

Complementary feeding practices and their influences

by

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Declaration

I, Nazeeria Sayed declare that the thesis, which I hereby submit for the degree PhD in Nutrition at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

Signature:

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28 August 2020

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Dedication

This thesis is dedicated to the memory of my grandfather, Yusuf Akbar, and to my daughter, Neha Simran Moodley.

Thank you Nana, for instilling in me the dream to study, the ethic to work hard, and to always give off my best in everything I attempt.

Neha – work hard and dream big my sweetheart. May you have the courage to pursue your dreams and make many come true.

Abstract

The global focus on a 1 000 days from conception to 2 years stresses the importance this period has on improving infant health. South Africa has focused on policies and actions to improve breastfeeding rates but specific attention to complementary feeding practices is still lacking. The 2016 South African Demographic and Health Survey indicated an increase in stunting from 8 to 23 months of age – further highlighting the complementary feeding phase as a vulnerable stage for infants. Disaggregated local data on infant feeding practices is required to better inform decision makers on the current infant feeding situation before interventions can be considered.

The objectives of this PhD study were to review the current complementary feeding practices in South Africa; to describe and assess the infant feeding practices of 6-11 month-old infants attending the KwaMashu Community Health Centre in KwaZulu-Natal, South Africa; to use Optifoods software to ascertain if infant nutrient requirements can be met with a food-based approach, as well as to identify the nutrients that are difficult to achieve adequate intakes of; and to describe the main influences on mothers' complementary feeding decisions.

A review of complementary feeding practices in South Africa (**CHAPTER 1**), revealed that despite updated infant feeding policies, in reality, poor infant feeding practices still prevail. In general, foods and liquids are introduced too early. Poor dietary diversity is of major concern.

A cross-sectional survey was conducted with mothers and caregivers from the KwaMashu Community Health Centre (**CHAPTER 2**) to determine the infant feeding practices of 6-11 month-old infants attending the well-baby clinic. One hundred and thirty-four interviews were completed with mothers/caregivers. 80.6% of infants were breastfed, with 63.5% of mothers/caregivers reporting breastfeeding initiation in the first hour after birth. Only 25.4% of mothers/caregivers reported exclusively breastfeeding to the age of 6 months. Almost a third of infants (30.6%) had started solid foods before 3 months of age. Cereals were the main first foods given, with 56.7% of caregivers preparing foods at home and 43.3% using

commercial foods. At the time of data collection, 36.6% of the 6-11 month-old infants were breastfeeding, 47.0% were formula feeding and 16.4% received mixed feeding. Soft maize meal porridge and commercial infant cereals were the most popular foods consumed daily. Close to two-thirds of infants (64.9%) had at least one meat food group item and just over two-thirds of infants (68.7%) had eaten eggs in the previous 7 days. It is concerning that just over half of the infants (52.2%) were being given biscuits, two-thirds (66.4%) ate chips, and close to a third (32.8%) consumed sweets or chocolates.

The information from the 134 interviews conducted provided the food consumption input for the model using Optifoods software (**CHAPTER 3**). The objective was to determine if the nutrient requirements of 6-11 month-old infants can be met with a food-based approach, as well as to identify the nutrients that are difficult to achieve adequate intakes of. The results from the modelling exercise revealed that with the current food pattern of infants from the study group in KwaMashu, iron, zinc, and calcium were identified as the nutrients whose requirements are likely not to be met in the diet of these infants (nutrients of concern). The percentage RNI (Recommended Nutrient Intake) for iron was 25.2%, zinc 51.3% and calcium 77%. Nutrient intakes for these nutrients of concern improved in the “No pattern” diet but iron and zinc intakes still remained below the RNI. According to the best diets modelled by Optifoods, it appears that infants in KwaMashu would be able to achieve the recommended intakes of energy and protein, as well as the desired nutrient intakes for 8 of the 11 micronutrients as long as breastfeeding on demand continues during the complementary feeding phase.

In efforts to improve infant feeding practices, knowing what foods infants are currently consuming is important. However, it is equally important to understand why caregivers make certain complementary feeding choices and to identify what influences their behaviour when feeding infants in their care. Four focus group discussions with a total of 19 mothers were held at the KwaMashu Community Health Centre to try to understand some of the factors that affect the infant feeding decisions of mothers more clearly (**CHAPTER 4**). Mothers in KwaMashu seem to be aware which foods they should provide to their infants, but guidance to them on the frequency of feeding and the amount of food that should be fed to infants was absent. Despite being informed by the clinic and mothers knowing that 6 months was the correct age to

introduce the baby to foods, they were uncertain about the age at which foods should be introduced. This matter regarding the age of food introduction is further complicated by the immense societal pressure, in particular from grandmothers in the household, to introduce foods earlier at a much younger age.

There are many issues associated with the complementary feeding diets of infants that need attention. The findings of this study call into question the continued food-based focus that is used to ensure nutrient adequacy in infants. In conjunction with efforts to improve household food security and the continued support and promotion of breastfeeding for the first 2 years of life, targeted micronutrient supplementation may be needed to ensure the optimal growth and development of infants in South Africa. The availability of new tools in nutrition, such as Optifoods, heralds an exciting phase in research and efforts need to be prioritised to train more people to use them and to make these tools available globally. To continue focussing infant nutrition education exclusively on mothers may not be a productive approach. The findings of this study support the inclusion of grandmothers (who in many cases may be the primary caregiver of infants) in education efforts to improve infant feeding practices.

Health facilities and provincial Departments of Health should review research findings from accredited research more systematically to make sure that they include these into their action plans. The South African government should consider an accessible repository dedicated to infant nutrition information. Infant feeding practices research requires active encouragement. It is essential for the dialogue between all stakeholders in the infant feeding field to continue with increased transparency and trust.

List of Acronyms

ADSA	Association for Dietetics in Southern Africa
DOH	Department of Health
EBF	Exclusive breastfeeding
GAIN	Global Alliance for Improved Nutrition
IYCF	Infant and Young Child Feeding
KMCHC	KwaMashu Community Health Centre
KZN	KwaZulu-Natal
LSHTM	London School of Hygiene and Tropical Medicine
POPD	Paediatric Out-Patient Department
RNI	Recommended Nutrient Intake
SADC	Southern African Development Community
SA FCT	South African Food Composition Tables
SA FQM	South African Food Quantities Manual
SAM	Severe Acute Malnutrition
SDGs	Sustainable Development Goals
UNICEF	United Nations International Children's Emergency Fund
WHO	World Health Organisation

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Complementary feeding practices and their influences

Introduction

Justification for this study

The 2019 South African Child Health Gauge^[1] stated that *“Early and sustained investment in child and adolescent health is therefore essential and has the potential to protect children from ‘toxic stress’ and disrupt the intergenerational cycles of poverty, violence and ill health. If we want children to thrive and achieve optimal health and development, we need to intervene early – starting in the first 1 000 days of life and continuing into adolescence – as investments made during these two sensitive periods of development yield the greatest returns.”* This statement sets the context for this study as it highlights the need to focus on the first 1 000 days of life.

In 2018, the Nurturing Care Framework was launched at the 71st World Health Assembly^[2] in response to the First 1 000 Days Movement and the Sustainable Development Goals (SDGs). This framework recognises five components of Nurturing Care essential to the development of children (Figure 1). These components are: adequate nutrition, responsive caregiving, safety and security, opportunities for early learning, and good health. These components should be supported by an “Enabling Environment”, which includes capable caregivers, empowered communities, supportive services and policies.



Figure 1: The 5 components of the Nurturing Care Framework^[2]

Adequate nutrition is positioned within this framework, together with other related factors which could also impact on nutrition. This framework highlights the fact that a solely food-based focus and nutrition education may not be enough to improve infant feeding practices and make a difference to the nutritional status of infants. As one of the first steps towards improving the understanding of the adequate nutrition component, the current state of infant feeding practices needs to be assessed in a community together with potential influencers of infant feeding practices (the so-called “Enabling Environment” in the Nurturing Care Framework). This type of assessment will help to inform the growth and expansion of a First 1 000 Days service package in South Africa. Researchers have reported that South Africa has a gap in providing a First 1 000 Days service package^[3]. Furthermore, efforts made to understand the gaps and ensure adequate nutrition of infants in South Africa will contribute towards achieving the 2030 Sustainable Development Goals^[4], in particular Goal 2 and 3 (Zero hunger and improved health and wellbeing).

When considering priorities in child nutrition in South Africa, the 2019 South African Child Gauge Report called for increased exclusive breastfeeding, as well as improved complementary feeding practices to help reduce stunting levels in children. One of the actions being called for in the Report is disaggregated child-centred data to target support and track progress being made in child health. The SADC (Southern African Development Community) Food and

Nutrition Security Strategy (2015-2025)^[5] also calls for more frequent data collection and reporting on complementary feeding. Local specific data on infant feeding practices, such as the data collected in this study, is part of the reaction to these calls. This effort will increase evidence on current infant feeding practices, identify gaps, and assist the government and other stakeholders in deciding on nutrition interventions and in measuring progress being made in child nutrition.

According to UNICEF (United Nations International Children's Emergency Fund)^[6], complementary foods are defined as the solid, semi-solid and soft foods provided to children between the ages of 6 and 23 months to complement breastmilk (or other milk received by the infant). This period is known as the complementary feeding period, and is regarded as one of the most challenging periods in which to meet nutrient needs^[6]. UNICEF also refers to food system related drivers in their 2020 Programming Guide on Improving Young Children's Diets During the Complementary Feeding Period^[6]: the behaviour of caregivers, their knowledge, their beliefs and the influence exerted on them by others, are important considerations in the set of food system related drivers that impact on complementary feeding. This study will describe current complementary feeding behaviours in the selected community, and also seek to understand what influences the infant feeding practices of mothers and caregivers.

Objectives of this study

1. To review the current complementary feeding practices in South Africa (see Chapter 1).
2. To describe and assess the infant feeding practices of 6-11 month-old infants attending the well-baby clinic at the Paediatric Out-patients Department at the KwaMashu Community Health Centre in KwaZulu-Natal, South Africa (see Chapter 2).
3. To use Optifoods software to ascertain if these infant nutrient requirements can be met with a food-based approach with the foods commonly used for infant feeding, as well as to identify the nutrients that are difficult to achieve adequate intakes of (see Chapter 3).
4. To describe the main influences on mothers' complementary feeding decisions (see Chapter 4).

The outcomes of this study have direct relevance to nutrition communication on complementary feeding and will provide guidance on other actions needed to improve nutrient intakes of infants* in KwaMashu, KwaZulu-Natal, South Africa. (*An infant refers to a child younger than 12 months of age.) This study will also provide evidence if a continued food-based focus and nutrition education for mothers should continue as it currently does, or if revisions and other actions should be considered.

Outline of this thesis

This first introductory chapter gives the context and justification of the study and the main objectives of the PhD study. This thesis consists of 4 papers as described below. The first paper has been published^[7] and the published version is included in this thesis. References for each paper are included at the end of the relevant chapters. The subheadings used in, and the word count of each of the 3 unpublished papers, were drafted based on guidelines for the journal they will be submitted to. For consistency, the same referencing style has been used throughout this thesis.

The four papers are:

Chapter 1

- Paper 1 (published): “A review of complementary feeding practices in South Africa”

Chapter 2

- Paper 2: “An assessment of infant feeding practices using infant and young child feeding indicators: a descriptive cross-sectional study from KwaMashu, KwaZulu-Natal, South Africa”

Chapter 3

- Paper 3: “The use of linear programming to determine whether breastfed infants can achieve a nutritionally adequate complementary feeding diet: a case study of 6-11 month-old infants from KwaMashu, KwaZulu-Natal, South Africa”

Chapter 4

- Paper 4: “Grandmothers are strong influencers of complementary feeding decisions of mothers from KwaMashu, KwaZulu-Natal, South Africa: results from a pilot exploration”

The thesis concludes with a section including a summary, conclusions, limitations and recommendations. The Appendices include all other relevant documentation pertaining to research that was conducted:

- Appendix 1: Ethics approval letter
- Appendix 2: Approval from KwaZulu-Natal Department of Health
- Appendix 3: Information leaflet and consent forms
- Appendix 4: Eligibility screening form
- Appendix 5: Interview forms
- Appendix 6: Focus group discussion guide

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Chapter 1 - A review of complementary feeding practices in South Africa

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Abstract

Introduction: Infant health and nutrition in South Africa are a priority, as evidenced by the political commitment and policy development history of the last 25 years. Current efforts focus on improving breastfeeding rates, but the action plan for complementary feeding gets less attention and resourcing. A thorough analysis of the current infant feeding situation is required to assist with policy and targeted programmes associated with complementary feeding.

Aim: The aim of this review was to identify and collate all published research in South Africa on the complementary feeding practices of infants and young children, aged 0 – 24 months.

Methodology: Searches included English-language research published between 2006 and 2017, within PubMed, Scopus, Web of Science, and Google Scholar. All papers included in the review had to meet defined eligibility criteria. Papers older than 11 years were excluded. In total 34 papers relevant to South Africa were identified and included in this review.

Main findings: Early introduction of foods and liquids other than breastmilk is a common practice. Maize porridge is a common first food for infants, but there is also a high reliance on commercial infant cereal. Water and other liquids (e.g. tea, herbal mixtures) are commonly given to infants younger than 6 months. There is little information on the number of meals per day. The diets of many older infants do not meet the criteria for a minimally acceptable diet. Few animal-source foods are used in complementary feeding. There are indications that processed meats, soft drinks, sweets and salty crisps are given regularly to older infants between 6 months and 1 year.

Conclusion: Complementary feeding practices in South Africa are suboptimal and appropriate action is needed to improve this situation. Further investigation is needed on whether older infants and young children can achieve their required dietary intakes from the food that is available to them. If a change in older infant and young child feeding behaviour is desired, then existing methods and approaches need to change.

Keywords: complementary feeding, IYCF, infant nutrition, weaning, South Africa

Infant and young child feeding in South Africa

Infant health and nutrition in South Africa are a priority, as evidenced by the political commitment and policy development history of the last 25 years (Table 1). The 2016 South African Demographic and Health Survey^[1] indicated improved exclusive breastfeeding (EBF) to a level of 32% in infants younger than 6 months. However, in the same report, the rates of stunting for infants below the age of six months (32.3%) and for children younger than 5 years (27%), show that there is a need to improve older infant and young child nutrition through addressing complementary feeding practices in South Africa.

Table 1: Selected strategies of the South African government to improve infant and young child nutrition^[2]

Year:	Action:
1990, revised 2005	Innocenti declaration signed
1994, revised 2007	BFHI (Baby Friendly Hospital Initiative) Renamed to MBFI (Mother Baby Friendly Initiative)
2007, revised 2013	IYCF (Infant and young child feeding) policy
2011	Tshwane declaration of support for breastfeeding by Minister of Health
2012	Regulations relating to Foodstuffs for Infants and Young Children
2012	Maternal New-born, Child and Women's health and Nutrition strategy
2012	Roadmap for Nutrition in South Africa

In 2003, Piwoz *et al*^[3] suggested that globally, complementary feeding has not received adequate attention with regards to infant and young child feeding. Oftentimes, complementary

feeding was not sufficiently addressed and the main objective has been the promotion, protection and support of breastfeeding. Similarly, in South Africa, the importance of complementary feeding during older infancy and young childhood (6-36 months) has not received adequate attention amongst the various stakeholders and research institutions.

Bhutta *et al*^[4] assessed various interventions and modelled how many lives could be saved if these interventions were implemented. This was done for the 34 countries in which 90% of the world's children with reported stunting are to be found. Following management of severe acute malnutrition (SAM), preventative zinc supplementation in infants and children, and promotion of breastfeeding, complementary feeding interventions (scaled up to 90% coverage), are estimated to have the fourth largest impact on deaths averted from 10 interventions that were assessed. Furthermore, a focus on IYCF is second to management of malnutrition in terms of numbers of lives saved^[4]. A South African assessment of lives saved only attributed 117 lives saved to appropriate complementary feeding, but this assessment only assumed coverage of complementary feeding education scaled up from 10% to 20%, and that complementary feeding education and provision of supplementation was scaled up from 5% to 15%^[5].

Older infants from 6 months are most vulnerable to malnutrition and growth faltering during the transition period from a milk diet to a diet that includes complementary food^[6]. There may also be consequences to the late introduction of complementary foods, for example, the late introduction of complementary foods may also affect adult obesity^[7] and predispose the infant to obesity later on.

In 2014, the Department of Health/ Department of Social Development/ Department of Performance Monitoring and Evaluation (DOH/DSD/DPME) evaluation report^[8] highlighted the need to change the focus across sectors from current practices to nutrition promotion, exclusive breastfeeding, complementary feeding, dietary diversity, and hygiene education. In assessing high impact nutrition interventions, complementary feeding was singled out as the only one that was not prioritized and received a low (red) implementation score of 37.5%^[8].

South Africa has excellent policies in place and political commitment to improve infant health and nutrition, but the action plan for complementary feeding gets less attention and resourcing when compared to breastfeeding efforts. To the authors knowledge, national food consumption surveys have not been conducted in South Africa on older infants between 6 months and 1 year, and there are no comprehensive literature reviews on complementary feeding practices during this critical life stage. A thorough analysis of the current complementary feeding situation is needed to facilitate policy and programme decisions.

Aim of this review

The aim of this review was to identify and collate all research that has been published in South Africa on the complementary feeding practices of infants, aged 0–24 months. Information on breastfeeding, age of introduction of other foods/liquids, the types of foods/liquids consumed, dietary diversity/adequacy and feeding frequency were investigated. It is anticipated that this review will provide more information regarding the complementary feeding practices in South Africa and encourage decision makers to prioritise programmatic and research action on complementary feeding initiatives in South Africa.

Methodology

Electronic databases were searched using selected keywords in the following four search engines: PubMed, Scopus, Web of Science and Google Scholar.

The search terms used were:

- “Complementary feeding South Africa”
- “Complementary food South Africa”
- “Infant feeding South Africa”
- “Infant food South Africa”
- “Infant nutrition South Africa”
- “Weaning South Africa”
- “Weaning food South Africa”
- “IYCF South Africa”
- “Infant and young child feeding South Africa”

- “Breastfeeding South Africa”
- “Formula feeding South Africa”

To ensure more recent information on complementary feeding practices, articles older than 11 years (published before 2006) were excluded. However, two older articles (from 2005) were included as they were frequently cited in other articles. Studies on breastfeeding alone were also included, as they added valuable information to create a more comprehensive picture. One study was excluded because it included a sample of preschool children. All articles included in this review were read by the first author and their inclusion was confirmed by the second author. A total number of 34 articles were included in this review.

Results

The published research mainly comprised cross-sectional studies with varying sample sizes, and varying sites of data collection across South Africa. Two national surveys (2016 SADHS^[1] and the 2012 SANHANES^[9]) were included. The supplementary table, provides additional information pertaining to the details of each of the studies included in the review such as sample size, description, where the study was undertaken and type of study. (Supplemental data for this article can be accessed at <http://dx.doi.org/10.1080/16070658.2018.1510251>).

Data from all the articles included was collected using standardised questionnaires. There were three qualitative studies^[10-12]. In the articles included in the review, breastfeeding estimates were made by asking about the current situation and by recall of past behaviour, and complementary feeding practices were obtained by the food frequency^[13-17], 24-hour^[14, 16-23] and 7- day recall of foods. Four studies^[1, 13, 24, 25] used the WHO IYCF indicators^[26].

The public health implications of infant feeding during HIV, and the research funding available for HIV research has undoubtedly led to an increase in the number of studies on IYCF that have been conducted. This is evidenced by the high number of HIV/PMTCT infant and young child feeding studies included in this review (n = 14 articles)^[11, 20, 22, 23, 25, 27-35]. However, the results on breastfeeding practices found by this review needs to be interpreted against the

existing policy background and the changes made in HIV and infant feeding guidelines in South Africa. The practice of giving free formula might have influenced more mothers to choose to formula feed and might have made formula feeding more acceptable in communities.

Key findings of this review are shown in Table 2.

Table 2: Key findings of review of the complementary feeding practices in South Africa

<i>Criteria</i>	<i>Finding</i>
1) Initiation of breastfeeding	<p>Nine (9) studies indicated that breastfeeding initiation rates were high in South Africa, ranging from 75% to 100%^[13, 16-18, 21, 23, 24, 32, 36].</p> <p>One national survey indicated 83% breastfeeding initiation^[9].</p> <p>One study indicated 51.1% breastfeeding initiation in the first hour, which increased to 85.2% by 24 hours^[28].</p> <p>Another study indicated 42% breastfeeding initiation in the HIV positive group but 97% in the HIV negative group^[23].</p> <p>Pre-lacteal feeds were being given and colostrum was not given by some mothers (3 studies)^[19, 28, 32].</p>
2) Exclusive breastfeeding	<p>Results for exclusive breastfeeding were mixed - but overall exclusive breastfeeding practices were suboptimal.</p> <p>National studies reported 7.4%, and more recently 32%, of children younger than 6 months were exclusively breastfed^[1, 9].</p> <p>Other studies:</p> <ul style="list-style-type: none"> - <1% were exclusively breastfed up to 6 months^[17] - <1% were exclusively breastfed at 24 weeks^[22] - 6% of <1 month–5 month-olds were exclusively breastfed^[36] - 7.6% of <12 month-olds were exclusively breastfed^[37]

Criteria	Finding
	<ul style="list-style-type: none"> - 12% were exclusively breastfed for 6 months^[21] - 13% were exclusively breastfed for 6 months^[13] - 18% were exclusively breastfed at 14 weeks^[32] - 27% of 0-10 month-olds were exclusively breastfed ^[33] - 29.5% were exclusively breastfed at 30 days^[19] - 35.6% of 3-6 month-olds were exclusively breastfed ^[31] - 36.5% were exclusively breastfed >3 months^[38] - 38.5% of < 6 month-olds were exclusively breastfed ^[24] - 40% of HIV positive and 45% of HIV negative mothers exclusively breastfed for 6 months^[34] - 52% were not exclusively breastfed beyond 2 months^[15] - 61.8% were exclusively breastfed in HIV infected mothers and 72.6% were exclusively breastfed in HIV uninfected mothers at 3-4 months^[29] <p>Three studies reported that there was no exclusive breastfeeding in the surveyed community^[12, 16, 30].</p> <p>The duration of exclusive breastfeeding reported in studies was not standardised and this makes it difficult to draw any conclusions about this aspect of IYCF.</p>
3) Continued breastfeeding	<p>One study reported that 31% of mothers had stopped breastfeeding before 24 weeks^[27].</p> <p>In studies that reported breastfeeding for longer than 6 months:</p> <ul style="list-style-type: none"> - 80% of 6-12 month-old infants were being breastfed,^[16] - 58% were still being breastfed at 12 months,^[13] and - 14.4% of 6-24 month-olds were still being breastfed^[14].
4) Age of introduction of	<p>There was significant evidence of the early introduction of foods/drinks other than breastmilk/other milk.</p>

Criteria	Finding
complementary foods	<p>In the first month:</p> <ul style="list-style-type: none"> - 2.6% had completely stopped breastfeeding,^[19] - between 17%^[21]- 32%^[12] had been introduced to food, and - 66.8% of HIV positive women who did not breastfeed, gave water and other foods from 3 weeks^[30]. <p>Ninety-one percent (91%) had food introduced by 7 weeks:^[39]</p> <ul style="list-style-type: none"> - 73% had food introduced by 14 weeks,^[32] - 72.7% of mothers gave food/liquids by 12 weeks,^[18] - about a third gave food/liquids before 3 months,^[36] - 43.2% at 3 months, 15% before 3 months,^[37] - half by 3 months,^[40] - solid food or formula introduced within 3 months,^[41] - 19% before 4 months,^[13] - 61% before 4 months, 87% before 6 months,^[17] and - 84.6% had introduced food before 6 months^[38]. - Age of introduction of solid foods was 3.5 months in rural and 4.2 months in urban areas^[14].
5) Types of foods used in complementary feeding	<p>Cereal based foods were the most popular type of complementary food (13 studies) – specifically maize meal porridge (sometimes described as soft and thin), and commercial infant cereal^{[13], [21], [36], [17], [19], [37], [15], [12], [10], [14], [20], [39], [41]}.</p>
6) Use of water and other non-milk liquids	<p>Water was commonly given to infants before 6 months (10 studies)^[1, 11, 12, 15, 19, 20, 30, 32, 36, 39].</p> <p>Black tea, rooibos tea, sugar water, traditional herb mixtures, gripe water, antacid preparations and ijuba (a sorghum beer) were also given to children from birth^[11, 12, 14, 19, 20, 36].</p>

<i>Criteria</i>	<i>Finding</i>
7) Foods of concern	Processed meats, soft drinks, sweets and salty crisps were some of the foods being given to older infants and young children, that are cause for concern ^[13, 14, 17] .
8) Meal frequency	<p>Only four studies reported on the total number of feeds per day:</p> <ul style="list-style-type: none"> - Food was given between 2 and 6 times to infants aged 8 weeks or younger^[39]. - Fifty-nine percent (59%) of 0-12 month-olds had 3 meals a day, and 38% had food twice during the day^[37]. - Seventy-one percent (71%) of 6-23 month-olds received food the recommended minimum number of times or more^[24]. (The recommended minimum number of times being 2 times for breastfed infants 6–8 months, 3 times for breastfed children 9–23 months, and 4 times for non-breastfed children 6–23 months)^[26]. - Fifty-four percent (54%) of 6-24 month-olds received 3 meals a day and 76% had one snack a day^[38].
9) Dietary diversity* *Dietary diversity: the number of items consumed from different food groups.	<p>The number of older infants and young children who consumed food from 4 or more food groups were:</p> <ul style="list-style-type: none"> - 5% at 6 months, 24% at 9 months, 75% at 12 months,^[13] - 44% of 6-23 month-olds,^[24] and - less than 25% of 6-24 month-olds^[14]. <p>One study reported that only one infant aged 6 months and younger met the criterion for minimum dietary diversity^[21].</p> <p>There is some evidence of dietary diversity increasing as the infant gets older. This was found in two studies, one with a 6-12 month-old group and another with a 6-24 month-old group of older infants and young children^[13, 35].</p>

<i>Criteria</i>	<i>Finding</i>
	<p>It was reported that for urban areas in KwaZulu-Natal chicken consumption in older infants and young children (6-24 month-olds) was 18.5%, meat 14.8% and eggs 46,3% in the previous 7 days (in rural areas this was 38.6%; 18.5%; and 42.6% respectively)^[14]. One study reported that no infant aged 6 months and younger received meat, poultry, egg or fish^[21].</p>
10) Minimum acceptable diets	<p>The number of older infants and young children reportedly meeting the criteria for a minimally acceptable diet varied.</p> <p>In the recent South African Demographic and Health Survey, only 15% of 6-8 month-olds and 15% of 9-11 month-olds were found to have met the criteria for a minimally acceptable diet^[1].</p> <p>Another study reported that 44.4% of 0-23 month-olds met the criteria for a minimally acceptable diet^[24].</p>

<i>Criteria</i>	<i>Finding</i>
11) Reasons for introducing solid foods	<ul style="list-style-type: none"> - Breastmilk was not enough^[12]. - Told by friends / relatives; babies hungry; babies not sleeping^[37]. - Advised by family members; to keep baby full and help baby sleep at night^[42]. - Solid food introduction was the mothers' own decision but grandmothers (33%) and nurses (6%) were also named as sources of advice^[32]. - The main reason for starting solids was that the baby was still hungry after getting milk (73%)^[32]. - A crying baby and one that did not sleep well at night^[43]. - Thirty percent (30%) said breastmilk alone was insufficient, while returning to work (23%) and that the infant was thirsty (19%) were the other main reasons^[21]. - Insufficient milk production (14%), returning to studies (11%) and advice of a family member (10%) were also cited^[21].
12) Home-made versus commercial food choice	<ul style="list-style-type: none"> - Thirty-five percent (35%) of caregivers said special baby foods are better than ordinary foods^[17].
13) Knowledge relating to or about complementary feeding	<ul style="list-style-type: none"> - Eighty-two percent (82%) of caregivers said that solid foods should be introduced at 4-6 months^[17]. - The majority of mothers (76%) said they had not been told about foods to give their older infants and young children^[37]. - Fifty-nine percent (59%) said that 3 months was the recommended age to introduce solid foods, 13% said 2 months^[40].

Discussion

The recent South African Demographic and Health Survey^[1] results showed an increase in stunting in older infants and young children between eight and 23 months. This is the time

when a child is introduced to and gradually makes the transition to the family diet, clearly indicating a problem with the complementary feeding practices. While it is imperative to continue investing in breastfeeding, it is also important to realise that complementary feeding practices are also suboptimal. It is clear from this review that actions to improve complementary feeding practices are urgently needed.

Lutter *et al*^[44] proposed 3 broad interventions to improve complementary feeding: 1) counselling of mothers and social and behaviour change communication, 2) helping families overcome barriers to feed their children appropriate complementary foods, and 3) making the best of promoting local foods to reduce the dependence on aid or purchased foods. Local cultural and traditional practices in South Africa also affect complementary feeding practices. This review did not find much information on this topic, and more research is needed to understand how cultural/traditional practices influence complementary feeding.

Sanghvi *et al*^[45] shared knowledge that had been gained from Alive & Thrive efforts to improve infant feeding in Bangladesh. These authors emphasise that advocacy, community mobilisation, mass communication, and strategic use of data are necessary for optimal complementary feeding efforts to succeed.

The causes of stunting are multi-factorial and concerted efforts on all fronts are needed to combat stunting. Stewart *et al*^[46] proposed an expanded conceptual framework for stunted growth and development with causes grouped as: household and family factors, inadequate complementary feeding, inadequate breastfeeding and infection, within a context of broader community and societal factors. The 2016 SANHANES-1 study^[9] showed that at a national level only 45.6% of the population were food secure, with 28.3% at risk of hunger, and 26.0% experienced hunger (classified as food insecure). The SANHANES-1 also found the national mean Dietary Diversity Score was 4.2 (the cut-off for dietary adequacy being 4). The complementary feeding diet is reflective of a lack of diversity present in the adult diet and the struggle of dealing with food insecurity.

In 2015, Lartey^[47] discussed stunting prevention in sub-Saharan Africa, and emphasised the important role of education for girls, improved socio-economic situations, provision of water, sanitation and hygiene, and integrated actions across health-education-agriculture and social protection. Supporting mothers to follow older infant and young child feeding guidelines they have learned is also important: whether this is breastfeeding support or making nutrient dense or fortified foods more accessible, affordable and appealing^[47]. Breastfeeding support would enable mothers to breastfeed for longer and not introduce foods too early. Making the appropriate foods more accessible, affordable and appealing would mean that mothers are more likely to use them for complementary feeding.

It is beyond the scope of this review to critically assess the various interventions that could be employed to improve complementary feeding in South Africa, but the findings of this review merit discussion on possible ways forward. Consideration is warranted in two specific areas: (1) the older infant and young child feeding messages, and (2) actions beyond training and nutrition education.

1) The older infant and young child feeding messages:

Investing in nutrition education efforts aimed at healthcare workers and mothers in South Africa by providing evidence-based and best practice messages on older infant and young child feeding is important.

- Training of health care workers to improve counselling of mothers: Globally, it has been seen that health care workers do not use the contact they have with mothers to convey evidence-based and best practice older infant and young child feeding messages^[44]. This is also true in South Africa, where identification of malnutrition and appropriate older infant and young child feeding counselling implementation could still be strengthened in the South African health care system^[48]. Current training needs to be critically assessed and the barriers to health worker implementation investigated and addressed.
- The message emphasis: The information that is given to mothers about older infant and young child feeding practices needs to be reconsidered.

- One specific problem which was highlighted is that only the exclusivity of breastfeeding and not the duration is emphasised in South African older infant and young child feeding policy communication^[27].
 - Furthermore “exclusive” breastfeeding may be interpreted as “not mixing 2 milks” and does not include information about the early introduction (i.e. before 6 months) of other liquids and food^[43].
 - Crocetti *et al*^[49] propose that pre-emptive advice given early and consistently may help influence behaviour and prevent early introduction of solids. Parents also need to be taught to understand older infant and young child cues, e.g. sleepiness and dealing with babies who have different characters/personalities, in addition to when and what to feed.
 - Critical aspects of the complementary feeding messages include how often to feed, how to prepare and make best use of foods available to the household, nutrient density, consistency of meal prepared, giving of water, teas, juices and snacks, and responsive feeding^[50].
 - Related practices like hand washing before food preparation also need to be included^[44].
- The receiver of the message: Although the mother is targeted with older infant and young child feeding information, she may not be the only one making the decisions^[42]. Mothers function in a broader socio-cultural context and influences from the community (their friends and family, even the media), as well as the health care system, need to be considered^[43]. Communication of older infant and young child feeding messages needs to extend beyond just the mother or caregiver if an impact on optimal older infant and young child feeding is to be achieved. The attitudes and advice of the father, grandmothers, and creche owners would also influence feeding.

2) Other nutrition interventions that need consideration:

Funding and strategy play a major role in the available nutrition interventions. Piwoz *et al*^[3] creatively suggests a “Ten steps approach to complementary feeding” – similar to the 10 steps of the baby friendly hospital initiative. Complementary feeding interventions should consider linking with the Mother Baby Friendly Initiative (MBFI) in South Africa since it is well established and understood by many South African health care workers. The use of multiple

micronutrient powders for home fortification of complementary foods is also a venture with promising returns. Research has indicated that it is feasible and well accepted by caregivers^[41]. This intervention has the added advantage of providing an opportunity for the health care worker to talk about feeding. Another opportunity that cannot be ignored is partnership with other stakeholders: these could be partnerships with creative marketing agencies to assist with behaviour change campaigns or partnerships with the food industry to provide affordable and appropriate complementary foods that are appropriately promoted. Improving complementary feeding is not just the domain of nutrition and health professionals.

There is an emerging discipline of conducting opinion leader research to inform strategy and evidence-based advocacy ^[51]. In consideration of action to improve complementary feeding practices in South Africa, perhaps opinion leader research is one of the first actions that need to take place, as it may identify opportunities to strengthen current activities and new actions that may be considered by the government.

Conclusion

In summary, the key findings of this review are that:

1. Breastfeeding initiation rates range from 75% to 100%.
2. Exclusive breastfeeding up to six months is not a common practice.
3. Continued breastfeeding after 6 months varies.
4. Early introduction of foods and liquids other than breastmilk is widespread.
5. Maize porridge is a common first food for infants, but there is also a high reliance on commercial infant cereal.
6. Water and other liquids (e.g. tea, herbal mixtures) are commonly given to infants younger than 6 months.
7. There are indications that processed meats, soft drinks, sweets and salty crisps are being given regularly to children between 6 months and 1 year.
8. There is little information available about the number of meals per day that older infants and young children receive.
9. Dietary diversity is poor in many older infants and young children, and the use of animal-source foods appears to be low.

10. The diets of many older infants and young children do not meet the criteria for a minimally acceptable diet.
11. Mothers have varying knowledge, and there are a variety of influencers and reasons for introducing complementary foods.

From the information gathered from the 34 studies, which included 2 national surveys, it can be concluded that complementary feeding practices in South Africa are suboptimal and appropriate action is needed to improve this situation. Policy makers and implementers need to be sure that it is indeed worthwhile to invest in behaviour change and education in a resource limited setting. They need the evidence that a continued emphasis on a food-based approach is the right action to improve the complementary feeding situation. An investigation into whether older infants and young children can achieve their required dietary intakes from the food that is available to them, in an affordable manner, would be a good first step. Nutrition modelling software can be helpful to assess if older infant and young child nutrient needs can be met with foods commonly available, and to test specific food-based recommendations.

If a change in older infant and young child feeding behaviour is desired, then existing methods and approaches need to change: a paradigm shift is required – changes in infant feeding behaviour are not just about education and information given to mothers but must also include support for the desired behaviour change. There are a host of internal and external enablers and barriers to change, but there is little information and even less understanding of the many factors that impact a mother's complementary feeding decisions in South Africa. Whichever strategy and actions are pursued to improve complementary feeding practices, they need to be supported by research which takes into account current challenges, and ensures that the action can be scalable and sustainable.

Conflicts of interest/Disclosure statement

No potential conflict of interest was reported by the authors.

Author contributions

The first author is a PhD student and the second author is the PhD supervisor. The first author conceptualised and designed the study, led the data collection, performed the data analysis and drafted the manuscript. The second author gave input into the study, checked all results and edited the manuscript. Both authors reviewed and approved the manuscript for submission.

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Chapter 2 - An assessment of infant feeding practices using infant and young child feeding indicators: a descriptive cross-sectional study from KwaMashu, KwaZulu-Natal, South Africa

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Abstract

Background: Despite updated infant feeding policies in South Africa, poor infant feeding practices still persist and are acknowledged as a contributory factor to stunting in children. Disaggregated local data on infant feeding practices is required to better inform decision makers on the current infant feeding situation before interventions can be considered.

Objective: The objectives of this study were to determine the infant feeding practices of 6-11 month-old infants attending the well-baby clinic at KwaMashu Community Health Centre, in KwaMashu, South Africa. KwaMashu is a peri-urban area about 12 km outside the city of Durban on the east coast of South Africa.

Methods: Mothers and caregivers were interviewed by trained interviewers. Details on their sociodemographic characteristics and feeding patterns were collected using a questionnaire.

Results: One hundred and thirty-four interviews were completed with mothers/caregivers. 80.6% of infants were breastfed, with 63.5% of mothers/caregivers reporting breastfeeding initiation in the first hour after birth. Only 25.4% of mothers/caregivers reported exclusively breastfeeding to the age of 6 months. Almost a third of infants (30.6%) had started solid foods before 3 months of age. Cereals were the main first foods given, with 56.7% of caregivers preparing foods at home and 43.3% using commercial foods as first foods. At the time of data collection, 36.6% of the 6-11 month-old infants were breastfeeding, 47.0% were formula feeding and 16.4% received mixed feeding. Soft maize meal porridge and commercial infant cereals were the most popular foods consumed daily. Close to two-thirds of infants (64.9%) had at least one meat food group item and just over two-thirds of infants (68.7%) had eaten eggs in the previous 7 days. It is concerning that just over half of the infants (52.2%) were getting biscuits, two-thirds (66.4%) ate chips, and close to a third (32.8%) consumed sweets or chocolates.

Conclusion: There are many issues associated with the complementary feeding diets of infants that need attention. In conjunction with the necessary increased efforts to support breastfeeding in South Africa, increased attention to the improvement of complementary feeding practices is warranted.

Keywords: complementary feeding, IYCF, infant feeding, infant nutrition, South Africa

Background

Stunting affects 21.3% of children under 5 globally and disadvantages children from reaching their potential and contributing to society^[1]. South Africa is not spared from this and also experiences high stunting levels in children. The South African Demographic and Health Survey^[2] showed that 77% of 6-24 month-old children did not receive a minimally acceptable diet and also showed an increase in stunting between eight and 23 months ranging from 2% to 20%. This time-period coincides with the stage when a child is being introduced to and gradually makes the transition to the family diet. This is indicative of a potential problem with complementary feeding practices as a contributory factor to the stunting problem.

A 2018 review of complementary feeding practices in South Africa^[3] found evidence of suboptimal feeding practices. South Africa has policies in place to support optimal infant feeding but despite this, poor infant feeding persists. The 2019 South African Child Gauge Report^[4] called for increased exclusive breastfeeding, as well as improved complementary feeding practices to help reduce stunting levels in children, and requested disaggregated child-centred data to target support and track progress being made in child health. Disaggregated local data on infant feeding practices, such as that collected in this study, is necessary to better inform decision makers on the situation before interventions can be considered.

Objective

The objective of this study was to determine the sociodemographic characteristics and infant feeding practices of mothers/caregivers of 6-11 month-old infants attending a well-baby clinic in KwaMashu, KwaZulu-Natal, South Africa.

Methods

Study site and permission

The study was conducted at the KwaMashu Community Health Centre. This site was purposively selected after discussion with the Ethekewini Municipality district dietitians. KwaMashu is a peri-urban area about 12 km outside the city of Durban on the east coast of

South Africa^[5]. According to StatsSA^[5], KwaMashu has 175 663 residents and 50 683 households, with 38% of households being female-headed, and 77.3% of houses classified as formal dwellings. The majority of households have electricity for cooking (95.9%) and flush toilets connected to a sewer system (75.9%). The KwaMashu Community Health Centre (CHC) is a referral site for 6 clinics and has a catchment population of about 750 000^[6]. The CHC treats around 169 000 patients a year, of which about 9 500 patients are younger than 5 years of age (Personal communication 2018). Ethics approval for this study was obtained from the University of Pretoria Faculty of Natural and Agricultural Sciences Ethics Committee (reference number 180000016). Permission was also granted by the KwaZulu-Natal Health Research Ethics Committee (reference number: KZ_201809_018).

Study design and sampling

The study was a cross-sectional survey with data collected using questionnaires developed specifically for this study for sociodemographic and dietary information. Sampling was convenient based on those available and willing to participate on the days of data collection. A research assistant, familiar with Zulu, the local language, approached mothers and primary caregivers at random times and addressed them in groups to explain the purpose of the study. The mothers and primary caregivers who agreed to participate were subsequently screened for eligibility (according to the inclusion and exclusion criteria listed below), and were then taken to the data collection site nearby to sign the informed consent forms and participate in the interviews. This process was repeated each day until the end of the data collection period. A sample size of 130 was aimed for. This translates to 50% of all infants (under 12 months of age) who attend the KMCHC each month (assuming that a maximum of one third of under-5 years-olds who come to KMCHC are under the age of 1, i.e. 33% of 9 500 under-5 year-olds = $3135 / 12 = 261$ infants each month) (Personal communication 2018).

Study participants

All mothers and primary caregivers of older infants (6-11 months) attending the well-baby clinic at KwaMashu CHC were invited to participate in the study.

Inclusion criteria were:

- that the mother had resided in the area before giving birth,
- that the infant was aged 6 to 11 months at the time of the study (must have reached the age of 6 months-old already and be younger than 12 months-old),
- that the infant had no current known illness affecting his/her food intake, and
- the infant had started receiving food at least in the last 2 weeks.

Exclusion criteria were:

- a mother younger than 18 years and older than 45 years,
- if the caregiver had not known the infant since birth,
- if the caregiver did not live in the same household as the infant,
- if the caregiver did not participate in the feeding of the infant,
- infants younger than 6 months and young children of 12 months and older,
- an infant with an existing illness or illness in the previous week (diarrhoea, cough, fever),
- if the infant was classified as underweight, wasted or stunted prior to this visit*.
- if the infant had received any nutritional supplements from the clinic/other clinic for use at home*, and
- if the infant had ever been hospitalised*.

The last 3 exclusion criteria(*) were included to ensure that possible intense nutrition intervention received, such as therapeutic foods to improve the diet and counselling by a hospital dietitian, did not influence the reported food intake. In addition, these therapeutic foods would not have been available to all households in the community to feed their infants. Both research assistants estimated that 2 or 3 respondents were excluded due to this criterion. It is likely that the sample still included underweight, wasted and stunted children as the records in the Road to Health booklet** was not verified. (**The Road to Health booklet is issued to all infants at birth in South Africa; it documents all their health information – including growth monitoring information such as height and weight at each clinic visit.)

Informed consent

All mothers and caregivers who agreed to participate in the study were informed about the objectives of the study and subsequently screened for their eligibility to participate in the study by the study assistant. They were given a short description of what the study was about, and asked to sign a written consent form (available in both English and Zulu).

Questionnaires

Interviews were conducted in Zulu by trained Zulu-speaking study assistants (both were university graduates in nutrition/dietetics). The questionnaires for data collection were developed in English specifically for this study, and translated into Zulu by a Zulu language primary school teacher. The questionnaire collected sociodemographic information and dietary information and included a 7-day quantified Food Frequency Recall. The Food Frequency Recall questionnaire was tested by student dietitians to check the timing and understanding. The infant dietary assessment in this study was guided largely by the infant and young child feeding^[7] indicators recommended by the World Health Organisation (WHO)^[7], and by the information that would be required for input into a nutritional modelling exercise as part of this study. It should be noted that the age group of this study sample was different to WHO age criteria for collection of IYCF (Infant and young Child Feeding) information (6-11 month-olds in this study vs. 0-23 or 6-23 month-olds in the WHO indicators), and that this study did not enquire about previous day feeding behaviour and food intake (as stipulated in the WHO indicators), but enquired about food intake over the last 7 days. New guidance has been released on IYCF indicators^[8] and the results of this study are presented to incorporate some of the new suggestions such as including indicators for non-dairy animal-source food consumption, fruit and vegetable consumption, and foods of minimal intrinsic nutritional value. This new report^[8] is, however, not clear on the continued use of older indicators, but introductory remarks suggest ongoing discussion and consideration of using dietary diversity over the minimally acceptable diet indicator outlined in the 2008 IYCF indicator definition document. Dietary diversity is not reported in this article as the dietary diversity indicator is based on the previous day's intake and not intake over the previous 7 days. (Appendix 7 includes dietary intake information per food group.)

Interviews were conducted in an undercover ambulance shelter close to the well-baby clinic (see Figure 1). Visual aids purchased at a local supermarket were used to assist mothers and caregivers with the selection and quantification of foods consumed by the infant. These included: a set of plastic bowls, cups, tumblers, plates, baby bottles, baby feeding cups, measuring cups, measuring spoons, standard teaspoon, tablespoon, and serving spoons (see Figure 2). Dried uncooked couscous was used to assist in the estimation of quantities. Information on quantities consumed will not be reported in this article. A flipchart of food pictures was available to assist with the Food Frequency recall. The research assistants checked each questionnaire at the end of each day and tracked the ages of the infants interviewed. This data was double checked by the first author.



Figure 1: Area where interviews were conducted



Figure 2: Visual aids used to assist participant response

A token of thanks for the participants

Items relating to personal care to the maximum value of R30 (around 2 US dollars) were purchased as tokens of thanks. This value was selected so that something useful could be purchased without it becoming a motivator for the clinic attendees to participate. Participants were also given a Department of Health information pamphlet on feeding 6-11 month-old infants to take home on completion of their participation.

Data entry and statistical analysis

Data was entered in Microsoft Excel for analysis. The first author entered all data, double checked all the data entry, ran data checks and conducted the preliminary statistical analysis. All results were rechecked by the second author.

Results

The study was conducted from 29 October to 16 November 2018 and 134 interviews were completed. These included 120 or 89.6% of interviews with mothers, and 14 or 10.4% with caregivers (which included 7 aunts, 4 fathers and 3 grandmothers). The final sample of 134 included 68 6-8 month-old infants and 66 infants aged 9-11 months. There were 55.3% male

infants and 44.7% female infants in the sample. Table 1 indicates the main sociodemographic characteristics of the study sample.

Table 1: Sociodemographic characteristics of the study sample

	Number	Range	Percentage
Total number of respondents	134	-	100%
Mothers	120	-	89.6%
Caregivers	14	-	10.4%
Infants	134	-	100%
6-8 months	68	-	50.7%
9-11 months	66	-	49.3%
Infants	132*	-	
Male	73	-	55.3%
Female	59	-	44.7%
Mother			
Age in years – mean (<i>SD</i>)	27.2 (6.4)	18 – 44	-
Single	84	-	63.6%
Married	18	-	13.6%
Unmarried but living with partner	27	-	20.5%
Currently employed	35	-	26.5%
Currently a student	21	-	18.9%
Completed grade 12	71	-	54.2%
Training/education after school	19	-	14.5%
Maternity leave >16 weeks	96	-	72.2%
Recipient of child care support grant	100	-	74.6%
Household			
Monthly household income < R5000	76	-	57.1%
Monthly food expenditure in Rands - mean (<i>SD</i>)	1760 (745)	600 - 5000	-
Number of people in households – mean (<i>SD</i>)	5.5 (2.2)	2 – 15	-
Has home garden	37	-	27.6%

*2 missing gender information

Sociodemographic characteristics

The age of mothers ranged from 18 to 44 years of age (mean age of 27.2 years). Most mother were single (63.6%) or unmarried but living with their partner (20.5%). Just over half of the mothers (54.2%) had completed high school (grade 12) and 14.5% had some training/education after completing school. Only 35 mothers (26.5%) had some form of employment at the time of the study and 21 (18.9%) of the mothers were students. Maternity leave duration of more than 16 weeks was reported by 96 (72.2%) of mothers. One hundred of the mothers (74.6%) were recipients of the child care support grant.

Close to sixty percent (57.1%) of households had monthly incomes of less than R5 000 with an average reported household food expenditure of R1 760 (range R600 – R5 000). Household size ranged from 2 to 15 occupants (mean household size of 5.5). Thirty-seven (27.6%) households were growing some food for consumption. The types of foods grown (range 1 to 4 types of food grown) included: amadumbe (a starchy root vegetable also known as the African potato), beans, beetroot, butternut, brinjal, cabbage, carrot, mealies, onion, potato, pumpkin, spinach/green leafy vegetables, sweet potato and tomato.

Feeding patterns

Table 2 summarises the infant feeding practices according to various infant and young child feeding indicators. The WHO indicator description and the indicator description as used in this study are included for clarification.

Table 2: Infant feeding practices according to various infant and young child feeding indicators

Indicator	WHO IYCF indicator description^[7]	Information collected and reported on in this study	Number (percentage)
Infants who ever breastfed	<i>Proportion of children born in the last 24 months who were ever breastfed</i>	<i>Proportion of 6-11 month-old infants who ever received breastmilk</i>	108 (80.6%) were ever breastfed
Early initiation of breastfeeding	<i>Proportion of infants put to the breast in the first hour</i>	<i>Proportion of breastfed infants in which</i>	85 (78.7%) initiated breastfeeding in the first hour

Indicator	WHO IYCF indicator description^[7]	Information collected and reported on in this study	Number (percentage)
		<i>breastfeeding was initiated in the first hour</i>	
Exclusive breastfeeding under 6 months	<i>Proportion of 0-5 month-old infants who were being exclusively breastfed</i>	<i>Proportion of 6-11 month-old infants who were exclusively breastfed, who received mainly breastmilk, mainly formula milk or were mixed fed in the first 6 months</i>	<p>Exclusively breastfed: 34 (25.4%)</p> <p>Mainly breastmilk: 72 (53.7%)</p> <p>Mainly formula milk: 28 (20.9%)</p> <p>Mixed fed (breastmilk and formula milk): 34 (25.4%)</p>
Duration of breastfeeding	<i>Median duration of breastfeeding among children less than 36 months of age</i>	<i>The age when breastfeeding was stopped in the 6-11 month-old infant and the proportion of infants still continuing with breastfeeding</i>	<p>Continued breastfeeding: 71 (66% of ever breastfed infants)</p> <p>Stopped breastfeeding: 37 (34% of ever breastfed infants)</p> <p>Age when breastfeeding was stopped:</p> <p>In the first month - 9 (24.3%)</p> <p>2 months - 7 (18.9%)</p> <p>3 months - 4 (10.8%)</p> <p>5 months - 2 (5.4%)</p> <p>6 months - 13 (35.1%)</p> <p>7 months - 1 (2.7%)</p> <p>8 months - 1 (2.7%)</p>
Continued breastfeeding	<i>Proportion of children 12-15 month-olds who were being breastfed</i>	<i>Proportion of 6-11 month old infants who were receiving only breastmilk, only formula milk, or being mixed fed at the time of the study</i>	<p>Breastmilk only: 49 (36.5%)</p> <p>Formula milk only: 63 (47%)</p> <p>Breastmilk and formula milk: 22(16.4%)</p>
Milk feeding frequency for formula fed infants	<i>Proportion of non-breastfed children 6–23 months of age who receive at least 2 milk feedings</i>	<i>Proportion of non-breastfed 6-11 month old children receiving at least 2 milk feeds a day</i>	63 (100%) of all formula fed infants had at least 2 milk feeds a day
Introduction of complementary feeding	<i>Proportion of 6-8 month-old infants who received solid/semi-solid/soft food the day before</i>	<p><i>Proportion of 6-11 month old infants who received food the day before</i></p> <p><i>The age of introduction of complementary foods</i></p>	<p>134 (100%) received food the day before</p> <p>Age of introduction of complementary food: At or before 3 months:</p>

Indicator	WHO IYCF indicator description ^[7]	Information collected and reported on in this study	Number (percentage)
			41 (30.6%) At 4 – 5 months: 36 (26.9%) At 6 months: 53 (39.6%) At 7 months and older: 4 (3%)
First foods given as complementary foods		<i>The first food foods used for complementary feeding</i>	117 (87.3%) used a cereal as the first food 17 (12.7%) used a fruit or vegetable as the first food 76 (56.7%) used foods prepared at home 58 (43.3%) used a commercial infant food product
Minimum meal frequency	<i>Proportion of 6-23 month-olds who received food the minimum number of times: Minimum is defined as: 2 times for breastfed infants 6–8 months, 3 times for breastfed children 9–23 months, 4 times for non-breastfed children 6–23 months – (milk + food)</i>	<i>Proportion of 6-11 month old infants who received food the minimum number of times (reported separately for 6-8 month-old and 9-11 month-old breastfed and 6-11 month-old formula fed infants)</i>	6-8 month-old breastfed infants: 25 (100%) met minimal meal frequency 9-11 month-old breastfed infants: 18 (75%) met minimal meal frequency 6-11 month-old formula fed infants*: 61 (97%) met minimal meal frequency (*2 formula fed infants were missing meal frequency data)

Results of infant feeding practices as found in this study are described below according to each indicator.

1. Infants who ever breastfed:

One hundred and eight infants (80.6%) were ever breastfed.

2. Early initiation of breastfeeding:

Eighty-five (78.7%) of those who ever breastfed reported initiation of breastfeeding in the first hour after birth.

3. Exclusive breastfeeding under 6 months:

Seventy-two infants (53.7%) received mainly breastmilk for the first 6 months, 28 (20.9%) mainly formula milk and 34 (25.4%) were mixed fed for the first 6 months. Only 34 (25.4%) reported exclusive breastfeeding to the age of 6 months.

4. Duration of breastfeeding:

Just over a third (34.2% of ever breastfed infants) or 37 mothers had stopped breastfeeding, and just over half of them (20 or 54.1%) by 3 months. Close to two-thirds (71 or 65.7%) of the 6-11 month-old infants who were ever breastfed, were still receiving breastmilk at the time of the study.

5. Continued breastfeeding:

At the time of data collection, forty-nine (36.6%) of 6-11 month-old infants were still receiving breastmilk, 63 (47.0%) were receiving formula milk and 22 (16.4%) received mixed feeding (breastmilk and formula milk).

6. Milk feeding frequency for formula fed infants:

The mothers and caregivers of the 63 infants receiving formula milk at the time of the study, all reported a feeding frequency of 2 or more times a day. This ranged from 2 to 7 times a day in 6-8 month-old infants and 2 to 6 times a day in 9-11 month-old infants.

7. Introduction of complementary feeding:

Overall, food was introduced in 57.5% of infants before 6 months of age. The age of introduction of complementary foods was at or before 3 months for 30.6% (n = 41 infants), at 4 to 5 months for 26.9% (n = 36 infants), at 6 months for 39.6% (n = 53 infants) and at 7 months

and older for 3.0% (n = 4 infants). All 134 respondents reported giving their infants food the day before.

8. First foods given as complementary foods:

Cereal was the most popular first food consumed (87.3%) with the rest receiving vegetable or fruit (12.7%). Analysis of the type of first food showed that homemade foods (maize meal porridge, cooked potato/butternut/mixture) were slightly more popular than commercially purchased foods (commercial infant cereal, ready to eat fruit or vegetable baby food), i.e. 56.7% homemade food vs 43.3% using commercial products as the first food.

9. Minimum meal frequency:

All breastfed 6-8 month-old infants and 75.0% of breastfed 9-11 month-old infants met the requirements for minimum meal frequency (this was 2 times per day for breastfed infants 6–8 months, 3 times per day for breastfed children 9–23 months)^[7]. The majority (97%) of formula fed infants (6-11 months-old) also met the requirements for minimum meal frequency (this was assessed using the total number of milk feeds and times food was given in the day as >4)^[7].

10. Consumption of specific foods:

Table 3 indicates the consumption of specific food items, with the percentage response for each frequency of consumption and includes how many of the infants did not consume the food item. Consumption patterns are reported for “daily” consumption, “most days” (consumed on 4 or more days), “some days” (consumed 2 to 3 times per week), consumed “once”, and “not consumed” in the previous 7 days.

Table 3: The consumption of selected food items in the 7-day recall period for 6-11 month-old infants

	<i>Consumed daily</i>	<i>Consumed most days</i>	<i>Consumed some days</i>	<i>Consumed once</i>	<i>Not consumed</i>
<i>Soft maize meal porridge</i>	55.2%	11.2%	22.4%	2.2%	9.0%
<i>Commercial/shop bought infant cereal</i>	50.0%	12.7%	19.4%	6.0%	11.9%
<i>Potato</i>	3.0%	21.6%	44.8%	8.2%	22.4%
<i>Pasta/noodles</i>	2.2%	5.2%	10.4%	11.9%	70.1%
<i>Beans</i>	0.0%	2.2%	7.5%	14.2%	76.1%
<i>Peanut butter</i>	24.6%	6.7%	20.9%	2.2%	45.5%
<i>Cow's milk (fresh/long life)</i>	0.0%	0.0%	3.7%	2.2%	94.0%
<i>Maas</i>	0.7%	4.5%	12.7%	14.9%	67.2%
<i>Sweetened yogurt</i>	1.5%	7.5%	35.1%	20.9%	35.1%
<i>Meat</i>	0.0%	0.0%	2.2%	6.7%	91.0%
<i>Chicken</i>	0.0%	7.5%	20.9%	17.9%	53.7%
<i>Fish</i>	0.0%	3.0%	16.4%	14.9%	65.7%
<i>Liver</i>	0.0%	3.0%	11.2%	14.2%	71.6%
<i>Polony/vienna</i>	3.0%	3.7%	20.1%	15.7%	57.5%
<i>Boiled egg</i>	7.5%	8.2%	27.6%	11.9%	44.8%
<i>Fried egg</i>	1.5%	0.7%	6.0%	6.7%	85.1%
<i>Scrambled eggs</i>	0.7%	0.0%	0.7%	2.2%	96.3%
<i>Any other egg / portion</i>	2.2%	3.0%	5.2%	1.5%	88.1%
<i>Spinach/imifino (green leafy vegetables)</i>	0.7%	0.0%	8.2%	14.9%	76.1%
<i>Butternut</i>	7.5%	21.6%	41.8%	9.7%	19.4%
<i>Carrot</i>	1.5%	6.7%	13.4%	5.2%	73.1%
<i>Banana</i>	3.0%	9.0%	26.1%	25.4%	35.8%
<i>Apple</i>	1.5%	2.2%	14.9%	7.5%	73.9%
<i>Orange</i>	0.0%	6.0%	9.0%	19.4%	65.7%
<i>Fruit juice</i>	2.2%	4.5%	13.4%	6.7%	73.1%
<i>Other juice/cordial</i>	2.2%	0.7%	3.0%	2.2%	91.8%
<i>Carbonated sweetened beverage</i>	0.0%	0.0%	0.0%	1.5%	98.5%
<i>Tea (Black)</i>	0.0%	0.0%	3.7%	0.7%	95.5%
<i>Coffee</i>	0.0%	0.0%	0.0%	0.0%	100.0%
<i>Rooibos tea</i>	4.5%	3.7%	7.5%	8.2%	76.1%
<i>Sweets/chocolates</i>	2.2%	1.5%	12.7%	16.4%	67.2%
<i>Biscuits</i>	3.7%	3.0%	20.1%	25.4%	47.8%
<i>Chips/crisps</i>	2.2%	5.2%	27.6%	31.3%	33.6%
<i>Sugar</i>	30.6%	11.9%	10.4%	3.0%	44.0%
<i>Margarine</i>	29.1%	13.4%	18.7%	1.5%	37.3%

	<i>Consumed daily</i>	<i>Consumed most days</i>	<i>Consumed some days</i>	<i>Consumed once</i>	<i>Not consumed</i>
Water	47.8%	12.7%	16.4%	6.7%	16.4%

Table 4 indicates the foods and amount most frequently consumed by the infants:

Table 4: Foods consumed by at least 40% of the infants and the amounts most frequently consumed

	<i>Food item</i>	<i>Percentage of infants consuming the food item in past 7 days</i>	<i>Most frequent amount consumed</i>	<i>Percentage of infants consuming the most frequent amount</i>	<i>Minimum amount reported consumed</i>	<i>Maximum amount reported consumed</i>
1	Soft maize porridge	91%	200ml	69%	15ml	500ml
2	Commercial/shop bought infant cereal	88%	200ml	69%	20ml	600mls
3	Butternut	81%	200ml	51%	5ml	470ml
4	Potato	78%	200ml	44%	25ml	250ml
5	Chips/crisps	66%	1 small packet (14g)	74%	4 units	1 small packet (14g)
6	Sweetened yogurt	65%	1 small tub (100g)	79%	30ml	250ml
7	Banana	63%	1 small banana (or ½ banana) (25g)	53%	¼ banana (6g)	1 small banana (25g)
8	Hard margarine	63%	5ml	74%	2.5ml	15ml
9	Sugar	56%	5ml	65%	1ml	15ml
10	Boiled egg	55%	1 egg (50g)	95%	½ egg (25g)	2 eggs (100g)
11	Peanut butter	55%	5ml	67%	2.5ml	37.5ml
12	Biscuits	52%	1½ biscuits (9g)	83%	½ biscuit (3g)	4 biscuits (24g)
13	Chicken	46%	¼ cup (55g)	37%	1 tsp (4.4g)	½ cup (110g)
14	Polony/viennas	43%	1 vienna (42g)	70%	½ slice polony / ¼ vienna (10.5g)	1 thick slice polony/ 1 vienna (42g)

Cereals and starchy foods:

Soft maize meal porridge was the most popular food item consumed daily by over half of the 6-11 month-old infants (55.2%), followed by commercial infant cereal which was consumed daily by 50% of the infants. Potatoes were consumed 2 to 7 times in the 7-day recall period by

just over two-thirds of the infants. A full infant feeding bowl of 200ml was the most frequent amount consumed for soft maize meal porridge, commercial infant cereal and potato. Instant noodles (and in a few cases also pasta) was consumed by 29.9% of the infants in the previous 7 days.

Legumes and nuts:

Peanut butter appeared to be a popular food choice with a quarter of the infants (24.6%) using it daily, but overall legume and nut consumption in infants appeared to be low. Two-thirds of the infants consumed 5ml of peanut butter daily. Beans were only utilised by 23.9% of infants and most commonly eaten once a week.

Dairy products:

Sweetened yogurt was the most popular dairy product with 64.9% of infants consuming it in the 7-day recall period, and 1 small tub of yogurt (100g) was the most frequent amount consumed. Maas was being consumed by a third of the infants (32.8%) and 6% were consuming cow milk (in addition to their usual milk feed).

Animal foods:

Close to two-thirds of infants (64.9%) had at least one meat food group item (this group included processed meats). Chicken and processed meats (specifically polony and viennas) were the most popular animal-source foods consumed by infants. A quarter cup of cooked chicken (55g) and 1 vienna (42g) was the most frequent amount consumed by infants. Just over a third (34.3%) of infants had fish and 28.4% had eaten liver in the last 7 days.

Eggs:

Just over two-thirds of infants (68.7%) had eaten eggs at least once in the past 7 days, with one egg (50g) being the amount most frequently consumed. Boiled eggs were the most common form consumed (compared to fried or scrambled eggs), and 11.9% of infants had egg yolk added to their maize meal porridge.

Fruit and vegetables:

One hundred and twelve infants (83.6%) had fruit and the same number had eaten vegetables in the previous 7 days. Butternut was the most popular vegetable consumed by 80.6% of infants and the majority (41.8%) ate butternut 2-3 times in the previous 7 days. Butternut was consumed in the same amount as cereal and starchy foods (maize meal, infant cereal, potato), i.e. 200ml. Only 23.9% consumed spinach or imifino (a green leafy vegetable) in the previous 7 days and 26.9% had eaten carrots. Bananas were the most popular fruit consumed (63.4% of infants), with apples eaten by 26.1% and oranges (mainly the juice squeezed from segments) by 34.3%. Over half of the infants consumed 1 small banana or half a banana (25g).

Beverages:

Fruit juice (pure 100%) was consumed by 26.9% of the infants and some (8.2%) had other juice or cordial, or a carbonated sweetened beverage (1.5%). Rooibos tea was the most popular beverage consumed (23.9% of infants), with a few having regular tea (4.5%). None of the infants had coffee.

Snack foods:

It is concerning to note that just over half of the infants (52.2%) were consuming biscuits, two-thirds (66.4%), ate chips, and close to a third (32.8%), were given sweets or chocolates in the previous 7-day recall period. Biscuits and chips/crisps appear in the list of food items most frequently consumed by infants, with the majority of infants consuming 1.5 biscuits (9g) and 1 small packet of chips/crisps (14g).

Sugar, margarine and water consumption:

Sugar was being added to the foods consumed by 56% of the infants, while 30.6% of the infants were eating foods to which sugar had been added on a daily basis. Margarine was being consumed by 62.7% of the infants with 29.1% consuming it daily. Both sugar and margarine were consumed in an amount of 5mls by the majority of the infants. Close to half of the infants (47.8%) were given water to drink on a daily basis.

Discussion

Breastfeeding initiation rates reported in this study (80.6%) are similar to national initiation rates reported (83%), and the 6 months exclusive breastfeeding rates did not differ greatly (32% nationally vs. 25.4% in this study)^[9]. Even though most mothers in this study were unemployed, this did not appear to encourage them to breastfeed for a longer duration. Social peer pressure and community support cannot be ignored as strong influencers on feeding choice^[10]. The early introduction of food and types of food first used for complementary feeding resonate with the findings of a recent review^[1] of complementary feeding practices in South Africa.

Feeding frequency also appeared to be inadequate in the 9-11 month-old breastfed infants in this study, but it is also probable that some nutrient needs are met by breastfeeding on demand. The types of fruits or vegetables eaten are probably also influenced by seasonality, affordability and availability in the community. It was encouraging to find households engaging in food production, as this has the potential to be increased to influence the dietary diversity of infants and households. Bean, egg and liver consumption could potentially be increased, and vegetables and fruit could be included daily in the diets of infants residing in KwaMashu.

The consumption of processed meats, biscuits, chips and sweets/chocolates by infants found in this study is concerning, but not unusual, and has been found in other communities in South Africa^[11, 12]. This problem is not unique to South Africa though: in Kathmandu Valley, Nepal 74.1% of 6-24 month-old infants had eaten a commercially produced snack food the day before, this figure was 58.7% in Dakar, Senegal, 55.0% in Phnom Penh, Cambodia and 23.1% in Dar es Salaam, Tanzania^[13]. A recent study in Early Childhood Development (ECD) centres in the North West Province in South Africa to identify the contribution of processed foods to sodium in the diet of children (2-5 years), reported crisps, processed meats and instant noodles as frequently consumed^[14]. A 2019 survey^[15] of added sugar in foods targeted to infants under 1 in South Africa, found that 1 in 4 products had added sugar, and that over 70% were sweet tasting, predisposing infants to developing a preference for sweet tasting foods from an early age.

The role of the food industry and its contribution to nutrition is regarded with strongly held and often polarised views. The fact remains that this industry produces foods that contribute to the food baskets of households. When the diets of young infants with very high nutritional needs are considered, the contribution of processed foods deserves critical appraisal. The value of their contribution and how they can better contribute to improved nutritional intake should be ascertained. Processed food products can have a place in terms of convenience and providing a nutrient-dense option, e.g. infant cereal and ready-to-eat vegetable and fruit-based products, but there are also products such as processed meats, biscuits, chips, sweets and chocolates that are commonly eaten by under 1 year-old infants that may displace more nutritious options.

The use of IYCF indicators relating to complementary feeding are beneficial in the assessment of infant feeding practices and useful in evaluating the impact of various programmes, however a review of these indicators and their wider use would further encourage action to improve infant nutrition^[16]. Many crucial reports that focus on nutrition matters, e.g. The 2019 South African Early Childhood review which reported on nutrition issues, disregarded complementary feeding indicators^[17]. Kenyan researchers have proposed the inclusion of complementary feeding indicators into routine health monitoring systems^[18]. There are also possible shortfalls of complementary feeding indicators which needs to be considered. A recent review of IYCF indicators in Sub-Saharan Africa (South Africa was not included), found that complementary feeding indicators in particular were not being met, and highlighted that the seasonal availability of foods may also impact on complementary feeding practices^[19].

Conclusion

In conjunction with the necessary increased efforts to support breastfeeding in South Africa, it would be desirable if more attention was paid to improving complementary feeding practices. There are many processed food items reported in the diets of infants of 6-11 months of age in KwaMashu in KwaZulu-Natal which potentially displace more nutritious options and encourage unhealthy snacking from an early age. Paediatric food-based dietary guidelines for 0-11 month-old infants in South Africa (currently tested^[20] but not yet approved) need to consider the prevailing food consumption patterns, and should not only encourage positive behaviours, but also actively discourage unhealthy eating behaviours. The food industry has an important role to play, extending beyond product formulation to the distribution, marketing

and communication of their products to specific audiences. Hence, they need to step up to the challenge to help meet the nutrition agenda of the country within the guidelines of existing regulations for marketing. Parallel to this challenge is the challenge in the nutrition research arena to produce more dietary consumption information and explore ways to track these datasets nationally and link them to strategy. Discussion and alignment of indicators of infant and young child feeding on a national level would be helpful.

Conflicts of interest/Disclosure statement

No potential conflict of interest was reported by the authors.

Author contributions

The first author is a PhD student and the second author is the PhD supervisor. The first author conceptualised and designed the study, led the data collection, performed the data analysis and drafted the manuscript. The second author gave input into the study, checked all results and edited the manuscript. Both authors reviewed and approved the manuscript for submission.

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Chapter 3 - The use of linear programming to determine whether breastfed infants can achieve a nutritionally adequate complementary feeding diet: a case study of 6-11 month-old infants from KwaMashu, KwaZulu-Natal, South Africa

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Abstract

The objectives of this study were to ascertain if the nutrient requirements of 6-11 month-old infants can be met with a food-based approach, as well as to identify the nutrients that are difficult to achieve adequate intakes of. A cross-sectional survey and interviews with mothers and caregivers from the KwaMashu Community Health Centre were conducted. One hundred and thirty-four interviews were completed. This information provided the food consumption input for the model using Optifoods software. The results from the modelling exercise reveal that with the current food pattern of infants from the study group in KwaMashu, iron, zinc, and calcium are identified as the nutrients whose requirements are likely not to be met in the diet of these infants (nutrients of concern). The percentage RNI (Recommended Nutrient Intake) for iron was 25.2%, zinc 51.3% and calcium 77%. Nutrient intakes for these nutrients of concern improved in the “No pattern” diet but iron and zinc intakes still remained below the RNI. According to the best diets modelled by Optifoods, it appears that infants in KwaMashu would be able to achieve the recommended intakes of energy and protein, as well as the desired nutrient intakes for 8 of the 11 micronutrients, as long as breastfeeding on demand continues during the complementary feeding phase. Availability of new tools in nutrition, such as Optifoods, heralds an exciting phase in research and efforts need to be prioritised to train more individuals and to make these tools available globally. This study calls into question the continued food-based focus that is used to ensure nutrient adequacy in infants. In conjunction with efforts to improve household food security and the continued support and promotion of breastfeeding for the first 2 years of life, targeted micronutrient supplementation may be needed to ensure the optimal growth and development of infants in South Africa.

Keywords: Optifoods, complementary feeding, nutrient requirements, infant nutrition, South Africa

Introduction

In resource-limited settings, conducting research to provide the relevant information to enable the best evidence-based decisions, is always challenging. Tools that allow the assessment of options at a lower cost and in a shorter time are valuable. One such tool in the field of nutrition is modelling. Modelling various scenarios based on specific inputs will allow researchers to weigh up various courses of action and their possible outcomes in a timely and financially efficient manner. For complementary feeding in South Africa, it would be useful to model whether available foods in a community can help achieve recommended nutrient intakes, and to test specific food-based recommendations that could be promoted.

The World Health Organisation / London School of Hygiene and Tropical Medicine (WHO / LSHTM) Optifoods linear programming software assists in formulating and evaluating a food-based approach, testing various food-based recommendations, and assessing the cost of various dietary patterns^[1]. This can facilitate better decision making and advocacy for the assessed complementary feeding efforts. Furthermore, Optifoods has greater objectivity and provides stronger evidence for actions than other assessments^[1]. This software is currently only made available to users once they have received training in its use as no comprehensive user manual is currently available. The first author of this paper was trained by Dr Elaine Ferguson from the LSHTM on how to use the software (August 2017). This linear programming approach has been used to assess the complementary feeding diet in other countries as outlined in Table 1.

Table 1: Recently published research on the complementary feeding diet that used Optifoods

Country	Year of publication	Age of children in study population	Sample size	Dietary intake methodology
Cambodia	2014 ^[2]	6-11 month-old infants	78	Single 24 hour recall
Ghana	2017 ^[3]	6-23 month-old infants	705	Multiple-pass 24 hour recall, repeated in 20% of subsample
Guatemala	2017 ^[4]	breastfed 6–11 month-old infants and 12–23 month-old infants	73 91	Household consumption and expenditure data, 24 hour recall and food frequency data from an older study
	2018 ^[5]	non-breastfed 12–23 month-old infants 6-11 month-old infants	26 94	
Indonesia	2016 ^[6]	12-23 month-old infants	>8000	1 day weighed diet records, single 24 hour recall, 5 day food tally
	2014 ^[7]	6-23 month-old infants		
Kenya	2016 ^[8]	6-23 month-old infants	882	Multiple-pass 24 hour recall with weighing of foods, recipe information collected
	2015 ^[9]	6-23 month-old infants	401	
Myanmar	2016 ^[10]	12–23 month-old infants	106	12 hour weighed diet records, single 24 hour recall, 5 day food record

Objectives

The objectives of this study were to:

1. Describe the current food consumption patterns of 6-11 month-old infants attending a well-baby clinic in KwaMashu, KwaZulu-Natal,
2. Ascertain if the nutrient requirements of 6-11 month-old infants can be met with a food-based approach (as a case study for South Africa), and
3. Highlight the nutrients that are difficult to achieve adequate intakes of.

The study made use of the WHO / LSHTM Optifoods linear programming software. As the use of linear programming is relatively new to nutrition decision making in South Africa, it was the first time it was used in South Africa to assess complementary feeding diets.

Method

One hundred and thirty-four interviews were completed with mothers and caregivers from KwaMashu in South Africa, and this provided the input for the modelling exercise. The study was a cross-sectional survey with data collected using questionnaires for sociodemographic and dietary information at the KwaMashu Community Health Centre. KwaMashu is a suburb of Durban in KwaZulu-Natal with 175 663 residents according to Stats SA^[11]. The KwaMashu Community Health Centre (KMCHC) is a referral site for 6 clinics and has a catchment population of about 750 000^[12]. The KMCHC treats about 169 000 patients a year, including approximately 9 500 under 5 year-old children (Personal communication 2018). Ethics approval for this study was obtained from the University of Pretoria Faculty of Natural and Agricultural Sciences Ethics Committee (reference number 180000016). Permission was also granted by the KwaZulu-Natal Health Research Ethics Committee (reference number: KZ_201809_018).

The methodology described in this article is specific to the nutrition modelling conducted. Optifoods software version V4.0.14.0 (16 June 2015) was used to conduct the nutrition modelling.

Table 2 summarises the various inputs required for the nutrition modelling exercise for Optifoods and the rationale behind the decisions made. The main source of information for the input that was required was the information collected with the questionnaires on feeding practices and the quantified food frequency questionnaires regarding the previous 7-day dietary intake of the infants. The South African Food Quantities Manual (SA FQM)^[13] was used to translate household descriptions of foods to grams; and the South African Food Composition Tables (SA FCT)^[14] were used for the input of the food composition data of South African foods into the Optifoods software.

Table 2: Summary of the data inputs required for the linear programming for Optifoods modelling (adapted from Ferguson *et al* 2008^[1]) and the parameters that were selected

Information required for the Optifoods modelling	Input (modelling parameters)
<p>1. Foods that the target population typically consumes, including the typical portion sizes of foods, and frequency of consumption per week</p>	<p>The top 14 food items consumed by more than 40% of the 6-11 month-old infants in the past 7 days were selected for the modelling exercise. If more foods were selected then the food items would not represent what might be available to households in the community.</p> <p>The servings per week of each food were determined from the category most commonly selected in the quantified food frequency recall, i.e. daily consumption, most days (consumed on 4 or more days), some days (consumed 2 to 3 times), and consumed once in the previous 7 days. Where a range of intake was most commonly cited the upper limit in the range was selected as the consumption amount.</p> <p>The typical portion size of each of the foods was determined by using the most frequently described portion and translating it into grams. The food quantities manual^[13] was used to translate portions into grams and this was confirmed with a shop visit by the first author to determine typical serving unit weights of the 14 items as declared on food labels.</p> <p>The minimum serves per week for all foods were indicated as 1, except for 2 food items where the typical consumption was 1 time a week. In these cases the minimum consumption was set to 0.1 times per week.</p> <p>Maximum consumption for each of the food items was set to 0.1 higher than the typical consumption.</p>
<p>2. Food consumption patterns of the target group (defined as the number of times foods from a selected food group were consumed)</p>	<p>Table 3 describes the typical, minimum (low consumption level) and maximum servings (high consumption level) per week of each food item.</p> <p>Table 4 outlines the food group level input required for the modelling exercise.</p>
<p>3. Energy and nutrient requirements of the target population</p>	<p>The Optifoods default energy and nutrient requirements for 6-11 month-old infants was used as the reference for daily energy and nutrient intakes. A weight of 9kg was used in calculations based on infant weight after consultation of the WHO 50th percentile weight for boys and girls at 9 months^[15].</p> <p>The reference energy per day in Opifoods was 693kcal (about 2897kJ) and protein was 10.26g per day. Daily micronutrient requirements were: calcium 400mg per day, vitamin C 30mg per day, thiamine 0.3mg per day, riboflavin 0.4mg per day, niacin 4mg per day, vitamin B6 0.3mg per day, folate 80µg per day, vitamin B12 0.7µg per day, and vitamin A 400µg Retinol Equivalents per day. These nutrient intakes will be referred to as Recommended Nutrient Intakes - RNI.</p> <p>For iron, the Optifoods user can select bioavailability of 5%, 10%, 12% or 15% to determine the requirement. For zinc the Optifoods user can select low, moderate or high bioavailability to determine the requirement. A selection was made based on which value best matched the nutrient requirement specified by the South African government for infant food labelling purposes</p>

Information required for the Optifoods modelling	Input (modelling parameters)
	for 6-12 month-old infants ^[16] , i.e. 11mg for iron (10% bioavailability gives 9.3mg/day) and 3mg for zinc (moderate bioavailability gives 4.1mg/day).
4. Nutrient composition of foods per 100g	Nutrient information for the 14 food items was mainly selected from the South African Food Composition Tables ^[14] . This was also checked against current food label information for the selected nutrients in Optifoods. Some of the nutrient data for yogurt, processed meats and hard margarine was updated with product label information (as products changed due to new legislation). The nutrient information for the infant cereal was calculated from on pack directions for preparation and using the as sold nutrient data from the SAFCTs. Table 6 details the information on food composition and food quantities information.
5. Target population breastfeeding status	<p>Forty-nine (36.6%) of 6-11 month-old infants in this study were still receiving breastmilk, 63 (47.0%) were receiving formula milk and it was reported that 22 (16.4%) were mixed feeding (breastmilk and formula milk).</p> <p>Just over half (52.9%) of the infants were still receiving some breastmilk and since breastmilk is the ideal, the target population breastfeeding status was selected as “yes”.</p>
6. Energy and nutrient contribution from breastfeeding	<p>The Optifoods food composition values for the energy and nutrient contribution from breastmilk were used. In Optifoods breastmilk provides 66kcal (or 276kJ) per 100g. Optifoods uses kcal but kJ is used in South Africa, and so both units are reported.</p> <p>Breastmilk consumption was estimated at 600g per day. This is the average of 626g and 574g – calculated from the energy provided by breastmilk and the WHO reference values for the amount of energy provided by average breastmilk intake by 6-8 month-old infants (providing 413kcal (or 1726kJ)), and of 9-11 month-old infants (providing 379kcal (or 1584kJ))^[17].</p> <p>These WHO reference values were also used by Skau <i>et al</i> (2014)^[21] in an estimation of 576g for 6-8month-old infants and 541g for 9-11 month-old infants (with breastmilk energy values of 70kcal/100g (293kJ/100g) in their calculation of the contribution of breastmilk to use in the Optifoods modelling exercise).</p> <p>600g of breastmilk will provide 396kcal (or 1655kJ) (57% of total daily energy), with energy from complementary foods contributing the remaining 297kcal (or 1242kJ) to meet total energy needs of 693kcal (or 2897kJ) per day. The 2002 WHO Complementary Feeding Summary of Guiding Principles Report references that complementary food should provide about 200kcal (or 836kJ) for 6-8 month-old breastfed infants and 300kcal (or 1254kJ) for 9-11 month-old breastfed infants^[18]. The calculated estimate used in this study falls within these acceptable limits.</p>

In Table 3, the consumption information of the 14 food items used in the modelling exercise is provided. Table 4 outlines the food group level input required for the modelling exercise, and the source of food quantities information and food composition data is detailed in Table 5. South Africa has mandatory food fortification regulations for maize meal and wheat flour to be fortified with vitamin A, thiamine, riboflavin, niacin, folic acid, pyridoxine (vitamin B6), iron and zinc^[19].

Table 3: Consumption details of the 14 food items used in the modelling exercise (x denotes ‘times’ a week)

	<i>Food item</i>	<i>Percentage of infants consuming the food item in past 7 days</i>	<i>Most frequent amount consumed</i>	<i>Percentage of infants consuming most frequent amount</i>	<i>Weekly consumption: typical (the upper limit in a range was used)</i>	<i>Weekly consumption: minimum</i>	<i>Weekly consumption: maximum</i>
1	Soft maize porridge*	91,00%	200ml	69%	daily or 7x a week	1 x a week	7.1 x a week
2	Commercial/ shop bought infant cereal*	88,10%	200ml	69%	daily or 7x a week	1 x a week	7.1 x a week
3	Butternut*	80,60%	200ml	51%	2 - 3 x a week	1 x a week	3.1 x a week
4	Potato*	77,60%	200ml	44%	2 - 3 x a week	1 x a week	3.1 x a week
5	Chips/crisps**	66,40%	1 small packet	74%	1 x a week	0.1 x a week	1.1 x a week
6	Sweetened yogurt**	64,90%	1 small tub	79%	2 - 3 x a week	1 x a week	3.1 x a week
7	Banana**	63,40%	1 small banana	53%	2 - 3 x a week	1 x a week	3.1 x a week
8	Hard margarine	62,70%	5ml	74%	daily or 7x a week	1 x a week	7.1 x a week
9	Sugar	56,00%	5ml	65%	daily or 7x a week	1 x a week	7.1 x a week
10	Boiled egg	55,20%	1 egg	95%	2 - 3 x a week	1 x a week	3.1 x a week
11	Peanut butter	54,50%	5ml	67%	daily or 7x a week	1 x a week	7.1 x a week
12	Biscuits**	52,20%	1 1/2 biscuits	83%	1 x a week	0.1 x a week	1.1 x a week
13	Chicken	46,30%	1/4 cup	37%	2 - 3 x a week	1 x a week	3.1 x a week
14	Polony/ Viennas	42,50%	1 vienna	70%	2 - 3 x a week	1 x a week	3.1 x a week

Footnote:

**designated as a starchy staples in Optifoods analysis.*

***designated as a snack in Optifoods analysis.*

Table 4: The food group level input required for the modelling exercise

Food group and Subgroup	Foods in each group	Low servings/week	Average servings/week	High servings/week
Added fats: margarine, fortified	Margarine	1	7	7.1
Added sugars: sugar, unfortified	Sugar	1	7	7.1
Bakery & breakfast cereals: sweetened bakery product, unfortified	Biscuits	0.1	1	1.1
Breastmilk		6.9	7	7.1
Dairy product: yogurt	Sweetened yogurt	1	3	3.1
Fruit	Banana	1	3	3.1
Grain & grain products: fortified products	Soft maize porridge Commercial infant cereal	2	14	14.2
Legumes, nuts & seeds: sweetened product	Peanut butter	1	7	7.1
Meat fish and eggs: Eggs, Poultry or Processed meat		3	9	9.3
	Boiled egg	1	3	3.1
	Chicken	1	3	3.1
	Polony/viennas	1	3	3.1
Savoury snacks: Savoury snacks	Chips/crisps	0.1	1	1.1
Starchy roots & other starchy veg: Starchy plant foods	Butternut Potato	2	6	6.2
Snacks		3	9	9.3
Staples		2	14	14.2

Table 5: The source of food quantities information and food composition data

	<i>Food item</i>	<i>Most frequent amount consumed (in grams)</i>	<i>Source of food quantities information</i>	<i>Source of food composition data and rationale when country data not used</i>
1	Soft maize porridge	200g	SA FQM ^[13] – footnote (a)	SA FCT ^[14] – footnote (b)
2	Commercial infant cereal	246g	Weighed	Calculated – footnote (c)
3	Butternut	168g	SA FQM	SA FCT
4	Potato	200g	SA FQM	SA FCT
5	Chips/crisps	14g	Product label	SA FCT
6	Sweetened yogurt	100g	Product label	Product label – footnote (d)
7	Banana	25g	SA FQM	SA FCT
8	Hard Margarine	5g	SA FQM	Product label – footnote (e)
9	Sugar	4g	SA FQM	SA FCT
10	Boiled egg	50g	SA FQM	SA FCT
11	Peanut butter	5g	SA FQM	SA FCT
12	Biscuits	9g	Product label	SA FCT
13	Chicken	55g	SA FQM	SA FCT
14	Polony/viennas	42g	Product label	Product label – footnote (f)

Footnote:

- a) SA FQM is the South African Food Quantities Manual^[13].
- b) SA FCT is the South African Food Composition Tables^[14].
- c) The “as consumed” data for the infant cereal was calculated as only the “as sold” data was available in the SA FCT.
- d) The yogurt categories have changed^[20], the small tub yogurt is now a medium fat yogurt and not a low fat yoghurt as published in the SA FCT.
- e) The margarine formulation has changed^[21], and the fat content in the market products is different to that in the SA FCT.
- f) There is large discrepancy in the fat and energy content in the SA FCT versus product label data for these processed meats in the market, which is probably due to salt reduction legislation^[22] (and resultant product reformulation).

Results

The modelling conducted by Optifoods aims to model the best 7-day diet within the given parameters that comes closest to mathematically achieving greater than or equal to 100% of the RNI for the selected nutrients. Optifoods models the “2 best diets”, i.e. a “Food pattern” diet which is the best diet closest to the target population’s average food pattern, while the “No food pattern” diet is the best diet that can deviate from average food group patterns but remains within upper and lower food group constraints set for the modelling exercise. Table 6 describes the number of servings of food from each food group in the 2 best diets that had been modelled. Table 7 outlines the energy and nutrient content of the 2 best diets that had been modelled and includes the percentage of the RNI.

Table 6: The number of serves of each food in the “2 best diets”

Food	Serving Size (grams)	Food Pattern (#Serves per week)	No Food Pattern (#Serves per week)
Banana	25	3	1.8
Sugar	4	7	1
Sweetened yogurt	100	3	1
Hard margarine	5	7	1
Chips/crisps	14	1	0.1
Biscuits	9	1	0.1
Butternut	168	3.1	1
Potato	200	1	1
Boiled egg	50	1	1
Chicken	55	1	3.1
Polony/viennas	42	2.7	1
Commercial infant cereal	246	1	4.3
Soft maize porridge	200	1	1
Peanut butter	5	7	1
Breastmilk	600	6.9	6.9

The number of serves in the 2 best diets that had been modelled shows that the “No pattern” diet minimises most foods and selects the use of the fortified infant cereal, chicken and banana in preference to other foods to meet nutrient requirements (Table 6).

Table 7: Energy and nutrient content of the 2 best diets that had been modelled and %RNI

Nutrient	Food Pattern	No Food Pattern	Food Pattern (%RNI)	No Food Pattern (%RNI)
Energy (kcal)	693	693	100	100
Protein (g)	16.8	21.9	164	213.6
Fat (g)	34.1	30.1	N/A	N/A
Carbohydrate (g)	76.6	81.3	N/A	N/A
Calcium (mg)	308.1	403.3	77	100.8
Vitamin C (mg)	40.1	60.4	133.8	201.4
Thiamin (mg)	0.4	0.6	129.7	182.2
Riboflavin (mg)	0.4	0.5	108	115.6
Niacin (mg)	5.2	5.1	130.3	127.4
Vitamin B-6 (mg)	0.4	0.4	150.6	135.8
Folate (µg)	97.3	95	121.6	118.8
Vitamin B-12 (µg)	1	1.1	145.2	156.6
Vitamin A RE (µg)	649.7	584.9	162.4	146.2
Iron (mg)	2.4	5.2	25.2	55.6
Zinc (mg)	2.1	2.7	51.3	65.6

The nutrients for which the percentage RNI is less than 100% are shaded in Table 7. With the current foods most commonly consumed in the study group in KwaMashu, the diet modelled according to current food patterns identifies iron, zinc, and calcium as the nutrients whose requirements are likely not to be met in the diet of infants (nutrients of concern). The percentage RNI for iron was 25.2%, zinc 51.3% and calcium 77%. Nutrient intakes for these nutrients of concern improve in the “No pattern” diet but iron and zinc intakes still remain below the RNI.

Table 8 depicts the top 3 food sources of each nutrient in the food pattern diet as portrayed by Optifoods.

Table 8: Top 3 food sources of each nutrient

Nutrient	Food source 1	Food source 2	Food source 3
Energy	Breastmilk	Butternut	Infant cereal
Protein	Breastmilk	Chicken	Peanut butter
Fat	Breastmilk	Margarine	Peanut butter
Carbohydrate	Breastmilk	Butternut	Infant cereal
Calcium	Breastmilk	Yogurt	Infant cereal
Vitamin C	Breastmilk	Infant cereal	Potato
Thiamine	Breastmilk	Infant cereal	Margarine
Riboflavin	Breastmilk	Yogurt	Margarine
Niacin	Breastmilk	Peanut butter	Chicken; Margarine
Vitamin B-6	Butternut	Margarine	Processed meat
Folate	Breastmilk	Margarine	Maize meal
Vitamin B-12	Breastmilk	Yogurt	Eggs
Vitamin A RE	Breastmilk	Butternut	Infant cereal
Iron	Infant cereal	Processed meats	Butternut
Zinc	Breastmilk	Chicken	Butternut

Breastmilk continues to be the main source of energy, macronutrients, and 9 of the 11 micronutrients in the modelled diet, highlighting the important contribution of continued breastfeeding when foods are introduced to the diets of infants. Breastmilk and animal-source foods provided 71% of the protein intake. Fortified foods (infant cereal, margarine) and starchy plant foods (butternut) stood out as main contributors to nutrient intakes in this modelled diet. Even though processed meat appears in the table of main nutrient sources, it should be remembered that the modelled diet does not take into consideration the levels of nutrients such as sodium and saturated fat in the diet of infants. Government fortified maize meal which is widely used in South Africa as a complementary food only features as a key source of folate for infants in this modelled diet. A report compiled by the South African food fortification programme attributed the reduction of neural tube defects in South Africa to food fortification with folic acid.^[19]

Discussion

According to the best diets modelled by Optifoods, it appears that infants in KwaMashu would be able to achieve adequate energy, protein and micronutrient intakes for 8 of the 11 micronutrients, as long as breastfeeding on demand continues during the complementary feeding phase. Although foods consumed in the diets of infants in other countries are very

different to those consumed by infants in KwaMashu, iron, zinc and calcium were also identified as problem nutrients by Optifoods modelling exercises conducted in countries such as Cambodia, Ghana, Guatemala, Indonesia, Kenya & Myanmar ^[2-10].

A recent GAIN/UNICEF nutrient gap assessment of 6-23 month-old infants in South Africa found best evidence for vitamin A and calcium to be nutrients of concern, but the iron and zinc gap burden was found to be low (this was based on moderate certainty evidence for iron and low certainty evidence for zinc)^[23]. The GAIN/UNICEF brief called for more quality data on those micronutrients for which conclusions were based on low certainty evidence. The GAIN gap analysis was based on various pooled data and it is possible that infants in different areas in South Africa have different challenges in meeting the requirements for different nutrients. Butternut availability in KwaMashu is usually seasonal and consequently infants residing in KwaMashu could experience challenges in meeting their Vitamin A needs if this food is left out of their diets. The affordability of fortified infant cereal at different times of the month and the year could also impact on micronutrient intakes. Nutrient intakes will also be negatively impacted by suboptimal breastfeeding practices.

When the low absolute amount of iron and zinc in the modelled 2 best diets is considered, it is probable that the intake of these micronutrients will still remain lower than recommendations, even when compared to lower revised recommendations for diets based on foods which have a higher bioavailability.

The results from this study emphasise the continued promotion of breastfeeding alongside nutrient-dense complementary foods such as fortified infant cereal and adding fortified margarine to foods being consumed. Food-based strategies and their communication need to be relevant and based on the actual food consumption and availability in a community, and not a generic message.

GAIN/UNICEF have highlighted chicken, fish, peanut butter, dried beans, beef liver, chicken liver, carrots and milk as the most affordable foods to fill nutrient gaps in the diets of

children^[24]. These are all foods that were being consumed by some infants in this study. It may be that while households purchased these nutritious food items, the quantity that is consumed is not adequate to meet infant needs, due to lack of knowledge or food insecurity, or both, or that these foods may not be available throughout the month or year. Attention to making nutritious foods more affordable in South Africa is warranted, but GAIN/UNICEF emphasise that even with price reductions, 20–35% of households would still be unable to afford the foods they need to be able to feed their children a diet meeting all nutrient requirements^[24].

A 2019 Cochrane review^[25] on the value of animal-source foods for growth and development of infants, found limited quality evidence and some uncertainty regarding the impact of animal-source foods when compared to cereal products or no intervention. Nevertheless, in this study, animal-source foods were an important contributor to nutrient intakes in infants' diets in KwaMashu. An IFPRI report^[26] highlighted the fact that animal-source food energy derived from eggs and dairy products is relatively more expensive than food energy obtained from other animal-source foods, which may restrict their consumption. Consequently these foods are most sensitive to prices impacting their consumption^[26]. This IFPRI report also suggests that promoting household production of animal-source foods is likely to not have an impact on intakes, as these foods are valued for the high prices they can generate if they are sold. Research has been conducted on the addition of South African green leafy vegetables to maize meal, which showed that regular consumption could contribute to iron intakes^[27].

If it holds true that the problem nutrients identified in this study are also difficult to achieve in other infant diets, it would give direction to product formulation for infants and for biofortification of foods with iron, zinc and calcium. Promising research on potatoes biofortified with zinc and iron has been conducted, with bioavailability studies currently underway^[28]. Targeted fortification and supplementation of infants, e.g. with micronutrient sprinkles containing specific nutrients, appear to be the more pressing option to be considered alongside food-based strategies that include the promotion of breastfeeding.

The output from data modelling is only as useful as the consideration given to the input parameters. The nature of this type of exercise requires deliberated decisions on a number of input parameters, each of which rely on logical and substantiated decision making. While due care and deliberation has gone into this exercise, it is plausible that the errors in selection of each of the parameters affects the results presented here. These results are only applicable to infants residing in KwaMashu and are based on a relatively small sample of respondents, without consideration of monthly or seasonal variation in intake and types of foods consumed by infants. One key assumption which was made in the estimation of nutrient composition of foods in this study, was that they were prepared in such a way that the product had the appropriate consistency and were not overdiluted.

One of the limitations experienced with the use of Optifoods was the inflexibility in real-time manipulation and not being able to customise the output in any way. Nevertheless, with training Optifoods, is easy to use and it facilitates quick assessments and produces results that are easy to export for further analysis. With the availability of this type of software, further testing using infant food consumption information from other regions in South Africa should be conducted to obtain a better picture of nutrients of concern in infants. It would also be useful to assess the diets of other age groups in South Africa using recently published national data.

Conclusion

The results from the modelling exercise reveal that the current food pattern of infants from the study group in KwaMashu, identified iron, zinc, and calcium as the nutrients whose requirements are likely not to be met in the diet of these infants (nutrients of concern). This study calls into question the continued food-based focus to ensure nutrient adequacy in infants. Together with efforts to improve household food security and the continued support and promotion of breastfeeding for the first 2 years of life, other targeted interventions such as micronutrient supplementation may be needed to ensure the optimal growth and development of infants in South Africa. The availability of new software for analysis such as Optifoods, in the field of nutrition, heralds an exciting phase in research and more should be done to train individuals in the use of these tools. In addition, these tools should be made available globally at no/low cost.

Conflicts of interest/Disclosure statement

No potential conflict of interest was reported by the authors.

Author contributions

The first author is a PhD student and the second author is the PhD supervisor. The first author conceptualised and designed the study, led the data collection, performed the data analysis and drafted the manuscript. The second author gave input into the study, checked all results and edited the manuscript. Both authors reviewed and approved the manuscript for submission.

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Chapter 4 - Grandmothers are strong influencers of complementary feeding decisions of mothers from KwaMashu, KwaZulu-Natal, South Africa: results from a pilot exploration

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Abstract

In efforts to improve infant feeding practices, knowing which foods infants are currently consuming is important. However, it is equally important to understand why caregivers make certain food and feeding choices and to identify what influences their behaviour when feeding infants in their care. The objective of this study was to conduct 4 focus group discussions with mothers attending the well-baby clinic in KwaMashu, KwaZulu-Natal, South Africa, to gain an understanding of some of the factors that affect the infant feeding decisions of mothers. The study site was the KwaMashu Community Health Centre. Four focus group discussions engaging a total of 19 mothers were held in June 2019. Each recorded discussion was transcribed verbatim by the first author, and checked by another Zulu-speaking (local language) speaking dietitian before analysis began. Coding was done manually. The key themes that emerged in each of the areas that was explored is presented in this article. Mothers in KwaMashu seem to be aware which foods they should provide to their infants, but guidance regarding the frequency of feeding and the amount of food that should be fed to infants was absent. Despite being informed by the clinic, and mothers knowing that 6 months was the correct age to introduce the infant to foods, they were still uncertain about the age at which foods should be introduced. This matter regarding the age of food introduction is further complicated by the immense societal pressure, in particular from grandmothers in the household, to introduce foods earlier than the recommended age of 6 months. To continue focussing infant nutrition education exclusively on mothers may not be a productive approach. The findings of this study support the inclusion of grandmothers (who in many cases may be the primary caregiver of infants) in education efforts to improve infant feeding practices.

Keywords: complementary feeding, infant feeding practices, influencers, grandmothers, South Africa

Introduction

In efforts to improve infant feeding practices, knowing which foods infants are currently consuming is important. However, it is equally important to understand why caregivers make certain foods and feeding choices and to identify what influences their behaviour when feeding infants in their care. Aibel (2012)^[1] highlighted the narrow focus on the “mother-child dyad” in most child nutrition policies and programmes, with no regard for the influences of the broader household and community. One of the key determinants of complementary feeding behaviour change interventions identified by Fabrizio *et al* (2014)^[2], was formative research to identify barriers and enablers, to shape the intervention, and formulate messages and inform the delivery medium. There is no “one-size-fits-all” complementary feeding message: it is likely, that tailoring the message and delivery to specific local circumstances (informed by research) will ensure a higher likelihood of positive behaviour change.

Objectives

The objective of this study was to conduct focus group discussions with mothers attending the well-baby clinic in KwaMashu, KwaZulu-Natal, to understand some of the factors that affect their infant feeding decisions more clearly. More specifically, the aims of the study were to:

1. Investigate if there are any cultural beliefs or practices associated with, or specific foods used for complementary feeding,
2. Describe some of the main messages received by the study participants at the clinic on complementary feeding,
3. Understand if there is any confusion or uncertainty associated with messages about complementary feeding,
4. Describe some of the main influencers of complementary feeding, and
5. Ascertain the barriers to using more nutrient-dense food options available for complementary feeding.

Method

The study site was the KwaMashu Community Health Centre (KMCHC) in the KwaZulu-Natal province on the east coast of South Africa. Ethics approval for this study was obtained from the University of Pretoria Faculty of Natural and Agricultural Sciences Ethics Committee (reference number 180000016). Permission was also granted by the KwaZulu-Natal Health Research Ethics Committee (reference number: KZ_201809_018). This was the same site used for the quantitative research arm of this study. The qualitative study was adjunct to the quantitative data collected in the initial phase of this study. Only the qualitative component of the study is presented here.

Four focus group discussions with a total of 19 mothers were held in June 2019. A research assistant, a grade 12 learner who regularly volunteered as a nutrition assistant at the clinic, was employed to assist with recruiting mothers from the immunisation area of the Paediatric Out-patient Department (POPD) and to screen them for eligibility. The research assistant was trained by the first author. This training covered the study objectives, roles and responsibilities, and familiarisation with all the study documentation and the focus group discussion guide. Mothers with infants aged 6 to 11 months and who had commenced with complementary feeding were asked if they would like to participate in a discussion where they would be asked to share their complementary feeding experiences.

The training room at the KMCHC was used for the focus group discussions. The groups of participants were asked for permission to proceed with the discussion in English and all of them consented. Prior to commencement of the discussion, all the mothers first signed an informed consent form after having it explained to them by the research assistant. This included consent to record the discussion. The duration of each focus group was approximately 30 minutes, and the discussion was recorded on a voice recorder placed in the middle of the discussion area. The research assistant was available for the duration of the discussion for mothers who preferred answering in Zulu (the predominant local language) to translate these answers for the recording. The transcript also made note of points of agreement that had been raised, including non-verbal cues such as mothers nodding their heads in approval and agreement of what was being mentioned by others.

Questions were drafted in a focus group discussion guide to assist the discussion and enable probing around the 5 objectives of the study. During the training sessions with the research assistant, and the clinic nutritionist, both of whom also resided in KwaMashu, the questions wording was finalised to improve understanding. The cue for moving on to the next question in the discussion guide was when no further responses were received, even on repeated probing. There was no time limit for the discussions and participants were given the opportunity to speak until they felt they had shared enough. Considering that very similar feedback was received from each of the discussions held, four focus discussion groups was felt to be adequate for data analysis. It is acknowledged that the individual conducting the research was of different ethnicity to the study participants, but this is not unusual in a health care setting, and the researcher was always assisted by the research assistant who is familiar with the local vernacular language and Zulu culture. The plan for the clinic nutritionist to facilitate the focus group discussions failed as she was absent during the data collection period.

Participants were given refreshments (a carton of juice and a snack bar) and a “thank you token” (a toiletry item) on completion of the discussion. They were also given a copy of the study information and consent form, together with a Department of Health pamphlet on complementary feeding.

The recorded discussion was transcribed by the first author. This transcription was checked by another registered dietitian who was Zulu-speaking, before analysis began. Coding was done manually by the first author, and checked by the second author. The key themes that emerged in each of the areas which were explored, are presented in this article.

Results

Four focus group discussion were completed on 19-20 June 2019. During this time the clinic was out of stock of some vaccines, resulting in a low turnout at the clinic compared to the usual attendance. Overall, there were 19 participants in the focus group discussions with group sizes ranging from 4 to 6. Selected quotes from the participants are included in the results section with the specific focus group number (e.g. FG1, FG2, FG3 or FG4), and the respondent number, (e.g. R1, R2) indicated.

Foods used in complementary feeding

Specific foods mentioned for feeding infants aged 6 months to 1 year, included breastmilk, formula milk, maize meal porridge, commercial infant cereal, butternut, mashed potato, instant dehydrated mashed potato, carrots, spinach, eggs, chicken, apple, banana, macaroni and mince, rice and soup, and peanut butter as well as hard margarine that was added to foods.

“Well mostly porridge (maize meal)” FG2, R1

“Also butternut...where you just chop the butternut, add Rama” FG3, R3

Mothers did not believe that ready-to-eat baby food was better than foods prepared at home. They indicated that homemade food was preferred and superior because they knew exactly what it contained, and it had the advantage of being cheaper than buying baby food. However, mothers acknowledged the convenience of ready-to-eat baby foods, especially when travelling.

“You just need it for going out- we do buy” FG1, R1

“I prefer making it at home, it’s much more cheaper....it’s easy to make at home and when its left - when there’s leftovers you can take it and put it in a container in the fridge, the next day you can feed too” FG3, R2

When asked about the manner in which baby foods were prepared, the following ideas were noted: everything must be clean, food must be boiled, food must be cooked for long time, food must be well-cooked, food must be smooth, a pinch of salt can be added to the food, margarine can be added to the food, and spices must not be added.

“But you must make sure whenever you talk about the baby you make sure there’s no curry powder. I think the preparation that you do it has to be boiled – it doesn’t need any spices like we old people we like spices. Something that goes into the baby (food) doesn’t need any spices – it just has to be natural” FG3, R1

“Everything must be clean” FG4, R1

Main messages received from the clinic

The main infant feeding messages from the clinic that mothers remembered and were able to recall are listed in Table 1. Interestingly, there was one mention of the posters* at the clinic that featured information on infant feeding. (*The mother did not recall the specific poster details.)

Table 1: The main messages on infant feeding that mothers remembered and recalled from the clinic

Breastfeeding is best
Breastfeed exclusively for 6 months
Breastmilk is better than formula milk
For the first 6 months, only give milk
Don't mix feed (don't give 2 different milks)
Give other foods from 6 months
Don't overfeed the baby
Give babies porridges and vegetables with peanut butter and margarine
Liver, meat, fruit, banana can be given to babies
Make food at home instead of buying
Give foods that you eat at home

When mothers were encouraged to further think about the messages they received from the clinic about complementary feeding at 6 months, they were less specific. A few additions were: don't overfeed, don't give salt and sugar, and give small portions of starch. When mothers were probed further about what they were told to do and not do, no new messages emerged. All participants indicated that they had understood all the messages they received from the clinic on infant feeding. When asked if they were confused about any message pertaining to infant feeding (whether from the clinic or other sources), a few indicated the younger age of introducing foods (earlier than 6 months), with one mother mentioning concern over giving only pap (soft maize meal porridge) to the baby as it would not be healthy.

“Maybe they say when you should feed your child at 2 months but they told you 6 months” FG2, R1

“Some people are saying you can feed a child at the age of 2 weeks, give them foods like porridge or something” FG3, R1

Who they trusted

Although mention was made of clinic staff (doctors, nurses, nutritionist) and other mothers as trustworthy sources of information for infant feeding, the overwhelming feedback was that the grandmother of the infants, and the mothers’ own grandmothers were trusted the most about all matters concerning their infants, including infant feeding.

“My mother” FG1, R3

“Grandmothers and mothers - those are the people you can trust” FG3, R5

“I trust my mum cause most of the time the baby spends the day with my mother” FG4, R2

Influence of friends and family

The discussion relating to “influence”, highlighted the strong pressure mothers in this community faced from their friends and family, and in particular from grandmothers, to feed solid foods early, as demonstrated by some of the direct quotes below:

“.....once the baby cries – they always say the baby is hungryjust feed the baby!” FG1, R1

“They said 6 months is too long – you must feed them from birth. (They tell you) how old are you now? We fed you from birth and you are fine, you are busy listening to the nurse. They think you clever now – ay it’s hard.” FG1, R2

“Give her something – at 2 months – I was giving a little cause of pressure from family” FG2, R1

Friends were trusted much less than the grandmother in the household. It was also mentioned that some mothers who worked relied on grandmothers to take care of the infant and had no option but to agree to what the grandmother wanted to do.

“I trust my mum cause most of the time the baby spends the day with my mother” FG4, R2

“The baby is with my mum while I am school, after school I look after the baby” FG4, R4

Mention was also made of hygiene advice, food ideas and handwashing as key advice mothers obtained from others. There was only one mention of a partner’s influence which was negative:

“Partners they don’t know anything! They only say ‘Oh the child eats now’, that’s all.”

Barriers to the use of other nutritious foods available in the community

Mothers were probed regarding the barriers to feeding of four nutritious food items consumed by infants in the community that had been identified in earlier research, these foods were: beans, carrots, spinach/imifino (green leafy vegetables), and chicken liver. Table 2 lists the barriers to use mentioned by the mothers.

Table 2: Barriers to the use of beans, carrots, spinach/imifino (green leafy vegetables) and chicken liver in infant feeding

<i>Food item</i>	<i>Barrier</i>
<i>Beans</i>	Are hard; causes running stomach; baby gets constipated; takes too long to cook
<i>Carrot</i>	Takes long to peel and cook; the texture is a problem; not usually given to babies
<i>Spinach/imifino (green leafy vegetables)</i>	Don’t know it can be used; haven’t tried it; sometimes there are worms; people urinate on the wild imifino

<i>Food item</i>	<i>Barrier</i>
<i>Chicken liver</i>	Not a baby food; it is too expensive (cereal and vegetables are cheaper); it is not always available; baby might not like the taste; babies don't have teeth to bite it

All the groups were given an opportunity to ask questions after the discussion ended, and all had questions – these ranged from general health and nutrition concerns to how to cook different foods for infants. This was addressed by a dietitian facilitated group discussion conducted by the first author.

Discussion

Running discussions with mothers when their small infants are present is indeed challenging as mothers have diverted attention and infants are sometimes restless. A lesson that was learnt from conducting these focus group discussions in KwaMashu is that patience and extra time is required to elicit feedback from participants, and that questions sometimes need to be repeated. There is no doubt, however, that these types of discussions yield a richness and depth of information that would not be possible to obtain from standard questioning.

The foods mentioned by the mothers in this study corroborate the foods identified by the quantitative arm of the study. Mothers in KwaMashu seem to be aware about which foods they can use to feed their infant, but guidance regarding the frequency of feeding and the amount of food to feed infants was absent.

Despite being informed by the clinic staff and mothers knowing that 6 months was the correct age to introduce the infant to foods, they were still uncertain about the age at which foods should be introduced. This matter regarding the age of food introduction is further complicated by the immense societal pressure from family and friends, and in particular grandmothers, to introduce foods earlier than the recommended age of 6 months. This societal pressure and family interference with infant feeding was also found in a study conducted in Hammanskraal, South Africa^[3]. In another study from Tembisa, South Africa, the strong influence of

grandmothers on infant feeding was also cited^[4]. The authors of the Tembisa study also emphasised that grandmothers are often the primary caregiver of infants after birth. Grandmothers in Pakistan are also involved in caregiving of young children, and recent research suggests that grandmothers can have a positive influence on a child's cognitive, motor and socio-emotional development^[5]. A study in Sierra-Leone^[6] found grandmothers to be the “culturally designated advisor” on maternal and child matters, and called for a revised family-systems approach in public health nutrition programmes.

A recent GAIN /UNICEF report^[7] highlighted beans, chicken liver and carrots among a list of 8 food items as the most affordable foods to fill nutrient gaps in the diets of children. There were many barriers to including nutritious foods like beans, carrots, spinach/imifino (green leafy vegetables), and chicken liver in the community at KwaMashu. If these foods are promoted for infant feeding, the specific barriers must be addressed and the education/communication campaign must include elements on how the food item should be cooked so that it is texturally suitable for the infant. In addition, it should allay concerns regarding the taste of the food, and it should motivate and assure mothers concerning the cost and affordability of nutritious food items. Kenya has embarked on a comprehensive complementary feeding improvement programme, and their efforts included a recipe booklet and cooking demonstrations to deal with some of the barriers they find mothers have to preparing nutritious and appropriate complementary foods^[8]. Mothers from Ghana also reported challenges with the preparation and cooking of complementary foods for infants, and researchers call for education on use of local foods for complementary feeding^[9].

Communication on infant feeding in South Africa is largely targeted at the mother, e.g. the Department of Health pamphlets on infant feeding and the Road to Health card messages on infant feeding. The power and influence of grandmothers to positively impact on infant feeding in South Africa is an opportunity that has not yet been fully explored, but it could in all probability be a potentially promising approach. A Malawian study^[10] found that grandmothers' views often differed from those of the health care system when it came to infant feeding, but that grandmothers were also not involved in health education efforts. Another study from Columbia found that grandmothers and other female relatives were trusted more than health care professionals, and influenced infants starting foods before 6 months^[11]. There

are plans to initiate a mother-to-mother breastfeeding and infant feeding support group at the KMCHC and it would be of value to investigate educating and involving grandmothers to champion appropriate infant feeding. A study in Nepal^[12] found that grandmothers' knowledge translated to better infant feeding practices, including the introduction of complementary foods. South African grandmothers' influence on infant feeding and the need to educate them to support infant feeding are echoed in a paper by Mlambo and Pelzer (2020)^[13], who found a high endorsement of mixed feeding by grandmothers (early introduction of complementary foods) to have “fuller, fatter and calmer” babies.

McInnes *et al*^[14] mentioned the need for a paradigm shift from “the dominant approach of support and education of individual women to a more holistic, family-centred narrative approach” to impact infant feeding. The behaviour of caregivers, their knowledge, their beliefs and the influence exerted on them by others, are important considerations in the set of food system related drivers that impact on complementary feeding^[15]. There are many factors that impact on the food and nutrition security of an infant in addition to family and community influences: health services, the workplace, and the market and the socio-cultural context^[16] all need consideration in interventions to improve infant feeding practices. Any behaviour change intervention to improve complementary feeding practices must be based on evidence and a clear theoretical foundation, and must be efficient, cost-effective and scalable^[17].

Conclusion

Mothers who participated in these focus group discussions conducted in KwaMashu mentioned foods suitable for infant feeding and had good recall of infant feeding messages they had heard at the clinic, but they were less convinced about introducing complementary feeding from 6 months. There is immense pressure on mothers, particularly from grandmothers, to start feeding infants earlier before they reach the age of 6 months. To continue focussing infant nutrition education exclusively on mothers may not be a productive approach.

Clinic-based communication make an important contribution to relaying important messages on infant feeding. However, this is seemingly not enough because broader community-based education and behaviour change campaigns are needed to inform and correct beliefs and

perceptions. It is unlikely there will be positive change in infant feeding behaviour until the pressure that mothers face to feed their infants as per advice from influencers such as grandmothers, is addressed. The influence of household dynamics and hierarchy should not be underestimated, and more importantly support from grandmothers to improve infant feeding practices should be encouraged. Grandmothers may just be the missing link in the efforts made so far to improve infant nutrition in South Africa.

Conflicts of interest/Disclosure statement

No potential conflict of interest was reported by the authors.

Author contributions

The first author is a PhD student and the second author is the PhD supervisor. The first author conceptualised and designed the study, led the data collection, performed the data analysis and drafted the manuscript. The second author gave input into the study, checked all results and edited the manuscript. Both authors reviewed and approved the manuscript for submission.

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Summary, conclusions, limitations and recommendations

This study has improved the knowledge and understanding of infant feeding practices in KwaMashu, KwaZulu-Natal, South Africa by providing more and better data for stakeholders in KwaMashu on what to do to improve infant feeding practices., and can serve as a baseline for measuring progress being made in relation to child nutrition in KwaMashu.

Summary of main findings of this study

A review of complementary feeding practices in South Africa revealed that despite updated infant feeding policies in South Africa, in reality, poor infant feeding practices still prevail. In general, foods and liquids are introduced too early. Poor dietary diversity is also of major concern.

The cross-sectional survey conducted with mothers and caregivers recruited at the KwaMashu Community Health Centre found that 80.6% of infants were breastfed, with 63.5% of mothers/caregivers reporting breastfeeding initiation in the first hour. Only 25.4% of mothers/caregivers reported exclusively breastfeeding their infants to the age of 6 months.

Almost a third of infants (30.6%) had started solid foods before 3 months of age. Cereals were the main first foods given, with 56.7% of caregivers preparing foods at home and 43.3% using commercial foods as first foods. At the time of data collection, 36.6% of the 6-11 month-old infants were being breastfed, 47.0% were formula feeding and 16.4 % received mixed feeding. Soft maize meal porridge and commercial infant cereals were the most popular foods consumed on a daily basis.

Close to two-thirds of infants (64.9%) had at least one meat food group item and just over two-thirds of infants (68.7%) had eaten eggs in the previous 7 days. It is concerning that just over

half of the infants (52.2%) were getting biscuits, two-thirds (66.4%) ate chips, and close to a third (32.8%) consumed sweets or chocolates.

The information from the cross-sectional survey provided the food consumption input for the model using Optifoods software. The results from the modelling exercise revealed that with the current food pattern of infants from the study sample in KwaMashu, iron, zinc, and calcium were identified as the nutrients whose requirements are likely not to be met in the diet of these infants (nutrients of concern). The percentage RNI (Recommended Nutrient Intake) for iron was 25.2%, zinc 51.3% and calcium 77%. Nutrient intakes for these nutrients of concern improved in the “No pattern” diet but iron and zinc intakes still remained below the RNI. According to the best diets modelled by Optifoods, it appears that infants in KwaMashu would be able to achieve the recommended intakes of energy and protein, as well as the desired nutrient intakes for 8 of the 11 micronutrients as long as breastfeeding on demand continues during the complementary feeding phase.

Four focus group discussions were held at the KMCHC to gain insight into some of the factors that affect the infant feeding decisions of mothers and caregivers. Mothers in KwaMashu seem to be aware which foods they should provide to their infants, but guidance regarding the frequency of feeding and the amount of food that should be fed to infants was absent. Despite being informed by clinic staff and mothers knowing that 6 months was the correct age to introduce the infant to foods, they were still uncertain about the age at which foods should be introduced. This aspect regarding the appropriate age of food introduction is further complicated by the immense societal pressure, in particular from grandmothers in the household, to introduce complementary before 6 months of age.

Main conclusions of this study

There are many issues associated with the complementary feeding diets of infants that need attention. The findings of this study call into question the continued food-based focus that is used to ensure nutrient adequacy in infants. In conjunction with efforts to improve household food security and the continued support and promotion of breastfeeding for the first 2 years of life, targeted micronutrient supplementation may be needed to ensure the optimal growth and

development of infants in South Africa. The availability of new tools in nutrition, such as the Optifoods software, heralds an exciting phase in research and efforts need to be prioritised to train more individuals to use them and to make these tools available globally. To continue focussing infant nutrition education exclusively on mothers may not be a productive approach. The findings of this study support the inclusion of grandmothers (who in many cases may be the primary caregiver of infants) in education efforts to improve infant feeding practices.

Limitations of this study

The findings of this study have to be considered in terms of possible limitations:

- The findings of this study are only relevant to the study population at KwaMashu and cannot be extrapolated to the general South African population.
- The sample size of the study was limited by the available research funding and capacity available to conduct the research.
- All dietary intake methodology has limitations. The use of a quantified food frequency in this research was largely influenced by the participants' ability to recall the foods given to infants both truthfully and accurately.
- The use of modelling in this study required the input of various parameters with each having their own potential failings that may limit the validity of the research findings.

Recommendations

This thesis is being finalised during a lockdown period in South Africa due to the Covid-19 pandemic, and at a time when the health resources of the entire world are being stressed and over-extended. Food systems are severely impacted at this time, from farm to fork. Household food insecurity and hunger in children have gained attention as situations worsen. The financial impact on countries and health care will be enormous, and the impact of decreased incomes of many households will also be far-reaching. The availability and access to food items, as well as the purchasing power of households were severely affected, and will continue to be for some time to come. This will translate into an even greater number of vulnerable households being challenged to meet their food needs and even more malnutrition in South Africa and around the world. In this dire time, the responsibility that researchers have to communities, which are

involved as subjects in research studies, becomes even more crucial. The recommendations of this study, as set out below, have been drafted with this important consideration in mind.

- 1) If the findings arising from this study are considered in terms of the Nurturing Care Framework outlined in the introduction of this thesis, then some pointers emerge that can assist in identifying the direction which priority actions need to take. The components of Nurturing Care include ensuring that women and young children have access to good-quality health and nutrition services, and making health and nutrition services more supportive of Nurturing Care. The delay in addressing possible nutrient gaps in the diets of infants (as found in this study), cannot be considered as being part of a good quality nutrition service and is not supportive of Nurturing Care. Even with the timeous feedback to health facilities where research is conducted, there is still a great deal of delay in how research findings are translated into policy and action at ground level to make a difference and improve the situation for communities that participate in research. Health facilities and provincial Departments of Health should review research findings from accredited research more systematically to make sure that they include these findings into their action plans.
- 2) The South African government (national and disaggregated to provincial level), should consider an accessible repository dedicated to infant nutrition information that is actively updated and applied in collaboration with South African researchers. This will facilitate further collaboration and assist in identifying gaps in infant nutrition research that need priority funding. Only with joint efforts will there be better resource use and efficiency in convening a research agenda to bring about policy changes in the right direction (to achieve optimum nutrition support for vulnerable communities).
- 3) Infant feeding practices research requires active encouragement. It should not be regarded as less scientific than other research or an unoriginal pursuit. This encouragement needs to include financial support for students and researchers, and support from journals for the publication of articles based on research on this topic.
- 4) It is essential for the dialogue between all stakeholders in the infant feeding field to continue with increased transparency and trust. This group of stakeholders includes

researchers, the government, non-governmental organisations, civil society organisations, health care workers, the food industry and community representatives. A forum of multi-sectoral stakeholders will hopefully provide richer insights, experiences and skills to address the infant nutrition situation in South Africa. Dialogue should be directed to establishing an action plan to improve the infant nutrition situation in South Africa, with specific time bound commitments owned and honoured by the various stakeholders.

- 5) The food industry in South Africa and throughout the world is often blamed for nutrition problems. However, public reliance on manufactured food products is immense, and this extends to infant feeding products. There is a real opportunity for the food industry in South Africa to collaborate ethically with researchers and communities to make affordable nutrient-dense options available for infants.
- 6) The South African Department of Health has invested a great deal of time and energy into developing nutrition communication tools to educate mothers on better infant feeding practices. A review of the complementary feeding messages conveyed by health care workers would be essential as it is possible that some messages need more emphasis. This study also highlighted the important role of grandmothers, and the need for reassurance regarding the importance of appropriate timing for the introduction of complementary foods. The frequency of feeding during complementary feeding in the community of KwaMashu should be stressed in communication efforts.
- 7) The findings of this study have been shared with the nutritionist at KwaMashu and with the Provincial Nutrition Directorate in KwaZulu-Natal. It is recommended that the KwaMashu Community Health Centre give urgent attention to the formation of a community support group steered by mothers and grandmothers from the community. This will strengthen other efforts to improve infant feeding practices already in place.
- 8) The final recommendations from this study is related to the Optifoods modelling programme. It is regrettable that the Optifoods software is not yet freely available as it provides the opportunity for the novel assessment of community diets. When the software does become available, it will require a comprehensive user manual and training for wider audiences to be able to understand and use it. It would be useful if

the software is updated to include more user-defined functionality and output reports of the analyses. It is recommended that the organisations involved in the development of Optifoods intensify their efforts for funding to enable the update and wider distribution of the programme.

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Appendices

Appendix 1: Ethics approval letter



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Natural and Agricultural Sciences
Ethics Committee

E-mail: ethics.nas@up.ac.za

27 July 2018

ETHICS SUBMISSION: LETTER OF APPROVAL

Ms N Sayed
Department of Centre for Food Nutrition
Faculty of Natural and Agricultural Science
University of Pretoria

Reference number: 180000016
Project title: A food-based approach to complementary feeding: is it enough?
A case study of KwaMashu, KZN

Dear Ms N Sayed,

We are pleased to inform you that your submission conforms to the requirements of the Faculty of Natural and Agricultural Sciences Ethics committee.

Note that you are required to submit annual progress reports (no later than two months after the anniversary of this approval) until the project is completed. Completion will be when the data has been analysed and documented in a postgraduate student's thesis or dissertation, or in a paper or a report for publication. The progress report document is accessible on the NAS faculty's website: Research/Ethics Committee.

If you wish to submit an amendment to the application, you can also obtain the amendment form on the NAS faculty's website: Research/Ethics Committee.


The digital archiving of data is a requirement of the University of Pretoria. The data should be accessible in the event of an enquiry or further analysis of the data.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'S. J. ...', on a light grey rectangular background.

Chairperson: NAS Ethics Committee

Appendix 2: Approval from KZN Department of Health

 health Department: Health PROVINCE OF KWAZULU-NATAL	DIRECTORATE: Health Research & Knowledge Management
Physical Address: 330 Langalibalele Street, Pietermaritzburg Postal Address: Private Bag X9051 Tel: 033 395 2805/ 3188/ 3123 Fax: 033 384 3782 Email: hrkm@kznhealth.gov.za www.kznhealth.gov.za	

NHRD Ref: KZ_201809_018

Dear Ms N. Sayed
University of Pretoria

Approval of research

1. The research proposal titled '**A food-based approach to complementary feeding: is it enough? A case study of KwaMashu, KZN**' was reviewed by the KwaZulu-Natal Department of Health.


The proposal is hereby **approved** for research to be undertaken at KwaMashu Community Health Centre.

2. You are requested to take note of the following:

- Kindly liaise with the facility manager **BEFORE** your research begins in order to ensure that conditions in the facility are conducive to the conduct of your research. These include, but are not limited to, an assurance that the numbers of patients attending the facility are sufficient to support your sample size requirements, and that the space and physical infrastructure of the facility can accommodate the research team and any additional equipment required for the research.
- Please ensure that you provide your letter of ethics re-certification to this unit, when the current approval expires.
- Provide an interim progress report and final report (electronic and hard copies) when your research is complete to **HEALTH RESEARCH AND KNOWLEDGE MANAGEMENT, 10-102, PRIVATE BAG X9051, PIETERMARITZBURG, 3200** and e-mail an electronic copy to hrkm@kznhealth.gov.za

For any additional information please contact Mr X. Xaba on 033-395 2805.

Yours Sincerely



Dr E Lutge
Chairperson, Health Research Committee

Date: 09/10/18

Fighting Disease, Fighting Poverty, Giving Hope

Appendix 3: Information leaflet and consent forms

INFORMATION LEAFLET AND CONSENT FORM:

INCWAJANA EQUKETHE ULWAZI NGOCWANINGO KANYE NEFOMU

LOKUZIBOPHEZELA

Good morning / afternoon, (NAME) _____

Sawubona, (IGAMA) _____

We are from the University of Pretoria. We would like to invite you to take part in a research study. This information leaflet will help you to decide if you want to participate. Before you agree to take part you should fully understand what is involved. If you have any questions that this leaflet does not fully explain, please do not hesitate to ask the research personnel.

Thina siyiNyuvesi yasePitoli. Sifisa ukukumema ukuba ube yingxenywe yocwaningo lwethu. Lencwajana yolwazi izokusiza ukuba ucabangisise kahle ukuthi uyathanda yini ukuba yingxenywe yalolucwaningo noma awuthandi. Ngaphambi kokuba uvume ukuba yingxenywe yocwaningo kumele uqonde ukuthi kwenzakalani. Uma unemibuzo engachazekanga kahle kulencwajana, sicela ungangabazi ukubuza umphathi waloluhlelo.

We are doing a project to understand what mums feed their babies. Babies grow fast in the first year of life and we need them to get the right food to grow strong and healthy. We would like to understand how babies in KwaMashu are eating so we can help the mothers better. To get the information we need to interview mums and caregivers of 6 – 11-month-old children. The interview will take about 45 minutes.

Senza ucwaningo ukuze sazi kabanzi ukuthi omama babafunza kudla kuni abantwana babo. Abantwana bakhula masinyane kunyaka wokqala bezelwe, manje sidinga ukuba badle ukudla okufanele ukuze bakhule benempilo, futhi benamandla. Sifisa ukwazi ukuthi abantwana bakwaMashu badla kanjani ukuze sikwazi ukusiza omama. Ukuze siluthole lolulwazi sidinga ukubuza omama nabanakekeli bezingane ezinezinyanga eziw 6 kuyakweziwu 11. Lemibuzo izothatha nje imizuzu ewu45 kuphela.

Your participation in this study is entirely voluntary. All the information you give us will remain strictly confidential and your answers and name will never be revealed in any reports, articles or presentations. Also, you are not obliged to answer any question you do not want to, and you may stop the interview at any time. Please do not feel pressured to give a certain answer. We want you to answer honestly and freely. Please do not feel shy or worried about what you answer. Please take your time and answer slowly. IF there is anything you want us to repeat or explain please tell us.

Ukubamba iqhaza kulolucwaningo kusothehandweni lwakho kuphela, awuphoqelekile. Lonke ulwazi ozosinika lona luzoba yimfihlo yethu, nezimpendulo Kanye namagama awasoze adalulwa kwimibiko yethu, nasezincwadini, ngisho nalapho sikhulumisana nabantu. Futhi-ke awuphoqelekile ukuphendula umbuzo ongafuni ukuwuphendula, kanti uvumelekile ukuyimisa imibuzo noma yini. Uyacelwa ukuba ungazizwa sengathi uphoqelekile okanye ucindezelekile ukunikeza impendulo. Sifuna uphendule ngeqiniso nangenkululeko. Siyacela ukuba ungabi namahloni ngempendulo yakho. Sicela uthathe isikhathi sakho uphendule kancane. Uma kukhona into ofuna ukuthi siphinde siyachaze, uvumelekile ukusazisa.

This study has received written approval from Research Ethics Committees of the Faculty of Natural and Agricultural Sciences, tel 012 420 4356. If you have any questions or comments about the study please contact Nazezia Sayed, tel 0833575433.

Lolucwaningo luthole isivumelwano esibhalwe phansi ukuthi lungaqhubeka kwikomidi lososayensi elibizwa ngokuthi: Research Ethics Committees of the Faculty of Natural and Agricultural Sciences, ucingo 012 420 4356. Uma unembuzo noma imibandela ngalolucwaningo, ungathimtana no Nazezia Sayed, ucingo: 0833575433.

Before we continue please tell us if you agree to participate in this interview?

Yes _____ No _____

Ngaphambi kokuba siqhubeke sicela usazise ukuthi uyavuma yini ukuba yingxeny yalolucwaningo?

Yebo _____ Cha _____

If yes, continue to the next question; if no, stop the interview. Do you have any questions before we start? (Answer questions)

Uma uthi Yebo, Qhubeka nombuzo olandelayo, uma uthi Cha, usungama ungabe usaqhubeka nemibuzo. Kungabe ikhona imibuzo ngaphambi kokuba siqale? (phendula imibuzo)

Please read the information below and write your name and sign.

Uyacelwa ukuba ufunde iminingwane engezansi bese ubhala igama lakho, bese uyasayina.

I confirm that the person asking my consent to take part in this study has told me about the nature, process, risks, discomforts and benefits of the study. I have read this form and I understand the information regarding the study. I am aware that the results of the study, including personal details, will be anonymously processed into research reports. I am participating willingly. I have had time to ask questions and have no obligation to participate in the study. I understand that there is no penalty should I wish to discontinue with the study and my withdrawal will not affect any treatment in any way. I have a right to access the information about me.

Ngiyaqinisekisa ukuthi lomuntu ocela imvumo yokuba ngibe yingxenye yalolucwaningo ungitshelile ngenqubo, nohlobo lwayo, nengcuphe, nokungakhululeki Kanye nokuhle okungatholakala ngalolucwaningo. Sengilifundile ifomu futhi ngiyayiqonda yonke iminingwane ephathelene nalolucwaningo. Ngiyazi ukuthi imiphumela yalolucwaningo, kubandakanya neminingwane yami kuyoshicilelwa ngokufihliwe kwimiphumela yalo. Ngibamba iqhaza ngokuthanda kwami. Nginikeziwe isikhathi sokubuza imibuzo, kodwa angisibonanga isidingo sokwenqaba ukuba yingxenye yalolucwaningo uma ngifisa ukungabe ngisaqhubeka nalolucwaningo, kanti futhi nokuhoxa kwami akuyuphazamisa indlela engiphathwa ngayo. Nginelungelo lokuthola iminingwane ephathelene nami.

I have received a signed copy of this informed consent agreement.

Ngiyitholile ikhophi esayiniwe yalesisivumelwano engisenza ngokuzinikela.

Participants name (Please print)

Igama lalowo ohlanganyelayo (Bhala ngokuhlukanisa)

Participants signature..... (Date).....

Isignesha yalowo chlanganyelayo (Usuku)

Investigators name ...NAZEEIA SAYED.....(Please print)

Igama lomcwaningi (Bhala ngokuhlukanisa)

Investigators signature.....*N. Sayed*.....(Date)...15 OCTOBER 2018.....

Isignesha yomcwaningi (Usuku)

Witness's Name.....(Please print)

Igama likafakazi (Bhala ngokuhlukanisa)

Witness's signature(Date).....

Isignesha kafakazi (Usuku)

Appendix 4: Eligibility screening form

ELIGIBILITY / UKUZE UFANELEKE

Dear mum / caregiver / **Mama / Mnakekeli wengane**

Thank you for your interest in the research we are doing to understand how you feed your babies. Before we tell you more about the research we need to check if you can participate:

Siyabonga ukuthi uye waba nothando kulolucwaningo lwethu lokuthola ulwazi lokuthi ubapha kanjani abantwana bakho ukudla. Ngaphambi kokuba sikwazise okuningi ngalolucwaningo, sidinga ukuthola ukuthi ungakulungela yini ukubamba iqhaza ube yingxenye yalo.

1. Have you / has the mother lived in this area since before giving birth (Yes or No)
Ngabe wena noma umama wengane benhlala kulendawo ngaphambi kokuba umntwana azalwe na? (Yebo noma Cha)
2. What is the babies age now? (must have turned 6 months old already and less than 12 months)
(Yes the right age or No not the right age)
Uneminyaka emingaki umntwana njengamanje? (kumele kube wumntwana osenezinyanga eziyisithupha ezigcwele noma ngaphezulu kodwa futhi abe nezinyanga ezingaphansi kweziw 12) (Yebo, izinyanga zinjalo, Cha, izinyanga azinjalo)
3. Is the baby healthy now and nothing is affecting their food intake? (Yes or No)
Kungabe umntwana uphilile njengamanje kanti futhi akukho okumphazamisayo uma edla? (Yebo noma Cha)
4. Has the baby been getting food in at least the last 2 weeks (Yes or No)
Kungabe umntwana ubekuthola ukudla okungenani emasontweni amabili adlule? (Yebo noma Cha)
5. What is the age of the mum? Is the mother between 18 and 45 years old? (Yes or No)
Ngabe uneminyaka emingaki umama womntwana? Kungabe uneminyaka ephakathi kuka 18 no 45? (Yebo noma Cha)
6. Have you the caregiver known the baby since birth? (Yes or No)
Ngabe wena njengomnakekeli wengane, uyazi kusukela isazelwe lengane? (Yebo noma Cha)
7. Do you the caregiver live in the same house hold as the baby? (Yes or No)
Kungabe wena Mnakekeli wengane uhlala endlini / emzini ndawonye nalengane oyinakekelayo? (Yebo noma Cha)

8. Do you the caregiver participate in the feeding of the baby? (Yes or No)

Ngabe wena njengomnakekeli wengane uke uyiphe okanye uyifunze ukudla ingane?
(Yebo noma Cha)

MUST SAY YES TO ALL ABOVE QUESTIONS TO CONTINUE

KUMELE ATHI YEBO KUYO YONKE IMIBUZO ENGENHLA UKUZE AKWAZI UKUQHUBEKA.

1. Does the baby have a sickness or has the baby been sick in the last week? (Yes or No)

Ngabe sikhona isifo anaso umntwana okanye kuke kwenzeka yini umntwanma wagula
kulelisonto eledlule? (Yebo noma Cha)

2. Has the baby ever got any food or nutritional supplements from the clinic / other clinic for use at home, (e.g. Imunut)? (Yes or No)

Ngabe umntwana uke wanikezwa ukudla noma izakhamzimba emtholampilo nokuthi
ayozidla ekhaya? (Yebo noma Cha)

3. Did the nurse or doctor ever tell you / the mum that the baby was not growing properly, or the baby was underweight, wasted or stunted before this clinic visit? (Yes or No)

Kungabe umhlengikazi noma udokotela uke wakutshela wena noma umama wengane
ukuthi ingane ayikhuli kahle, noma inesisindo esingaphansi kwaleso esilindelekile?
(Yebo noma Cha)

MUST ANSWER NO TO ABOVE 3 QUESTIONS

KUMELE IZIMPENDULA ZAKHO KUBE WU "CHA" KULEMBIBUZO ENGENHLA UKUZE SIKWAZI UKUQHUBEKA.

Thank you for your time. We are sorry, but you cannot continue with this interview because (give specific reason) OR you can continue in this study – we will tell you more about it and we need your signature to say you understand what we have told you.

Siyabonga ngesikhathi sakho. Siyaxolisa, angeke ukwazi ukuqhubeka nemibuzo elandelayo (nikeza isizathu esiqondile) NOMA : Ungakwazi ukuqhubeka nembuzo yalolucwaningo – sizokwazisa kabanzi ngalo kanti futhi sizodinga ukuba usayine ukuthi uyakuqonda konke esesikutshela khona.

Appendix 5: Interview forms

QUESTIONNAIRE

Interviewer: TM or NM (please ring)

Date: (day, month and year)

Usuku: (usuku, inyanga, unyaka)

Participant ID: *sequence number completed on day/highlight when checked*

Inamba kamazisi yalowo ohlanganyelayo kulolucwaninga

Sociodemographic information: Ulwazi oluphathelene nezenhlalakahle Kanye nokubalwa kwabantu: *please complete using blue pen, tick LHS option or write in CAPS*

- 1) Are you the mum or caregiver? (Mum or caregiver)

Ngabe ungumama wengane noma ungumnakekeli wayo? (Umama noma umnakekeli)

<input type="checkbox"/>	Mum
<input type="checkbox"/>	Caregiver

- 2) If caregiver – what is your relationship with the baby? (father, grandmother, aunt, other)

Uma ungumnakekeli wengane – unabudlelwano buni nalengane? (ubaba, ugogo, u-anti, noma okunye)

<input type="checkbox"/>	Father
<input type="checkbox"/>	Grandmother
<input type="checkbox"/>	Aunt
<input type="checkbox"/>	Other – please specify:

- 3) What is your age / the age of the mother? (years)

Uneminyaka emingaki wena / umama wengane uneminyaka emingaki? (iminyaka)

Age of the mother: (years)	<input type="text"/>
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- 4) What is the highest level of education completed by you / the mother? (no schooling, some primary school, primary school completed, some high school, high school completed, post graduate diploma or degree)

Ngabe wena wafunda wagcina kuliphi ibanga? Umama wengane yena, wagcina kuliphi ibanga ngemfundo? (awfundanga nhlobo, wafunda amabanga aphantsi kuphela nawo

awangawqeda, wafunsa amabanga aphansi wawaqeda, wafunda amabanga aphezulu wangawaqeda, waqeda wonke amabanga aphezulu, wenza i-degree noma idiploma kwimfundo ephakeme.)

	no schooling
	some primary school
	primary school completed
	some high school
	high school completed
	post graduate diploma or degree

- 5) What is your marital status / the marital status of the mother? (Single, divorced, married, living with partner)

Sithini isimo sakho ngokomshado? / esikamama wengane sona sithini? (akashadile nhlobo, wehlukanisile, ushadile, uhlala nomasihlalisane.

	Single
	Divorced
	Married
	living with partner (unmarried)

- 6) Are you / is the mother working? (yes or no, working full time or working part time)
Kungabe wena / noma umama wengane uyasebenza na? (yebo noma cha, usebenza ngokugcwele noma uyitoho.)

	No
	Yes
	Yes – working part time (seasonal / casual)
	Yes – working full time

- 7) Are you / is the mother a student? (yes or no, student full time or student part time)
Ngabe wena / noma umama wengane usafunda na? (yebo noma cha, ufunda ngokugcwele noma ufunda ebe esebenza)

	No
	Yes
	Yes – student full time (school or other)
	Yes – student part time

- 8) If working: what job do you the mother do / does the mother do? (description) **Uma kuwukuthi uyasebenza: wenza msebenzi muni / noma umama wengane usebenza msebenzi muni? (chaza)**

	Not working
	Working
Job description:	

- 9) When the baby was born, how much maternity leave did you / the mother have? (don't know, <1 week, 1 – 6 weeks, 7 – 12 weeks, 13 – 16 weeks, > 16 weeks)

Ngenkathi kuzalwa ingane, wanikezwa isikhathi esingakanani emsebenzini ukukhulisa ingane / okanye umama wengane wanikwa isikhathi esingakanani ukuyobeletha? (angazi, < isonto elilodwa, isonto elilodwa kuya kwayisithupha, amasonto ayisikhombisa kuya kwayishumi nambili, amasonto awu 13 kuya kwawu 16, amasonto awu 16.

	don't know
	<1 week
	1 – 6 weeks
	7 – 12 weeks
	13 – 16 weeks
	> 16 weeks

- 10) How many other people live in the same house as you / as the mother? (Total + (number) – adults > 18 years (number) <18 years old)

Bangaki abanye abantu ohlala nabo laphekhaya / okanye umama wengane uhlala nabantu abangaki ekhaya? (ithothali yabo bonke behlangene + abadala bebodwa, abangaphensi kweminyaka ewu 18, abano 18 kuya phezulu.

Total number of people in the household (includes mother):	
Number of people > 18 years of age:	
Number of people < 18 years of age:	

- 11) Where is household food shopping done mainly? Supermarket (name) or other – specify **Ngabe ukudla kwasekhaya nivamise ukukuthenga kuphi? (igama lesitolo nivamise ukukuthenga kuphi? (igama lesitolo enigrosa kuso ngokujwayelekile, noma enye indawo – chaza kahle.**

Supermarket (name/location):	
Or Other - specify:	

- 12) What is the approximate monthly household income? (R0-R2500, R2500-R5000, R500-R7500, >R7500, don't know)

Ngabe umholo wasekhaya nje ucishe ube malini uhlangene wonke? (ngabe uphakathi

kuka O kuya ku R2500, noma ungacishe ube phakathi kuka R2500 kuya ku R5000, noma uphakathi kuka R5000 kuya ku R7500, noma ungaphezulu kuka R7500, noma awazi ukuthi umalini)

	R0-R2500
	R2500-R5000
	R5000-R7500
	>R7500
	don't know

13) What is the amount spent monthly on food in the house? (in Rands / don't know)

Malini eniyisebenzisa ukuthenga ukudla kwasekhaya ngenyanga? (ngamarandi awu / noma angazi)

Amount spent monthly on food:	
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14) Are you / the mother a recipient of a child care grant (yes or no) / other grant (yes or no; specify other grant)

Ngabe wena / noma umama wengane uyasithola isibonelelo semali kahulumeni? (yebo noma cha) / noma-ke olunye uhlobo lwesibonelelo (yebo noma cha) chaza kabanzi ngesinye isibonelelo.

	Yes – have a child a grant
	No – do not have a child care grant
	Yes – have other grant
Other grant – specify:	

15) Are any foods grown at home for eating? (yes or no)

Ngabe kukhona yini ukudla okutshalwe ekhaya enikudlayo? (yebo noma cha)

	Yes – foods grown
	No – foods not grown

16) If yes to above question: what foods are grown? (describe)

Uma impendulo yakho ngenhla kungu yebo, ngabe yikuphi ukudla enikutshalile? (chaza)

Foods grown:	
--------------	--

Ask for the RTHC and let mum / caregiver know you are getting info from the card, verify out loud with the mum / caregiver (Q 17 – Q 21)

17) Infant date of birth from RTHC (day, month, year)

Usuku lokuzalwa lwengane njengolokhu kubhalwe ekhadini lomgomo. (usuku, inyanga, unyaka)

DAY	MONTH	YEAR
-----	-------	------

18) Infant age (in months)

Ubudala bengane (ngokwezinyanga)

Age in months:	
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19) Is the baby a boy or girl?

	Boy
	Girl

20) Infant weight (00.0kg) from RTHC

Isisindo sengane (amakhilogremu) njengokuba kubhalwe ekhadini lomgomo.

Weight (00.0kg):	
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21) Infant height (00.0cm) from RTHC

ubude bengane (ngokwamasentimitha) njengalokhu kubhaliwe ekhadini lomgomo.

Height (00.0cm):	
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22) Do you / does the mother have other living children (yes or no, how many others) from RTHC confirmed by interviewer

Kungabe wena / okanye umama wengane unabo abanye abantwana abaphilayo>? (yebo noma cha, bangaki laba abanye?) Qinisekisa ngokubhalwe ekhadini lomgomo.

	No other living children
	Yes – has other living children
Number of other children (excluding this child):	

Return RHTC

please check all questions are completed before moving on to next section

Let mum / caregiver know you are now moving to part 2 to ask about what the baby is eating

Dietary Information: Iminingwane mayelana nezokudla:

1) Did the baby ever receive breastmilk? (yes or no)

Ngabe umntwano uke waluthola ubisi lwebele? (yebo noma cha)

	Yes
	No

- 2) What milk did the baby mainly get for the first 6 months – breast, formula or both?
 Ngabe yiluphi uhlobo lobisi olunikeze umntwana ezinyangeni eziyisithupha zokuqala?
 \ngabe wubisi lwebele, noma yilolu olusethinini, noma ubumnikeza zombili lezinhlolo zobisi?

	Mainly breastmilk
	Mainly formula milk
	Both milk types (breastmilk and formula milk) used

- 3) If breast or both: was breastfeeding started in the first hour after the baby was born? (yes or no, unsure)
 Uma kungolwebele, noma zombili lezinhlolo, ngabe ubisi lwebele wamnikeza umntwana ehoreni lokuqala ezelwe na? (yebo noma cha, okanye awunasiqiniseko)

	Not applicable
	Yes breastfeeding was started in first hour
	No breastfeeding was not started in first hour
	Unsure

- 4) If breastfed: was the baby given only breastmilk for the first 6 months (no water, herbal mutis or other food except for medicines/vitamins? (yes or no, unsure)
 Uma wamnikeza ubisi lwebele umntwana, ngabe wawumnikeza lona kuphela ezinyangeni eziyisithupha zokuqala ezelwe? (akubanga amanzi, noma imithi yesizulu, noma okunye ukudla ngaphandle kwemithi yakwadokotela Kanye namavithamini) (yebo noma cha, okanye awunasiqiniseko)

	Not applicable – baby had only formula milk
	Yes
	No
	Unsure

- 5) What milk is the baby getting at the moment – breast, formula or both?
 Yiluphi ubisi olunikeza umntwana njengamanje? Olwebele, olusethinini, noma umnikeza lolubili?

	Breastmilk
	Formula milk
	Both breast and formula milk

- 6) What age was the baby when breastfeeding was stopped? (months 00.0)
 Wamyekisa ibele umntwana esengakanani ubudala (ngezinyanga)

	Not applicable – baby is still getting breastmilk
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	Not applicable – baby only got formula
Age breastfeeding was stopped (months):	

- 7) If the baby is getting formula milk currently: how many times a day is the baby getting fed the milk? (number)

Uma umntwana wakho umnikeza ubisi olusethinini njengamanje umnikeza kangaki ngosuku? (inombolo)

	Not applicable – baby only receiving breastmilk and no other milk
Number of times a day baby is getting fed formula milk:	

- 8) At what age did the baby first get other foods (apart from other milk and water)? (in the first month, 1-3 months, 4-5 months, 6 months, > 6 months old)

Umntwana wakho uqale ukudla okunye ukudla ngaphandle kobisi namanzi esengakanani ubudala? (enyangeni yokuqala, phakathi kwenyanga yokuqala neyesithathu, phakathi kwenyanga yesine neyesihlanu, esehlenganise izinyanga eziyisithupha, noma esenezinyanga ezingaphezulu kweziyisithupha)

	in the first month
	1-3 months
	4-5 months
	6 months
	> 6 months old (7 months onwards)

- 9) What was the first food that the baby got to eat? Specify brand names if purchased or homemade (homemade:... purchased... food...)

Kungabe yikuphi ukudla aqala ngakho ukukudla umntwana wakho? Cacisa kahle amagama okudla, noma okuthengwa ezitolo, noma owawuzenzela uziphekele kona ekhaya. (engizenzele kona ekhaya, okuthengwe ezitolo, noma igama lakho lokokudla.)

First food given to baby:	
	This was homemade food
	This was purchased food
Brand name/description:	

- 10) Has the baby eaten other foods apart from milk yesterday? (yes or no)

Kungabe umntwana wakho ukudlile okunye ukudla izolo, ngaphandle kobisi? (yebo noma cha)

	Yes
	No

11) Apart from the milk, how many times a day was the baby given food yesterday? (number 0)
 Ngaphandle kobisi, umntwana wakho umnikeze kangaki lokhu okunye ukudla izolo? (inombolo)

Number of times baby had food yesterday (number)	
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12) I am now going through a list of foods. Please think if the baby had this food in the last 7 days. If the baby had the food then I will ask you on how many days in the past 7 days the baby had the food and how much (the amount) the baby eats at one time.

Please think about ALL the foods the baby had in the last 7 days. Take your time.

Ngizokufundela uhla lwezinhlobo zokudla. Ngicela ucabangisise ukuthi ngabe umntwana uke wakudla yini lokho kudla ezinsukwini eziyisikhombisa ezedlule. Uma umntwana ekudlile lokho kudle ukudla izinsuku ezingaki kweziyisikhombisa ezendlule, nanokuthi ubekudla kangakanani ngesikhathi esisodwa. (Isilinganiso). Ngicela ucabangisise ngakho “konke” ukudla okudliwe wumntwana ezinsukwini eziyisikhombisa ezedlule. Thatha isikhathi sakho.

Did the baby have... in the last 7 days?

Did the baby have the food every day/daily, most days (at least 4 days +), some days (2-3 times a week), seldom (once a week), or not at all/never had the food (A4 card with these choices and the word amount to assist response)

Ngabe umntwana ubekudla lokhokudla zonke izinsuku, noma ubekudla kwaze kwaba yizinsukwana, noma-ke ukudle izinsuku ezingaphezulu kwezine, noma ukudle kabili noma kathathu ngesonto, noma ekavamisile ukukudla, (kungaba Kanye ngesonto, noma akazange akudle nhlobo kulelisonto, noma bengingenakho lokho kudla. Uzokhetha kulelishadi uzuze usizakale ukuphendula.

Food Ukudla	Not at all/never had the food Azange nhlobo akudle loku kudla	Everyday daily Nsukuzonke	Most days (at least 4 days +) Kuvamisile (okungenani izinsukueziw 4)	Some days (2-3 times a week) Ngezinye izinsuku kabili noma kathathu ngosuku	Seldom (once a week at least) Akuvamile (okungenani kanye ngeviki	Typical amount eaten at one time (describe in household portions - ¼ cup, 1 tablespoon etc) Isilinganiso asidlile (chaza noma uhafu wenkomishi, noma yisipunu esisodwa)

FOR DIETARY INFO: show food category card & prompt cards for responses, use household measures and portions to assist with quantification

Food	Not at all/never had the food	Everyday daily	Most days (at least 4 days +)	Some days (2-3 times a week)	Seldom (once a week at least)	Typical amount eaten at one time
GRAINS,ROOTS,TUBERS(1) Okusanhlamvu, izimpande nezilimo eziyizigaxa						
Soft maize porridge - Iphalishi lempuphu elithambile						
Stiff maize porridge - Iphalishi lempuphu						
Fermented maize porridge - Iphalishi elimuncwana/umdokwe						
Commercial/shop bought baby cereal - Ukudla kwengane okuthengwe ezitolo Brand & type.....						
Any other porridge/cereal - Elinye-ke nje iphalishi noma ukudla kwengane						
Rice – irayisi						
Potato – izambane						
Bread – isinkwa						
Pasta – Iphasta						
Noodles - amanoodles						
Any other grain/root/tuber - Okunye okusanhlamvu/izimpande/izilimo eziyizigaxa						
LEGUMES AND NUTS (2) Imidumba namakinati						
Beans – Ubhontshisi Type:.....						
Soya/Toppers - Isoya noma ama veji agayiwe						
Peanut butter - Ibhotela lamakinati						

Food	Not at all/never had the food	Everyday daily	Most days (at least 4 days +)	Some days (2-3 times a week)	Seldom (once a week at least)	Typical amount eaten at one time
Nuts – Amakinati						
Any other legume or nut - Okunye okuyimidumba noma amakinati						
DAIRY PRODUCTS (3) Imikhiqizo yobisi						
Cows milk(fresh/long life) - Ubisi lwenkomo						
Powdered cows milk - Ubisi oluyimpuphu (confirm not creamer)						
Maas – Amasi						
Sweetened yoghurt - lyogathi enoshukela						
Any other dairy product - Okunyeke nje okuwumkhiqizo wobisi						
ANIMAL FOODS (4) Ukudla okuvela ezilwaneni						
Meat – Inyama						
Chicken – inkukhu						
Fish – inhlanzi Type.....						
Liver – isibindi Type.....						
Polony/viennas - Upholoni/amaviyena						
Any other animal food - Okunye-ke nje ukudla okuvela ezilwaneni						
EGGS(5) Amaqanda						
Boiled egg - Amaqanda abilisiwe						
Fried egg - Amaqanda athosiwe						

Food	Not at all/never had the food	Everyday daily	Most days (at least 4 days +)	Some days (2-3 times a week)	Seldom (once a week at least)	Typical amount eaten at one time
Scrambled egg - Amaqanda ayiskrembuli						
Any other egg/portion - Amaqanda enziwe ngenye indlela						
VEGETABLES(6) Amaveji						
Spinach/imifino - Ispinashi/imifino						
Butternut - Ithanga						
Carrot - Izaqathi/ukherothi						
Cabbage – Iklabishi						
Other vegetable - Amanye amaveji						
FRUIT(7) Izithelo						
Banana – Ubhanana						
Apple (raw) - i-apula						
Orange – Iwolintshi						
Other fruit / Ezinye izithelo						
OTHER(8) Okunye						
Fruit juice / Ijuzi yezithelo						
Other juice/cordial - Enye ijuzi/ijuzi ehlanganiswa namanzi						
Cold Drink – unemenaydi						
Tea – Itiye						
Coffee – Ikhofi						
Rooibos - Iroybhos/izingodo						
Sweets/chocolates - Amaswidi/ushokolethi						
Biscuits – amabhiskidi						

Food	Not at all/never had the food	Everyday daily	Most days (at least 4 days +)	Some days (2-3 times a week)	Seldom (once a week at least)	Typical amount eaten at one time
Chips/crisps - Amashibusi ahlofozelayo						
Sugar – ushukela						
Margarine – Imajarini						
Oil – amafutha						
Water – Amanzi						
Oral rehydration/sugar-salt solution - Isiphuzo esinikeza Amandla njengamanzi anoshukela nosawoti						
Did the baby have any other food? Ngabe umntwana ukudlile okunye nje ukudla?						
Other – Okunye (overleaf if more)						

Please check questionnaire is complete before mum leaves. Thank the mum / caregiver for their time - Mum to be given the deodorant and complementary feeding pamphlet as token of thanks.

File completed questionnaire in plastic sleeve along with consent form - thank you! Check questionnaires at end of day & collate to hand to Naz

Appendix 6: Focus group discussion guide

FOCUS GROUP DISCUSSION GUIDE

UMHLAHLANDLELA WEQEMBU ELIGXILE EZINGXOXWENI ZOCWANINGO

Date / Usuku:

Number of participants / Inombolo yalabo ababambe iqhaza:

Welcome and thank you for being a part of our study. Today we would like to understand more about how babies from 6 months to under one year are fed.

Siyakwamukela futhi siyabonga ukuba ubambe iqhaza kulolucwaningo. Namhlanje sifisa ukwazi kabanzi ngokuthi nibapha kanjani ukudla abantwana abanezinyanga eziwu 6 kuya kulabo abangaphansana konyaka owodwa.

- 1) Tell me more about how babies in your community are fed?
Awungitshela kabanzi ngokuthi nibapha kanjani ukudla abantwana abancane kulomphakathi wangakini?
- 2) Who do you trust for information on how to feed your child?
Wethemba bani ukuthi angakunikeza ulwazi olungcono mayelana nokupha umntwana wakho ukudla?
- 3) What were you told at the clinic about feeding your child?
Ngabe watshelwa ukuthini emtholampilo mayelana nokupha umntwana wakho ukudla?
- 4) What messages on feeding your child did you receive from your clinic?
Ngabe yimiphi imiyalelo owayithola emtholampilo mayelana nokupha ingane yakho ukudla?
- 5) What were you told about giving your child solid foods?
Bakutshela ukuthini mayelana nokupha umntwana wakho ukudla okuqinile?
- 6) Were you told about what foods to use and what foods not to use?
Ngabe watshelwa yini ukuthi yikuphi ukudla ongakupha ingane yakho nokuthi yikuphi okungafanele ukuphe ingane yakho?
- 7) Did you understand everything the clinic told you about feeding your child?
Ngabe wakuzwisisa konke abakutshela kona emtholampilo mayelana nokupha umntwana wakho ukudla?

- 8) Was there anything they told you at the clinic or you heard from others that you were confused about?
Ngabe kukhona yini abakutshela kona emtholampilo noma-ke owakuzwa ngabanye okwakudida wanqakuqonda?
- 9) Tell me a bit about the support and advise you get from family and friends.
Ake ungixoxele kafushane ngokwesekwa noma ukuboniswa okuthola emndenini Kanye nakubangani bakho.
- 10) Are there any special foods used to feed babies?
Ngabe kukhona yini ukudla okuyisipesheli okusetshenziswayo ukuze abantwana badle?
- 11) What foods are usually used to feed babies under 1 year?
Yikuphi ukudla okuvamise ukunikwa abantwana abangaphansi konyaka ubudala?
- 12) Do you think shop bought food for babies is better than homemade food?
Ngabe ucabanga ukuthi ukudla okuthengwa ezitolo sekwenziwe kungcono kunalokho ozenzela khona ekhaya?
- 13) Is there any special way food to prepare food for babies?
Ngabe ikhona indlela ethile engcono ongayisebenzisa ukwenzela abantwana ukudla?
- 14) There are some healthy foods available to feed babies (XYZ examples from 2018 survey), why do you think more mums do not feed their babies XYZ?
Kukhona ukudla lokunempilo okunempilo ukuba kuphiwe abantwana (ngokwezibonelo zocwaningo luka 2018) kungani ucabanga ukuthi omama ababaniki lokhu kudla abantwana babo?

Appendix 7: Infant dietary diversity according to food group consumption

Table 7.1: Consumption of food items from various food groups in the previous 7 days

FOOD GROUP NAME	CONSUMPTION IN THE LAST 7 DAYS					
	NUMBER (n) AND PERCENTAGE (%) OF 6-8 MONTH- OLDS		NUMBER (n) AND PERCENTAGE (%) OF 9-11 MONTH- OLDS		TOTAL NUMBER (n) AND PERCENTAGE (%) OF INFANTS 6-11 MONTHS-OLD	
	n	%	n	%	n	%
1. GRAINS, ROOTS,TUBERS	67	98.5%	65	98.5%	132	98.5%
2. LEGUMES AND NUTS	32	47.1%	53	80.3%	85	63.4%
3. DAIRY PRODUCTS	38	55.9%	55	83.3%	93	69.4%
4. ANIMAL FOODS	32	47.1%	55	83.3%	87	64.9%
5. EGGS	43	63.2%	49	74.2%	92	68.7%
6. VEGETABLES	53	77.9%	59	89.4%	112	83.6%
7. FRUIT	54	79.4%	58	87.9%	112	83.6%

Table 7.2: Number of infants consuming foods from different number of food groups

NUMBER OF FOOD GROUPS:		1	2	3	4	5	6	7
6-8 MONTH-OLDS	<i>Number</i>	4	6	10	9	11	14	14
	<i>Percentage</i>	5.9%	8.8%	14.7%	13.2%	16.2%	20.6%	20.6%
9-11 MONTH-OLDS	<i>Number</i>	1	0	4	6	8	11	36
	<i>Percentage</i>	1.5%	0.0%	6.1%	9.1%	12.1%	16.7%	54.5%
6-11 MONTH-OLDS	<i>Number</i>	5	6	14	15	19	25	50
	<i>Percentage</i>	3.7%	4.5%	10.4%	11.2%	14.2%	18.7%	37.3%

Table 7.3: Percentage of infants consuming less than 4 food groups in the previous 7 days

	Percentage
6-8 MONTH-OLDS	29.4%
9-11 MONTH-OLDS	7.6%
6-11 MONTH-OLDS	18.7%