteral feeding volume.

Health professionals were asked about the targeted enteral feeding volume in preterm infant. ESPGHAN (2022) recommends that the target enteral feeding volume in all preterm infant be 180ml/kg/day, furthermore, for preterm infant not gaining weight sufficiently (less than 15g/kg/day), fluid is recommended to be increased up to 200ml/kg/day (Embleton et al., 2022; Mustapha et al., 2021; Thoene et al., 2021). However, Koletzko et al. (2021) recommend fluid up to 220ml/kg/day in all preterm infant. Table 4.6 depicts that most health practitioners 55% (n = 22) indicated that the target enteral feeding volume in preterm infant less than 1000 grams. Furthermore, most of the participants (65% (n=26) knew that the target enteral feeding volume in preterm infant between 1000 and 1500 grams is 180ml/kg/day. Almost two-thirds of health practitioners (60% (n=24) knew that the targeted volume of feed in preterm infant less than 2500 grams is 180ml/kg/day. These results show that health practitioners had good knowledge about the target enteral feeding volume.

The results of our study are consistent with the results of Perez et al. (2022), where the targeted enteral feeding volume was 180 ml/kg/day. As such, for

properly growing preterm infant, they must be maintained at 180 ml / kg / day; however, if the growth rate is satisfactory (indicated by a daily weight gain of less than 15 g/kg/day), fluid intake can be increased to a maximum of 220 ml/kg/day.

Table 4.6 Knowledge of health practitioners regarding feed of choice (n = 40).

Statements	True	False
1. The targeted enteral feeding volume for preterm less than 1000g is 180ml/kg/day.	22 (55%)	18 (45%)
2. The targeted enteral feeding volume for preterm less than 1500g is 180ml/kg/day.	26 (65%)	13 (32.5%)
3. The targeted enteral feeding volume for preterm less than 2500g is 180ml/kg/day.	24 (60%)	15 37.5%)

4.3.6. Knowledge of health practitioners regarding feed of choice.

Mother's own milk is the first feed of choice in preterm infant, followed by donor human milk as the second feed of choice, and the third feed of choice is preterm formula milk in preterm infant (Moreira-Monteagudo et al., 2022; WHO, 2022; Mustapha et al., 2021; Tran et al., 2020; Wiechers et al., 2021;). Health practitioners were asked the choice of feed in preterm infant. The results in Table 4.7 indicate that, all health practitioners (100% (n=40) indicated that mothers' milk is the first feed of choice. About 95% (n=38) of the participants showed that pasteurized donor human is the second feed of choice. Furthermore, 67.5% (n=27) of the health practitioners denoted that preterm formula milk is not the second feed of choice.

The choice of feed in our study is corroborated by Cheang, Yeung, Cheah, Tjipta, Lubis et al. (2022), where MOM was the preferred feed of choice in preterm infant among health practitioners, and donor human milk was the second feed of choice. The proper choice of feed in preterm infant by the health practitioners is possibly influenced by the mother-baby friendly hospital initiative (MBFHI) trainings provided to health practitioners in previous years, so the years of experience and years of experience of working with preterm infant could have influenced the feed of choice in preterm infant.

Table 4.7 Knowledge of health practitioners regarding feed of choice (n = 40).

Statements	True	False
1. Mothers' own breastmilk is the first feed of choice for preterm infant.	40 (100%)	0 (0%)
2. Pasteurized donor human milk is the second feed of choice for preterm infant if mothers' own milk is not available.	38 (95%)	2 (5%)
3. Is preterm formula milk the second feed of choice.	13(32.5%)	27 67.5%)

4.3.7. Knowledge of health practitioners on monitoring on feeding tolerance.

Feed intolerance is the presence of one or more of the symptoms such as vomiting more than three times during any 24-hour period, any episode of bile or blood-stained vomiting, increased abdominal girth increase greater than >2 cm from the previous abdominal circumference, abdominal wall erythema or tenderness, and gross or occult blood in stools (Nangia et al., 2018). Health practitioners were assessed on the monitoring of feeding in preterm infant. The results in Table 4.8 reflect that the majority of health practitioners (75% (n = 30), in this study knew that bile-stained vomits are indicative of feeding intolerance. Furthermore, 72.5% (n=29) of the health practitioners indicated that the presence of abdominal wall erythema is indicative of intolerance to feeds.

Health practitioners should monitor feeding tolerance and avoid feeding interruptions that delay the progression of feed, prolong the duration to reach maximum feeding volume, and delay the growth and development of preterm infant (Yaun et al., 2019). Feeding is usually stopped in the presence of blood-stained vomits and the abdominal wall erythema, which is indicative of surgical NEC (GaŁĄzka, Chrzanowska & Styczyński, 2021).

Gastric residual volume is no longer routinely recommended and is a measure of feeding tolerance in preterm infant (Elia et al., 2022). Most health practitioners (90% (n=34) indicated that gastric residual volume (GRV) is used to monitor feeding tolerance. These results indicate that health practitioners were less knowledgeable about gastric residual volume.

In contrast to the results in our study, Elia et al. (2022), recommend that GRV, should not be used to monitor feeding tolerance, and only recommend that GRV be performed only in the presence of abdominal distention. Gastric residual

volume should not be performed routinely in preterm infant, as this practice can delay the progression of feedings and further delay the duration to reach full nutritional supply in preterm infant (Singh et al., 2018). However, GRV can be performed in preterm infant who develop abdominal distention, which is hard on palpation. The findings on GRV are possibly due to years of experience working with preterm infant, and possibly the practice of gastric aspiration which was performed routinely over the years.

Abdominal distention is not a strange phenomenon in preterm infant, possible causes are due to intestinal immaturity, other causes include feeding intolerance, neonatal sepsis, and continuous positive airway pressure (Alshafei & Ahmed, 2019). The majority of health practitioners (72.5% (n = 29) indicated that soft abdominal distention is used to monitor feeding tolerance.

The findings of this study on abdominal distention contradict the recommendations of Elia et al. (2022), in which soft abdominal distention on palpation does not indicate feeding intolerance. Increased abdominal girth of more than 2 cm from baseline is considered a sign of feeding intolerance (Nangia et al., 2018). The results on abdominal distention could be due to the availability of feeding protocol, additionally, in most of the cases feeds are stopped when abdominal distention occurs, which was the practice over the years.

Health practitioners were asked if early enteral feeding causes NEC. The results showed that more than half of the health practitioners (65% (n = 25), indicated that early initiation of feeding does not cause NEC.

These results in our study are in consistent with the study by Kwok et al. (2017), in which early enteral nutrition in preterm infant was found not to be associated with the development of NEC. Furthermore, early enteral nutrition was associated with a low risk of recurrent NEC (Patel, Wilson, Brennan, Leshner & Ryan, 2020). Early enteral nutrition is associated with decreased motility, decreased length of hospital stays, and intestinal mucosal nutrition thus contributing to good enteral

nutrition tolerance (WHO, 2022; Mustapha et al., 2021). The risk of necrotizing enterocolitis is reduced when breast milk is fed in the early onset of feeding in a preterm infant (Embleton et al., 2022; WHO, 2022). The observation of health practitioners of less preterm infant developing NEC when breastfed could have influenced the results of our study.

Health practitioners were assessed on the knowledge on preterm infant formula being associated with NEC. The results indicated that the majority of health practitioners (92.5% (n=37), indicated that the use of preterm infant formula to feed preterm infant increases the risk of NEC.

The results of our study are in line with the findings of WHO and UNICEF (2020), in which preterm formula milk is associated with increased risks of feeding intolerance, late-onset sepsis, later obesity, high blood pressure, and NEC. Preterm infant formula milk is recommended only to be used in cases where both mother's own breast milk and donor human milk are unavailable (WHO, 2022). The results of our study indicate that health practitioners are knowledgeable about preterm infant' formula been associated with increased risk of NEC.

Table 4.8 Knowledge of the participants regarding monitoring of feeding tolerance (n= 40).

Statements	True	false
1. Bile stained vomits are indicative of feeding intolerance in preterm infant.	30 (75%)	10 (25%)
2. The presence of abdominal wall erythema indicative of feed intolerance.	29 (72.5%)	11 (27.5%)
3. Gastric residual volume can be used to monitor feeding tolerance.	34 (90%)	6 (10%)
4. Abdominal distention soft on palpation is used to monitor feeding tolerance.	29 (72.5%)	11 (27.5%)
5. Early initiation of feeding (i.e., first day of life) cause necrotising enterocolitis.	15 (37.5%)	25 (62.5%)
6. Feeding the preterm infant with preterm infant formula milk increase the risk of necrotising enterocolitis.	37 (92.5%)	3 (7.5%)

4.3.8. Knowledge of preterm infant feeding by professional category.

The overall knowledge per professional category was determined based on all the 29-items of the knowledge questionnaire. Health practitioners were categorised in to registered nurses and medical practitioners. The correct answer was assigned the score of one and incorrect answer was assigned the score of zero. The percentage was calculated by combining the number of correct answers, and dividing them by the total number of questions, and multiplying it by 100. The results for overall knowledge were analysed based on Bloom's cut-off point of 80-100% being good score, 50 -79% being moderate score and less than 50% and below for poor score (Seid & Hussen. 2018). The knowledge of preterm infant feeding by health practitioners is presented in Figure 4.5. The results of our study depicted that most of the registered nurses (69 % (n=11) obtained a moderate score on knowledge. Whilst 87.5% (n=18) of the medical practitioners obtained moderate score on knowledge.

The results of our study differ from those of Hashim (2021), who found that nurses had greater knowledge about the care of preterm infant with 98.3 % compared to moderate score of 75% in our study. However, Fadlalmola and Mohammed (2020) found that nurses had poor knowledge of preterm infant care. Buloze (2021) found that nurses have moderate knowledge about low and very low birth weight feeding. In contrast, the Egyptian study to assess nurse performance on trophic feeding for preterm infant in the neonatal unit found that more than 40% of the nurses had poor knowledge about trophic feeding (Galal et al., 2023). The difference in the results of our study might be because of the availability of preterm infant feeding protocol in our study. Nurses should have enough knowledge enabling them to support mothers carrying for preterm infant, including early breastmilk expression that allows feeding to be initiated withing the first day of life, storage of expressed breast milk, encourage early skin-to-skin contact, kangaroo mother care, tube and cup feeding (Mörelus et al., 2022; Mahwasane et al., 2020). Maastrup et al. (2021), reported that nurse education on breast feeding significantly increases the exclusive breastfeeding rate in preterm infant.

The study amongst medical student by Sudarsanan et al. (2021), found a moderate knowledge score of 68% in preterm infant feeding, which is similar to the results in our study of 69%. There is a similarity in the level of knowledge among medical student in the study by Sudarsanan et al. (2021), and medical practitioners in our study about preterm infant feeding. Most preterm infant feeding knowledge studies are assessing nurses compared to other health practitioners. The difference in the level of knowledge about preterm infant feeding in this study compared to the other studies might be due to the level of experience and exposure of the health practitioners when working with preterm infant.

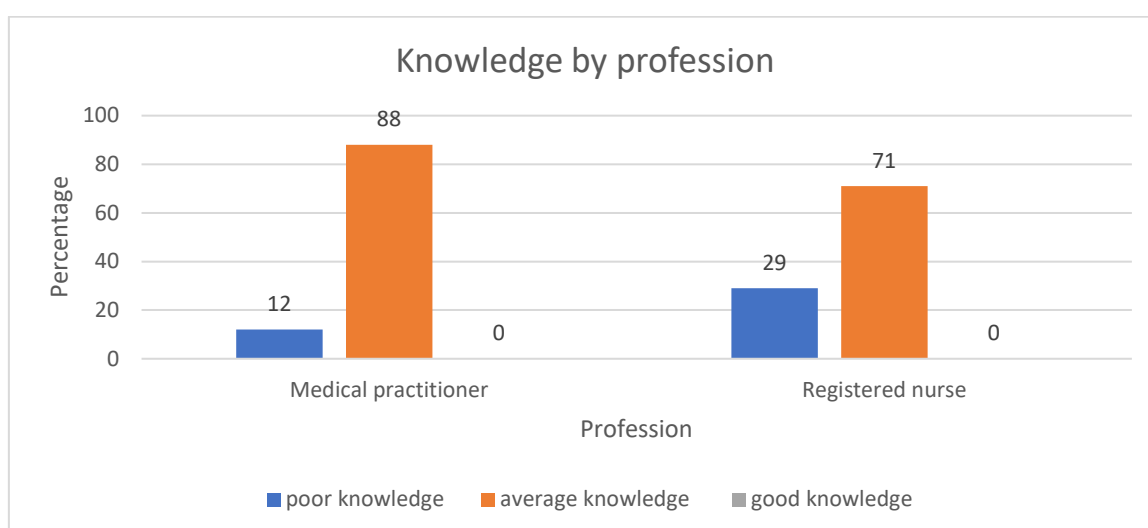


Figure 4.3 Knowledge results according to profession.

4.3.9. *The overall preterm infant feeding knowledge of the health practitioner.*

The overall knowledge per professional category was determined based on all the 29-items of the knowledge questionnaire. The correct answer was assigned a score of one and incorrect answer assigned a score of zero. The percentage was calculated by combining the number of correct answers and dividing them by total number of questions and multiplying it by 100. The results for overall knowledge were analysed based on Bloom's cut-off point of 80-100% being good score, 50 -79% being moderate score and less than 50% and below for poor

score (Seid & Hussen. 2018). The overall knowledge score was determined using the mean and standard deviation presented in Table 4.9.

The overall results of the knowledge of preterm infant feeding from healthcare professionals were determined and are illustrated in Figure 4.3. Most of the health practitioners (77% (n=31), obtained a moderate score on knowledge of preterm infant feeding. The mean score obtained by health practitioners was 67 % (19/29).

Table 4.9 . Overall knowledge score (n = 40).

	Minimum	Maximum	Mean	Standard deviation
Overall knowledge score	48% (14/29)	79% (23/29)	67 % (19)	7.8 (2.2)

The result of this study is corroborated by Yang et al. (2018), where in health practitioners in mainland China had insufficient knowledge on breastfeeding in preterm infant. Most studies on the knowledge of health practitioners on preterm infant feeding evaluate nurses (Galal et al., 2023; Hashim, 2021; Fadlalmola & Mohammed, 2020). Available studies agree with the findings of our study.

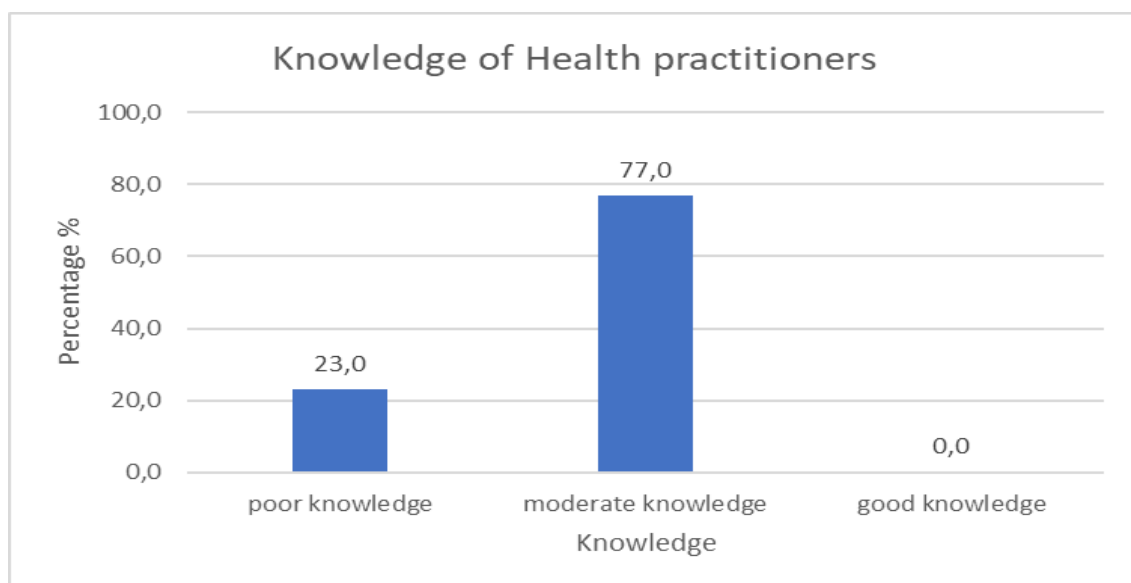


Figure 4.4 Overall knowledge of health practitioners.

4.4. The attitudes of the health practitioners about feeding preterm infant

The preterm infant feeding attitudes among health practitioners was established using the three (3)- point Likert scale consisting of agree (1), neutral (2) and disagree (3). The attitudes section consisted of 11 items, adapted from the Food and Agricultural Organization (FAO) on the guidelines for assessing nutrition-related knowledge, attitudes, and practices (FAO, 2014). A three-point Likert scale was used to test attitudes ranging from 3 to 1, 3 being agree, 2 neutral and 1 disagree. The score of attitudes per question was obtained by dividing the sum of the scores of the responses by the total number of responses per question (FAO, 2014). The question score was analysed and interpreted using three-point scale interval, where in the interval score between 1.00 and 1.66 indicates negative attitudes, score interval between 1.67 and 2.33 indicates neutral, and the score than falls between 2.34 and 3.00 indicates positive attitudes (Pimentel & Pimentel. 2019). For overall attitudes, analysed based on Bloom's cut-off point of 80-100% as a good score, 60 -79% as moderate score and less than 60% and below for a poor score (Seid & Hussen. 2018). The results of health practitioners who responded to the attitudes questionnaire are presented in Table 4.10.

Enteral feeding has been shown to have a positive effect on the physical well-being of preterm infant, which includes, increased weight gain, reduced incidence of feed intolerance, shorten the duration to full enteral feeding and reduced length of hospital stays (Lui et al., 2023; Hossain, Qasem, Friel & Omri, 2021). The results of the current study showed that most health practitioners (87.5% (n=35) agreed that enteral feeding has a positive effect on the physical well-being of preterm infant. Health practitioners have a positive attitude with a score of 3 towards enteral feeding having a positive effect on physical wellbeing of preterm infant. The positive attitudes of health practitioners were due to their knowledge on growth and development of enterally fed preterm infant.

The finding of this study is consistent with that of Liu, Abudusalamu, Yang and Su (2023), where in enteral nutrition was associated with a positive effect on the growth and development of preterm infant. Furthermore, Thoene and Anderson-

Berry (2021) reported that enteral feeding has a positive effect on the growth and neurodevelopment of preterm infant.

Preterm infant fed expressed milk have been shown to have a lower risk of developing NEC (WHO, 2022). The results of our study indicate that approximately 93% (n=37) of health practitioners agreed that preterm infant fed expressed breast milk (EBM) have a low risk of NEC. The health practitioners showed a positive attitude with a score of 2.9 toward EBM reducing the risk of NEC. This result is due to the knowledge health practitioners have regarding the risk of NEC in preterm infant and their knowledge on the benefits of breastfeeding.

The results of our study differ with that of Bulozé (2021), where 38% of health practitioners agreed that early initiating oral feeding could cause NEC. Furthermore, a relative risk reduction for surgical NEC was reported in approximately 50% of preterm infant fed donor human milk (Silano, Milani, Fattore & Agostoni, 2019). The results of a systematic review by Altobelli, Angeletti, Verrotti and Petrocelli (2020) showed a significant reduction in the risk of developing NEC in preterm infant fed breast milk or expressed breast milk.

Several guidelines indicate that MOM is the first and preferred feed of choice in preterm infant (Koletzko et al., 2019; ESPGHAN, 2022; WHO, 2022). Most health practitioners (97.5% (n = 39) agreed that MOM is the first feed of choice. Health practitioners obtained a score of 3, indicating that they have a positive attitude towards MOM being the first feed of choice.

The results of our study agree with the Nigerian study in which breast milk was unanimously preferred by health practitioners as the optimal feeding choice, due to its nutritional composition, appropriate temperature, accessibility, affordability, and intestinal stimulation properties (Owolabi, Samuel, Feskens, Schaafsma & Melse-Boonstra, 2023). Furthermore, mothers' own breast milk was preferred as the default feed of choice in preterm infant by health practitioners (Heller, Rüdiger, Hoffmeister & Mense, 2021; Brown et al., 2020). The results of our study are due to mother-baby-friendly hospital initiative trainings provided to health practitioners and the knowledge on the benefits of breastfeeding in preterm infant.

The benefits of early enteral feeding include physiological gastrointestinal growth and maturation, prevention of atrophy and intestinal permeability, and promotion of microbial health and immunity (Chitale, Ferguson, Talej, Yang, He et al., 2022; Wiechers et al., 2021). On the other hand, delayed initiation of enteral feeding in preterm infant was found to be associated with postnatal growth failure (Nakubulwa et al., 2020). Most of the health practitioners in our study, 90% (n=36) agreed that early enteral feeding does not delay growth and development. A score of 2.9 was obtained by health practitioners, which indicates a positive attitude towards enteral nutrition not delaying growth and development of preterm infant.

The results of our study are consistent with a study by Nangia, Vadivel, Thukral and Saili (2019), wherein early enteral feeding was reported by health practitioners to be associated with early achievement of total enteral feeding and reduction in the length of hospital stay. The reduction in the length of hospital stay was due to improved growth and development (Nangia et al., 2019). The findings on the early enteral nutrition in our study is due to the availability of feeding protocol in the neonatal unit, though from the practice results feeding is usually initiated in the second day of life in preterm infant.

Health practitioners are important in improving mothers' confidence, encouraging them to express their breastmilk, and providing enough information to encourage them to breastfeed (WHO, 2018). Additionally, parents should be informed about the benefits of breastfeeding so that they can make an appropriate choice for feeding their preterm infant (WHO, 2022). Approximately, 95% (n=38) of health practitioners showed positive attitudes towards enhancing parental confidence with regards to breast milk expression, and health practitioners had a positive attitude with a score of 2.9. Approximately, 95% (n=38) of health practitioners agreed that parental confidence increases when breast milk is expressed, and they had a positive attitude with a score of 2.8. Furthermore, 68% (n=27) of health practitioners agreed that all preterm infant mothers should be encouraged to express breastmilk, they obtained a score of 3, indicating positive attitudes.

Furthermore, all health practitioners (100% (n=40) agreed that mothers should receive relevant information about breastmilk expression, and a score of 3 was obtained indicating positive attitudes.

The results are corroborated by Asztalos (2018), wherein health practitioners within the neonatal unit established an initiative to support mothers as they strive to initiate and maintain breast milk expression. These results might be influenced by the African population as historically Africans in SA are a breastfeeding nation, on observation even if a child cries in public transport mothers are able to breastfeed (Gallegos, Vicca & Streiner, 2015).

Prioritising preterm infant feeding by health practitioners is important for physiological growth and development, as well as to provide support that mothers need to establish and maintain breastmilk production (Yang, Chen, Wang & Xu, 2022). Most of the health practitioners (92.5% (n=37) agreed that preterm infant feeding should be prioritised by the health practitioners, a score of 2.9 was obtained indicating that the health practitioners have a positive attitude. These results are not in agreement with a study by Buloze (2021), in which preterm feeding is not prioritized by health practitioners.

Preterm infant mothers must be educated on the importance of breastfeeding and breast milk expression. The choice of feed to be used must be guided by the information provided to them by health practitioners (Ericson & Palmér, 2019). The results showed that almost half of the health practitioners (47.5% (n=19) agreed that the mother's choice of feed should be considered when starting enteral feeding. A score of 2.5 was obtained, indicating health practitioners had a positive attitude toward considering mothers choice when initiating enteral feeding. Mothers need to be empowered by health practitioners on preterm infant feeding, the benefits, and the disadvantages of all modalities of feeding for them to make the right choice when choosing feed to be used in their preterm infant (Radzynski & Callister, 2016).

A low osmolality parenteral nutrition of less than 850–900 mOsm/L is recommended for peripheral venous access administration (Suganuma, Bonney, Andersen, Mcphee, Sullivan et al., 2020; Fessler & Rejrat, 2021). The majority of health practitioners (87.5% (n=35) agreed that total parenteral nutrition can be administered peripherally. Health practitioners showed a positive attitude towards peripheral parenteral nutrition in preterm infant with a score of 2.9. The results in this study are influenced by the knowledge of health practitioners regarding peripheral parenteral nutrition.

The results of the study agree with Suganuma et al. (2020), where peripheral parenteral nutrition was found to be associated with improved the rate of weight gain in preterm infant born 30 to 33 weeks gestation by health practitioners.

KMC is recommended for all stable preterm infant as soon as possible (Sivanandan & Sankar, 2023; WHO, 2023; WHO, 2022; Bear & Mellor, 2017). Most of the health practitioners in our study (90% (n=36) agreed that kangaroo mother care can begin immediately after birth. A positive attitude was shown by health practitioners with a score of 2.9 towards KMC initiated immediately after birth. The results of KMC in our study indicate that health practitioners have a positive attitude and is influenced by their knowledge about KMC.

This result of our study differs with the results by Pramoto et al. (2020), where health practitioners recommended that only stable preterm infant were eligible for KMC. Stable preterm infant included those with no respiratory problems, no asphyxia, no hypothermia and not requiring incubator (Pramoto et al., 2020). Adisasmita et al. (2021) reported that 100% of health practitioners had a positive attitude towards KMC. Immediate KMC was reported to reduce preterm infant mortality in infant born between 1000g and 1800g (Arya, Naburi, Kawaza, Newton, Anyabolu et al., 2021).

Table 4.10 Attitudes of health practitioners about preterm infant feeding (n = 40).

Statement	Agree	Neutral	Disagree	Attitudes score
1. Enteral feeding has a positive effect on the physical well-being of the preterm infant.	35 (87.5%)	5 (12.5%)	0%	3
2. Preterm infant fed on expressed breastmilk has a low risk of necrotising enterocolitis and feeding intolerance.	37 (92.5%)	3 (7.5%)	0%	2.9
3. Mother own breastmilk is the first feed of choice in preterm infant.	39 (97.5%)	1 (2.5%)	0%	3
4. Early enteral feeding of preterm infant does not delay growth and development.	36 (90%)	2 (5%)	2 (5%)	2.9
5. Expressing breastmilk for preterm infant enhances parenting confidence.	38 (95%)	1 (2.5%)	1 (2.5%)	2.9
6. All preterm infant mothers should be encouraged to express breastmilk for their preterm infant.	27 (67.5%)	1 (2.5%)	2 (5%)	2.8
7. All preterm infant' mother should be given relevant information and support on breastmilk expression.	40 (100%)	0%	0%	3
8. Preterm infant feeding should be prioritised by health practitioners.	37 (92.5%)	1 (2.5%)	2 (5%)	2.9
9. When initiating enteral feeding, mother's choice is taken into account.	19 (47.5%)	8 (20%)	3 (7.5%)	2.5
10. Total parenteral nutrition in preterm can be run via peripheral or central route.	35 (87.5%)	4 (10%)	1 (2.5%)	2.9
11. Kangaroo mother care can be started immediately after birth in stable preterm infant.	36 (90%)	4 (10%)	0%	2.9

4.4.1. Attitudes of health practitioners per profession on preterm infant feeding.

The overall attitudes per registered nurses and medical practitioners was determined based on all the 11 elements. A 3-point Likert scale attitudes questions using agree, neutral, and disagree (Joshi, Kale, Chandel & Pal., 2015). Overall attitudes were considered as positive attitudes, neutral was considered neutral and disagree was considered poor attitudes (El-Elimat et al., 2021). For overall attitudes, each highest score was multiplied by the number of participants, then divided by the total score. The dividend was multiplied by 100. All the percentages were added together, and the sum divided by the number of questions to determine the overall score. The percentage was analysed based

on Bloom's cut-off point of 80-100% being good score, 60 - 79% being moderate score and less than 60% and below for poor score (Seid & Hussen, 2018). The results of the preterm infant feeding attitudes are illustrated in Figure 4.7.

The results reflect that 88% (n=14) of medical practitioners obtained positive attitudes score on preterm infant feeding. Likewise, almost 90 % (n=22) of registered nurses had a positive attitude on preterm infant feeding.

These results agree with that of Mörelius et al. (2022), who found that nurses have a positive attitude towards feeding preterm infant and provided guidance and support to mothers. Furthermore, nursing support was perceived as key to strengthening maternal role in mothers of preterm infant (Im & Oh, 2021). However, Xiang, Xia, Zhu, Gao, Gao et al. (2020) found nurses to have uncertain attitudes (not sure), about the effect of family integrated care on improvement of breastfeeding in neonatal unit. The findings on the attitudes of registered nurses regarding preterm infant feeding is influenced by the health practitioner's knowledge.

The results of the study on attitudes of medical officers on preterm infant feeding is corroborated by Xiang et al. (2020), wherein medical officers had a positive attitude in family integrated approach in the NICU. However, Shoghi, Nazarshodeh and Borimnejad (2020) found that health practitioners had unfavourable attitudes toward human donor milk. Im and Oh (2021) identified a warm professional attitude as an important element in providing support to preterm infant mothers. There are few studies evaluating medical professional attitudes on preterm infant feeding.

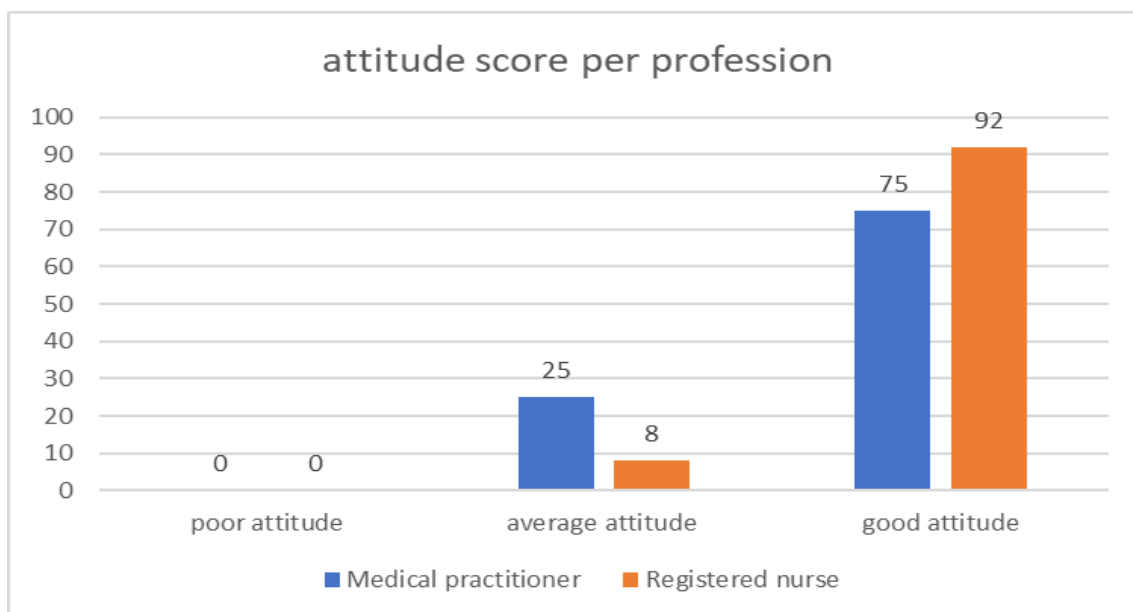


Figure 4.5 Attitudes score per profession

4.4.2. Overall attitudes of all health practitioners on preterm infant feeding.

The overall attitudes of all health practitioners were determined based on all the 11-items, 3-point Likert scale attitudes questions. For overall attitudes, each highest score was multiplied by the number of participants, then divided by the total score. The dividend multiplied by 100. All the percentages were added together, and the sum divided by the number of questions to determine the overall score. The percentage was analysed based on Bloom's cut-off point of 80-100% being good score, 60 -79% being moderate score and less than 60% and below for poor score (Seid & Hussien, 2018). Overall attitudes percentage was analysed as continuous variable and presented a maximum, minimum, mean and standard deviation. The results are presented in Figure 4.8 and Table 4.11. The overall results reflect that all health practitioners (82 % (n = 33) showed positive attitudes towards preterm infant feeding. The mean score on attitudes was 89.9 % (n = 9.8) with the standard deviation of 11% (n = 1.3).

Table 4.11 Overall attitudes score (n = 40).

	Minimum	Maximum	Mean	Standard deviation
Overall attitudes score	64% (7/11)	100% (11/11)	89.9 % (9.8)	11 (1.3)

The results agree with Sudarsanan et al. (2021), wherein more than 90% of medical students have a positive attitude toward preterm infant feeding. However, Shattnawi (2017) revealed that health professionals preoccupied themselves with the task of caring for babies than with supporting mothers in feeding and subsequently caring for their preterm infant. Mäkelä et al. (2022) found that the attitudes towards breastfeeding in the neonatal unit amongst health practitioners has improved after implementing the baby-friendly hospital initiative. Baker, Evans, Fielden and Arnott (2021) identified that good communication skills are needed to support infant feeding effectively, because some health professionals in this their study had attitudes that undermine breastfeeding. The positive attitudes may have been influenced by the knowledge that health practitioners have on preterm infant feeding.

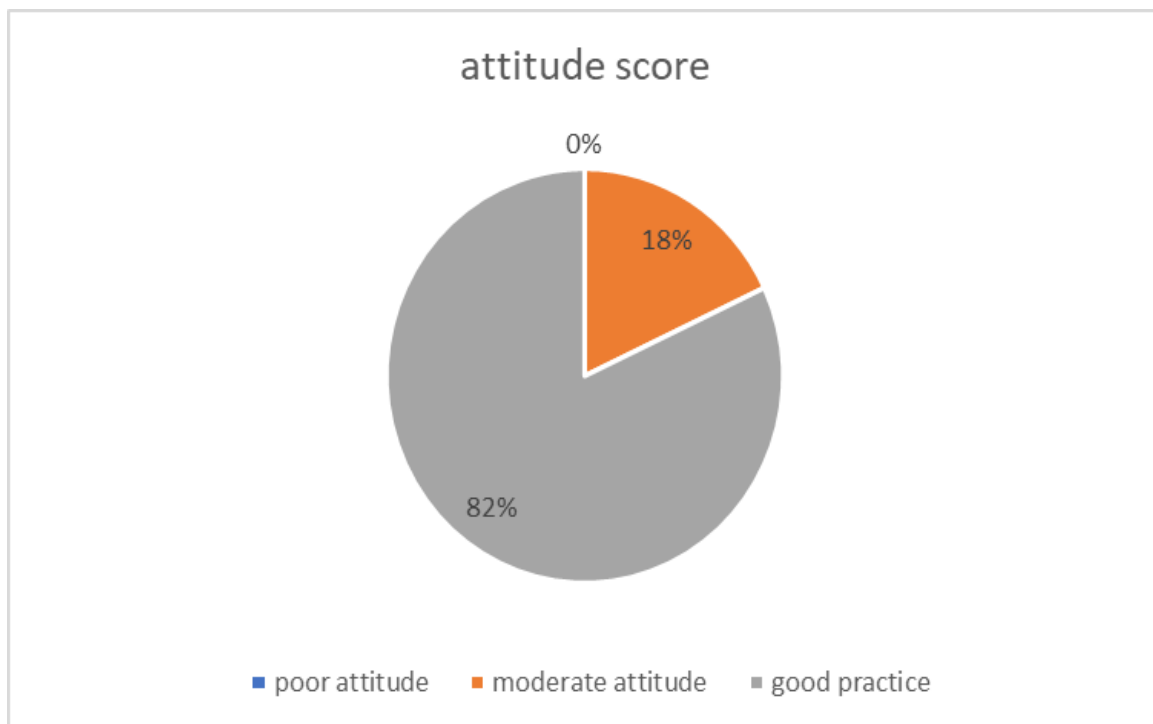


Figure 4.6 Health practitioners' attitudes score

4.5. Health practitioners practice on preterm infant feeding

The practice of feeding preterm infant among health practitioners was tested using 24-items, adapted from the Food and Agricultural Organization (FAO, 2014). For clear presentation and interpretation of the results in this study, the

analysis of questions was formulated into six (6) categories. The first category consists of three (3) items (Table 4.12), that presents the practice of health practitioners on when to start feeding in preterm infant. The second category consist of three (3) items (Table 4.13) representing the practice of health practitioners on enteral feeding. The third category consists of four (4) items (Table 4.14) indicating health practitioners practice on glycaemic control and mixed feeding. The fourth (4) category consist of two (2) items (Table 4.15) presenting breastfeeding and kangaroo mother care of preterm infant. The fifth (5) category consist of seven (7) items (Table 4.16) presenting parenteral nutrition of preterm infant. The six (6) categories consist of five (5) items (Table 4.17) presenting trophic feeding and feed of choice in preterm infant. Practice questionnaires had multiple- choice questions, each correct answer was given the value of one, and every incorrect answer was given a zero (Feleke et al. 2021). The percentage of correct responses was calculated by dividing the total number of correct answers by the total number of questions and multiplying that result by 100. The results for overall practice were analysed based on Bloom's cut-off point of 80-100% being good score, 50 -79% being moderate score and less than 50% and below for poor score (Seid & Hussien. 2018).

4.5.1. Health practitioners practice on when to initiate feeding in preterm infant.

Enteral feeding is recommended to be initiated within 24 to 48 hours after birth in all stable preterm infant (Darmstadt, Al Jaifi, Arif, Bahl, Blennow et al., 2023; Gao et al., 2023; ESPGHAN, 2022; WHO, 2022; Mustapha et al., 2021; Koletzko et al., 2019). Health practitioners were asked about the practice related to the initiation of enteral feeding in preterm infant. Table 4.12 indicates that most of the participants (65% (n=26) indicated that preterm feeding of less than 1000 gram should be started after 24 to 48 hours of life. Furthermore, more than half of the participants (52.5% (n=21) indicated that preterm infant less than 1500 grams, feeds should be started in 24 to 48 hours. However, all participants 100% (n=40) indicated that preterm infant greater than 1500 gram may start in less than 24 hours of life.

These results of our study on the initiation of feeding in preterm infant of less than 1500g differ from Berti, Puglia, Perugi, Gagliardi, Bosi, Ingargiola et al. (2018), who found that health practitioners initiated feeding within the first 24 hours of life in preterm infant of all weight categories. On the contrary, the findings in preterm infant, which is greater than 1500g, concur with Berti et al. (2018), where in health practitioners initiated preterm infant feeding after 24 hours. Furthermore, health practitioners initiated feeding within the first 24 hours and some not until after 72 hours in a study conducted in a Nigeria and Kenya (Tongo et al., 2022). However, Buloze (2021) reported that about 36% of health practitioners always delay feeding because they are busy with other activities, and therefore delayed insertion of an orogastric tube was given as a reason to delay feeding. The initiation of feeding is supported by the study conducted by Nakubulwa et al. (2022), wherein about 73% of preterm infant were below the weight of the 10th centile at discharge, this was associated with delayed initiation of enteral feedings after 48 hours, which was 3.7 times higher compared to when feeds were started within the first 48 hours of life. In our study the practice of initiation of feed may have been positively influenced by the availability and the use of preterm infant feeding protocol.

Table 4.12 Health practitioners practice on when to initiate feeding in preterm infant (n = 40).

Statement	< 24 hours of life	24 – 48 hours of life	> 48 - 72 hours of life	> 72 hours of life
1. When should feeding be started in preterm infant less than 1000g?	7 (17.5%)	26 (65%)	6 (15%)	1 (2.5%)
2. When should feeding be started in preterm infant less than 1500g?	9 (22.5%)	21 (52.5%)	0	0
3. When should feeding be started in preterm infant less than 2500g?	40 (100%)	0	0	0

4.5.2. Health practitioners practice on enteral nutrition of preterm infant.

WHO (2022) recommends feeding to be initiated and advanced by up to 30ml/kg/day in all stable preterm infant. Thoene and Anderson-Berry (2021), recommended that feeding should start and advance by 30 – 40 ml/kg/day for preterm infant > 750 grams. For preterm infant < 750 grams start feeding with 15

– 20 ml/kg/day and maintain trophic feeding for 72 hours and not more than 5 days and advance feeding by 15 – 20 ml/kg/day. The results of health practitioners' practice on enteral nutrition in preterm infant are presented in Table 4.13. Most health practitioners (52.5% (n=21) disagreed that feeding should be initiated with 30 to 40 ml/kg/day in preterm infant greater than 750 grams. In addition, more than half of the health practitioners (57.5% (n=23) agreed that feeding should start and continue at 15 to 20 ml/kg/day for 72 hours and no more than 5 days.

The results of our study concur with Tongo et al. (2022), where in health practitioners initiated feeding amongst preterm infant of all weight category with the rate between 10 and 80 ml/kg/day. Initiation and advancement of feed by 30ml/kg/day in preterm infant between 750g and 1000g was well tolerated without increasing the risk of NEC and resulted in decrease of all course mortality in preterm infant (Debata et al., 2022). From the available literature and evidence, feed can be started at 30 – 40 ml/kg/day in preterm infant greater than 750 grams, with careful monitoring of feeding tolerance, and for those less than 750 grams, trophic feeding can be started at 15 – 20 ml/kg/day, with careful monitoring of feeding tolerance (ASPGHAN, 2022; WHO, 2022; Mustapha et al., 2021; Thoene & Anderson-Berry, 2021). The results of our study may be due to the knowledge of health practitioners with regards to the initiation feed volume for preterm infant less than 750 grams and for preterm infant greater than 750 grams, and the availability of preterm infant feeding protocol.

Gastric residual volume is no longer routinely recommended as a measure of feeding intolerance, and naso-gastric-free drainage is recommended for preterm infant who develop abdominal distention and emesis (Akar, & Turgut, 2020). About 88% (n = 35) of health practitioners in this study, agreed that a high residual gastric volume delays the start of enteral feeding. These results agree with Parker, Weaver, Murgas Torrazza and Shuster Li et al. (2019), in which the health practitioners reported that omission of gastric residual evaluation increased enteral nutrition delivery, improved weight gain, and led to earlier hospital discharge in extreme preterm infant. Furthermore, the reverse pressure created by repeated aspiration of gastric contents could damage the fragile gastric

mucosa, and removal of gastric contents results in loss of gastric enzymes and gastric acid in preterm infant (Elia et al., 2022; Singh et al., 2018). Additionally, Debata et al. (2022) recommend that pre fed aspirates/ gastric residual volume be measured when there is abdominal distention. A study in SA by Coutts et al. (2022) reported that pre-feeding gastric residual volume and suctioning was not performed before feed commencement in preterm infant by health practitioners. The results on GRV in our study is due to the knowledge of health practitioners have on gastric residual volume and the availability of preterm infant feeding protocol. Preterm infant feeding protocol state that prefeed GRV should not be routinely performed in the neonatal unit.

Table 4.13 Health practitioners practice on enteral nutrition of preterm infant (n = 40).

Statement	Yes	No
1. Feeding should be started and advanced by 30 – 40 ml/kg/day in preterm infant greater than 750g?	19 (47.5%)	21 (52.5%)
2. Feeding should be started by 15 – 20 ml/kg/day and maintain the trophic feeding for 72 hours and not more than 5 days and advance feed by 15 – 20 ml/kg/day.	23 (57.5%)	14 (35%)
3. Does high gastric residual volume delay the onset of enteral feeding?	35 (87.5%)	5 (12.5%)

4.5.3. Health practitioners practice on hyperglycaemia and mixed feeding.

Neonatal hyperglycaemia is the serum blood glucose of greater than 8.3 mmol/l or whole blood glucose of greater than 6.9 mmol/l and occurs in approximately 45% to 80% of preterm infant (Parappil, Gaffari, Paramban, Rijims, Skaria et al., 2022). Hyperglycaemia should be diagnosed and treated in preterm infant (Beardsall et al., 2021). Health practitioners were asked about the practice on hyperglycaemia in preterm infant. Table 4.14 depicts that most of health practitioners (65% (n=24) disagreed that hyperglycaemia, when it occurs, feeding should be stopped.

These results contradict with finding by Barrero-Castillero et al. (2020), where in health practitioners did not observe hyperglycaemia in preterm infant fed enterally. The blood glucose level observed by health practitioners in enterally fed preterm infant was 4 mmol/l (Barrero-Castillero et al., 2022). Glucose

monitoring Mankweng neonatal unit is conducted by nurses, the result of our study is influenced by the knowledge of health practitioners and the availability of preterm infant feeding protocol.

Preterm infant' formula milk is safe to use in preterm infant (Darmstadt et al., 2023; WHO, 2022). WHO, 2022 recommends preterm infant' formula as the third feed of choice in preterm infant. Mixed feeding is giving an infant's breastmilk or expressed breastmilk in combination with commercial formula milk or animal milk (Al Sabbah et al., 2022; Papadopoulos et al., 2022). In preterm infant, it refers to giving breast milk and preterm formula milk at the same time (Menezes et al., 2018). When asked about safety of preterm infant's formula milk and mixed feeding, most health practitioners (55% (n=21) and, 95% (n=38), indicated that preterm formula milk and mixed feeding is not safe for preterm infant respectively.

The result of our study on safety of preterm formula milk differs with the results by Alexander et al. (2022), who found that health practitioners prefer to use preterm formula milk in VLBW and LBW, as compared to in ELBW. Additionally, Gidi et al. (2020) found that health practitioners trust the safety of preterm formula because the use was higher among preterm. Alexander et al. (2022) found that preterm infant formula milk was used by health practitioners as an alternative or second choice of feed when MOM was not available. Preterm formula milk demonstrated the ability to increase weight gain as compared to MOM and donor human milk due to its higher nutrient concentration (Moreira-Monteagudo et al., 2022). This result of our study on mixed feeding agrees with Tongo et al. (2022), where health practitioners used preterm formula milk to supplement shortfalls in expressed breast milk. Moreover, Chinnappan, Sharma, Agarwal, Thukral, Deorari et al. (2021) found an increase in weight gain averaging 15.7 g/kg/day in preterm infant who were fed expressed breastmilk fortified with preterm infant' formula powder. This finding indicates that health practitioners in our study are lacking information with regards to the safety of preterm formula milk (Appleton, Fowler, Laws, Russell, Campbell et al., 2020).

Due to strict criteria for donor milk requirements, formula milk is often used to supplement expressed breast milk in Mankweng hospital. Mixed feeding in HIV-exposed preterm infant increases the risk of HIV transmission to infant, through the interruption of the mucosal lining (WHO, 2022). Preterm formula milk furthermore increases the risk of NEC in both HIV-exposed and non-exposed preterm infant (WHO & UNICEF, 2020). Therefore, where possible, only breastmilk and donor breastmilk should be preferred for the feeding of preterm infant.

The researcher observed in practice that for preterm infant who do not qualify for donor human milk, the commercial preterm infant formula is administered as a supplement to the mother's breast milk. The eligibility criteria to qualify for donor human milk for Breast Milk Bank Mankweng hospital are, infant born less than 1.8 kg birth weight, infant less than 14 days of age, and at risk of NEC, preterm infant born before 32 weeks of gestation, maternal death/ mother critically ill, born less than 1.8 kg, and is only indicated for short-term use (less than 14 days). These recommendations and observations are consistent with the findings of this study.

There are only two breastmilk banks in Limpopo province, located in Mankweng Hospital and the other in the Sekhukhune district, which are supposed to serve the entire province. The availability of stock for hospitals located far away might be a challenge. This may result in an increase in the use of preterm formula milk in situations where mothers cannot provide breastmilk to feed their preterm infant, or the breastmilk expressed is insufficient.

Table 4.14 Health practitioners practice on hyperglycaemia and mixed feeding (n = 40).

Statement	Yes	No
1. When feeding intolerance (e.g., hyperglycaemia) occur are feed stopped	14 (35%)	24 (65%)
2. Preterm infant formula milk safe to use for feeding preterm infant.	18 (45%)	21 (55%)
3. Mixed feeding safe for preterm infant.	2 (5%)	38 (95%)
4. Does mixed feeding occur in the neonatal unit?	22 (55%)	17 (42.5%)

4.5.4. Health practitioners practice on breastfeeding and kangaroo mother care of preterm infant.

Breastfeeding and transition from the gastric-tube to breast feeding is indicated when the preterm infant is physiologically stable, able to suck-swallow and breath in a coordinated manner and should not only be based on weight of preterm infant alone (Van Rooyen, 2023). Moreover, most preterm infant start breastfeeding from 28 weeks of gestation and reaching full nutritional breastfeeding at 36 weeks of gestation (Van Rooyen, 2023). Bedroni (2023) indicated that readiness for breastfeeding in preterm infant was observed between 34 to 36 weeks of gestation, and preterm infant demonstrate feeding cues and were medically ready. When asked about the indication of breastfeeding in preterm infant, most health practitioners (70% (n=28) indicated that preterm infant should be breastfed when their weight is greater than 1300 grams. The results are presented in Table 4.15.

The result of our study differs with the results by Maastrup et al. (2021), where in health practitioners demonstrated readiness for breastfeeding in preterm infant with, the ability to such-swallow, and physiological stability rather than the weight alone. Moreover, breast feeding was initiated in physiologically stable preterm infant, with gestational age around 32 to 34 weeks (Morag, Hendel, Karol, Geva & Tzipi, 2019). The results are influenced possibly by the availability of preterm infant feeding protocol in the neonatal unit. However, on practice transition from cup to breastfeeding is usually done when the weight of preterm infant is greater than 1500 grams as opposed to 1300 grams. And transition from gastric tube to

cup feeding is done in preterm infant who are stable and demonstrated an element of weight gain.

Kangaroo mother care is recommended as soon as possible after birth in all stable preterm infant, irrespective of the gestational age (Darmstadt et al., 2023; WHO, 2023; WHO, 2022). Furthermore, 8 to 24 hours of KMC is recommended per day in all preterm infant (Darmstadt et al., 2023). Health practitioners were assessed on practice of kangaroo mother care in preterm infant. Most health practitioners 97.5% (n=39) indicated that kangaroo mother care is not recommended for all stable preterm infant.

The result of our study corresponds with Singh et al. (2018), observed that the practice regarding KMC among health practitioners is poor, including kangaroo feeding of preterm infant. Cristóbal-Cañadas, Parrón-Carreño and Nievas-Soriano (2022), recommends KMC to be practiced intermittently in stable preterm infant and continuously in well-growing preterm infant. The result of our study on kangaroo mother care indicates that health practitioners were not practicing KMC as per recommendations. Although health practitioners were knowledgeable about the benefits conferred by KMC and had a positive attitude towards preterm infant feeding.

Table 4.15 Health practitioners practice on breastfeeding and kangaroo mother care of preterm infant (n = 40).

Statement	Yes	No
1. Preterm infant is breastfed when the weight is more than 1300g	28 (70 %)	12 (30%)
2. Kangaroo mother care is recommended for all stable preterm infant	1 (2.5%)	39 (97.5%)

4.5.5. Preterm infant feeding practice of health practitioners on total parenteral nutrition.

Total parenteral nutrition is recommended preterm infant less than 30 to 31 weeks of gestation (Mustapha et al., 2021; Wiechers et al., 2021; Wilson & Barr, 2021). Moreover, total parenteral nutrition is also indicated for preterm with congenital

gastrointestinal defects, including, gastroschisis, intestinal obstructions (duodenal atresia, jejunal atresia), and for preterm infant whom feeds are withheld (e.g., NEC) for more than 48 hours (Robinson, Calkins, Chen, Cober, Falciglia et al. 2023; Mustapha et al., 2021). Parenteral nutrition was also indicated in preterm infant less than 1500g (VLBW), as it takes longer to reach their nutritional demand with only enteral feeding (Jiménez et al., 2023). The results of health practitioners practice on parenteral nutrition are presented in Table 4.16.

Most of the health practitioners (67.5% (n=27) indicated that parenteral nutrition is indicated in preterm infant who are born not later than 30 to 31 weeks of gestation. Furthermore, most of the health practitioners (87.5% (n=35), indicated that in preterm infant less than 1000 grams, where there is not enough progress in enteral nutrition within three to five days, total parenteral nutrition is indicated. Moreover, majority of health practitioners (70% (n=28) indicated that preterm infant of less than 1250g requires supplemental parenteral nutrition.

The result of our study concurs with the results by Jiménez, Sierra-Ramírez, Rivas-Ruiz, Rivas-Ruiz, Cruz- Reynoso et al. (2023), where in health practitioners indicated that combined nutrition with enteral and parenteral nutrition in VLBW infant was associated with better growth and development, and meeting the nutritional requirements early, compared to those receiving enteral nutrition or parenteral nutrition alone. Supplemental parenteral nutrition was indicated in preterm infant born later than 30 to 31 weeks of gestation (Jiménez et al., 2023). The result of our study is possibly influenced by the knowledge health practitioners had on parenteral nutrition and by the availability of preterm infant feeding protocol.

Infant born at or after 31 weeks of gestation where in enteral nutrition is not tolerated in the first 72 hours after birth, they should be initiated on supplemental parenteral nutrition (Mustapha et al., 2021; Wiechers et al., 2021; Wilson & Barr, 2021; Webbe & Gale, 2020). Additionally, preterm infant born less than 1250g, when enteral feed is stopped for two to three days and insufficient progress on enteral feeding in is made in two to three days are indications for parenteral

nutrition (Mustapha et al., 2020). Therefore, preterm infant born before 31 weeks of gestation and those weighing less than 1250 grams requires supplemental parenteral nutrition. These results on the indication of parenteral nutrition in our study may be influenced by the availability of the preterm infant feeding protocol, and the knowledge on the indication of parenteral nutrition in preterm infant.

Monitoring of preterm infant with parenteral nutrition should include serum glucose 6 hourly, and 3 – 4 hourly for infant experiencing hyperglycaemia and hypoglycaemia (Mustapha et al., 2021). National Institute for Health and Care Excellence (NICE) guideline (2023) also recommends monitoring of blood glucose prior to commencement of total parenteral nutrition, and 2 hours after commencement of total parenteral nutrition. When asked about glucose monitoring, nearly all the health practitioners (92.5% (n = 37), agreed that glucose should be monitored in preterm infant receiving parenteral nutrition. Similarly, most of the health practitioners in this study (65% (n=26), agreed that if hyperglycaemia occurs, total parenteral nutrition should be discontinued.

Preterm infant experiencing hyperglycaemia on total parenteral nutrition need to be evaluated on glucose infusion rate, and possibly be given a lower glucose bag (Angelika, Etika, Utomo, Ladydi & Sampurna et al., 2023). The result of our study concurs with Perri, Giordano, Corsello, Priolo, Vento et al. (2018), where in blood glucose was monitored in preterm infant receiving total parenteral nutrition. Hyperglycaemia has also been observed in preterm infant receiving aggressive parenteral nutrition (Angelika et al., 2023).

Peripheral venous access was used to administer total parenteral nutrition by health practitioners (Webbe et al., 2020). A low osmolarity parenteral nutrition of < 850–900 mOsm/L is recommended peripherally (Fessler & Rejrat, 2021; Sukanuma et al., 2020). Most of the health practitioners (77.5% (n=31), indicated that the peripheral line cannot be used to administer total parenteral nutrition.

The results agree with those of Sukanuma et al. (2020), where in peripheral parenteral nutrition was administered by health practitioners in preterm infant

born between 30 to 33 weeks of gestation. All preterm total parenteral nutrition solutions available in SA are suitable for both peripheral and central venous access routes. These results in our study are influenced by availability of preterm infant feeding protocol. Therefore, while waiting for central venous access, the peripheral line can be used to administer parenteral nutrition to preterm infant.

Table 4.16 Health practitioners practice on parenteral nutrition of preterm infant (n = 40).

Statement	Yes	No
1. Total parenteral nutrition is indicated for preterm infant born not later than 30 - 31 weeks' gestation.	27 (67.5%)	13 (32.5%)
2. Total parenteral nutrition is indicated where insufficient progress with enteral nutrition is made within 3 - 5 days in preterm infant less than 1000g.	35 (87.5%)	4 (10%)
3. Preterm infant less than 1250g requires supplemental parenteral nutrition	28 (70%)	10 (25%)
4. Total parenteral nutrition in preterm infant less than 1250g should be initiated within the first 24 hours of life?	23 (57.5%)	17 (42.5%)
5. Monitoring of glucose level is essential in preterm infant receiving total parenteral nutrition	37 (92.5%)	2 (5%)
6. Total parenteral nutrition should be discontinued when there is hyperglycaemia	11 (27.5%)	26 (65%)
7. Peripheral vein access cannot be used to administer total parenteral nutrition	8 (20%)	31 (77.5%)

4.5.6. Health practitioners practice on trophic feeding and feed of choice.

Table 4.17 illustrates the results on trophic feeding, choice of feed, and acceptability of donor human milk in preterm infant.

Trophic feeding or minimum enteral feeding in preterm is defined giving a preterm infant 12 to 24 ml/kg/day (Galal et al., 2022; Mustapha et al., 2021). Trophic feeding is recommended for providing nutrition to the gastrointestinal tract's mucosa and minimally contributes to overall nutrition (Mustapha et al., 2021). The results of our study showed that more than half of health practitioners (62.5% (n=25), agreed that trophic feeding should be used for less than 4 days.

The results of our study are consistent with a Chinese study by Hu, Lu, Zhang, Zhang and Yu et al. (2023) found that minimal enteral feeding was initiated in preterm infant born below 1500 gram within the first 24 hours after. This practice

is further supported by Mustapha et al. (2021), wherein they showed that minimal enteral feeding in preterm infant can be administered within the first day of life, without increasing the risk of any adverse effect. ASPGHAN (2022) furthermore recommends trophic feeding within the first 24 hours of life with 12 to 24 ml/kg/d, with the targeted increment from three to seven days. Thoene et al. (2021) recommend that feeding can be started with 15 – 20 ml/kg/day and maintain trophic feeding for 72 hours and not more than 5 days. The results of our study are positively influenced by the availability of the feeding protocol and the knowledge of health practitioners on trophic feeding in preterm infant.

Mothers own milk (MOM) is the recommended first choice of feed in preterm infant (Darmstadt et al., 2023; WHO, 2022). When MOM is not available donor human milk is recommended as the second feed of choice, then followed by preterm infant' formula milk (Darmstadt et al., 2023; WHO, 2022). All health practitioners (100% (n=40) indicated that the feed that is usually given first in the facility is mothers' milk and that the ultimate feed of choice is breast milk from mothers.

The results of our study concur with Owolabi et al. (2023) and Brown et al. (2020), where in MOM was the feed of choice amongst health practitioners. Due to superiority and immunological benefits conferred by breast milk, it is recommended as the ultimate choice of feed in preterm infant (ASPGHAN, 2022; WHO, 2022; Mustapha et al., 2021; Koletzko et al., 2019). The results in our study may be influenced by the MBFHI training provided to health practitioners in the Hospital. And black South African have high rates of breastfeeding, contributed by the influence of family and relatives (Oyelana, Kamanzi & Richter, 2021).

The results reflect that almost all the health practitioners (98% (n=37), agreed that donor human milk is acceptable in the neonatal unit. Furthermore, most health practitioners (75% (n=30) agreed that donor milk is used to supplement breastmilk if it is insufficient. The results of our study on donor human milk indicate that health practitioners used donor human milk when MOM is not available as well as to supplements if MOM is insufficient.

The results on the acceptability of donor human milk differ from a result of a study conducted in Limpopo province, SA, by Mahlatjie, Bopape and Mothiba (2022), in which the use of donor human milk was not fully acceptable amongst health practitioners. However, a study conducted in Zimbabwe on the acceptability of donor breast milk banks showed that clinical health workers were more receptive to donor human milk (Chagwena, Mugariri, Sithole, Mataga & Danda et al., 2020). Our results reflect that health professionals are accepting donated breast milk, compared to Mahlatjie et al. (2022), wherein donor breastmilk was not fully acceptable amongst health professionals, while Chagwena et al. (2020) indicated that health practitioners were more receptive towards donor human milk. Acceptability of donor human milk in our study is due to knowledge of health practitioners regarding the benefits of breastmilk in preterm infant.

The results on what is used to top-up breastmilk in preterm infant differs with Moreira-Monteagudo et al. (2022), where in preterm formula milk was used as a supplement when breastmilk was not enough. However, Soni, Jain, Chawla, Khurana and Rani (2023) reported that donor human milk was used to supplement mothers' milk when is insufficient. The results of our study reflect that health practitioners understand the benefits of breastmilk.

Table 4.17 Health practitioners practice on trophic feeding and feed of choice (n = 40).

Statement	
1. Minimal enteral (trophic) feeding in preterm can be given for how long.	
Use minimal enteral feeding for less than 4 days	25 (62.5%)
Use minimal enteral feeding for more than 4 days	5 (12.5%)
Use minimal enteral nutrition for 1 day	9 (22.5%)
2. When enteral feeds are initiated what is the usual feed that is given first in your facility.	
Mothers own milk	40 (100%)
Donor human milk	0
Premature infant' formula milk	0
Term infant' formula	0
3. In the neonatal unit, what is the ultimate choice of enteral nutrition?	
Mothers' breastmilk	40 (100%)
Donor human milk	0
Preterm infant's formula	0
Preterm infant formula milk safe to use for feeding preterm infant.	
4. What is your belief on the acceptability of the use of donor milk?	
Acceptable	37 (92.5%)
Not acceptable	2 (5%)
5. What is used to top up if mothers' milk is insufficient?	
Donor human milk	30 (75%)
Preterm infant' formula	10 (25%)

4.5.7. Health practitioners practice on preterm infant feeding by professional category.

The overall practice per professional category was determined based on all the 24-items of the practice questionnaire. Practice questionnaire had multiple response, each correct answer was given the value of one, and every incorrect answer was given a zero (Feleke et al., 2021). The percentage of correct responses was calculated by dividing the total number of correct answers by the total number of questions and multiplying that result by 100. The results for practice per profession were analysed based on Bloom's cut-off point of 80-100% being good score, 50 -79% being moderate score and less than 50% and below for poor score (Seid & Hussien, 2018). The results are illustrated in Figure 4.9. The results reflect that 43 % (n=7) medical practitioners and 77 % (n=18) of registered nurses achieved a moderate score on practice.

These results contradict with Gomaa et al. (2022), where in nearly two-third of nurses studied had unsatisfactory practice feeding preterm infant. Additionally, Gunes and Cetinkaya (2023) found that registered nurses could not reflect on

their practice in feeding preterm infant, and therefore recommended continuous training on evidence-based practice.

In the current study, the overall knowledge of health practitioners was moderate, and health practitioners have overall positive attitudes towards preterm infant feeding. This may have influenced the practice results obtained in our study. Brantes and Curado (2021) emphasise the importance of continuous education with regards to oral feeding was recognised by the nurses, and choosing methods of feeding preterm infant was based on preference and ease to perform.

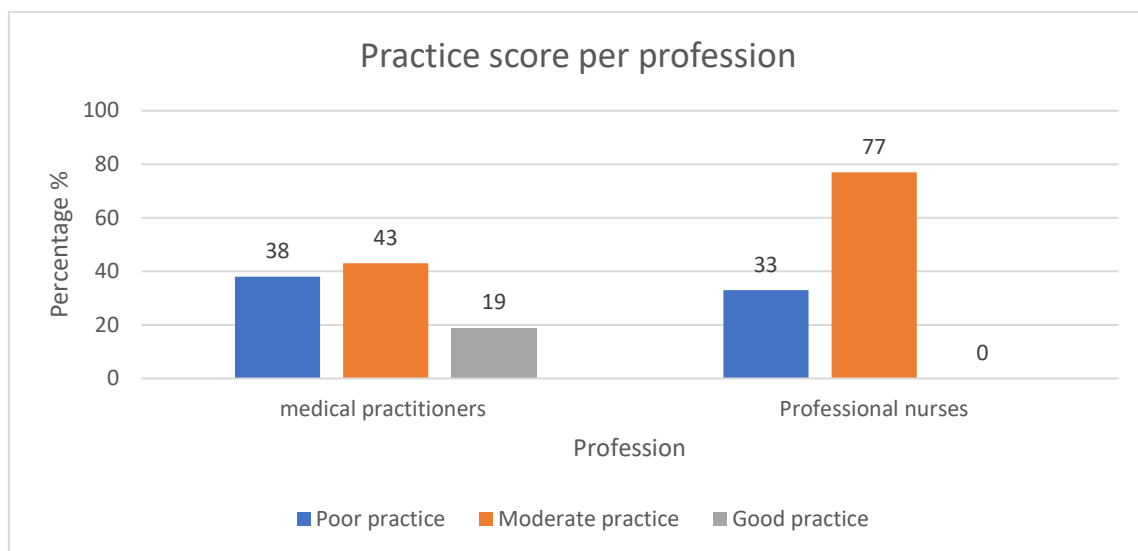


Figure 4.7 Practice score per profession

4.5.8. Overall health practitioners practice on preterm infant feeding.

The overall practice of health practitioners was determined based on all the 24-items of the practice questionnaire. Practice questionnaire had multiple choice, each correct answer was given the value of one, and every incorrect answer was given a zero (Feleke et al., 2021). The percentage of correct responses was calculated by dividing the total number of correct answers by the total number of questions and multiplying that result by 100. The results for overall practice were analysed based on Bloom's cut-off point of 80-100% being good score, 50 -79% being moderate score and less than 50% and below for poor score (Seid & Hussen., 2018). Overall practice percentage was analysed as continuous

variable and presented a mean and standard deviation. The results are presented in Table 4.18 and Figure 4.10. The results reflect that 58% (n=23) of health practitioners had a moderate score on practice of feeding preterm infant. The mean score for health practitioners was 64.7% and the standard deviation was 11.3.

Table 4.18 Overall practice score (n = 40)

	Minimum	Maximum	Mean	Standard deviation
Overall practice score	42% (10/24)	91% (22/24)	64.7 (15.5)	11.3 (2.8)

The overall preterm infant feeding results concur with the survey by Hu et al. (2023), in which enteral feeding practice was moderate amongst health practitioners. Furthermore, Mäkelä et al. (2022), found that health professionals had an improvement in breastfeeding-related practice in the neonatal ICU after the Baby-Friendly Hospital Initiative for neonatal wards (Neo-BFHI). Most of the health practitioners had a high level of feeding practice with respect to infant with low and very low birth weight (Buloze, 2021). Owolabi et al. (2023) found health practitioners to have a good practice on preterm infant feeding. Çelen, Taş Arslan and Soylu (2022) reported health practitioners to have improved practice post receiving preterm infant' education from 58% pre-test to 78% post-test.

The moderate practice score obtained by health practitioners in our study regarding preterm infant feeding is possibly influenced by the presents of feeding protocol, and possibly as well by the moderate knowledge and the positive attitudes obtained in our study.

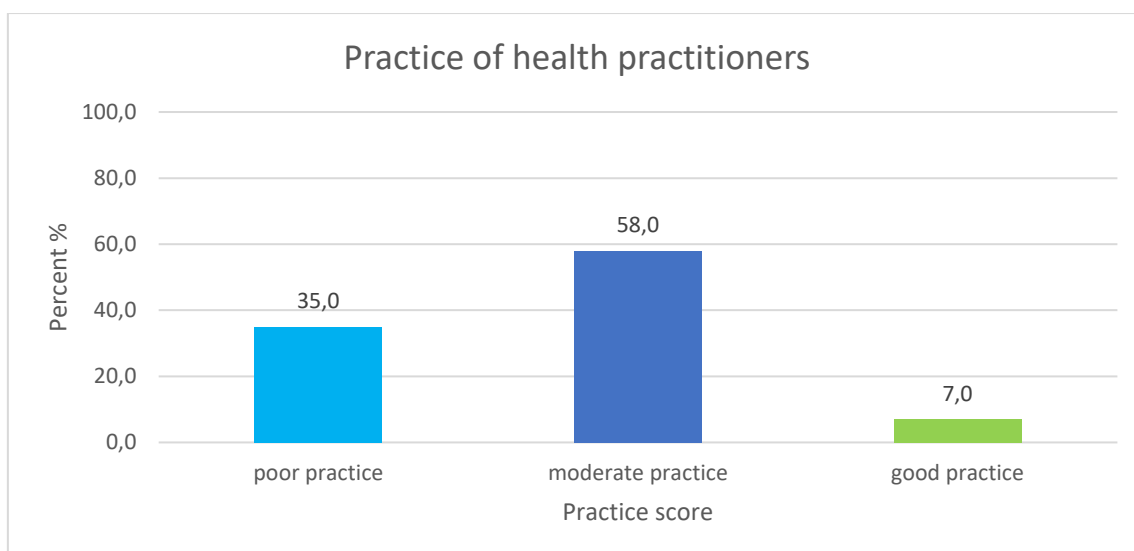


Figure 4.8 Health practitioner's practice score

4.6. The relationship between socio-demographic data of health practitioners and preterm infant feeding knowledge, attitudes, practice

The relationship between preterm infant feeding knowledge, attitudes and practice, and all sociodemographic variables was statistically determined using SPSS version 29. Pearson's Chi-Square Test were used to determine the relationship between sociodemographic data and KAP. The level of significance was established using the Pearson's chi-square, p-value was set at 0.05, the confidence interval of 95% and a 5% margin of error. The variables were considered significant if the p-value was equal or less than 0.05 and insignificant if the value was greater than 0.05. The results are presented in Table 4.19.

The results indicated no significant relationship between knowledge and overall profession of all health practitioners ($p=0.901$). However, there was a significant relationship between registered nurses and knowledge on preterm infant feeding ($p=0.003$). This reflects that the registered nurses were knowledgeable about preterm infant feeding. The result of our study differs with the study by Yang et al. (2018), where in profession of health practitioners was significantly associated with preterm infant feeding knowledge of health practitioners with a $p=0.001$. Moreover, the registered nurses were also associated with preterm infant feeding knowledge with a $p=0.034$ (Yang et al., 2018). However, Mwikali, Salim, Sylvester

and Munubhi (2023) found no significant association between preterm infant feeding knowledge and profession of health practitioners with a $p=0.760$.

The results of the relationship between preterm infant feeding knowledge and age of all health practitioners indicated no significant relationship between knowledge of health practitioners and the overall age of health practitioners ($p=0.112$). These results indicated that the age of health practitioners did not influence their knowledge on preterm infant feeding. In summary there was no significant relationship between preterm infant feeding knowledge and age of paediatricians and registered nurses. The results of our study concur with Mwikali et al. (2023), wherein there was no association between age and preterm infant knowledge with a $p=0.320$.

The results of the relationship between gender of all health practitioners and KAP, showed no significant relationship ($p=0.353$). This showed that gender did not influence knowledge of health practitioners. The results of our study differ with the study by Yang et al. (2018), wherein there was a significant relationship between preterm infant feeding knowledge and gender of health practitioners with a $p=0.023$. However, there was no significant relationship between preterm infant feeding knowledge and gender of health practitioners in a study by Mwikali et al. (2023).

There was no significant relationship between preterm infant feeding knowledge and years of service of all health practitioners ($p=0.224$). However, there was a significant relationship between knowledge and years of service for registered nurses ($p=0.046$). The results show that registered nurses acquired more knowledge with years of experience. The results of our study concur with the study by Mwikali et al. (2023), who found that there was no association between preterm infant feeding knowledge of health practitioners and years of experience with a $p=0.390$.

The results of the relationship between preterm infant feeding knowledge and years working with preterm infant of all health practitioners showed no significant

relationship ($p=0.930$). However, there was a significant relationship between knowledge of and years of working with preterm infant for registered nurses ($p=0.031$). The results reflect that professional nurse acquired more knowledge over the years working with preterm infant.

The results indicated no significant relationship between preterm infant feeding attitudes and profession of all health practitioners ($p=1.00$). This showed that the profession of nurses did not influence the attitudes on preterm infant feeding. The results of our study differ with the results by Gerhardsson, Oras, Mattsson, Blomqvist and Funkquist et al. (2021), where in there was a significant relationship between profession of health practitioner and their attitudes on preterm infant feeding $p=0.035$.

There was no significant relationship between preterm infant feeding attitudes and age of all health practitioners ($p=0.720$). These results indicate that age of health practitioners did not have an influence the attitudes of health practitioners. The results of our study differ with Adegbayi, Scally, Lesk and Stewart-Knox (2023), who argue that there was significant association between age of health practitioner and their attitudes on preterm infant feeding $p=0.001$.

The results indicate no significant relationship between preterm infant feeding attitudes and gender of all health practitioners ($p=0.333$). These results show that gender of health practitioners does not influence attitudes on preterm infant feeding. The results of our study concur with a study by Adegbayi et al. (2023), wherein there was no significant relationship between preterm infant feeding attitudes and gender of health practitioners.

There was no significant relationship between preterm infant feeding attitudes and years of service of all health practitioners ($p=0.550$). These results showed that years of service of health practitioners did not influence attitudes of preterm infant feeding.

The results indicate no significant relationship between preterm infant feeding attitudes and years of working with preterm infant of all health practitioners ($p=0.633$). These results showed that years of working with preterm infant for health practitioners did not influence their attitudes on preterm infant feeding.

There was no significant relationship between preterm infant feeding practice and profession of health practitioners ($P=0.688$). This result indicates that the profession did not influence the health practitioner practice of preterm infant feeding. The results of our study differed with the study by Abo El Magd Fathi et al. (2022), where in there was a significant relationship between knowledge and profession with a $p < 0.001$.

The results showed no significant relationship between preterm infant feeding practice and age of all health practitioners ($p=0.622$). The results shows that age of health practitioners did not influence practice of preterm infant feeding in this study. The results of our study concur with the study by Zhang, Duan, Zhao, Williams, Wall et al. (2020) where is there was no significant association between age of health practitioners and the practice of preterm infant feeding with $p=0.213$.

There was no significant relationship between preterm infant feeding practice and gender of all health practitioners ($p=0.075$). This result means that gender did not influence the practice in this study.

There was no significant relationship between preterm infant feeding practice and years of service of health practitioners ($p=0.688$). These results reflect that years of service of all health practitioners did not have an influence on practice of preterm infant feeding. The results of our study differ with the study by Gerhardsson et al. (2021), wherein there was a significant relationship between years of service of health practitioners and their preterm infant feeding practice. Moreover, Abo El Magd Fathi et al. (2022) found a significant relationship between years of experience and health practitioners and preterm infant feeding practice $p < 0.001$.

The results showed no significant relationship between preterm infant feeding practice and years working with preterm infant of health practitioners ($p= 0.438$). These results indicate that the years of experience of health practitioners working with preterm infant did not influence the practice of preterm infant feeding. The result of our study differs with the study by Gerhardsson et al. (2021), where in there was a significant relationship between years of working with preterm infant and the practice of preterm infant feeding amongst health practitioners.

There was no significant relationship between availability of protocol and knowledge ($p=0.552$). Moreover, there was no significant relationship between the availability of protocol and attitudes of health practitioners ($p=0.336$). There was also no significant relationship between the availability of preterm infant feeding protocol and the practice of health practitioners ($p=0.741$).

Table 4.19. The relationship between preterm infant feeding knowledge, attitudes and practice and sociodemographic data of health practitioners (n = 40).

Socio demographic data		n	Knowledge P-value	Attitudes P-value	Practice P-value
Profession	Overall	N=40	0.901	1.00	0.688
	Paediatrician		0.414	0.273	0.273
	Medical officer		-	-	-
	Registrar		-	-	-
	Registered nurses		0.003	0.094	0.336
Gender	Overall	N=40	0.124	0.047	0.075
	Males		-	0.233	0.392
	Females		0.353	0.720	0.437
Availability of protocol	Overall		0.552	0.366	0.741
Age	Overall	N=40	0.112	0.720	0.622
	Paediatrician		0.392	0.112	0.753
	Medical officer		-	0.157	0.157
	Registrar		-	0.554	0.140
	Registered nurses		0.293	0.558	0.293
Years of service	Overall	N=40	0.224	0.550	0.514
	Paediatrician		0.441	0.199	0.199
	Medical officer		-	0.157	0.157
	Registrar		-	0.161	0.056
	Registered nurses		0.046	0.741	0.648
Year working with preterm*	Overall	N=40	0.930	0.633	0.438
	Paediatrician		0.441	0.663	0.199
	Medical officer		-	0.157	0.157
	Registrar		-	0.554	0.317
	Registered nurses		0.031	0.422	0.174
Availability of protocol	Overall	N=40	0.552	0.366	0.741

The dash (-) means it could not be determined due to small sample size.

4.7. The relationship between socio-demography and overall KAP.

The relationship between overall KAP and socio-demography was analysed using Pearson's correlation coefficient (r). The correlation coefficients were interpreted as 0.00 – 0.10 indicated a negligible correlation, 0.10 – 0.39 indicated a weak correlation, 0.40 – 0.69 indicated a moderate correlation, 0.70 – 0.89 indicated a strong correlation and 0.90 – 1.00 indicates a very strong correlation (Schober, Boer & Schwarte, 2018). The association between the categorical socio-demographic data and KAP, could not be analysed due to small sample size. However, the overall socio-demographic data was used to determine the

association with overall KAP. Pearson's Chi-Square Test was used to determine the significance between sociodemographic data and overall KAP, p-value was set at 0.05, the confidence interval of 95% and a 5% margin of error. The variables were considered significant if the p-value is equal or less than 0.05 and insignificant if the value is greater than 0.05. The results are shown in Table 4.20.

The results indicate that there was a weak positive correlation and no significant relationship ($r=0.314$, $n=40$, $p=0.385$), between overall knowledge and age of health practitioners. These results suggest that age was not associated between the overall knowledge of preterm infant feeding and age of health practitioners. Therefore, according to our results, the preterm infant feeding knowledge might be the same amongst different age categories. Furthermore, there was a positive weak correlation and no significant relationship ($r=0.308$, $n=40$, $p=0.858$) between overall knowledge and gender of health practitioners. These results imply that knowledge of preterm infant feeding was not associated with the gender of health practitioners in our study. Therefore, whether the health practitioner was male or female it would not affect their knowledge. The correlation was negligible and no significant relationship ($r=0.072$, $n=40$, $p=0.175$) between overall preterm infant feeding knowledge and overall profession. These results suggest that profession of health practitioners (i.e. registered nurses and medical practitioners) did not have association with the overall knowledge of preterm infant feeding in our study. The results also indicate that there was a weak positive correlation and there was no significant relationship ($r=0.264$, $n=40$, $p=0.126$) between overall knowledge and years of service of the health practitioners. These results may suggest that overall knowledge of preterm infant feeding was not associated with years of working of health practitioners in our study. There was a negligible correlation and there was no significant relationship ($r=0.060$, $n=40$, $p=0.190$) between overall knowledge and years working with preterm infant. These results suggest that no matter how many years health practitioner worked did not have association with the overall knowledge of preterm infant feeding. Lastly, there was a positive weak correlation and there was no significant relationship ($r=0.170$, $n=40$, $P=0.891$) between the availability of protocol and overall knowledge of health practitioners.

These results imply that the availability of protocol in our study did not have an association the overall knowledge of preterm infant feeding.

The results indicate that there was a negligible correlation and no significance relationship ($r=0.057$, $n=40$, $p=0.599$) between age and overall attitudes of health practitioners. These results imply that the age (i.e. whether old or young) of health practitioners did not have an association with the overall attitudes of preterm infant feeding in our study. Furthermore, there was a weak positive correlation and there was no significance relationship ($r=0.300$, $n=40$, $p=0.306$) between the overall gender and overall attitudes of health practitioners. These results suggest that the attitudes of preterm infant feeding may be associated with the gender (whether male or female) of health practitioners in our study. The results also depict that there was a negligible correlation and there was no significance relationship ($r=0.000$, $n=40$, $p=0.546$) between overall profession and the overall attitudes of health practitioners. These results imply that the health practitioner's profession whether medical officer or registered nurse did not have association with overall attitudes of preterm infant feeding. There was a negligible correlation and there was no significance relationship ($r=0.094$, $n=40$, $p=0.604$) between years of service and the overall attitudes of health practitioners. These results suggest that the overall attitudes of health preterm infant feeding may not be associated with the years of practice of health practitioners in our study. There was a negligible correlation and no significance relationship ($r=0.075$, $n=40$, $p=0.217$) between years of working with preterm infant and overall attitudes. The results also imply that the years of working with preterm infant do not have an association with overall attitudes of preterm infant feeding in our study. Lastly there was a weak positive correlation and there was no significance relationship ($r=0.141$, $n=40$, $p=0.727$) between the availability of preterm infant feeding protocol and overall attitudes. These results suggest that the availability of preterm infant feeding protocol in our study did not have association with the overall attitudes of health practitioners in our study.

The results reflect that there was a weak positive correlation and no significance relationship ($r=0.152$, $n=40$, $p=0.613$) between age and overall practice. These

results imply that age of health practitioners does not have association with overall practice of preterm infant feeding. Similarly, there was a weak positive correlation and no significance relationship ($r=0.338$, $n=40$, $p=0.465$) between gender and overall practice. Again, these results suggest that the gender of health practitioners does not have an association with the overall of preterm infant feeding. Furthermore, there was a weak positive correlation and no significance relationship ($r=0.135$, $n=40$, $p=0.640$) between overall profession and overall practice of health practitioners. This implies that the profession of health practitioners does not have association with overall practice of preterm infant feeding. The results also indicate that there a weak positive correlation and no significance relationship ($r=0.180$, $n=40$, $p=0.688$) between years of service of health practitioners and overall attitudes. These results suggest that years of service of health practitioners does not have association with the overall practice on preterm infant feeding. The results also indicates that there was a weak positive correlation and no significance relationship ($r = 0.199$, $n=40$, $p=0.846$) between years of working with preterm infant and the overall practice of health practitioners. These results imply that years of working with preterm infant do not have association with the overall practice on preterm infant feeding in our study. The results reflect a weak positive correlation coefficient and there was no significance relationship ($r =0.121$, $n=40$, $p=0.692$) between the availability of preterm infant feeding protocol and the practice of health practitioners. This result implies that the availability of preterm infant feeding protocol in our study does not have association with overall practice in our study.

Table 4. 20. The relationship between socio-demography of health practitioners and overall knowledge, overall attitudes, and overall practice of preterm infant feeding (n = 40).

Demographics	n	Knowledge		Attitudes		Practice	
		Correlation coefficient (r)	Significance	Correlation coefficient (r)	Significance	Correlation coefficient (r)	significance
Age	40	0.314	0.385	0.057	0.599	0.152	0.619
Gender	40	0.308	0.858	0.300	0.306	0.338	0.465
Profession	40	0.072	0.175	0.000	0.546	0.135	0.064
Years of service	40	0.264	0.126	0.094	0.604	0.180	0.688
Years working with preterm	40	0.060	0.190	0.075	0.217	0.199	0.846
Availability of protocol	40	0.170	0.891	0.141	0.727	0.121	0.692

4.8. Conclusion

Health practitioners showed a moderate knowledge about preterm infant feeding, as well as positive attitudes and a moderate practice during the study. Only a minority of the participants received a moderate score in the preterm infant feeding practice component of this study. The positive attitudes and the moderate practice score obtained in our study is contradicts with the theory of planned behaviour. The moderate knowledge in our study influenced positive attitudes of health practitioners, and the practice of health practitioners with regards to preterm infant feeding was moderate.

There was a significant relationship between registered nurses and knowledge of preterm infant feeding and well as years of experience of registered nurses and knowledge. Additionally, there was also a significant relationship between registered nurses' years of working with preterm infant and their knowledge on preterm infant feeding.

CHAPTER 5: CONCLUSSION AND RECOMMENDATIONS

5.1. Introduction

This chapter focuses on the summary of the findings, conclusion, limitation, and recommendation.

5.2. Aim of the study

This study aimed to determine the preterm infant' feeding knowledge, attitudes, and practices amongst health practitioners at tertiary hospitals in the Capricorn district, Limpopo province, South Africa. The aim of the study was achieved as presented in chapter four.

5.3. Conclusion on the objective of the study

The first objective was to assess preterm infant's feeding knowledge amongst health practitioners at tertiary hospital in Capricorn district, Limpopo Province, South Africa. Most of the health practitioners (77% (n=31), obtained a moderate score on knowledge of preterm infant feeding. This indicates that health practitioners had a moderate knowledge on preterm infant feeding.

The second objective was to describe the attitudes regarding preterm infant feeding amongst health practitioners at tertiary hospitals in Capricorn district, Limpopo Province, South Africa. The overall results reflect that all health practitioners showed positive attitudes towards preterm infant feeding. Which reflects that health practitioners approached preterm infant feeding optimistically.

The third objective was to describe health care practitioners' practices regarding preterm infant feeding at tertiary hospitals in the Capricorn district, Limpopo Province, South Africa. The results reflect that 58% (n=23) of health practitioners

had a moderate score on practice of feeding preterm infant. This reflect that health practitioners had good practice on preterm infant feeding.

The fourth objective was to determine the relationship between socio-demography and knowledge, attitudes, and practice of health care practitioners about preterm infant feeding at tertiary hospitals in Capricorn district, Limpopo Province, South Africa. The results show that age, gender, profession, years of experience, years of working with preterm infant, and availability of feeding protocol were not significantly associated with knowledge. However, there was a significant relationship between registered nurses and knowledge ($p=0.003$). Furthermore, there was a significant relationship between knowledge and years of service for registered nurses ($p=0.046$). And there was a significant relationship between registered nurses' years of working with preterm infant and their knowledge of preterm infant feeding ($p=0.031$). There was also no significant relationship between demographics and attitudes. Furthermore, there was also no significant relationship between demographics and practice.

5.4. Conclusions

Knowledge of preterm infant feeding amongst health practitioners – health practitioner had a moderate knowledge on preterm infant feeding.

Attitudes of health practitioners regarding preterm infant feeding – health practitioners had a positive attitude regarding preterm infant feeding.

Practice of preterm infant feeding amongst health practitioners – health practitioners had a moderate practice on preterm infant feeding.

The relationship between socio-demography of health practitioners and KAP on preterm infant feeding - there was a significant relationship between registered nurses and their knowledge of preterm infant feeding, years of service for registered nurses and years of service working with preterm infant for nurses and their knowledge of preterm infant feeding.

Notably, Mankweng Hospital have a Breastmilk Bank, its availability does not really cater for preterm infant in the hospital and the Limpopo province due to its

eligibility criteria. The results of our study are praiseworthy because health practitioners who participated have difference scope of practice, and they are not the custodian of nutrition in preterm infant.

5.5. Strength of the study

The study was able to describe the knowledge, attitudes and practice of health practitioners regarding preterm infant feeding.

5.6. Limitation of the study

The permission to conduct the study was granted for Mankweng hospital. Therefore, the pilot and the main study was conducted in Mankweng hospital and affected the total sample size. Because some of the health practitioners participated in the pilot study and were excluded from the main study.

The study did not classify the specialities within the registered nurses. Classification of registered nurses by speciality might have possible indicated the distribution of knowledge, attitudes, and practice results across the categories.

5.7. Recommendations

Knowledge of health care practitioners regarding preterm infant feeding - Health practitioners need continuous training in the latest guidelines regarding preterm infant feeding. This will ensure that latest information is practiced with regards to preterm infant feeding in the Hospital.

Practice of preterm infant feeding amongst health practitioners - There should be an annual preterm infant feeding protocol update. Training institution should incorporate preterm infant feeding as part of curriculum to improve practice in the health institutions. This will ensure that health practitioners practice the latest available information which is updated in the available protocol in the neonatal unit.

The overall recommendation - The study should be expanded around all the Hospitals in Limpopo province. There is a need to conduct a qualitative study on

preterm infant feeding to understand the in-depth in to practice of preterm infant feeding, which include when to initiate feeding, which feed is more preferred for preterm infant and why is the feed preferred.

CHAPTER 6: SUMMARY AND CONCLUSIONS

6.1. Summary of the research findings

Knowledge of preterm infant feeding amongst health practitioners – the study reflects that health practitioner had a moderate knowledge on preterm infant feeding.

Attitudes of health practitioners regarding preterm infant feeding – the study depicts that health practitioners had a positive attitude regarding preterm infant feeding.

Practice of preterm infant feeding amongst health practitioners – the study showed that health practitioners had a moderate practice on preterm infant feeding.

The relationship between socio-demography of health practitioners and KAP on preterm infant feeding - there was a significant relationship between registered nurses and their knowledge of preterm infant feeding, years of service for registered nurses and years of service working with preterm infant for nurses and their knowledge of preterm infant feeding.

6.2. Conclusion of the research findings

The results of this study show that health practitioners got a moderate score on knowledge, positive attitudes, and a moderate score on practice of preterm infant feeding. There was no significant association between demographics and knowledge, demographics and attitudes and demographics and practice in this study.

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7. Annexures

Annexure 1. Informed consent

Dear Participant,

I invite you to participate in a MSc (Dietetics) research study titled: **PRETERM INFANT' FEEDING KNOWLEDGE, ATTITUDES, AND PRACTICES AMONGST HEALTH PRACTITIONERS AT TERTIARY HOSPITALS IN LIMPOPO PROVINCE, SOUTH AFRICA.**

The objectives of the research are:

1. To assess preterm infant's feeding knowledge amongst health practitioners at Tertiary hospitals in Limpopo Province, South Africa.
2. To describe preterm infant's feeding attitudes amongst health practitioners at Tertiary hospitals in Limpopo Province, South Africa.
3. To describe preterm infant's feeding practice amongst health practitioners at Tertiary hospitals in Limpopo Province, South Africa.
4. To determine the relationship between knowledge, attitudes, and practice of preterm infant about preterm infant feeding at Tertiary hospitals in Limpopo Province, South Africa.

Your participation in this research project is completely voluntary. You may withdraw at any time without any explanation or prejudice. There are no known risks to participation beyond those encountered in everyday life. Your responses and data will remain confidential and anonymous. If you agree to participate in this project, please complete the attached questionnaire as best you can. It should take approximately 20-30 minutes to complete.

If you have any questions about this project, feel free to contact (researcher: Mr. Ralebapa Khomotso, contact no: 0717138651, email address: kralebapa@gmail.com,

Supervisor: Mrs. Rabodiba DA (0761490997), email address: ditope.rabodiba@ul.ac.za.

Co-supervisor: Dr. Mphasha MH (0658971490), email address mabitsela.mphasha@ul.ac.za.

Thank you for your assistance in this important endeavour.

Sincerely yours

Mr. Ralebapa K

Annexure 2. Consent form

I agree to participate in the research project titled: **PRETERM INFANT KNOWLEDGE, ATTITUDES, AND PRACTICES AMONGST HEALTH PRACTITIONERS AT A TERTIARY HOSPITAL, LIMPOPO PROVINCE, SOUTH AFRICA.**, conducted by **Ralebapa Khomotso**, who has (have) discussed the research project with me.

I have had the opportunity to ask questions about this research and I have received satisfactory answers. I understand the general purposes, risks, and methods of this research.

I consent to participate in the research project and the following has been explained to me:

- The research may not be of direct benefit to me.
- My participation is completely voluntary.
- My right to withdraw from the study at any time without any implications to me.
- There are no possible risks.
- What I am expected and required to do.
- Whom I should contact for any complaints with the research or the conduct of the research.
- Publication of results from this study on the condition that my identity will not be revealed.

Signature: _____

Date: _____

Annexure 3. Questionnaire

PRETERM INFANT' FEEDING KNOWLEDGE, ATTITUDES, AND PRACTICES AMONGST HEALTH PRACTITIONERS AT A TERTIARY HOSPITAL, LIMPOPO PROVINCE, SOUTH AFRICA.

Answer the following questions.

Tick the appropriate response, tick only once per question

SECTION 1: DEMOGRAPHIC INFORMATION

1.1. What is your profession?

Pediatrician	1
Pediatric Surgeon	2
Neonatologist	3
Medical officer	4
Registrar	5
Registered nurses	6
Other (specify)	7

1.2. What is your Gender?

Male	1
Female	2
Non-Binary	3
Prefer not to say	4

1.3. What is your race?

African	1
White	2
Indian	3
Coloured	4
Other(specify)	5

- 1.4. What is your age? _____ years
- 1.5. How many years of service do you have? _____ years
- 1.6. How long have you been working with preterm infant? _____ years
- 1.7. Is there a feeding protocol available in the neonatal unit?

Yes	1
No	2

SECTION 2. HEALTH PRACTITIONERS' KNOWLEDGE

Choose the correct answer for the following statement:

- 2.1. Preterm infant are infant born before 37 weeks of gestation.

True	1
False	2

- 2.2. Enteral nutrition is administration of nutrition via the gut, either sucked by the infant or given through a feeding tube inserted through the nose or the mouth into the stomach or small intestine.

True	1
False	2

- 2.3. Parenteral nutrition is administration of nutrition through the veins directly into the bloodstream, bypassing the digestive tract.

True	1
False	2

- 2.4. Preterm infant are classified according to gestational age and birth weight.

True	1
False	2

- 2.5. Mothers' own breastmilk is the first feed of choice for preterm infant.

True	1
False	2

- 2.6. Pasteurized donor human milk is the second feed of choice for preterm infant if mothers' own milk is not available.

True	1
False	2

- 2.7. Is preterm formula milk the second feed of choice.

True	1
False	2

- 2.8. Addition of breastmilk fortifier to breastmilk is regarded as mixed feeding.

True	1
False	2

- 2.9. Mixed feeding is giving a preterm infant expressed breast milk and preterm formula milk.

True	1
False	2

- 2.10. Mixed feeding can be used when mothers own milk is insufficient.

True	1
False	2

- 2.11. Mixed feeding is giving a preterm infant mothers own milk and donor human milk.

True	1
False	2

- 2.12. Bile stained vomits are indicative of feeding intolerance in preterm infant.

True	1
False	2

- 2.13. The presence of abdominal wall erythema indicative of feed intolerance.

True	1
False	2

- 2.14. Gastric residual volume can be used to monitor feeding tolerance.

True	1
False	2

2.15. Abdominal distention soft on palpation is used to monitor feeding tolerance.

True	1
False	2

2.16. For preterm Infant less than 1250g, the preferred route of feeding is nasogastric.

True	1
False	2

2.17. For preterm greater than 1250g, the preferred route of feeding nasogastric?

True	1
False	2

2.18. Minimal enteral (trophic) feeding in preterm is defined as feeding with small volumes i.e., 0.5-1 ml/kg/d up to a maximum of 20 ml/kg/d.

True	1
False	2

2.19. Early initiation of feed is feeding with the 1st 24 hours of life.

True	1
False	2

2.20. Early initiation of feeding (i.e., first day of life) cause necrotising enterocolitis.

True	1
False	2

2.21. Feeding the preterm infant with preterm infant formula milk increase the risk of necrotising enterocolitis.

True	1
False	2

- 2.22. Continuous feeding is preferred over bolus feeding in preterm infant born less than 1000g.

True	1
False	2

- 2.23. Fast progression of feed is increasing feeds by greater than 30 ml/kg/day.

True	1
False	2

- 2.24. Kangaroo mother care improves weight gain preterm infant.

True	1
False	2

- 2.25. Benefits of kangaroo mother care exclude preterm infant temperature regulation, breast feeding, and bonding with the mother.

True	1
False	2

- 2.26. Bolus feeding is preferred over continuous feeding in preterm infant between 1000g to 1500g.

True	1
False	2

- 2.27. The targeted enteral feeding volume for preterm less than 1000g is 180ml/kg/day.

True	1
False	2

- 2.28. The targeted enteral feeding volume for preterm less than 1500g is 180ml/kg/day.

True	1
False	2

- 2.29. The targeted enteral feeding volume for preterm less than 2500g is 180ml/kg/day.

True	1
False	2

SECTION 3. HEALTH PRACTITIONER'S ATTITUDES.

Please indicate whether you agree, neutral and disagree. Tick only one response per question.

	Agree (1)	Neutral (2)	Disagree (3)
3.1. Enteral feeding has a positive effect on the physical well-being of the preterm infant.			
3.2. Preterm infant fed on expressed breastmilk has a low risk of necrotizing enterocolitis and feeding intolerance.			
3.3. Mothers' own breastmilk is the first feed of choice in preterm infant.			
3.4. Early enteral feeding of preterm infant using expressed breast milk does not delay growth and development.			
3.5. Expressing breastmilk for preterm infant enhances parenting confidence.			
3.6. All preterm infant mother should be encouraged to express breast milk for their preterm infant.			
3.7. All preterm infant' mothers should be given relevant information and support on breastmilk expression.			
3.8. Preterm infant feeding should be prioritized by health practitioners.			
3.9. When initiating enteral feeds, mother's feeding choice taken into account.			

3.10. Total parenteral nutrition in preterm can be run via peripheral or central route.			
3.11. Kangaroo mother care can be started immediately after birth in stable preterm infant.			

SECTION 4. HEALTH PRACTITIONERS PRACTICE

Choose the correct answer for the following questions. Tick only one response per question

4.1. When should feeding be started in preterm infant less than 1000g?

< 24 hours of life	1
24 – 48 hours of life	2
> 48 - 72 hours of life	3
> 72 hours of life	4

4.2. When should feeding be started in preterm infant less than 1500g?

< 24 hours of life	1
24 – 48 hours of life	2
> 48 - 72 hours of life	3
> 72 hours of life	4

4.3. When should feeding be started in preterm infant less than 2500g?

< 24 hours of life	1
24 – 48 hours of life	2
> 48 - 72 hours of life	3
> 72 hours of life	4

4.4. Feeding should be started and advanced by 30 – 40 ml/kg/day in preterm infant greater than 750g?

Yes	1
No	2

- 4.5. Feeding should be started by 15 – 20 ml/kg/day and maintain the trophic feeding for 72 hours and not more than 5 days and advance feed by 15 – 20 ml/kg/day.

Yes	1
No	2

- 4.6. Does high gastric residual volume delay the onset of enteral feeding?

Yes	1
No	2

- 4.7. When feeding intolerance (e.g., hyperglycemia) occur are feed stopped.

Yes	1
No	2

- 4.8. Total parenteral nutrition is indicated for preterm infant born not later than 30 - 31 weeks' gestation.

Yes	1
No	2

- 4.9. Total parenteral nutrition is indicated where insufficient progress with enteral nutrition is made within 3 - 5 days in preterm infant less than 1000g.

Yes	1
No	2

- 4.10. Monitoring of glucose level is essential in preterm infant receiving total parenteral nutrition.

Yes	1
No	2

4.11. Preterm infant less than 1250g requires supplemental parenteral nutrition.

Yes	1
No	2

4.12. Total parenteral nutrition in preterm infant less than 1250g should be initiated within the first 24 hours of life?

Yes	1
No	2

4.13. Peripheral vein access cannot be used to administer total parenteral nutrition.

Yes	1
No	2

4.14. Total parenteral nutrition should be discontinued when there is hyperglycemia.

Yes	1
No	2

4.15. Minimal enteral (trophic) feeding in preterm can be given for how long.

Use minimal enteral feeding for less than 4 days	1
Use minimal enteral feeding for more than 4 days	2
Use minimal enteral nutrition for 1 day	3

4.16. When enteral feeds are initiated, what is the usual feed that is given first in your facility.

Mothers own milk	1
------------------	---

Donor human milk	2
Premature infant' formula milk	3
Term infant' formula	4

4.17. In the neonatal unit, what is the ultimate choice of enteral nutrition?

Mothers' breastmilk	1
Donor human milk	2
Preterm infant's formula	3

4.18. Preterm infant formula milk safe to use for feeding preterm infant.

Yes	1
No	2

4.19. What is your belief on the acceptability of the use of donor milk?

Acceptable	1
Not acceptable	2

4.20. Mixed feeding safe for preterm infant.

Yes	1
No	2

4.21. Preterm infant are breastfed when the weight is more than 1300g.

Yes	1
No	2

4.22. Kangaroo mother care is recommended for all stable preterm infant.

Yes	1
No	2

4.23. Does mixed feeding occur in the neonatal unit?

Yes	1
-----	---

No	2
----	---

4.24. What is used to top up if mothers' milk is insufficient?

Donor human milk	1
Preterm formula milk	2

Annexure 4. Faculty approval letter



University of Limpopo
Faculty of Health Sciences
Executive Dean

Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 2149, Fax: (015) 268 2685, Email:tebogo.mothiba@ul.ac.za

DATE: 28 JULY 2022

NAME OF STUDENT: RALEBAPA K
STUDENT NUMBER: 200510734
DEPARTMENT: DIETETICS
SCHOOL: HEALTH CARE SCIENCES
QUALIFICATION: MSc

Dear Student

FACULTY APPROVAL OF PROPOSAL (PROPOSAL NO. FHDC2022/5)

I have pleasure in informing you that your MSc proposal served at the Faculty Higher Degrees Meeting on 20 JULY 2022 and your title was approved as follows:

Approved Title: "Preterm Infants Feeding Knowledge, Attitudes, and Practices amongst Health Practitioners at Tertiary Hospitals in Capricorn District, Limpopo Province, South Africa"

Note the following:

Ethical Clearance	Tick One
Requires no ethical clearance Proceed with the study	
Requires ethical clearance (TREC) (apply online) Proceed with the study only after receipt of ethical clearance certificate	✓

Yours faithfully

Prof T.M Mothiba
Chairperson

Supervisor: Mrs DA Rabodiba
Co-Supervisor: Dr. MH Mphasha

Finding solutions for Africa

Annexure 5. TREC ethics clearance certificate



University of Limpopo
Department of Research Administration and Development
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 3935, Fax: (015) 268 2306, Email: anastasia.ngobe@ul.ac.za

TURFLOOP RESEARCH ETHICS COMMITTEE
ETHICS CLEARANCE CERTIFICATE

MEETING: 22 August 2022

PROJECT NUMBER: TREC/347/2022: PG

PROJECT:

Title: Preterm infants feeding knowledge, attitudes, and practices amongst health practitioners at tertiary hospitals in Capricorn District, Limpopo Province, South Africa.
Researcher: K Ralebapa
Supervisor: Mrs DA Rabodiba
Co-Supervisor/s: Dr. MH Mphasha
School: Health Care Sciences
Degree: Master of Science in Dietetics

PROF D MAPOSA

CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE

The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: REC-0310111-031

Note:

- i) This Ethics Clearance Certificate will be valid for one (1) year, as from the abovementioned date. Application for annual renewal (or annual review) need to be received by TREC one month before lapse of this period.
- ii) Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee, together with the Application for Amendment form.
- iii) PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.

Finding solutions for Africa

Annexure 6. Limpopo Province Department of Health permission



LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

Department of Health

Ref : LP_2022-09-007
Enquires : Ms PF Mahlokwane
Tel : 015-293 6028
Email : Phoebe.Mahlokwane@dhsd.limpopo.gov.za

Ralebapa Khomotso

PERMISSION TO CONDUCT RESEARCH IN DEPARTMENTAL FACILITIES

Your Study Topic as indicated below;

PRETERM INFANTS FEEDING KNOWLEDGE, ATTITUDES, AND PRACTICES AMONGST HEALTH PRACTITIONERS AT TERTIARY HOSPITALS IN CAPRICORN DISTRICT, LIMPOPO PROVINCE, SOUTH AFRICA

1. Permission to conduct research study as per your research proposal is hereby Granted.
2. Kindly note the following:
 - a. Present this letter of permission to the Office Clinical Executive Director a week before the study is conducted.
 - b. This permission is **ONLY** for **Mankweng Hospital**
 - c. In the course of your study, there should be no action that disrupts the routine services, or incur any cost on the Department.
 - d. After completion of study, it is mandatory that the findings should be submitted to the Department to serve as a resource.
 - e. The researcher should be prepared to assist in the interpretation and implementation of the study recommendation where possible.
 - f. The approval is only valid for a 1-year period.
 - g. If the proposal has been amended, a new approval should be sought from the Department of Health
 - h. Kindly note that, the Department can withdraw the approval at any time.

Your cooperation will be highly appreciated

Head of Department

24/10/2022

Date

PP

Private Bag X9302 Polokwane
Fidel Castro Ruz House, 18 College Street, Polokwane 0700. Tel: 015 293 6000/12. Fax: 015 293 6211.
Website: <http://www.limpopo.gov.za>

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Annexure 7. Mankweng Hospital permission



LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

**DEPARTMENT OF HEALTH
MANKWENG HOSPITAL**

Ref: S5/3/1/2
Enq: Modula MC
Tel: 015 286 1042/1022
Email: motlatso.modula@dhsd.limpopo.gov.za
From: HR Training and Development

TO: RALEBAPA KHOMOTSO

REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT MANKWENG HOSPITAL

1. The above matter has reference.
2. This is to confirm that the CEO has granted you permission to conduct research on

**"PRETERM INFANTS FEEDING KNOWLEDGE, ATTITUDES ,AND
PRACTICES AMONGST HEALTH PRACTITIONERS AT TERTIARY
HOSPITALS IN HOSPITALS IN CAPRICORN DISTRICT, LIMPOPO
PROVINCE, SOUTH AFRICA"**

3. We wish you all the best with your research.

Yours in service delivery



Director: Corporate Services
Mr. Sibuyi MV

02/11/2022

Date



Acting Chief Executive Officer
Dr. Muila SL

03/11/2022

Date

Private Bag X1117, SOVENGA, 0727 Tel: 015 286 1000 Fax: 015 267 0206
Houthbos Road, Sovenga

Restricted

The heartland of Southern Africa – development is about people!

Annexure 8. Editorial letter

LEBOMA INVESTMENTS (PTY) LTD

REGISTRATION NUMBER: 2018 / 299676 / 07

TO WHOM IT MAY CONCERN

This letter serves to confirm that I, **Prof T.W Molotja**, have proofread and edited the research report for

Ralebapa K

student number

200510734

entitled

**PRETERM INFANT FEEDING KNOWLEDGE, ATTITUDESS, AND
PRACTICES AMONGST HEALTH PRACTITIONERS AT TERTIARY
HOSPITALS IN CAPRICORN DISTRICT, LIMPOPO PROVINCE, SOUTH
AFRICA**

The report is edited focusing on the following:

Coherent writing.

Eliminating spelling errors.

Fluency in reading.

Academic writing.

I therefore recommend for its submission.

Yours Sincerely

Date: 12/02/2024

