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PREVALENCE OF MODIFIABLE RISK FACTORS FOR ACUTE MALNUTRITION AS WELL AS VALIDATION OF AN ASSESSMENT TOOL IN SIX TO TWENTY-FOUR-MONTH-OLD CHILDREN IN PERIPHERIES OF LAHORE, PAKISTAN

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Abstract

Undernutrition remains a global challenge for lower-middle-income countries (LMICs), including Pakistan. The recent COVID-19 pandemic-related economic crisis in the food and health system has threatened to deteriorate the indicators of undernutrition in LMICs. Nutrition interventions during the first two years of life are reported to have a significant impact on stunting prevention. The Lancet series on Maternal and Child Undernutrition in 2013, which included three new review papers building upon findings from the previous 2008 series, highlights the growing body of evidence supporting essential interventions in the fight against malnutrition. These review studies underscore the importance of interventions such as breastfeeding, complementary feeding, dietary supplementation for children, dietary diversity, feeding behaviours and stimulation, as well as the treatment of severe acute malnutrition, diarrhoea, and pneumonia. Ready to use Foods (RUF) are used by partners and governments in Pakistan to treat severe and moderate wasting in Pakistan. These RUFs are expensive, energy-dense, and sweet. Also, literature published in the country lacks evidence of its association with feeding and caring practices and malnutrition. Therefore, the research in this thesis aimed to:

1. Develop an assessment tool to assess and quantify the modifiable risk factors for malnutrition in this population.

2. Assess the prevalence of modifiable risk factors among both malnourished and healthy children.

3. Test the effect of supplementary foods on growth and eating behaviour.

4. Assess the feasibility of delivering a non-food-based targeted intervention.

The first study was conducted in Glasgow to develop and validate a tool to describe eating avidity and aversion among Urdu and English-speaking mothers in relation to their children. Phrases were taken from previously used tools and refined based on a back-translation approach by native Urdu speakers. These were then tested again with English-speaking mothers, as well as with Urdu mothers.

The eleven best-performing phrases describing different eating and feeding behaviours included, "likes food a lot, is interested in food, enjoys eating, enjoys a wide variety of foods, eats quickly, and finishes meals" for eating avidity and

“turns head when offered food, pushes food away, cries and screams during meals, spits out food and meals last more than one hour” for food refusal. These phrases were incorporated in the International Complementary Feeding Assessment Tool (ICFET) to be used further.

A total of 22 English-speaking and 16 Urdu-speaking participants were recruited for the study. Participants were shown four videos of children exhibiting different eating behaviours and were asked to complete the Likert scaling tool. Overall, participants from both language groups in UK showed high agreement for the avidity phrases, with the highest agreement, 97%, for the phrase related to interest in food and the lowest, 57%, for eating quickly. A set of identified phrases to describe infant eating avidity and avoidance were therefore validated and showed consistent intercorrelation among language groups.

The validated tool was then used to assess the prevalence of risk factors among healthy and malnourished infants in the peripheries of Lahore, Pakistan.

108 mother-child pairs (42% healthy & 58% malnourished 52% female infants) from four primary healthcare facilities in Lahore were recruited. In addition to maternal interviews, anthropometric measurements of children were recorded. This included 13% from 6 to 9 months age 22% were from 10–12 months, and the majority (64%) were from the age group of 13-24 months. The mean weight, height, and age of mothers at the time of recruitment were 60.1±10.7 kg, 160.4±10.3cm, and 28.5±5.2 years, respectively. While on average, there were three children born to every mother, and over half (65%) of the households had more than one under-five child. Both malnourished and healthy groups showed similar family characteristics. However, number of children who were still breastfeeding were higher among the healthy group (78.6%) compared to the malnourished ones (54.5%) ($p=0.01$). Complementary feeding started after the age of 7 months was more common among the malnourished group, but food frequency was similar. Avidity scores were higher among the malnourished group, though not significantly different. However, scores for food refusal, eating avidity, force-feeding, and maternal stress showed no significant association among both groups although "hold food in the mouth for too long and meals last more than 30 minutes" were more common among the healthy group, while "spits out food" was more common among the malnourished group.

The findings from the first study in Pakistan reported that ICFET has successfully identified critical modifiable practices among both healthy and malnourished children. However, training of data collectors, use of anthropometric equipment, and data on developmental milestones reflected the need to improve further.

Finally, a Cluster Randomized Control Trial (CRCT) was planned to assess the effect of RUF on childcare practices. For this study, 90 first-time identified moderately acute malnourished (MAM) children, along with their mothers (48 in Ready to Use Supplementary Food (RUSF) and 42 in Multi Micronutrient Sachets (MMS)), were recruited from eight primary healthcare facilities in Lahore, Pakistan. Due to the COVID outbreak, only one follow-up after four weeks could be completed for 43 Children (RUSF 32 & MMS 11). Despite the consumption of one sachet of RUSF, which provided around 500 kcal, no significant improvement in weight, MUAC, WAZ, and HAZ was found. However, a significant improvement in food refusal was seen (median change = -0.43, P=0.001) and in maternal anxiety (median change = -0.28; P= 0.005) was seen at a one-month follow-up. Force-feeding and avidity remained the same from baseline to follow-up.

Further analysis from combined datasets of study 1 conducted in Pakistan and CRTC showed no relationship between feed frequency, dietary diversity, and nutritional status.

Although non-significant, maternal anxiety scores were higher among the malnourished group (healthy; 0.93 vs wasted 1.14, stunted 1.36). Scores for food refusal were higher among stunted only (2.97) if compared with wasted and healthy 0.08 and 1.17, respectively.

As part of the CRCT, a qualitative study to assess the feasibility of delivering targeted nutrition advice through primary healthcare settings was also conducted to provide the basis for using ICFET by primary healthcare practitioners.

The qualitative study highlighted significant gaps in delivering nutritional counselling to mothers attending to primary healthcare facilities in Pakistan, which included training, IEC material, and clear guidelines for both treatment and prevention of malnutrition. A strong opinion from participants was reported for a need to have a comprehensive tool to identify the exact cause of malnutrition and subsequent capacity development to deliver targeted nutrition counselling at primary healthcare facilities.

It is suggested that additional evidence from local settings will be required to understand primary healthcare workers' capacity, time, and interest to engage in nutrition counselling, specifically targeted counselling, given the complex trends of under/over and the double burden of malnutrition.

As the CRCT could not be completed due to the pandemic, an additional analysis of the anthropometric data collected was undertaken.

A two-stage screening for acute malnutrition is suggested to minimise the chance of missing truly wasted and inclusion of not wasted children in nutrition programs.

Overall, it can be concluded that modifiable risk factors, such as low meal frequency and dietary diversity among infants aged 6 to 24 months, are prevalent in Pakistan. RUSF did not significantly improve anthropometry in moderately malnourished children. While MUAC is a common screening tool in community settings, using it alone for MAM children can misidentify healthy children and miss actual wasted ones. Further research with larger sample size and longer follow-up is needed, along with an online tool for improved data quality.

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Author’s Declaration

I, Amara Khan, hereby declare that this thesis was prepared primarily by myself with the assistance of others as acknowledged, and that it has not previously been presented in any application for a higher degree.

Abbreviations

CHW: Community Health Worker

FAO: Food and Agriculture Organization

HAZ: Height for age Z scores

IRMNCH: Integrated Reproductive Maternal New-born Child Health

LHV: Lady Health Visitor

LMIC: Lower Middle-Income Countries

LNS: Lipid-based Nutrient Supplement

MAM: Moderate acute Malnutrition

MCH: Maternal Child Health booklet

MUAC: Mid-Upper Arm Circumference

OTP: Outpatient Therapeutic Program

RUF: Ready to use food

RUSF: Ready to use supplementary food

RUTF: Ready to use therapeutic foods

SAM: Severe acute malnutrition

SFP: Supplementary Feeding Program

UNICEF: United Nations Children's Fund

UNWFP: United Nations World Food Programme

USAID: United States Agency for International Development

PAHO: Pan American Health Organization

WAZ: Weight for age Z scores

WHO: World Health Organization

WLZ: Weight for length Z scores

Chapter 1 Introduction and literature review

1.1 Introduction

Undernutrition remains a challenge around the globe for lower-middle-income countries (LMICs). The complexity of malnutrition has increased over the years, particularly in LMIC, with the increasing trend toward the double burden of malnutrition (Global Nutrition Report, 2020). The WHO global estimates suggest that on the one hand, 2.3 billion children and adults are overweight, while on the other150 million children are stunted. In low and middle-income countries (LMICs), these emerging trends may overlap the same household, individual, and population (WHO, 2019).

The first 1000 days of life are considered a "window of opportunity" as most of the interventions during this time can minimise the impact of malnutrition in later life. Also, these early days of life are characterised by rapid growth and development. Inappropriate care, nutritional deficiencies, and other economic and social factors can cause longer-term consequences on a child's growth and development (Victora *et al.*, 2010; Black *et al.*, 2013).

Despite all the interventions and nutrition programmes to address the problem, sustainability remains challenging. Based on the conceptual framework of UNICEF (Black et al., 2008b) and since 2013 (Black *et al.*, 2013), attention has been on a set of interventions to address the issue (Keats *et al.*, 2021). This set of interventions includes breastfeeding and complementary feeding, dietary supplementation for children, dietary diversification, feeding behaviour and stimulation, treatment of severe acute malnutrition, and treatment of diarrhoea and pneumonia. These areas of intervention can be looked at with a life cycle approach which recognises unique nutritional needs and vulnerabilities at various stages of life. However, over the years of experience and nutrition programme evaluations in Pakistan, it has been highlighted that there is a need to better understand the caring practices and prevalence of risk factors in lower middle-income areas so that a problem-solving approach can be adopted to treat malnutrition in local settings (Zaman, Ashraf and Martines, 2008).

Although few studies have been conducted in the country to assess infants' eating, feeding, and caring practices, gaps in the literature included the availability of reliable tools to identify key risk factors for acute malnutrition. In addition, the impact of ready-to-use foods on the eating and feeding behaviours of malnourished children and the reliability of MUAC for identifying acute malnutrition need to be studied. This research programme was therefore planned to develop a valid measure to assess risk factors among the malnourished population in Pakistan and to subsequently assess the prevalence of these risk factors and explore the feasibility of delivering targeted support to mothers/caregivers of these malnourished children.

1.2 Literature review

1.3 Purpose of the review

The purpose of this literature review was to critically examine and evaluate the existing body of knowledge related to malnutrition among the under two-year-olds in different populations, its causes, consequences, and treatment. This will provide an overview of the current state of research and identify gaps in the existing knowledge and practices regarding treating and preventing moderate malnutrition. This chapter further highlights the theoretical and practical implications of previous studies in nutrition programming in underdeveloped countries. We aimed to synthesise and analyse the findings of relevant studies and provides a conceptual framework for the current study programme. Additionally, it highlights the gaps, strengths, and inconsistencies in the literature for food-based and non-food-based interventions to treat malnutrition in lower middle-income settings. Finally, this chapter proposes potential research questions and hypotheses.

1.4 Literature search strategy

The literature search strategy employed for this thesis involved a systematic approach to identify relevant studies related to undernutrition among infants till 24 months age. A comprehensive search was conducted using various academic databases, including PubMed, Google Scholar, the University of Glasgow library site, and the Web of Science. In addition, grey literature sources such as government policy documents, Global Nutrition Reports, United Nations technical briefs/guidelines, and program assessment reports were included. The search focused on studies published in recent years (2012-2022), with an emphasis on studies conducted in low- and middle-income countries, including Pakistan. The search terms used included different keywords related to undernutrition, wasting, stunting, eating, and feeding behaviours, child malnutrition, screening, treatment, causes, consequences, caring practices, and nutrition situation of children in Pakistan. A comprehensive search strategy was used that included both selected terms and free text. Initially, the search was conducted using broad terms, and then, as more relevant studies were identified, the search terms were refined to include more specific keywords.

The results of the literature search were then screened for relevance based on the topic and context. The inclusion criteria focused on studies that examined the prevalence, causes, consequences, screening, and treatment of wasting in children under two years. The findings of the included studies were synthesised and summarised, highlighting key findings related to undernutrition among infants and its causes, focusing on caring practices, consequences, and screening with a focus on the reliability of Mid upper arm circumference (MUAC) for identification of moderate acute malnutrition, treatment including food based and non-food-based interventions, and the Pakistan specific literature.

1.5 Malnutrition

The term malnutrition is used to describe an imbalance of nutrient intake and energy expenditure. It broadly covers the excess or deficiency of nutrients. It can refer to an individual who is either over or undernourished; however, primarily, the term malnutrition is used to describe undernutrition (Saunders, Smith, and Stroud, 2015).

The WHO uses the term malnutrition to cover two broad conditions. The first 'undernutrition'— includes stunting (low height for age), wasting (low weight for height), underweight (low weight for age), and micronutrient insufficiencies, and the second overnutrition covers overweight for height (WHO, 2016).

Malnutrition is leaving long-term marks on the maternal and child populations of both underdeveloped and developed economies, health outcomes, and sustainable development around the globe (Das and Gulshan, 2017). The Global Nutrition Report (2017) described some improvements in malnutrition indicators (wasting). However, malnutrition is still considered one of the major issues affecting sustainable development goal (SDG) achievement (Beasley, no date).

The second emerging form of malnutrition is overweight or obesity, affecting 41 million children under the age of 5 years globally (World Health Organisation, 2016), and this has started showing consequences, such as an increased burden of noncommunicable diseases, i.e., diabetes, hypertension, and cardiovascular diseases.

1.6 Undernutrition and its types

John Waterlow introduced the term wasting and stunting in the early 1970s to distinguish between underweight children who had low weight for their height (wasted) from those with low height for their age (stunted)(Waterlow, 1969). Undernutrition can be classified into acute (wasting and micronutrient deficiencies) and chronic undernutrition as stunting (Black et al., 2008b). Wasted children are considered more at risk than stunted children, and the risk increases for children who are both wasted and stunted (Myatt *et al.*, 2018). The majority of studies conducted in India have reported common risk factors contributing to wasting and stunting (Young and Martorell, 2013). Severely wasted children are also often found to be stunted, suggesting that either both forms share common risk factors, or one type of malnutrition develops as a consequence of the other.

Many young children in developing countries also suffer from several micronutrient deficiencies along with wasting and stunting. Two forms of undernutrition, protein energy deficiency, and micronutrient deficiency, can be found in the same household. Usually, the same geographical areas share the burden of more than one type of undernutrition, probably due to common determinants for all types of

undernutrition. Stunting is commonly understood to be the long-term impact of wasting. However, stunting can also be found in children who are not wasted at all, but their physical and mental growth is compromised (Khara *et al.*, 2017). Children affected by stunting are less likely to achieve their optimum physical and mental growth (UNICEF, WHO, and Group, 2017). The relationship between wasting and stunting is complex, and more evidence is needed to understand this completely.

Recently there has been a double burden of different forms of malnutrition reported in various parts of the globe, making the situation complex to the global nutrition report 2018. The double burden is characterised by more than one form of malnutrition in the same household, community, population, or geographical area. WHO's definition of the double burden of malnutrition: "the coexistence of undernutrition along with overweight and obesity, or diet-related noncommunicable diseases, within individuals, households and populations, and across the life course" (WHO, 2016).

1.6.1 Chronic Undernutrition: stunting

The WHO states, "Children are classified as stunted if their height-for-age is more than two standard deviations below the WHO Child Growth Standards median" (WHO, 2015). There is strong evidence that the period starting from pregnancy to the first 1000 days is critical for growth and development, as after the 2nd year of a child's life, it becomes challenging to reverse the loss of compromised growth (Martorell *et al.*, 2010). Failure to achieve optimum growth during infancy results in adulthood short stature (Coly *et al.*, 2006; Stein *et al.*, 2010). The first 24 months of life are thus a critical window of opportunity as it is estimated that stunting starts from conception in utero and then continues with its maximum velocity during 6 to 24 months of age (Victora *et al.*, 2010).

1.6.2 Acute Undernutrition: wasting (marasmus)

Wasting is an acute and potentially life-threatening form of undernutrition with an increased risk of death, requiring immediate attention (UNICEF, WHO, and Group, 2017). Wasting is defined as low weight for height (moderate as below -2 z-scores and severe as below -3 z scores of the median WHO growth standards) by visible muscle wasting (World Health Organization *et al.*, 2007). Wasting can also

be detected using Mid Upper Arm Circumference (MUAC) tape among children aged 6-59 months (see section below). According to WHO standards, a MUAC measurement of less than 115 MM or 11.5 CM is indicative of severe acute malnutrition, while a MUAC measurement of less than 125 MM or 12.5 CM shows moderate acute malnutrition (World Health Organization *et al.*, 2007).

Severe acute malnutrition usually presents in one of three forms. Children with wasting (marasmus) exhibit significant weight loss over a relatively shorter time span. Marasmatic symptoms are often described as an "old man" appearance (Trehan and Manary, 2015). These children exhibit loss of body fat and muscle tissue, leading to a very thin, emaciated appearance. This loss of body mass makes these children appear older than their actual age, as the face becomes more gaunt and the skin may become loose and wrinkled. Marasmus is diagnosed using either a MUAC or a weight-for-height Z-score (WHZ) following WHO growth standards (WHO and UNICEF, 2009).

1.6.3 Severe complicated malnutrition

Kwashiorkor is a form of severe acute malnutrition associated with complication, usually bilateral pitting oedema starting from both feet and gradually progressing towards lower limbs, also known as nutritional oedema. The condition is caused by essential amino acid deficiency. The condition is common among young children in developing countries, with limited access to food and inadequate infant and young child feeding practices. A study by Lindblad et al. (2016) examined the role of oxidative stress in the pathogenesis of kwashiorkor. The researchers suggested that oxidative stress, which occurs due to an imbalance between the production of reactive oxygen species (ROS) and the body's antioxidant defences, maybe a pivotal contributor to the development of kwashiorkor (Lindblad et al., 2016). Heilskov et al. (2014) described skin depigmentation with a flaky appearance as a characteristic feature of kwashiorkor (Heilskov *et al.*, 2014). These findings are clinically significant and can aid in the diagnosis of kwashiorkor. Another study examined the association between wasting and kwashiorkor, specifically focusing on the impact of wasting on mortality risk in children with kwashiorkor. The study found that children presenting with both wasting and kwashiorkor had a more severe form of malnutrition, increasing their mortality risk (Chang *et al.*, 2013) (Trehan *et al.*, 2013). This provides additional insights into the pathogenesis,

clinical manifestations, and associated risks of kwashiorkor. It's important to note that a wealth of literature is available on this topic, and further exploration of research databases and relevant publications can provide a more comprehensive understanding of kwashiorkor and its implications.

1.7 MUAC for Assessment of Undernutrition

Mid-Upper Arm Circumference (MUAC) is an early identification tool for malnutrition in emergencies and community settings, including Pakistan (De Onis, Yip, and Mei, 1997). MUAC is measured in children, to the nearest 0.1 cm, using a flexible non-stretch tape laid at the midpoint between the acromion and olecranon processes on the shoulder blade and the ulna, respectively, of the arm (Eaton-Evans, 2012). In acute malnutrition, muscle and fat mass are reduced; thus, MUAC measurement is the sum of the muscle and subcutaneous fat in the upper arm (Eaton-Evans, 2012). MUAC is a good predictor of mortality, and in many studies, MUAC predicted death in children better than any other anthropometric indicator (O'Brien *et al.*, 2020)

This advantage of MUAC was greatest when the period of follow-up was short (The Mother and Child Health and Education Trust, 2020). There is little increase in fat and muscular mass in the upper arm area between 6 months and 59 months, so MUAC can be used as an age-independent screening tool for acute malnutrition (Eaton-Evans, 2012). However, there is mixed literature on the use of MUAC as a single identification tool.

Tammo Wieringa et al. (2018) conducted a study in Cambodia to evaluate the effectiveness of using Mid-Upper Arm Circumference (MUAC) as a standalone screening tool for identifying acute malnutrition among children aged 6-59 months. The study found that MUAC-only screening was effective in identifying moderate and severe acute malnutrition (MAM and SAM) among both boys and girls but missed a significant number of children who were wasted but not identified as malnourished by MUAC. The study recommended that MUAC-based screening be used in conjunction with other anthropometric measures, such as Weight-for-Height Z-score (WHZ), to improve the sensitivity of the screening tool and ensure that all wasted children are identified and treated.(Tammo Wieringa *et al.*, 2018). As per standard of nutrition programs, MUAC is recommended for use with children between six and fifty-nine months of age and for assessing acute energy deficiency

in adults during emergencies; MUAC measurement less than 12.5 cm among children suggests malnutrition; a MUAC greater than 13.5 cm is normal (De Onis, Yip and Mei, 1997).

Measuring weight and height to calculate WHZ has been difficult in community settings, and in addition, trained staff requires heavy equipment that needs to be carried. The MUAC measurement requires less equipment and trained human resources and is easy to perform. Therefore, as part of nutrition programs, mid-upper arm circumference (MUAC) has become a popular method to identify waste per the WHO recommendations (World Health Organization, 2013). However, MUAC and WHZ have both been used by nutrition programs; WHO recommends using WHZ specifically to assess wasting. (De Onis, Yip and Mei, 1997).

MUAC, however, is considered a simple and reliable screening tool to be used in large populations and has served as a practical proxy measure of acute malnutrition in nutrition programs in LMICs for the under-5 population (Goossens *et al.*, 2012) as well as in pregnant women (Tang *et al.*, 2013).

A considerable body of evidence supports the use of MUAC as an efficient and reliable tool for identifying wasting in children. Collins et al. (2006) conducted a study in Malawi and found that MUAC had high sensitivity (89%) and specificity (98%) for identifying children with wasting, compared to other measures such as weight-for-height Z-score (WHZ) and body mass index (BMI). Another study by Kolsteren et al. (2007) in Ethiopia showed that MUAC had a sensitivity of 93% and a specificity of 98% for identifying children with severe wasting. Moreover, MUAC is a predictor of mortality risk in children. A study by Briend et al. (2012a) conducted in Malawi found that MUAC < 115 mm was a stronger predictor of mortality than WHZ < -3, and MUAC < 125 mm was a stronger predictor than BMI < 16 kg/m2. In another study by Ali et al. (2013) conducted in Bangladesh, MUAC was a stronger predictor of mortality risk in children under five years of age than WHZ or mid-upper-arm muscle circumference (MAMC).

Similarly, cohort studies have shown MUAC to be a predictor of mortality risk in Gambian infants (Tammo Wieringa *et al.*, 2018) and Southeast African children and adolescents (Mramba *et al.*, 2017). Although both measures (MUAC and WHZ) for detecting high-risk children have been reported to have high specificity (>95%) (Briend *et al.*, 2012a), low sensitivities (<10%) have been reported for either

MUAC<115 mm and WHZ<−3 for predicting mortality (Briend *et al.*, 2012b) reflecting that most children under the age of five at risk of mortality can be missed by either of these indicators. A study conducted in Sudan to assess the operational implications of using MUAC as the only criterion for treatment of SAM reported that MUAC<115 mm failed to predict 33% of deaths, while 98% were predicted by WHZ<−3 alone and 100 % by MUAC<130 mm (Grellety, L. Kendall Krause, *et al.*, 2015). Although there is mixed evidence on the use of MUAC cutoff for the identification of SAM, MUAC has been proven to be an efficient tool overall to prevent malnutrition-associated children morbidity.

This thesis includes a chapter aimed at assessing the reliability of MUAC in identifying children with acute malnutrition in the Pakistani childrem.

1.8 Consequences of Undernutrition

The literature suggests that at least 10% of all deaths in children aged <5 years are attributed to acute malnutrition worldwide (Trehan and Manary, 2015). Undernutrition is linked to an increased risk of mortality and morbidity among children (Black et al., 2008b), as well as its long-term impact on stunting (Dewey and Begum, 2011). Undernutrition has been estimated to be a contributor to 45% of all deaths among under-five children worldwide (Black *et al.*, 2013).

A systematic review analysed data from 10 cohort studies conducted in Africa, Asia, and Latin America to quantify the association between under-five child deaths and multiple anthropometric deficits. The analysis showed that having two or more anthropometric deficits was significantly associated with a high mortality risk compared to children with normal anthropometry. Children with all three (underweight, stunted, and wasted) combined deficits had a 12-fold increased risk of mortality compared with children with no identified nutritional deficiency (McDonald *et al.*, 2013). However, the study could not present the cause-specific mortality and effect of possible confounding factors such as incidents of infectious diseases, small sample size, inconsistent definitions, and measurements of other covariant. The study also could not differentiate the association of moderate and severe forms of undernutrition separately on mortality due to limitations of data availability (McDonald *et al.*, 2013). In addition to compromised growth, stunting affects the schooling outcomes of the children. Delayed intellectual development of stunted children is associated with delayed enrolment in school and is reported

to result in lower grades if compared with non-stunted children of the same age (Hoddinott *et al.*, 2013; Prendergast and Humphrey, 2014). Behavioural problems linked with stunting are lesser attention span, less exploratory behaviours, and more crankiness leading to an impaired relationship with their caregiver. Delayed motor skills development in stunted children is associated with a lack of interest in exploratory behaviour, which negatively affects the interaction with caregivers and the environment (Brown and Pollitt, 1996).

Chronic undernutrition is associated with long-term economic consequences at individual, household, and community levels. There is evidence that delayed physical and intellectual development due to stunting is strongly associated with less earning and compromised productivity (Hoddinott *et al.*, 2013). The World Bank estimated a 1% loss in adult height due to childhood stunting is associated with a 1.4% loss in economic productivity (The World Bank, 2006).

Undernutrition and its immediate and underlying causes, disease, food insecurity, poverty, and poor health services, contribute to the loss of 64.6 and 54.9 million disability-adjusted life years, respectively (Robert E. Black et al., 2008).

In addition to impaired physical and mental development, undernutrition is associated with an elevated risk of noncommunicable diseases in adulthood (Black *et al.*, 2008a).

1.9 Determinants of Undernutrition

Undernutrition is a condition that can result due to one or more factors and is not necessarily related to food intake. The United Nations Children's Fund (UNICEF) developed a conceptual framework of the determinants of children's nutritional status (UNICEF, 1990). Figure 1.1 gives an overall understanding of the immediate, underlying, and basic causes of malnutrition (R. E. Black *et al.*, 2008). Various factors can contribute to the outcome of the nutritional status of children, including IYCF practices, incidents of infectious diseases, health-seeking behaviours, and hygiene conditions. However, the conceptual framework below develops a hierarchy among major determinants of undernutrition.

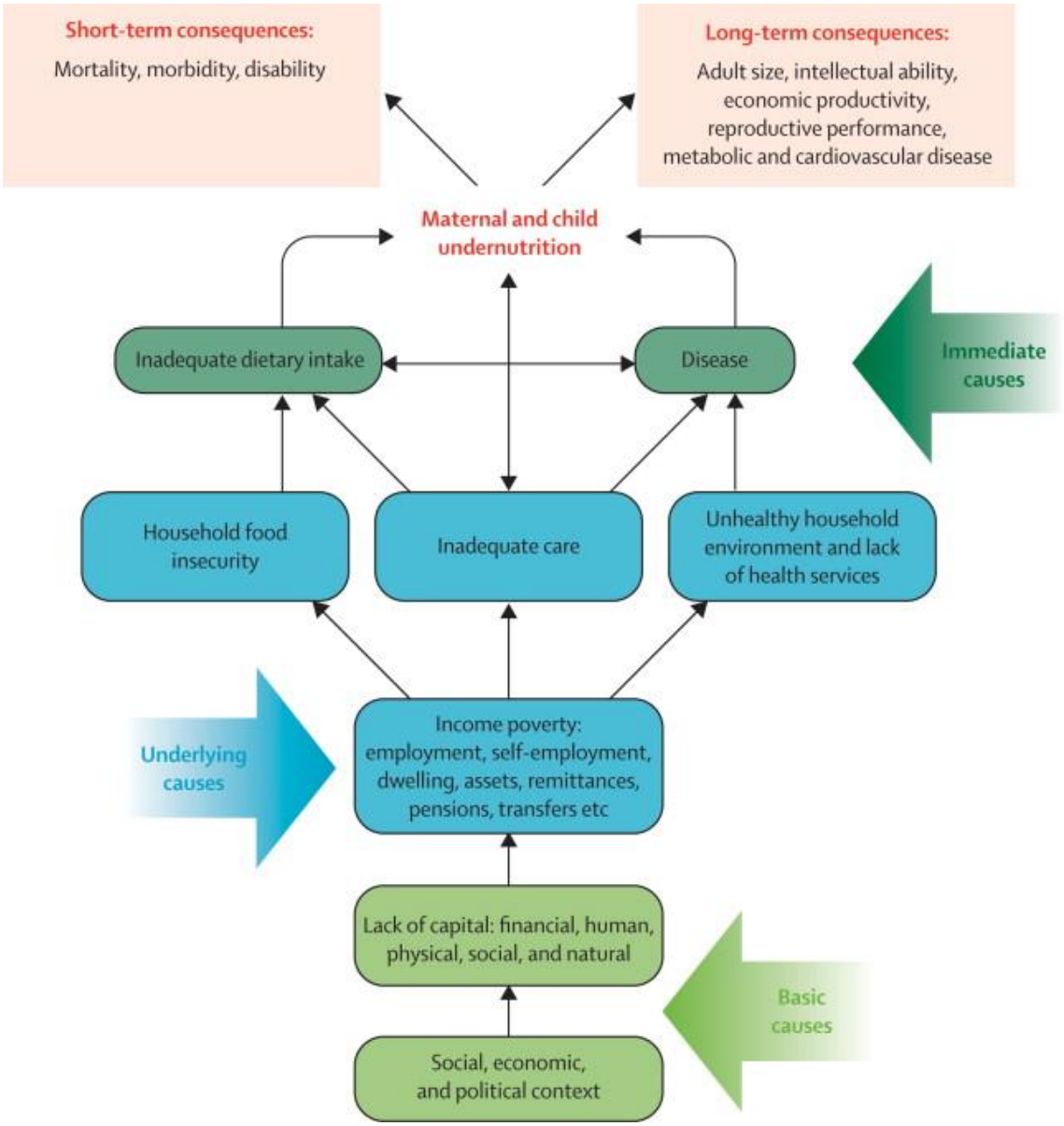

Figure 1.1 Casual pathway of malnutrition modified from UNICEF causal pathway by (Black et al., 2008)

1.9.1 Immediate causes

The immediate causes of malnutrition are mainly responsible at the individual level, including disease or inadequate intake of nutrients. Malnutrition can result from a low nutrient intake, leading to a weakened immune system, thus making the child more susceptible to disease, which in turn, can adversely affect appetite and nutrient absorption. The strong relationship between the two immediate determinants is illustrated in the infection and malnutrition cycle below (Black et al., 2008b).

Adequate dietary intake and food diversity are directly associated with nutritional outcomes. There can be multiple factors affecting the dietary/nutrient intake of children. The above pathway links it with the disease, as there is evidence that repeated episodes of infectious diseases can lead to compromised nutritional status, while undernutrition is thought to be the underlying cause of death due to these diseases. Two common killers of children under five, diarrhoea and pneumonia, are considered to have a strong relationship with the nutritional status of children. Children with poor nutritional status experience diarrhoea with longer and more severe episodes, thus increasing the high risk of mortality associated with diarrheal infection (Rice *et al.*, 2000). Repeated diarrheal infections are linked with poor water sanitation and hygiene (WASH) practices. Households using unsafe water and sanitation facilities are two times more likely to end up with acute malnutrition (Frozanfar *et al.*, 2016). Similarly, the literature supports a consistent relationship between nutritional status and acute lower respiratory infection (Rice *et al.*, 2000). Repeated infections, in turn, can result in a loss of appetite, and thus, fewer meals make children more prone to become malnourished (Frozanfar *et al.*, 2016). Although this concept shows the cyclic relationship between undernutrition and infection, evidence is still lacking as to whether undernutrition leads to infection or if it contributes only to the increased severity of diseases (Rytter *et al.*, 2014).

1.9.2 Child caring and feeding practices.

Childcare practices, where mothers or other caretakers provide food, healthcare, stimulation, and emotional support, are critical for child growth, development, and survival (WHO, 2004). Appropriate feeding practices are instrumental for adequate growth, development, and survival of infants and young children. These practices are known collectively as infant and young child feeding (IYCF) practices. Age-appropriate feeding following WHO guidelines for IYCF, with appropriate hygiene protocols during food preparation and psychosocial care, are important determinants of child growth and development (Smith and Haddad, 2015).

The WHO recommends early initiation of breastfeeding just after birth, with exclusive breastfeeding until six months. Standard guidelines for IYCF further recommend the introduction of appropriate, safe, and adequate complementary

foods at the age of six months, along with continued breastfeeding till two years of age (WHO, 2009). Infant and young child feeding is critical in improving child survival as well as healthy growth and development. Optimal breastfeeding is critical in saving the lives of under five years each year (WHO, 2000).

WHO and UNICEF recommend early initiation of breastfeeding within 1 hour of birth; exclusive breastfeeding for the first six months of life; and introduction of nutritionally adequate and safe complementary (solid) foods at six months, together with continued breastfeeding up to 2 years of age, or beyond (WHO, 2003b). The World Health Organization recommends that "infants should be exclusively breastfed for the first six months of life; after six months, caregivers are encouraged to continue on-demand breastfeeding until two years of age to provide 35-40% of energy for child's diet" (PAHO, 2013).

There is evidence that the early introduction of solids and age-inappropriate complementary foods is associated with poor nutritional status in children (Peltzer and Simaka, 1997). The benefits of exclusive breastfeeding and the risk of increased morbidity and mortality associated with appropriate breastfeeding practices are well established.

The literature supports a strong association between inadequate infant and young child feeding practices and nutritional outcomes. A Cochrane systematic review of 23 studies comparing the outcomes of infants who were exclusively breastfed. those who were partially breastfed included 11 from developing countries (two of which were controlled trials in Honduras) and 12 from developed countries (all observational studies). They concluded that exclusively breastfeeding reduces morbidity from gastrointestinal infection by half compared to those who were partially breastfed (Kramer and Kakuma, 2002, 2012). Exclusive breastfeeding also guards against the incidence of diarrhoea and pneumonia and thus protects from mortality caused by these infectious diseases. This was demonstrated by a systematic review of the literature of eighteen studies which found increased protection against diarrhoea and pneumonia by exclusive breastfeeding among infants 0-5 months of age and by any breastfeeding among infants and young children 6-23 months of age (RR:10.52). Specifically, infants who were not breastfed had twice the risk for diarrhoea-related mortality compared to children who received exclusive breastfeeding (RR:2.18) (Lamberti *et al.*, 2011, 2013). This

association can be better understood, as in addition to its direct immune protective effects, exclusive breastfeeding protects children from the early introduction of inappropriate and unhygienic complementary foods, which is otherwise very common among LMICs due to poor hygiene and sanitation practices (WHO, 2017).

Timing is critical for IYCF practices. Child feeding practices started too early, or delays have a negative impact on child growth. A study conducted in India investigated the potential relationship between neonate feeding practices and children's nutritional status. The findings demonstrated a significant correlation ($P<0.05$) between delayed lactation initiation beyond six hours after birth and the absence of colostrum intake in underweight and stunted children. (Kumar *et al.*, 2006). On the other hand, there was no significant association between infant feeding practices and wasting (Kumar *et al.*, 2006). The results of this study cannot be generalised, as a convenience sampling methodology was used from mostly lower social and economic groups from urban areas of Allahabad. Another large cohort study in Sudan assessed the relationship between prolonged breastfeeding and child growth. This large cohort study (n= 28753) found an increased risk of malnutrition among prolonged breastfed children (after two years with delayed solids) whose parents were illiterate and from poorer households who were less likely to have adequate complementary feeding (Fawzi *et al.*, 1998).

Maternal health is another significant predictor of child development and growth. Mothers who were stunted are more likely to have unhealthy outcomes for their pregnancies. Stunting starts from utero, mainly because of compromised maternal nutritional status and then inappropriate infant and young child feeding practices, and poor environmental and hygiene factors during the first two years of life, ultimately failing to achieve the child's genetic potential for height (de Onis and Branca, 2016). Literature shows that maternal short stature due to stunting is a contributor to neonatal and perinatal morbidity and mortality (Lawn, Cousens and Zupan, 2005; Özaltin, Hill and Subramanian, 2010). Maternal knowledge about health-seeking practices is also an important factor contributing to overall outcomes of the health status of children. Better-qualified mothers are less likely to have stunted children also because the better-qualified mothers are likely to be economically better than illiterate or just literate mothers. Households with

mothers who have attended less formal school years are more vulnerable to large family sizes and the prevalence of acute malnutrition (Baig-Ansari *et al.*, 2006).

1.9.3 Child Eating/Feeding behaviour

The causal pathway of undernutrition developed by UNICEF places feeding and caring practices as an underlying cause of undernutrition, but the child's eating behaviour is also critical.

The first year of life is characterised by rapid developmental transitions with regard to eating. As children progress from sucking liquids to eating semi-solid and solid food, they also transit from being fed by others to at least partial self-feeding (Black and Hurley, 2007).

Eating patterns developed early in life are influenced by multi-level interactions. These interactions can include individual, family or societal/cultural factors. (Black and Hurley, 2007). It is established that parents' feeding practices elicit a child's eating behaviour. (P L Engle, Bentley and Pelto, 2000). Feeding styles explain the interaction between child and caregiver during food time and have shown significant association with food acceptance among young children (Ha *et al.*, 2002; Dearden *et al.*, 2009; Abebe, Haki and Baye, 2017).

Three feeding styles commonly used to describe child-caregiver interaction during mealtime includes responsive/active, force and laissez-faire feeding. (Dettwyler, 1987; P L Engle, Bentley and Pelto, 2000)

A feeding style characterised by punishments and threats, either physical punishment or withholding favourite food to eat less favourite food or threats from any imaginary situation or figure, is known as force-feeding (Daniels, 2019). This feeding style was adversely associated with the child's feeding habits and higher food rejection among older children (P L Engle, Bentley and Pelto, 2000; Ha *et al.*, 2002; C. M. Wright, Parkinson and Drewett, 2006). However, the effects of this feeding style vary among different age groups. A meal observation study in rural Vietnam assessed the relationship between responsive feeding style, dietary intake, and nutritional status of 91 caregivers and children. The results of the study showed that children, who were 18 months old, rejected food more frequently when their caregivers tried to feed them forcefully, but results for 12-

month-old children showed improved food acceptance using the same feeding style (Ha *et al.*, 2002).

The laissez-faire style is characterised by minimal effort from caregivers to encourage eating, mostly with the expectation that children should eat without assistance at an early age. This attitude is usually supported by the belief that children respond to their stomach capacity and eat as much as they can. This feeding behaviour may be detrimental when children have low appetite or eating skills (Engle, 2002).

1.9.4 Responsive feeding

A positive attitude towards feeding is characterised by more responsive and interactive behaviour of the caregiver at mealtime. The responsive feeding style is "a caregiver's increased response to the child's hunger cues, in using encouragement, feeding consistently, and feeding more actively when the child is recovering from an illness" (Ha *et al.*, 2002). These behaviours are presumed to promote the development of an internal mechanism for regulating food intake. Poor feeding practices characterised by forcing, restricting or controlled feeding have been associated with reduced dietary intake leading towards poor nutritional outcomes in children when compared with more engaging and responsive feeding styles (Ha *et al.*, 2002; Nti and Lartey, 2008).

In a study carried out in rural Haiti by Bentley et al. (1991b), 255 mother-infant pairs were included. The researchers evaluated moms' feeding practices through observation and interviews. They discovered that mothers who actively encouraged their babies to eat had babies who were more willing to accept food. The study did discover that fewer infants accepted food when practices such as pushing or supporting the infant's head during feeding were used.

Similar research was done by Gittelsohn et al. (1998) in a rural Mexican community with 120 mother-toddler pairings. To evaluate feeding practices and children's acceptance of food, the researchers used interviews and observations. They discovered that mothers who actively encouraged their babies to eat had toddlers who were more likely to eat (Bentley *et al.*, 1991a; Gittelsohn *et al.*, 1998). Now focus is shifting to incorporating the concept of responsive feeding into nutrition programming (P L Engle, Bentley and Pelto, 2000).

Responsive feeding (RF) behaviours are less common in low-income countries and are likely to contribute towards malnutrition (Margaret E. Bentley, Wasser and Creed-Kanashiro, 2011). Mothers are the key caretakers of the children; thus, it is important to understand the key practices of mothers/parents, which in turn contribute to establishing their children's eating behaviours. Responsive feeding is an emerging area of interest, contributing towards children's eating behaviours and health outcomes. The result of responsive feeding can be established in the overall outcomes of linear growth of a child (M. E. Bentley, Wasser and Creed-Kanashiro, 2011).

An observational study in rural Ethiopia was conducted to assess mother-child feeding styles and their associations with accepted mouthful and linear growth and suggested that parents and caregivers with stunted children had poor IYCF practices along with less responsive feeding behaviours, compared with caregivers of healthy children (Abebe, Haki and Baye, 2017). Responsive feeding is described as a building block for the relationship between child and caregiver (Black and Aboud, 2011).

The systematic review by Black and Aboud (2011) found promising evidence for the role of responsive feeding in promoting healthy child growth and development in low- and middle-income countries. One aspect of responsive feeding that was highlighted in the review was the importance of positive verbalisation by caregivers during feeding.

Bentley, Wasser, and Creed-Kanashiro (2011) conducted a study in Peru that examined the relationship between caregiver verbalisation during feeding and child acceptance of food. The study included 144 mother-child pairs and used observations of mealtime interactions to assess feeding practices and child-feeding behaviours. The researchers found that positive verbalisation by caregivers during feeding, such as praise or encouragement, was associated with increased child acceptance of food. Specifically, the study found that children whose mothers used positive verbalisation during feeding had higher rates of food acceptance and were more likely to finish their meals than children whose mothers did not use positive verbalisation (M. E. Bentley, Wasser and Creed-Kanashiro, 2011). However, the limitations found by the review included different definitions of responsive feeding and different study designs. Therefore, the

findings could not be generalised. Also, none of the studies included assessed the isolated effect of responsive feeding.

Recently, in addition to all the factors described in the causal pathway of malnutrition, general attention is being drawn towards the importance of care practices for children's health and nutritional status. Caregiver's practices play a vital role in showcasing the outcome of all the available resources in the growth and development of a child. The UNICEF's framework positions maternal and childcare at the central level (UNICEF, 1990). There is an argument that a child's nutritional status can be compromised even in the presence of all the resources if appropriate care practices are not used (Berggren and Wray, 2002; Nti and Lartey, 2008). Moreover, it has been suggested that in resource-poor situations, even in food-insecure conditions, appropriate care can maximise the utility of available resources (P L Engle, Bentley and Pelto, 2000). Although the concept of caring practices has remained in the literature and policy documents for over a decade, its role in addressing child undernutrition in LMIC still requires further research (M. E. Bentley, Wasser and Creed-Kanashiro, 2011). Very little literature has explored the eating behaviours of Pakistani mothers or caregivers. However, there are several studies conducted in South Asia that explored the relationship of responsive feeding with undernutrition (Bhandari *et al.*, 2001; Perkins *et al.*, 2017)

A systematic review of 15 studies was conducted to explore the association between responsive feeding and overall child health outcomes, of which six studies were observational, and nine were based on interventions mainly related to behaviour change advocacy and supplementation. Four of the observational studies reported a positive relationship between responsive feeding and one or more child growth outcomes. However, it is important to consider that different methodologies were adopted to measure responsive feeding (M. E. Bentley, Wasser and Creed-Kanashiro, 2011). Improved nutrient intake is also reported to be associated with responsive feeding interventions. Although all the studies reported a positive relationship between the two, they could not demonstrate the role of responsive feeding isolated from other interventions (Bhandari et al., 2001; Bhandari Mazumder, Bahl, Martines, Robert E. Black, et al., 2004; Hotz and Gibson, 2005; Penny et al., 2005).

Considering the stagnant situation of undernutrition among children under five years of age in South Asia and the lack of evidence related to feeding practices and health outcomes, there is a need to explore the prevalence of feeding practices among mothers and their relationship with nutritional status.

Though feeding during infancy depends on complex interactions between the child and their caregiver, it is important to understand the importance of these child and caregiver interactions in association with the outcomes of successful feeding. Feeding behaviours can be affected by the problematic behavioural of any one child or caregiver (Skuse et al., 1995).

As part of formative research for the Sustainable Program Incorporating Nutrition and Games (SPRING) trial (Lingam *et al.*, 2014), a formative research programme was conducted looking at families' interaction during feeding and their expectations of growth and development, as well as the perceived benefits, consequences, opportunities, and barriers of adopting recommended feeding and developmental behaviours. The trial in rural India and Pakistan aimed to deliver a doable and cost-effective behavioural intervention to maximise the growth and survival of children as well as bring psychosocial well-being to mothers (Lingam *et al.*, 2014). The study was conducted in one district from each country to represent the different social and cultural dynamics associated with child feeding practices. However, some key practices were highlighted in the findings of the study. The results showed similar cultural taboos associated with early initiation of breastfeeding. At the same time, the introduction of complementary feeding was relatively age appropriate among Pakistani mothers, compared with Indian mothers' practices, who mostly introduced solids between the age of six and 12 months. In both countries, poorer families were found to opt for unhealthy and cheap foods as weaning foods and children were left to self-feed. In contrast to Indian mothers, Pakistani mothers were reported to practice play or encouragement around feeding.

Another cross-sectional observational study in Bangladesh of mother-child interactions during feeding, complemented with a short interview of mothers concerning their experiences feeding their child, reported that self-feeding was delayed beyond 24 months (Moore, Akhter and Aboud, 2006). A responsive feeding behaviour intervention demonstrated improved self-feeding behaviours among

children and more weight gain than the control group. However, the responsive feeding behaviour of mothers in the intervention group was not different from the mothers in the control group (Aboud, Moore and Akhter, 2008).

As described in the above studies, several behavioural interventions implemented by community health workers in the region have shown a positive impact on child health indicators; there is still a need to investigate the long-term effects of improved maternal caring practices on mother-child interactions and its contribution towards improved eating behaviours with special focused to malnourished children.

1.9.5 Underlying causes

The underlying causes highlighted in the causal pathway for malnutrition include food security, quality of healthcare facilities and environmental conditions. Food security is also linked to the economic condition of the household, defined as access to adequate food of acceptable quality to meet the requirements of all members of the household (Smith and Haddad, 2015). Food insecurity was significantly associated with undernutrition in both children and mothers. The study found that other factors, such as monsoon weather and maternal literacy, were associated with undernutrition. Specifically, children and mothers from households that experienced monsoon weather had higher odds of undernutrition, while higher maternal literacy was associated with lower odds of undernutrition ($p<0.01$)(Meshram *et al.*, 2014). The risk of underweight and stunting was reported to be 1.9 and 2.4 times higher among children of illiterate mothers (Meshram *et al.*, 2014).

Therefore, socioeconomic conditions, literacy, sanitation, and food security throughout the year are important determinants of the nutritional outcomes of the under-five population.

However, most studies in LMIC assessing the associations between food insecurity and undernutrition are observational and are, therefore, subject to response bias and selection bias. Response bias refers to the tendency of study participants to answer questions in a way that they think is socially desirable, which can impact the accuracy of the data collected. Selection bias refers to the potential for the study sample not to be representative of the general population, which can impact

the generalizability of the study findings. Studies conducted in a specific region or population may not be representative of other regions or populations, and small sample sizes can limit the study's statistical power and increase the likelihood of type I and type II errors.(Baig-Ansari *et al.*, 2006; Saha *et al.*, 2009; Mutisya *et al.*, 2015).

Therefore, it is important to interpret the results of observational studies in the context of the specific study population and to consider the potential for response bias, selection bias, and limited generalizability due to sample size and other factors. Additionally, future studies should strive to use rigorous methods to minimise bias and increase generalizability, such as using representative samples and controlling for confounding variables.

As mothers are the primary caretakers of the children, their health, educational status and attitude towards caring practice can also play a role in the outcomes of the child's anthropometric status (de Villiers and Senekal, 2002; Kumar *et al.*, 2006). There are other factors influencing the care practices, including the gender of the child, the size of the family and the economic conditions of the household. A cross-sectional survey conducted in Pakistan reported that preference for a boy child is still prevalent in the region, thus associating stunting more with a girl child (adjusted prevalence odds ratio, 2.8; 95% confidence interval, 1.6 to 4.7) (Baig-Ansari *et al.*, 2006). In addition, inadequate water, sanitation, and hygiene (WASH) are major contributors to the global disease burden, particularly in low- and middle-income countries (Prüss-Ustün *et al.*, 2014). Poor WASH conditions can lead to the spread of infectious diseases, such as diarrhoea, which can cause nutrient loss and impair the body's ability to absorb nutrients. Chronic exposure to such infectious diseases can lead to stunted growth and undernutrition. A study by Checkley et al. (2008) found that a community-based water and sanitation intervention in a peri-urban community in Peru was associated with significant reductions in diarrhoea prevalence and improved nutritional status among children (Checkley *et al.*, 2004).

Similarly, a review article argued that improving WASH conditions is critical for addressing undernutrition and promoting optimal early child development (Ngure *et al.*, 2014). Another study by Victora (1992) found that poor sanitation practices were associated with increased rates of diarrhoea, which in turn was associated

with decreased linear growth in young children (Victora, 1992). The study supports the idea that poor sanitation practices can lead to undernutrition even if a child's food intake is adequate.

1.9.6 Basic causes

The third tier of factors identified under the conceptual framework accounts for fundamental determinants of malnutrition that include the availability of economic and political resources. The basic level causes affect the outcome through the underlying causes at national, regional, and global levels. The scarcity of financial resources is directly related to poverty (Ruel and Alderman, 2013), ultimately limiting access to nutrition-rich foods, health services, water and sanitation (Alderman, 2015).

Substantial cultural, political, and social factors can potentially overcome a household's possible efforts to achieve adequate nutrition. On the other hand, women's rights, a well-protective political and economic system and effective policies for society can be instrumental in addressing the magnitude of the problem (Black et al., 2008b). Basic causes are essential to address to achieve nutrition goals. An integrated approach is mandatory to address all three levels of determinants to dent the overall burden of undernutrition, especially in resource-poor settings around the globe.

1.9.6.1 Food security

The Food and Agriculture Organization (FAO) defines "Food Security" as when "all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life"(FAO 2013, 2013). Food insecurity has been a consistent challenge for LMICs and has affected approximately 780 million people worldwide in 2021. The term hunger has also been used in the literature to describe undernutrition. However, the real context to describe hunger is relevant to food insecurity, wherein people do not have "physical and economic access to sufficient, safe, nutritious, and culturally acceptable food to meet their dietary needs" (Sanchez and Swaminathan, 2005).

Several factors, including conflict, extreme climate change and post-COVID economic impacts, have resulted in recent rises in food insecurity and hunger with

subsequent impact on malnutrition indicators (FAO, 2021b). Despite Pakistan being a food surplus country in terms of production (wheat, rice, fruits, vegetables, milk, and meat), food insecurity largely remains a significant challenge. As per FAO data, 24% of households in Pakistan were estimated to be either moderately or severely food insecure in 2018, with 10% being severely food insecure with hunger (FAO, 2021b). With regional disparities reported in the same data, the prevalence of moderate and severe food insecurity was highest in Baluchistan (38% and 21%, respectively), followed by Sindh (33% and 15%, respectively). Similarly, a food insecurity analysis of nine rural districts of Baluchistan reported that in seven rural districts of Khyber Pakhtunkhwa and nine rural districts of Sindh amounting to around 8.6% of Pakistan's population, the population had faced multiple shocks, including high food prices, drought, inadequate rainfall and livestock diseases, exacerbated by the impacts of the COVID-19 pandemic, in 2021(IPAC, 2021). Food insecurity-related insufficiency of food results in cutting out expensive foods such as animal sources of proteins, fruits, and vegetables, diluting the energy content, cutting off on intake, and low-quality intake of fruits and vegetables, and inequitable distribution of food within households (Millward and Jackson, 2004). Food insecurity has been reported to be associated with the prevalence of undernutrition. FAO suggests that moderate food insecurity impacts the quality and/or quantity of food intake and can increase the risk of malnutrition, such as stunting in children and micronutrient deficiencies (FAO, 2021a).

The association between malnutrition and various factors has been examined primarily through observational studies conducted in Pakistan. However, these studies are potentially subject to confounding factors such as responsive and selection bias that could influence the results(Baig-Ansari *et al.*, 2006)(Mutisya *et al.*, 2015). Measuring food security is critical to get correct estimates of the food availability situation at a household level. However, due to the complex and multi-dimensional nature of the problem, assessment methods are needed to include all contributing elements, from the availability of adequate food to access and food utilisation (Ganapathy, Duffy and Getz, 2014). Validation studies have found the Household food insecurity assessment score to be a simple and valid tool to measure the access component of household food insecurity (Salarkia *et al.*, 2014; Gebreyesus *et al.*, 2015). However, the discrepancy in the understanding of some

of the questions is reported, and therefore the adaptation of questions in different cultural contexts is suggested (Gebreyesus *et al.*, 2015).

1.10 Treatment of undernutrition

Malnutrition is treated with lipid-based nutrition supplements, micronutrient supplementation and nutrition counselling. There is standard WHO-endorsed SAM with medical complication management guidelines for treatment at health facilities (Ashworth *et al.*, 2003; WHO, 2013). Experts and the World Health Organization (WHO) recommend that guidelines for treating non-complicated cases of severe acute malnutrition (SAM) be implemented at the community level(UNICEF, WHO, 2007; WHO, 2013). There are still gaps in standard guidelines for the treatment of MAM. There is growing interest among researchers and policymakers to build the evidence for standard treatment of MAM. Some published documents (WHO, 2012; Lelijveld *et al.*, 2019; Imara Gluning *et al.*, 2021) suggest that using ready-to-use foods to treat moderate malnutrition showed a modest impact on anthropometric measurements. However, there needs to be a standardised approach to the management of MAM.

1.10.1 Lipid Base Nutritional Supplements

Lipid-based nutritional supplements (LNS) are energy-dense, micronutrient fortified, ready-to-use therapeutic and supplementary foods. The WHO has declared these foods an effective home-based treatment of acute malnutrition or wasting (Manary *et al.*, 2004; World Health Organization *et al.*, 2007). LNS are helpful in increasing weight for height and acute malnutrition. Several systematic reviews have examined the efficacy of LNS. A systematic review of 12 randomised control trials aimed to assess the effectiveness of specially formulated foods in treating children with moderate acute malnutrition in low- and middle-income countries like Burkina Faso, Bangladesh, Ethiopia, India, Kenya, Malawi, Mali, Niger, Uganda, and Zambia: the RCTs varied in sample size, ranging from 40 to 4,702 participants, ranging from 6 weeks to 12 months and reported that the provision of specially formulated food increased the recovery of malnourished children by 29% (RR 1.29, 95% CI 1.20 to 1.38; 2152 children, two trials; moderate quality evidence), decreased the default rate by 70% (RR 0.30, 95% CI 0.22 to 0.39; 1974 children, one trial; moderate quality evidence), and improved weight-for-height (MD 0.20 z-score, 95% CI 0.03 to 0.37; 1546 children, two trials; moderate

quality evidence). At the same time, a moderate-level evidence trial showed that lipid-based nutrient supplementation (LNS) significantly increased the percentage of cured children. LNS also showed good rates of weight gain and improved mid-upper arm circumference. Most of these trials were conducted in Africa, and none were from Asia, where moderate acute malnutrition is most common (Lazzerini, Rubert and Pani, 2013).

Ready-to-use foods (LNS) have gained popularity as a treatment option for malnutrition in low-income settings due to their high energy and nutrient density, long shelf-life, and ease of use. The high acceptability of LNS among children can be attributed to their sweet chocolaty taste, which makes them more palatable than other therapeutic foods. In addition, the convenience of feeding LNS is another factor that contributes to its popularity among caregivers. LNS eliminates the need for preparing home foods, and feeding the child is easier as children are more likely to prefer the sweet taste of LNS over relatively less sweet family foods (Adu-Afarwuah et al., 2015; Imdad et al., 2018).

These LNS rich in energy and sweet ready-to-use foods are quite popular and highly acceptable among young malnourished as well as healthy children (Flax *et al.*, 2013). Maternal acceptance towards these imported foods is also reported to be positive and accepting (Flax *et al.*, 2009; Adu-Afarwuah *et al.*, 2011).

Limited research has been conducted on interventions to improve maternal feeding behaviours and related factors in children with moderate acute malnutrition (MAM). For example, in food-secure settings, a comprehensive approach is needed that includes promoting the consumption of diverse and nutritious family foods, nutrition education and advocacy, and behaviour change communication aimed at improving childcare practices (Kavle et al., 2012). However, limited studies have investigated the effectiveness of such interventions in improving outcomes in MAM children. Therefore, further research is needed to develop and test comprehensive interventions that address the underlying determinants of MAM, including maternal feeding behaviours and childcare practices (Dede and Bras, 2020).

Table 1. 1 Systematic review comparing the effectiveness of ready-to-use foods /fortified foods for the treatment of moderate acute malnutrition

Author & year	Design & setting	Objectives	Inclusion criteria	Total (N)	Primary objective	Key findings
(Gera *et al.*, 2017)	intervention studies from Africa	To evaluate the effectiveness and safety of LNS for the treatment of MAM in infants and children 6 to 59 months of age.	1. cluster-randomised trials, 2. non-randomised cluster trials, 3. controlled before-after studies with at least two intervention sites and two control sites.	9 trials, incorporating data on 9270 children; 4 cluster randomised controlled trials, four randomised controlled trials and one non-randomised controlled trial.	Proportion recovered (Mortality, Weight-for-height z-score; Mid-upper arm circumference; Relapse Duration of recovery (> 1 month; 1 to 2 months; > 2 months)	LNS, in comparison to specially formulated (home-based foods), improved the recovery rate (RR 1.08; 95% CI 1.02–1.14, decreased the chances of no recovery (RR 0.70; 95% CI 0.58–0.85, and the risk of deterioration into severe acute malnutrition (RR 0.87; 95% CI 0.73–1.03. little impact on mortality (RR 0.94, 95% CI 0.54–1.52 or default rate (RR 1.32; 95% CI 0.73–2.4.
(I Gluning *et al.*, 2021)	Randomised Control Trials 12 studies from Africa and one from where? 2 in urban areas; 10 in rural and one both in U&R	To assess the evidence for lipid-based nutrient supplements (LNS), fortified-blended-flours (FBF) and nutrition counselling in the treatment of MAM.	1. MAM definition WHZ<-2>-3 2. Corn soy blend (CSB)/LNS/RUF/supplementary food used as an intervention 3. must have a control group	Thirteen papers were eligible for inclusion.	Primary outcome; defined as having a WHZ >-2, and/or a MUAC >12·5cm Secondary outcomes included persistent MAM, progression to SAM, death, defaulting, and any adverse effects.	Increased probability of recovery (as assessed by gaining normal weight-for-height and/or MUAC) among children treated with LNS compared to children treated with FBF (RR 1·05, 95%CI 1·01-1·09, p=0·009). Treatment with an LNS was also associated with a lower risk of persistent MAM at the end of treatment compared with a FBF (RR 0·82, 95%CI 0·71-0·95, p=0·007).

Author & year	Design & setting	Objectives	Inclusion criteria	Total (N)	Primary objective	Key findings
(Lelijveld *et al.*, 2020a)	Systematic review	To synthesise the evidence on outcomes of MAM children treated with food interventions compared with no treatment or management with nutrition counselling.	WHZ-2 MUAC<12.5 Compare two groups	Total 11 Ten randomised controlled trials; one prospective cohort study	Recovery Weight gain MUAC Nonrecovery/Nonresponse Default Deterioration into SAM Relapse Morbidities	7 out of 11 reported food products superior for anthropometric outcomes compared with counselling and/or micronutrient supplementation; two of the studies found no significant benefit of a food product intervention, and two were inconclusive.

1.10.1.1 Impact of Ready to use foods on Eating and caring practices.

A randomised control trial that assessed the long-term impact of RUSF treatment reported that children successfully treated for MAM with RUSF showed improved clinical outcomes after one year of recovery (Chang *et al.*, 2013). Although MAM children treated with RUSF showed satisfactory weight gain, they remained more susceptible to relapse and, in some cases, progression towards SAM and mortality (Chang *et al.*, 2013). This study was conducted in a rural region of Malawi, where food insecurity is common due to single-crop availability. Thus, the results of the study should be extrapolated with caution to other populations in different settings.

There is limited information on the effects of LNS on a caregiver's responsiveness during feeding. A trial was conducted in Malawi with the objective to assess whether and how caregiver and child behaviours differ during LNS and complementary food eating (Flax *et al.*, 2013). They found that caregivers, when feeding LNS, tended to use more physical pressure than complementary foods. Although there is no statistically significant difference in the proportion of bites accepted by type of food, however, caregiver feeding behaviour showed a positive association with LNS acceptance even when feeding forcefully or pressuring the child to eat (Flax *et al.*, 2013). This could be due to the pleasant taste of LNS, which may have helped to overcome non-responsive feeding behaviours associated with LNS that might otherwise have a negative impact on food acceptance. The study suggests that controlling behaviours during LNS feeding may be related to the caregivers' perception of LNS as a special food. Therefore, it is required to assess the impact of RUSF on caring practices as well as the intake of family foods in undernourished children in different population settings.

1.11 Energy Regulation

Foods are consumed to give energy for growth and perform vital body functions. The energy content of a food is measured in kilocalories and is defined as the energy density of a food (Vernarelli *et al.*, 2013). Energy compensation is a term used to describe the body's mechanism to adjust energy intake after the consumption of preloaded food (Blundell *et al.*, 2010). The energy density of a food is an important factor that influences the energy content, and the water content of the food can also impact the energy content (Rolls and Roe, 2002).

Energy regulation is an important aspect of nutrition, as foods are consumed to provide energy for growth and perform bodily functions. The energy content of a food is measured in kilocalories and is defined as the energy density of a food (Vernarelli *et al.*, 2013). Additionally, the water content of the food can influence the energy content (Rolls and Roe, 2002). Energy compensation is a term used to describe the body's mechanism to adjust energy intake after consuming preloaded food (Blundell *et al.*, 2010). Studies have shown that high-energy nutritional supplements have the potential to displace family food in the diets of malnourished children. For instance, a study conducted in India indicated that children under five who received a nutritional supplement providing 224 kcal for 52 weeks consumed 18 to 36% less energy from family foods than those who did not (Bhandari et al., 2001). Similarly, studies from Guatemala and Jamaica also reported reduced energy intake from family foods when a high-density nutritional supplement is consumed. The study from Guatemala reported around 10 kcal displacement of energy from family foods among children receiving 99 kcal per 100 ml of nutritional supplement (Bresnahan and Tanumihardjo, 2014). Still, they concluded that this displaced energy was not associated with child growth. Stunted children from 9 to 23 months in Jamaica are reported to consume fewer home foods after receiving 750 kcal of a milk-based supplement, which indicates that supplemented children reduced their energy intake (Walker et al., 1991). These findings highlight the importance of assessing the impact of ready-to-use supplementary foods on the eating behaviours of malnourished children to ensure that they do not displace important family foods in the diet.

1.12 Effectiveness of nutrition advocacy on energy intake and growth outcomes of 6 to 24 months old children:

Although literature reported that a targeted behaviour change campaign could bring sustainable change in maternal feeding practices (Iram and Sabihuddin Butt, 2004), there have been very few interventions targeting maternal feeding behaviours/caring practices in Pakistan.

Nutrition counselling, if delivered through trained health workers, is effective in improving feeding behaviours even in resource-poor settings with limited food availability (Roy *et al.*, 2005; Imdad, Yakoob and Bhutta, 2011). This helps mothers/caregivers to choose the best among locally available choices, which has a sustainable impact. Nutrition programmes in LMIC mainly aim for supplementation-related interventions, while the effectiveness of nutrition counselling remained weak despite being a component of this programme. Available literature reports that training improved the nutrition-related knowledge of health workers (Valle *et al.*, 2003; Pelto *et al.*, 2004; Aboud, Moore and Akhter, 2008). Subsequently, caregivers who received regular counselling from these trained health workers improved their nutrition knowledge (Pelto *et al.*, 2004).

A systematic review of 15 RCTs has assessed the effectiveness of nutrition training for health workers on child feeding practices that included food frequency, energy intake, and dietary diversity among children aged six months to two years (Sunguya *et al.*, 2013) is described in Table 1.2 below.

Table 1.2 Effectiveness of nutrition training of health workers toward improving nutritional outcomes of 6 month to 2 years old children: Systematic-review (Evidence Table)

Author Year setting & design	Population and Intervention	Comparator	Out comes				
Bhandari N 2001 RCT in India	Nutritionists, Caregivers, and their children Intervention group received nutrition training from the trained nutritionists. Description of training duration was not provided	Comparison group's health workers were not trained n= 106	Feeding Frequency	Energy intake	Dietary diversity	Growth	
						Height	Weight
			No details	At 9 months • I: 978kj/day; IQR 406–1371 • C: 577kj/day; IQR 196–1250 • P<0.05 At 12 months • I: 1417kj/day; IQR 723–2253 • C: 924kj/day; IQR 474–1471 • P<0.05	No Details	At 26 weeks I: 6.07± 0.97 C: 5.92±0.96 At 38 weeks I: 6.57±1.02 C: 6.51±0.90 At 52 weeks I: 7.08±0.91 C: 7.06±0.93 P<0.05	At 26 weeks I: 62.7± 2.9 C: 62.2±2.9 At 38 weeks I: 65.8±3.0 C: 65.5±2.8 At 52 weeks I: 68.6±2.9 C: 68.3±2.7 P<0.05
Santos I 2001 CRCT in Brazil	Doctors (Intervention-17, Control-16) and pairs of caregivers and their children (Intervention-218, Control-206)	16 doctors did not receive nutrition counselling training. They offered general	No Detail	At <18 months • Intervention: 3827.5 kJ/day; SD 1230.9	Compared to Control, Intervention group had higher	HAZ I: -0.37±0.97 C: -0.41±0.81 P= 0.4	Weight gain I: 2.18±1.11 C: 2.19±1.29 P=0.5

	Nutrition counselling component of WHO's Integrated Management of Childhood Illness (IMCI) given for 20 hours to doctors in the intervention group. The trained doctors provided counselling to caregivers.	care to caregivers and their children.		• Control: 3546.8 kJ/day; SD 1058.1 • P = 0.3	proportion of dietary diversity		WAZ I: -0.18±0.78 C: -0.25±0.78 P=0.2 WHZ I:0.04±1.35 C: -0.05±1.43 P=0.3
Bhandari N 2004 CRCT in India	Health and Nutrition workers, pairs of caregivers and their children Health and Nutrition workers in 4 intervention communities received nutrition training. They provided care to 552 Child-mother pairs.	Health and Nutrition workers in 4 communities without nutrition training. They provided care to 473 child-mother pairs.	At 9 months: • I: 4.4; SD 1.5 • C: 3.9; SD 1.7 At 18 months • I: 5.9; SD 1.2 •C: 5.4; SD 1.3	At 9 months: • I: 1556 kJ/Day; SD 1109 • C: 1025 kJ/Day; SD 866 • P<0.01 At 18 months • I: 3807 kJ/Day; SD 1527 • C: 2577 kJ/Day; SD 1058	Compared to Control, Intervention group had high proportion of dietary diversity.	At 12 months I: 70.36±3.14 C: 70.10±2.74 At 18 months I: 70.10±2.74 C: 75.49±3.17	At 12 months I: 7.83±1.10 C: 7.83±1.04 At 18 months I: 8.73±1.14 C: 8.73±1.02
Penny ME CRTC in Peru	Healthcare workers and pairs of caregivers and their children Healthcare workers received nutrition-	Healthcare workers in 6 health facilities without the nutrition training intervention,	No detail	At 9 months:	Dietary diversity at 18 months was higher in intervention	HAZ At 18 months I: -0.81 C: -1.19 P=<0.0001	WAZ at 18 months I: -0.33 C: -0.62 P=0.003

	training intervention in 6 health facilities; 187 babies were enrolled, and their caregivers were counselled by these trained health workers.	provided care to 190 children enrolled in these facilities.		• I: 450 kcal/day • C: 400 kcal/day At 18 months • I: 960 kcal/day • C: 800 kcal/day • P = 0.001 •P<0.01	group than the control group.		WHZ I: 0.15 C: 0.05 P=0.319
Zaman S 2008 CRTC in Pakistan	Community health workers and pairs of caregivers and their children Health workers in 18 health centres received a 5-half day nutrition training using the WHO's IMCI training module for nutrition. They recruited and provided counselling and consultation to 151 child-mother pairs.	Health workers in controlled 18 health centres without nutrition training intervention recruited and cared for 169 pairs of mothers and children.	No detail	No details	Intervention group had a higher proportion on all the food items consumption compared to the control group.	HAZ 1st Visit I: -1.115 C: -1.407 P=0.167 2nd Visit I: -1.360 C:-1.575 P=0.241 3RD Visit I: -1.582 C:-1.705 P=0.559	WAZ 1st visit I: Mean SD -1.089 C: -1.439 P=0.125 2nd Visit I: -1.319 C: -1.334 P= 0.950 3rd Visit I: -1.174 C: -1.720 P=0.012 WHZ 1st Visit I: -0.450 C: -0.559 P=0.452 2nd Visit

							I: -0.536 C: -0.382 P=0.447 3rd visit I: -0.286 C: -0.794 P= 0.0046
Shi L 2010 CRTC in China	Primary healthcare providers; pairs of mothers and infants. Healthcare providers received nutrition training on complementary feeding, breast feeding, and counselling skills. They counselled and provided care to 294 pairs of caregivers and their children.	Health workers from township hospital did not receive nutrition training. They recruited and provided care to 305 pairs of caregivers and their children.	At 9 months • I: 3.77; SD 1.62 • C: 2.53; SD1.82 • P < 0.001 At 12 months • 4.17 • I: 2.90; SD 1.85 • P < 0.001	No details	Intervention group had a higher proportion on all the food items consumed compared to the control group.	Increment between baseline and 12 months I: 14.16±3.48 C: 13.47±2.69 P= 0.04	Increment between baseline and 12 months I: 3.26±1.26 C: 3.02±1.01 P=0.047
Vazir S 2012 CRCT in India	Community health workers (village health workers) n=60 and 511 pairs of mothers and their children Village health workers received supervised training on how to counsel mothers/	Village health workers did not receive training. They provided only standard of care to caregivers and their children.	No Details	At 9 months • I: 348 kcal/day; IQR 229,540 • C: 209 kcal/ day; IQR 122,338	Intervention groups (complementary and responsive feeding groups) had a higher proportion on all the food items consumption compared to the control group.	At 9 months I: 68.3±2.48 C: 68.0±2.48 P=0.598 At 15th Month I: 74.4±2.51 C: 73.9±2.76 P=0.223	At 9 months I: 7.6±0.94 C: 7.4±0.94 P=0.616 At 15 months I: 8.7±0.95 C: 8.6±1.09 P=0.066

	caregivers on complementary feeding, and responsive feeding. Caregivers who received such counselling also received standard care.			• P < 0.005 At 15 months • I: 569 kcal/day; IQR 539,618 • C: 460; IQR 429,489 P < 0.005			
Roy SK 2005 CRTC in Bangladesh	Nutritionists, medical officer, and health assistants Two-week nutrition training was conducted for health workers. The training included nutrition education, counselling, and anthropometry. Trained health workers provided counselling to mothers of moderately malnourished children on complementary feeding.	Mothers of a control group received normal care from health workers who received no nutrition training.	Feeding frequency >3 times/day At 3 months I: 98%, C: 54% At 6 months I: 97%, C: 58%	No detail	No detail	No detail	No detail

Pachon H 2002 CRTC in Vietnam	Community health workers and 240 pairs of caregivers and their children. Training implementers (health workers) who are also health volunteers received nutrition training to implement intensive nutrition rehabilitation sessions for ten months. Counselling for caregivers was done twice a week for nine months.	Health workers were not trained to implement intensive nutrition rehabilitation sessions.	At 2–6 months • I: 4.6; SD 1.3 •C:4.2;SD1.1 • P<0.01 At 12 months • I: 4.9; SD 1.5 •C:4.4; SD1.5 P<0.01	At 2–6 months • I: 662.7 kcal/ day; SD 301.0 • C: 597.4 kcal/ day; SD 275.7 •P<0.1 At 12 months • I: 826.9 kcal/ day SD 324.4 • C: 718.4 kcal/ day SD 330.0) • P<0.01	No details	No detail	No detail
Kilaru A 2005 CRTC in India	Auxiliary nurse midwives, community health workers Auxiliary nurse midwives, community health workers received nutrition training from MCH consultant	Normal standard of care provided by auxiliary nurse midwives who did not receive any special nutrition training	At 7-11 months Feeding frequency >4 times/day • I: 78% • C: 51% • P < 0.001		At 11 months Feeding at least 5 types/day •I:42% •C:19% P=0.01	No detail	No detail

	(paediatrician and nutritionists). They provided counselling to 173 caregivers and their children						

1.13 Country Profile

Pakistan is classified as a lower-middle-income country and has committed to achieving the Sustainable Development Goals (SDGs) by 2030, including SDG 2, which aims to "End hunger, achieve food security and improved nutrition, and promote sustainable agriculture," and SDG 17, which aims to "Strengthen the means of implementation and revitalise the global partnership for sustainable development." However, the country faces significant challenges in achieving these goals due to various factors, including poverty, limited access to healthcare and education, political instability, and environmental issues. As of 2021, the country's progress towards achieving these goals is not on track, and significant efforts are required to accelerate progress., Rates of stunting and wasting among children under 5 remain high (Government of Pakistan & UNICEF, 2018a). Some of the challenges reported by UN agencies included a lack of good-quality data for policy decisions and monitoring of the SDGs (Sachs *et al.*, 2022).

Around seventy percent of Pakistani people are, in one way or another, associated with agriculture occupation and contribute 42% of labour force employment. Still, Pakistan's agriculture accounts for only about 20% of the GDP (Government of Pakistan, 2017). There has been some recent improvement in the economic indicators of the country, but nutrition indicators remain a challenge for Pakistan as well as maternal health, with a 2.0 growth rate and an average number of 3.55 births per woman (Population Reference Bureau, 2016). Pakistan's poor maternal health indicators can be attributed to rapid pregnancies, a weak healthcare system, and poverty (Laghari *et al.*, 2015). These factors also significantly impact the health and nutrition indicators of under-five children in the country, with significant inequalities observed between the rich and poor populations (Government of Pakistan & UNICEF, 2018b). The lack of access to adequate healthcare services and a nutritious diet further exacerbates the problem, leading to a high prevalence of malnutrition and stunting among children under five (Bhutta *et al.*, 2013). Thus, there is a pressing need for effective interventions and policies that address the underlying causes of poor maternal and child health in Pakistan. The inequality in Pakistan reflects disparities in the income of different segments of society. The poorest one per cent of the population holds only 0.15 per cent of the national income, compared to the richest one per cent, who held nine per cent of the national income in 2018–2019. Similarly, the

Pakistan human development index (HDI) value has only increased by 39 per cent in the past 27 years, considerably less than the improvements achieved by Bangladesh (59 per cent) and India (52 per cent). Pakistan has the second lowest HDI value among South Asian countries (UNDP Pakistan, 2020).

1.13.1.1 Acute and chronic malnutrition

As per the latest National Nutrition survey in Pakistan, four out of ten children under five years of age are stunted, while 17.7% suffer from wasting. The double burden of malnutrition is an emerging challenge, with almost one in three children underweight (28.9%) alongside around 9% overweight and 2% obese in the same age group (Government of Pakistan & UNICEF, 2018a). Undernutrition rates are reported with significant regional and urban/rural disparities in the country, with the lowest stunting rates in Punjab province.

Stunting remains a critical problem for the country, with around 12 million children under five reported to have low height for their age. The prevalence of stunting varies from 12.6% to 48.3% in the central Islamabad region to Khyber Pakhtunkhwa (KP) province (Government of Pakistan & UNICEF, 2018a). The prevalence of stunting in Sindh, Baluchistan, Khyber Pakhtunkhwa (KPK) and Gilgit-Baltistan (GB) is higher than the national average in surveys and literature. A study in Baluchistan reported 48% and 10% stunting and wasting, respectively (Achakzai College and 2016, 2016). Also, a Sindh study found underweight, stunting, and wasting at 39%, 48%, and 16%, respectively (Khan *et al.*, 2016). A SMART nutrition survey in Sindh province reported 30% of children from rural areas were malnourished compared to 19% in urban areas (Concern Worldwide, 2016).

A regional study across South Asia reported that Bangladesh and Nepal had shown some reduction in stunting from 1990 to 2014, by 2.9% and 4.1% points, respectively. In contrast, India and Pakistan reported only modest improvements, with 1.3% and 0.6% over this period (Krishna *et al.*, 2018).

According to a literature review conducted by Asim and Nawaz, sociodemographic factors such as maternal health and education, gender, poor and larger household size, the presence of a disabled family member, and living in rural areas were found to be associated with child malnutrition in each country (Asim and Nawaz, 2018).

In South Asia, the same study found that dietary diversity, maternal education, and wealth quintile were significant factors associated with child undernutrition.

Studies have shown that household food diversity, maternal education, and wealth are important determinants of child nutrition status. A study conducted in Nepal found that household food diversity was significantly associated with better child nutrition outcomes (Ali *et al.*, 2019). Similarly, a study conducted in Bangladesh found that children from households with higher food diversity had lower odds of stunting (Rahman et al., 2016). Additionally, maternal education is a significant factor in reducing child malnutrition. A study conducted in India found that children of mothers who had completed primary or secondary education had a lower prevalence of stunting (Rahman, Saima and Goni, 2015). Similarly, a study conducted in Ghana found that maternal education was positively associated with child nutrition status (Novignon *et al.*, 2015). Household wealth has also been shown to be a significant factor in reducing child malnutrition. A study conducted in Ethiopia found that the wealth index was positively associated with child nutrition status (Woldehanna *et al.*, 2006). Overall, these findings suggest that interventions aimed at improving household food diversity, maternal education, and household wealth may positively impact reducing child undernutrition. So based on the above evidence, this can be concluded that children who live in households with access to a more diverse diet, mothers with higher education levels, and wealthier families are less likely to suffer from undernutrition.

1.13.1.2 Infant and Young Child Feeding Practices

Breastfeeding is still the norm in Pakistani culture, but breastfeeding practices according to WHO guidelines, which include early initiation within one hour and exclusive breastfeeding for the first six months, are not being followed. Pakistan is reported to have the lowest rates for early initiation of breastfeeding (18%), exclusive breastfeeding (38%) and age-appropriate introduction of complementary foods (50%) in the south Asian region, with the highest numbers of children being bottle-fed (19% of 4-5 months old children) (Das, Achakzai and Bhutta, 2016).

Poor IYCF practices are also due to a lack of appropriate maternal knowledge. A study conducted in rural districts of Sindh province of Pakistan found that IYCF practices were poor (49% of early initiation, and 70% introduced complementary

feeding at 6-8months) due to maternal literacy level, unemployment, and household economic situation (Khan *et al.*, 2017). This study captures only the rural part of the province. However, even in urban regions, the situation is similar but with some different determinants. One study compared infant feeding practices of urban South Asian origin families in England to those in Pakistan (and India). They found that solids were introduced at similar ages (6 to 7 months) in both groups, with similar common foods (including rice, cereals and eggs with progression to fruit and vegetables and family food in Pakistan, and fruit, vegetables, meat and convenience foods (especially sweet options) in England) and both groups shared the urge to get more information related to health food practices (Sarwar, 2002).

While quite a high percentage of children are introduced to complementary foods at the age of six months, the quality and diversity of complementary foods offered to young children are not adequate. Only 15% of children receiving complementary feeding meet the minimum acceptable diet, while 22% meet the minimum dietary diversity scores for complementary feeding (Government of Pakistan, 2011; Pakistan Demographic and Health Survey, 2013).

1.13.1.3 Maternal malnutrition

It is established that childhood undernutrition is fundamentally associated with poor economic resources and household poverty. However, the role of maternal health is also substantial in pregnancy outcomes (Kramer, 1987). The latest nutrition survey (Government of Pakistan & UNICEF, 2018a) reported that 9% of women of reproductive age are underweight (BMI less than 18.5 kg/m2), with higher prevalence among the poorest, uneducated and women living in rural settings. At the same time, obesity and micronutrient deficiencies are becoming an area of concern. Overweight and obesity among women have increased from 40% in 2012-13 to 52%, with almost 50% of women in Pakistan suffering from anaemia.

The Government of Pakistan is delivering free healthcare services through public sector health facilities, which include antenatal care (ANC) services, iron folic acid (IFA) supplementation, institutional delivery and postnatal care (Ministry of National Health, 2016). Despite the availability of these services across the

country at the health facility and community levels, low consumption of IFA supplements (44%) has persisted over the years (Ministry of National Health Pakistan and UNICEF, 2022). Despite the reported improvement in health services (improved antenatal, postnatal, immunisation and skilled birth attendance) over the last five years, with provision of ANC by professional healthcare providers increasing from 73% to 86% and attended births at health facilities from 48% to 66% (Ministry of National Health Pakistan and UNICEF, 2022), this has not resulted in improvement in maternal nutrition and maternal mortality indicators, which remained high (186 deaths/100,000 live births) (Shaeen *et al.*, 2022).

1.13.1.4 Childcare practices

In addition to these primary causes, childcare practises have been reported as equally important to understand child development dynamics. There is evidence that children born in poor and food-insecure households have shown normal growth and development of appropriate childcare practices are adopted (Pelto, 2000). A community-based cross-sectional survey study conducted to assess the prevalent childcare and feeding practices and their role in stunting among 6 to 18-month-old children living in urban squatters in Karachi suggests that the sex of the child, food insecurity along with maternal feeding practices are significantly associated with nutritional outcomes of children (Baig-Ansari *et al.*, 2006). Results of the study show female children and children from food-insecure households were nearly three times more likely to be stunted than male children and children from food-secure households. Child caring practices associated with stunting included feeding the child family food and feeding the child by a sibling. Limitation of the study includes that the cross-sectional design of the study could not discuss casual interference, plus 77% of the sampled children were not weighed at birth, while birth weight was the factor whose effects were not controlled for. Thus, a risk exists for confounding.

There has been limited investigation into childcare practices and feeding behaviours in the region. However, a study conducted in Karachi found that tailored advocacy and behaviour change interventions, along with targeted training on child feeding practices integrated with routine preventive services, can significantly impact the growth and development of children living in resource-poor settings.

The study conducted in Karachi by Iram and Sabihuddin Butt (2004) aimed to evaluate the impact of an intervention program on child feeding practices and growth among children aged 6 to 23 months. The intervention program involved training community health workers and mothers on appropriate infant and young child feeding practices, as well as tailored advocacy and behaviour change interventions to promote these practices. The training and interventions were integrated with routine preventive services, such as immunisation campaigns and growth monitoring (Iram and Sabihuddin Butt, 2004).

The results of the study showed that the interventions were effective in improving child-feeding practices and growth outcomes among the children in the study. Specifically, the proportion of children who were exclusively breastfed increased, and the proportion of children who were stunted or underweight decreased significantly after the intervention program. The study highlights the importance of tailored interventions that are integrated with routine preventive services in improving child health outcomes in resource-poor settings.

Overall, this study suggests that community-based interventions that promote appropriate child-feeding practices and behaviour change, along with targeted training for mothers and community health workers, can have a significant impact.

Despite the fact that various initiatives to reduce under-5 mortality are taken by different public and private sectors, the percentage of under-5 deaths could not be reduced from 93/1000 live births (Bureau of Statistics Punjab Pakistan, 2014) to the agreed goal of 49/1000 live births as agreed for SDG. Still, infectious diseases, diarrhoea, and pneumonia remained the major killers of children under the age of 5 years, which could be the most preventable cause of mortality (Hasan and Khanum, 2000). Most of the research in Pakistan has focused towards socioeconomic and demographic determinants of child mortality (Iram and Sabihuddin Butt, 2004). Only one study conducted by Iram and Sabihuddin in 2004 explored the role of maternal and household characteristics that affects the provision of appropriate childcare practices. The study used the extended model of childcare adopted by UNICEF (Engle, Menon and Haddad, 1999). Some of the common indicators of this model, including breastfeeding, complementary feeding and maternal health, employment, and literacy levels, have received good

attention and data on these indicators was available. However, a few components of the framework, including child interaction with mother/caregiver and other aspects of psychosocial care, remained less focused in Pakistan, and very limited data is available against these indicators. As the study used data from one national survey, it can only show the analysis of available secondary data, as there was no primary data collection related to care practices.

1.13.1.5 Nutrition Supplementation

Vitamin A deficiency is recognised as a public health problem in lower and middle-income countries. Around 44-50% of preschool children in South Asian countries are reported to be affected by Vitamin A deficiency (WHO, 2009a). An estimated 1.02 billion people are affected by micronutrient deficiencies, of which Vitamin A deficiency is the most prominent. Vitamin A and malnutrition-associated mortality of neonates and under-fives in Asian countries, i.e., Bangladesh and India, contributes to one-third of the global mortality rates (FAO, 2000) (Nair *et al.*, no date). Similar studies indicated that 85% of South Asian children with xerophthalmia reside in India (WHO, 2009a).

The proportion of children who received Vitamin A supplementation, then a report by UNICEF and the National Institute of Population Studies in Pakistan found that the coverage of Vitamin A supplementation among children aged 6-59 months in Punjab was 81.4% in 2011 (UNICEF & NIPS, 2013); This suggests that the reported coverage of Vitamin A in Punjab is in line with the national average.

It is important to note that while the reported coverage of Vitamin A supplementation is relatively high, there may still be gaps in coverage and access to this intervention, particularly among vulnerable populations. Additionally, the impact of Vitamin A supplementation on reducing child mortality and morbidity depends on the coverage and effectiveness of the intervention, as well as other factors such as overall health status and access to healthcare services.

A study conducted in a local setting of Karachi to validate the coverage of vitamin A supplementation confirmed the coverage of polio and vitamin A supplementation as 88% and 74.8%, respectively. As per WHO data, almost 5.7 million children under five years of age are reported to be vitamin A-deficient in Pakistan (WHO, 2009a). Similarly, a study conducted in the Northwest Frontier

Province of Pakistan reported a 17% increased risk of blindness among children aged six years or less (Paracha *et al.*, 2000) (Akhtar *et al.*, 2013). One of the reasons for widespread vitamin A deficiency is lowered levels of Vitamin A in the breast milk of vitamin-deficient mothers. Also, pregnant women deficient in Vitamin A are reported to have restricted amounts of retinol in the foetus in the later weeks of pregnancy (Akhtar *et al.*, 2013) (Dijkhuizen *et al.*, 2001). NNS 2018 reported around 30% of pregnant and lactating women in Pakistan are vitamin A deficient, with significant regional disparities from 15% in Islamabad to 38% in Baluchistan province.

1.13.1.6 Treatment of undernutrition in the country

A review of the literature on the treatment of malnutrition in Pakistan reveals several challenges and opportunities for addressing this issue.

One of the main challenges is the access to healthcare services in many parts of the country, particularly in rural areas, making it difficult for malnourished children to receive medical treatment and nutritional support. Additionally, the high prevalence of poverty in Pakistan means that many families cannot afford to purchase nutritious foods or seek medical care when needed. However, there have been some successful interventions aimed at addressing malnutrition in Pakistan. For example, the World Food Programme has implemented a program to provide fortified wheat flour to women and children in rural areas, which has been shown to improve nutritional status (Nishtar, 2010). Similarly, a study of a community-based nutrition education program in rural Pakistan found that it significantly improved child nutrition status (Zahid Khan *et al.*, 2013). Another promising approach is the use of ready-to-use therapeutic foods (RUTFs) to treat severe acute malnutrition (SAM) in children. A study conducted in Pakistan found that treatment with RUTFs effectively reduced mortality and improved nutritional status among children with SAM (Iqbal et al., 2017).

In Pakistan, health departments are following the national community-based management of acute malnutrition (CMAM) guidelines for the treatment of acute malnutrition. Severe acute malnutrition is being treated with ready-to-use therapeutic food (RUTF) as per protocols defined by WHO (World Health Organization *et al.*, 2007). There are no standard guidelines for the use of RUSF

to treat moderate malnutrition. However, the literature suggests that energy-dense food supplementation can effectively manage moderate malnutrition (WHO, 2012). However, in the absence of a standard protocol for the treatment of MAM children, in Pakistan, children with moderate acute malnutrition are being provided with ready-to-use supplementary foods (RUSF), a lipid-based nutritional supplement to prevent them from turning into serve acute malnourished.

1.14 Study Design

The research plan outlined in this study aimed to address gaps in the existing literature concerning the assessment of child feeding and caring practices among infants and the impact of ready-to-use foods on caregiving practices in the context of moderate malnutrition in lower-middle-income settings, with a specific focus on Pakistan. The plan consisted of a series of studies, each with its own specific objectives. The first study, conducted in Glasgow, focused on the linguistic validation of the Infant and Child Feeding Questionnaire (ICFET), designed to assess the eating, and feeding behaviours of young children and other contributors to malnutrition. This study aimed to ensure the questionnaire's applicability and accuracy.

The second study took place in Pakistan and aimed to validate the ICFET within the local context while also investigating the prevalence of modifiable risk factors among healthy children and those affected by malnutrition. By conducting this study, the researchers aimed to gain a comprehensive understanding of the specific risk factors prevalent in the target population.

Using a Cluster Randomized Control Trial (CRTC) design, the third study aimed to examine the effects of ready-to-use supplementary food (RUSF) on the eating and feeding behaviours of children with moderate acute malnutrition. RUSF is a specialised food product utilised in the treatment of acute malnutrition. This study sought to assess the impact of RUSF on various aspects, including eating and feeding behaviours and anthropometric outcomes.

The fourth study focused on evaluating the reliability of Mid Upper Arm Circumference (MUAC) as a method for identifying moderate malnutrition in the Pakistani context. This study aimed to determine the accuracy and effectiveness

of MUAC in diagnosing moderate malnutrition, providing valuable insights for future screening and assessment practices.

Lastly, the fifth study employed a qualitative approach to assess the feasibility of delivering targeted nutrition counselling to caregivers of malnourished children. By exploring the acceptability and feasibility of providing tailored nutrition counselling through primary healthcare settings in Pakistan, this study aimed to identify practical strategies for improving caregiver engagement and support.

Collectively, these studies aimed to generate evidence that addresses the challenges and opportunities associated with addressing malnutrition in Pakistan. By shedding light on the specific context and potential strategies for enhancing nutrition programs, this research intends to contribute to the existing literature and inform policy and intervention efforts in the country.

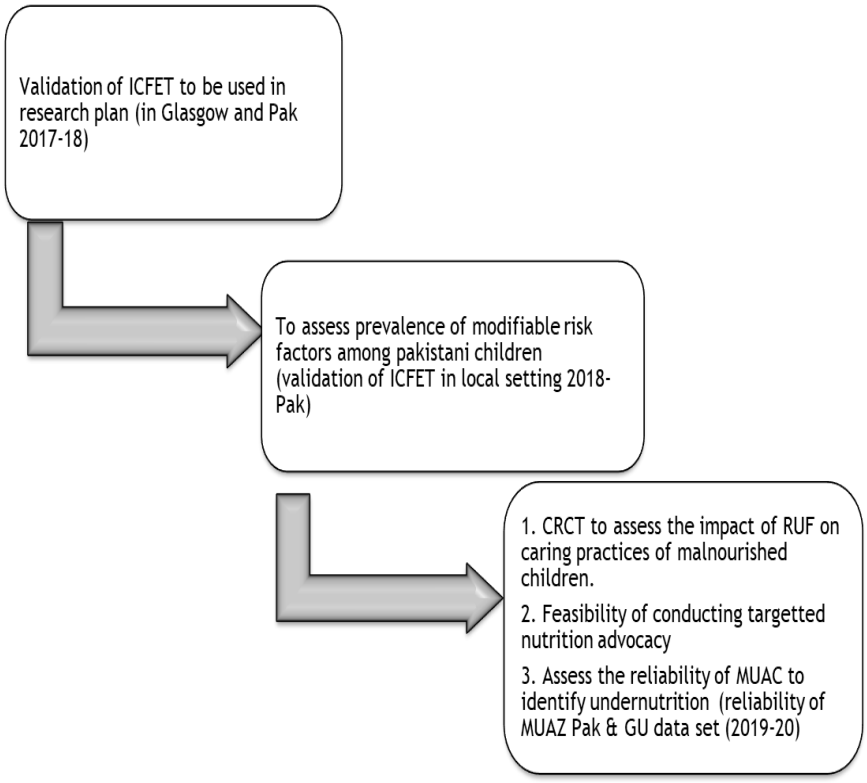

Figure 1.3 Sequence of studies conducted as part of research programme in Pakistan and UK.

Chapter 2 Research Tool Development (Developing a valid measure of eating behaviours)

2.1 Introduction

The literature suggests that eating patterns developed early in life are influenced by various factors at different levels. These factors include individual, family, and societal/cultural factors. Individual differences are predictive of children's growth and nutritional outcomes later in life, and these differences are believed to contribute to both undernutrition and overnutrition.

The preschool years are considered a critical window of opportunity for interventions promoting healthy eating behaviours and nutritional outcomes in later years of life; this is because this period is crucial for child eating behaviour development, and interventions during this period have the potential to have a lasting impact.

However, the literature also highlights the complexity of the issue, with multiple factors influencing child eating behaviours and nutritional outcomes. For example, a study by Wardle et al. (2001) found that genetic and environmental factors play a role in the development of eating behaviours and weight status in children (Wardle *et al.*, 2001; Fisher and Birch, 2002). Additionally, societal and cultural factors may also influence child eating behaviours, as highlighted by Black and Hurley (2007) (Black and Hurley, 2007)

It is also important to note that while preschool is a critical window of opportunity, interventions at later stages can still impact child eating behaviours and nutritional outcomes. For instance, a study by Quah et al. (2017) found that a school-based intervention promoting healthy eating behaviours among children effectively improved dietary intake and nutritional status (Quah *et al.*, 2017).

A recent study conducted by a PhD student from our research group in a low-income area of Nairobi, reported undernourished children showed less interest in food (undernourished 78%; healthy 90% p = < 0.001); subsequently, food refusal and force-feeding by the caregivers are more common for undernourished children. (Mutoro *et al.*, 2020). The study was designed based on a previous

project conducted by our research group in Kenya. Due to the high prevalence of malnutrition in Pakistan and limited studies on caring practices in the country, the current study aimed to investigate Pakistani children's eating and feeding behaviours.

Pakistan has been implementing nutrition-specific interventions to combat the issue of malnutrition among the under-five population. Still, unfortunately, there has not been any significant improvement in nutrition indicators (Government of Pakistan & UNICEF, 2018a), mainly due to a lack of a holistic approach because of limited resources to address the complex causal pathway involved in the triple burden of malnutrition.

Due to complex factors contributing towards malnutrition, complementary feeding and food-based interventions alone do not sufficiently address the retarded growth due to stunting and reduction in morbidity among under five years old children (Dewey and Adu-Afarwuah, 2008). Shloim conducted a systematic review of 31 peer-reviewed quantitative papers, comprising seven longitudinal studies, 23 cross-sectional studies, and one randomised control trial—the review aimed to explore the relationship between feeding styles and nutritional outcomes in later childhood. The findings of the review suggested that there is an association between feeding styles and later nutritional outcomes in childhood. (Shloim *et al.*, 2015). Considering the complex causal pathway of malnutrition (Bhutta *et al.*, 2013), it is also essential to investigate the health and nutritional outcomes associated with low appetite.

Low appetite in children is often characterised by their refusal to eat the food offered to them. This refusal can be more specifically described as food refusal, when a child consistently refuses to eat all or most of the foods offered, leading to a caloric deficit. (Field, Garland and Williams, 2003). Both decreased appetite and specific behaviours towards food that include turning the head away and keeping the mouth shut while food is being offered are considered characteristics of food refusal (Williams, Field and Seiverling, 2010).

Maternal perception of eating avidity and aversion is very important as this ultimately impacts the caring practices of mothers. Assessment of maternal perception towards child eating and feeding behaviour is used most commonly to

assess the relationship between appetite and child health and nutrition outcomes (Carnell and Wardle, 2007; Van Jaarsveld *et al.*, 2011; Buvinger *et al.*, 2017). Maternal perceptions, cultural and traditional taboos, and lack of adequate IYCF practices may negatively impact complementary feeding practices (Paintal and Aguayo, 2016). Also, using precise terminology to describe eating behaviours is essential. A study conducted in Bangladesh revealed that phrases used to describe feeding behaviours were interpreted differently. For instance, the phrase "cries" could be understood as food refusal, but it could also be interpreted as a hunger cue (Naila *et al.*, 2018).

Assessing eating behaviours through observational behavioural methods is an indirect method to assess appetite. Carnell has proposed a behavioural method of assessment comprised of two parts, "food approach" and "food avoidance" (Carnell *et al.*, 2013). As part of the assessment, external cues shown by the child when food is offered are taken as a "food approach" or avidity. At the same time, avoidance is characterised by internal cues for satiety or hunger (Carnell *et al.*, 2013). In a study conducted in Nicaragua, a child demand scale was used to assess eating and feeding behaviours among moderately malnourished children. The study reported that in only 39% of observations, the caregiver encouraged the child to eat (Engle and Zeitlin, 1996). In LMIC, various factors, including food insecurity, limited resources, and lack of encouragement during mealtime, affect the caring practices and makes force feeding common (Bentley *et al.*, 1991b; Engle and Zeitlin, 1996; Moore, Akhter and Aboud, 2006). Several studies have used assessment criteria developed by (Moore, Akhter and Aboud, 2006) to assess eating and feeding behaviours among young children in various settings (Aboud, Shafique and Akhter, 2009; Abebe, Haki and Baye, 2017). Also, WHO has guidelines on data collection for responsive feeding. Also, the tool is available by WHO (WHO, 2003a; UNICEF, 2013). However, the tool is not validated in different settings(Sall *et al.*, 2020).

Mealtimes are the interaction between child and caregiver, which in most cases is the mother. Child eating behaviours can be influenced by these interactions (Demir *et al.*, 2012). These interactions can be evaluated either by real-time observation or retrospective maternal reporting. Observational approaches are less typically used in community settings because they are resource intensive in

terms of time and skills (Gardner, 2000; Demir *et al.*, 2012; Mutoro, 2017). According to a study examining the effectiveness of observational techniques, the context in which observations are conducted and the presence of an observer can influence the type of interaction between a parent and child. The study highlights a potential limitation of observational techniques, as they may not always capture interactions that occur naturally in everyday settings(Gardner, 2000).

Maternal reporting is the most convenient method to use, especially in a population where the mother is the sole caretaker of the child. Several tools are using a caretaker's-report to assess eating and feeding behaviours, including the Baby Eating Behaviour Questionnaire (BEBQ) (Llewellyn *et al.*, 2011) and the Child Eating Behaviour Questionnaire (CEBQ) (Wardle *et al.*, 2001) have been developed and used in different studies. The most commonly reported tool to investigate the relationship of varying eating behaviours with growth outcomes is the CEBQ which was developed in the UK (Wardle *et al.*, 2001). The CEBQ consist of eight behavioural markers: food responsiveness, enjoyment of food, emotional overeating, desire to drink, satiety responsiveness, slowness in eating, emotional undereating and fussiness, mainly reported by parents (Wardle *et al.*, 2001). The tools have been validated in different populations and reported good psychometric properties (Freitas *et al.*, 2018). Recent literature reports that CEBQ is helpful for early identification of children with problematic eating behaviours, which ultimately translate into overweight. Existing literature mainly focused on the association between eating behaviours and their association with being overweight (Freitas *et al.*, 2018) and thus, complications of problematic eating and feeding behaviours with regard to undernutrition seem overlooked. This is in line with the countries and setting where CEBQ has been used. Also, CEBQ requires detailed inputs and is difficult to be used in low-resource healthcare settings. Several studies have reported inconsistencies in terms of ethnic and cultural interpretation when the CEBQ was validated in different settings (Loh *et al.*, 2013; Mallan *et al.*, 2013). Also, validation studies conducted in Western settings have reported poor performance of the questionnaire in American and Australian settings (Conway and Huffcutt, 2003; Mallan *et al.*, 2013). Thus, considering the context, there is a need to develop a validated measure of eating and feeding behaviour, which is equally effective in the context of undernutrition, and this was a key step for our research programme. Therefore, the first study of this thesis

aimed to validate phrases describing different eating and feeding behaviours as part of a wider cross-cultural study to develop a tool that could be used to assess the prevalence of different eating and feeding behaviours among healthy and malnourished children and consequently improve nutrition advocacy for mothers.

2.2 Objectives

To assess the consistency and accuracy of phrases used to describe eating avidity and refusal in children in Urdu compared to English to develop a culturally acceptable tool to assess eating behaviours in young children.

2.3 Material and Methods

2.3.1 Ethical Approval

This study was done as an extension of an already completed study by Jessica Megan Gurney (JMG), a medical student, as part of her Clinical Medicine Project 2016-17 in Glasgow under Professor Charlotte's supervision. Thus, the University of Glasgow ethics review committee in the UK obtained an extension of the same ethics approval. Ethical approval was granted by the College of Medical, Veterinary and Life Sciences Ethics Committee Non-Clinical Research Involving Human Subjects; project number 200170117.

2.3.2 Design

This was a cross-sectional study involving samples of English and Urdu-speaking mothers. English and Urdu-speaking mothers with Pakistani backgrounds were recruited using mother groups in Glasgow, Scotland.

2.3.3 Tool development

The first phase was undertaken by Jessica Megan Gurney (JMG), a medical student, as part of her Clinical Medicine Project 2016-17 in Glasgow. Phrases describing different eating behaviours were adopted from a set of already existing phrases from the CEBQ and used by our research group (Wardle *et al.*, 2001; Wright, C. M, Parkinson, K.N, Drewett, 2006; Mutoro, 2017). Four videos of children between

the ages of 15 months to 5 years sourced by Professor Charlotte Wright (CW) and with parents' consent were used for this study.

Two sets of phrases describing both food avidity and aversive eating behaviours adopted from JMG's study were selected to be tested for this phase of the study, with each respondent asked to rate each using the same scale from 1 (very likely) to 5 (not at all likely). JMG's study led to the modification of phrases related to eating time to improve their definitive meaning. Specifically, the previously used phrase "takes a long time to eat" was replaced with two phrases: "Meals often last more than 30 minutes" and "Meals sometimes last more than an hour." Additionally, two new phrases were added to the good eating behaviour descriptions: "eats quickly" and "is willing to try new foods." The modified phrases were then translated back and forth by two native Urdu speakers for accuracy (appendix 1).

2.3.4 First Phase of Study

The study conducted by JMG in Glasgow reported that some positive phrases describing child appetite showed high agreement between English and Urdu-speaking groups. These phrases included "loves food" and "interested in food." However, a phrase like "always asking for food" showed disparities between the two groups, suggesting cultural and language differences in the interpretation of this phrase. This highlights the importance of considering cultural and language factors when assessing maternal perceptions of a child's appetite and feeding behaviour. Urdu-speaking mothers took it as a good sign of appetite. At the same time, English speakers identified it as negative behaviour.

2.3.5 Second Phase of Study

In the second phase, two studies were conducted, one in Glasgow among Urdu-speaking and English-speaking mothers and one by a native Cantonese-speaking master's student interested in using the same tool in Hongkong. So, this opportunity was used to validate the tool in both settings. Therefore, to have a clear, culture sensitive and validated set of phrases, the second phase of the study was planned to be conducted in Glasgow among Urdu and English speaker mothers and in Hongkong for Cantonese-speaking mothers Figure 1.1.

A modified list of phrases was then developed based on findings from Phase 1 and again refined following forward and back translation into Urdu. These were then tested again with English-speaking mothers, as well as with Urdu mothers and Cantonese-speaking mothers (results of Cantonese-speaking mothers are not described in this thesis).

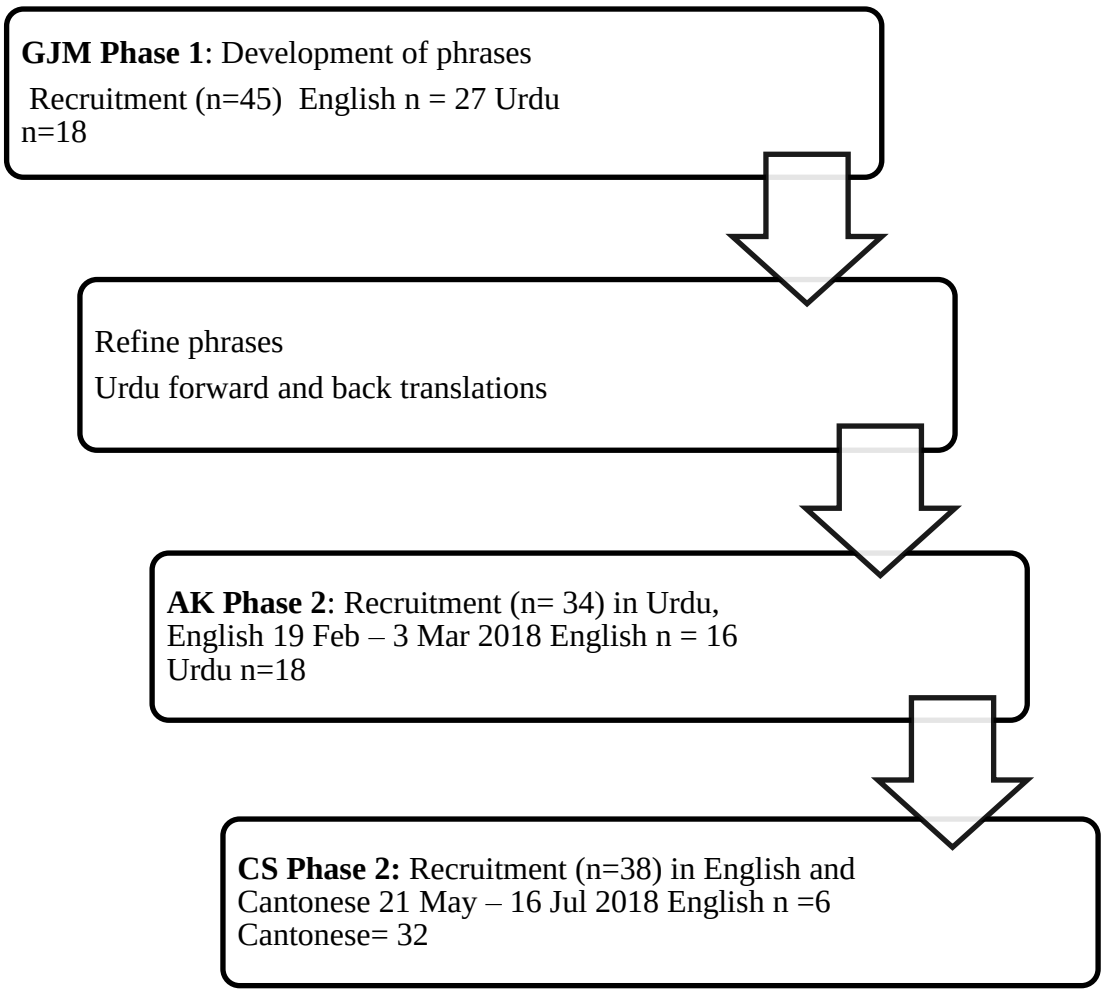

Figure 2.1 Phase-wise recruitment of subjects for different languages

2.3.6 Sample Size

A total of 34 English-speaking participants (n=16) and (n=18) Urdu speakers were recruited using purposive sampling for most participants in this study. Purposive sampling is a non-probability sampling technique that involves selecting a sample based on specific criteria or the purpose of the study. Participants were identified through mother and toddler groups, women groups and some of the staff working in New Lister Building Royal Infirmary of Glasgow.

2.3.7 Recruitment

Recruitment was done between 19th February 2018 to 7th March 2018. All the participants included in the study were women with one or more children of any age. Participants were approached face to face; the interview questionnaires were completed by a researcher for Urdu speaker participants, while English speaker mothers self-completed the interview questionnaire. All the participants were provided with an information sheet, briefed verbally about the study, and asked to sign a consent form before the interview started. All participants were given an identification number to ensure anonymity, and no personal information was recorded.

2.3.8 Data collection (Interviews)

A standard data collection procedure developed in the first phase of the study was followed in this phase of the study. Participants were approached one at a time and were provided with verbal information about the study by researcher AK; once they agreed to participate in the study then, they were invited to a private place and given an information sheet, and written consent was collected upon participation.

After consent, participants were asked questions about the number of children, age of youngest and eldest child, gender of children, language in terms of first language and length of stay in the UK Participants were then given a questionnaire describing a list of phrases (in English and Urdu respectively for English and Urdu speaking mothers) and were asked to classify each phrase according to their perception about the phrase describing either ‘good’ or ‘bad’ eating behaviour.

After this, the participants were shown videos 1, 2, 3 and 4, respectively and were asked to mark on a Likert scale of 1 (eating avidity) to 5 (definitely food avoider), with three as 'can't tell' each phrase as per their perception for the relevance of each child's behaviour shown in videos.

Four video clips comprised children of different ages showing different characteristics of good and bad eating behaviours described in Figure 2.2. In the end, mothers were asked to share their feedback/suggestions about phrases and were recorded on questionnaires by the researcher.

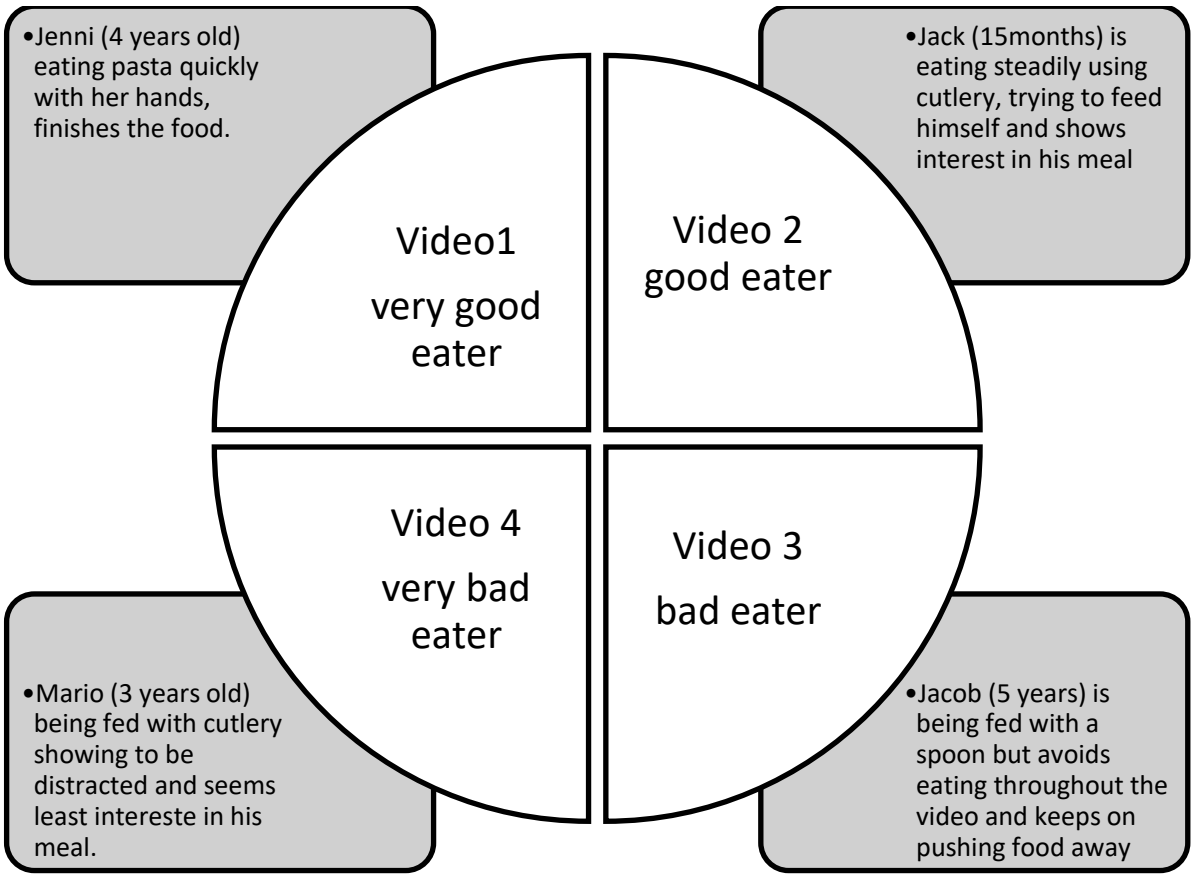

Figure 2.2 Descriptions of videos used for data collection

2.3.9 Analysis

Data was collected using a hard copy of the questionnaire; it was entered into a statistical software called SPSS version 26. Once the data entry was completed, the researchers cleaned the data to ensure that any missing data was handled appropriately by marking it as "missing" in the count. The researchers then recorded the responses from the Likert scale into four categories: "1" and "2" were categorised as eating avidity, "3" was categorised as cannot tell, and "4" and "5" were categorised as eating avoidance.

To assess the clarity of the phrases used to describe eating behaviours among both language groups, the researchers analysed the data based on whether the responses supported the expected phrase allocation to the corresponding videos. They used Pearson's chi-square statistical test to determine if there were any significant associations between the language groups and the phrase allocations. A significance level of $P<0.05$ was used to determine statistical significance.

2.4 Results

2.4.1 Participants Characteristics

All English-speaking participants (n=22) reported English as their first language. Most of Urdu speaking participants (n=16) stated Urdu as their first language and 1 participant reported Punjabi as her first language. All English-speaking participants completed the questionnaire themselves, while due to varying degrees of Urdu writing and reading capacities, questionnaires of Urdu-speaking participants were completed by the investigator herself. In response to the question about the number of years spent in the UK, those participating from the Urdu language group ranged from six to 53 years, with a median of 18 years. Overall, the median (range) number of children per mother was 2.50 (3), with mean ages of 13.3±11.1 and 18.9±13.4 years as the mean age of the youngest and eldest children, respectively.

2.4.2 The perceived meaning of phrases and allocation to 'good' or 'bad' eating among both language groups

Overall, participants from both language groups showed high agreement for the avidity phrases, with the highest agreement of 97% for the phrase related to interest in food and the lowest of 57% for eating quickly. Table 2.1 presents the significance of agreement of phrase allocations obtained from Pearson's Chi-squared test between language groups. Differences in agreement of less than 80% between the two groups are highlighted in red. "Always asking for food" was consistently perceived by about 1/3 of respondents as not related to 'good' eating among both language groups. "Eats Quickly" showed a significant disagreement among English and Urdu speakers' mothers (p=0.03) as English speaker mothers, in contrast to Urdu speaker mothers, perceived it as greedy and not good eating behaviour. "Meals often last more than 30 minutes" also showed a significant difference between language groups (P=0.03), as 100% Urdu speaking mothers perceived it as food refusal behaviour in contrast to only 68% English speaking mothers. Generally, very few, 5% (n=1) of the Urdu-speaking mothers rated "meals sometimes last more than one hour" as not clear/unsure phrase compared to 19% of English-speaking mothers who reported they are unsure about the phrase p=0.02 Table 2.1.

Table 2.1 Perceived meaning of phrases and agreement to hypothesis among both language groups (n = 22 English-Speaker, 18 Urdu-Speaker)

Avidity Phrases:		Avidity % (n)	Avoidance % (n)	Can't Tell % (n)	Hypothesis	Rate of agreement (%) Total	English	Urdu
Loves food		95.0 (38)		5.0 (2)	Good	95.0	90.9	100
Is interested in food		95.0 (38)	2.50(1)	2.5 (1)	Good	95.0	90.9	100
He is always asking for food.		62.5 (25)	30.0 (12)	7.5 (3)	Good	62.5	68.2	55.6
Enjoys a wide variety of foods		97.5 (39)	2.50 (1)		Good	97.5	95.5	100
Eats quickly		57.5 (23)	32.5 (13)	10.0 (4)	Good	57.5	63.6	50.0
Is willing to try new foods		95.0 (38)	5.0 (2)		Good	95.0	95.0	94.0
Finishes their meal		92.5 (37)	5.0 (2)	2.50 (1)	Good	92.5	86.4	100
Avoidant phrases								
Turns head away		2.5 (1)	90.0 (36)	7.5 (3)	Bad	90.0	81.8	100
Pushes food away		7.5 (3)	92.5 (37)		Bad	92.5	86.4	100
Cries/ screams		2.5 (1)	92.5 (37)	5.0 (2)	Bad	92.5	86.4	100
Holds food in mouth for too long		5.0 (2)	90.0 (36)	5.0 (2)	Bad	90.0	81.8	100
Spits out food		2.5 (1)	92.5 (37)	5.0 (2)	Bad	92.5	86.4	100
Meals often last more than 30 mins.		12.5 (5)	82.5 (33)	5.0 (2)	Bad	82.5	68.2	100
Meals sometimes last more than an hour		2.5 (1)	90.0 (36)	7.5 (3)	Bad	90.0	81.8	88.9

Table 2.2 Summary of agreement of phrase allocations describing good and bad eating behaviours by language (n = 22 English-Speaker, 18 Urdu-Speaker)

Phrases Avidity Phrases:	Eating avidity %(n) English	Urdu	Food refusal %(n) English	Urdu	Can't tell %(n) English	Urdu	P VALUE (Pearson chi-square)
Loves food	90.9 (20)	100 (18)	0		9.1 (2)	0	1.89
Is interested in food	90.9 (20)	100 (18)	4.5 (1)		4.5 (1)	0	0.42
He is always asking for food	68.2 (15)	55.6 (10)	18.2 (4)	44.4 (8)	13.6 (3)	0	0.08
Enjoys a wide variety of foods	95.5 (21)	100 (18)	4.5 (1)			0	0.36
Eats quickly	63.6 (14)	50 (9)	18.2 (4)	50 (9)	18.2 (4)	0	0.03
Is willing to try new foods	95.0 (21)	94 (17)	4.5 (1)	5.6 (1)		0	0.88
Finishes their meal	86.4 (19)	100 (18)	9.1 (2)		4.5 (1)	0	0.26
Avoidant phrases							
Turns head away	4.5 (1)	0	81.8 (18)	100 (18)	13.6 (3)	0	0.16
Pushes food away		0	86.4 (19)	100 (18)	13.6 (3)	0	0.10
Cries/ screams	4.5 (1)	0	86.4 (19)	100 (18)	9.1 (2)	0	0.26
Holds food in mouth for too long	9.1 (2)	0	81.8 (18)	100 (18)	9.1 (2)	0	0.16
Spits out food	4.5 (1)	0	86.4 (19)	100 (18)	9.1 (2)	0	0.26
Meals often last more than 30 mins	22.7 (5)	0	68.2 (15)	100 (18)	9.1 (2)	0	0.03
Meals sometimes last more than an hour	0	5.6(1)	81.8 (18)	88.9 (18)	18.2 (4)	5.6 (1)	0.12

Data presented as %(n) Chi-square P value

2.4.3 Rating of agreement of Phrases with Videos

Phrases were then analysed against video ratings for both sets of phrases, describing the percentage of participants reporting the likelihood of avid phrases matching two videos of children showing 'very good' and 'good' eating behaviour, similarly avoidant phrases with the videos showing 'very bad' and 'bad' eaters. Phrases reporting less than 80% agreement with the behaviour shown in the video are indicated in the tables below. Videos 1 and 3 had the highest number of disagreements for phrase allocations that did not match the behaviour of the child shown in the video. The eating behaviours demonstrated in Videos 2 and 4 showed high precision with respective phrases allocated. "Is always asking for food", "Meals often last more than 30 minutes", and "Meals last more than 1hr" performed poorly when describing corresponding videos. Additionally, "Cries/screams" and "Hold food in mouth for too long" also showed under 60% agreement towards supporting the hypothesised behaviour demonstrated in the video.

2.4.4 Likert scale ratings

The overall allocation of phrases to corresponding videos was accurate and consistent among both language groups, with more than 80% of agreement among both language groups. For Video 1, less than 60% of disagreements were reported among language groups for "Enjoys Wide variety of foods" and "Is willing to try new foods". The agreement of participants for video 2 showed the highest consistency between both language groups. Videos 2 and 3 showed the highest consistency among language groups for both phrases. While video 4 showed the highest consistency for eating avidity describing phrases, with some disagreements for food refusal-related phrases.

2.4.5 Video 1 – Very Good Eater (Table 2.3)

All phrases related to eating avidity and avoidance with a child shown in the video of a very good eater had an agreement between both Urdu and English speakers. "Enjoys a wide variety of foods" had the lowest agreement between language groups (50% n=18 for English speakers and 83.3% (n=15) for Urdu speakers, p=0.02). None of the phrases for eating avidity or food refusal were significantly different among both language groups.

2.4.6 Video 2 – Good Eater (Table 2.4)

"Loves food" and "Is interested in food" had 100% agreement supporting the video showing a 'good eater' between language groups. "Always asking for food", "Meals often last more than 30 minutes", and "Meals sometimes last more than one hour" reported low agreement between languages. However, the differences were not significant.

2.4.7 Video 3 – Bad Eater (Table 2.5)

"Loves food" and "Pushes food away" reached an agreement approaching 90.5 to 100%, describing a bad eater shown in the video among both English and Urdu speakers, respectively. The phrase with the lowest agreement, however, was "Enjoys a wide variety of food", where a significantly lower proportion of English speakers (57%), in contrast to 100% of Urdu speakers, allocated the behaviour as being likely to be predictive of 'avoidance' shown in the video (P=0.007). Additionally, "Is always asking for food" and "Is willing to try new foods" showed low agreement among both language groups. However, the chi-squared analysis showed no significant differences with these observations.

2.4.8 Video 4 – Very Bad Eater (Table 2.6)

Over 50% of respondents allocated "Holds food in mouth for too long" incorrectly with the very bad eater shown in the video. All phrases describing eating avidity had the highest agreement supporting the video showing very bad eaters among Urdu speakers (100%) as well as English speakers more than 80%. "Meals often last more than an hour" and "Cries/screams" showed non-significant but higher disagreement between both languages (p=0.01).

Table 2.3 Phrase allocations agreement with behaviour shown in Video 1 (n=22 English-Speaker, 18 Urdu-Speaker)

Video 1-Very Good Eater	Agree with the Child shown in Video %(n)		Disagree with the Child shown in Video %(n)		Can't tell %(n)		P VALUE (Pearson chi-square)
Avidity Phrases:	English	Urdu	English	Urdu	English	Urdu	
Loves food	82 (18)	83.3 (15)	4.5 (1)	11 (2)	13.6 (3)	5.5(1)	.54
Is interested in food	82 (18)	100 (18)	4.5 (1)	0	13.6 (3)	0	.16
He is always asking for food	76.2 (16)	77.8 (14)	4.5 (1)	11 (2)	19 (4)	11 (2)	.63
Enjoys a wide variety of foods	50 (11)	83.3 (15)	0	1 (5.5)	11 (50)	11 (2)	.02
Eats quickly	95.5 (21)	89 (16)	4.5 (1)	0	0	11 (2)	.19
Is willing to try new foods	54.5 (12)	83.3 (15)	45.5 (10)	11 (2)	0	5.5 (1)	.42
Finishes their meal	82 (18)	94 (17)	9.1 (2)	0	9 (2)	5.5 (1)	.37
Avoidant phrases							
Turns head away	9.1 (2)	11 (2)	81.8 (18)	83.3 (15)	9 (2)	5.5 (1)	.90
Pushes food away	4.5 (1)	27.5 (5)	81.8 (18)	72.2 (13)	13.6 (3)	0	.47
Cries/ screams	9.1 (2)	22.3 (4)	54.5 (12)	66.7 (12)	36.4 (8)	10.1 (2)	.14
Holds food in mouth for too long	22.7 (5)	22.3 (4)	50 (11)	61 (11)	27.3 (6)	16.5 (3)	.69
Spits out food	18.2 (4)	11 (2)	72.7 (16)	77.8 (14)	9 (2)	10.1 (2)	.81
Meals often last more than 30 mins	13.6 (3)	16.7 (3)	63.6 (14)	77.8 (14)	22.7 (5)	5.5 (1)	.31
Meals sometimes last more than an hr	9.1 (2)	16.7 (3)	54.5 (12)	77.8 (14)	36.4 (8)	5.5 (1)	.06

Table 2.4 Phrase allocations agreement with behaviour shown in Video 2 (n = 22 English-Speaker, 18 Urdu-Speaker)

Video 2- Good Eater	Agree with the Child shown in Video %(n)		Disagree with the Child shown in Video %(n)		Can't tell %(n)		P VALUE (Pearson chi-square)
Avidity Phrases:	English	Urdu	English	Urdu	English	Urdu	
Loves food	100 (22)	100 (18)	0	0	0	0	
Is interested in food	100 (22)	100 (18)	0	0	0	0	
He is always asking for food	68.5 (15)	83.3 (15)	9.1 (2)	0	22.7 (5)	16.7 (3)	.34
Enjoys a wide variety of foods	90.9 (20)	100 (18	0	0	9.1 (2)	0	.18
Eats quickly	86.4 (19)	100 (18)	0	0	16.5 (3)	0	.13
Is willing to try new foods	86.4 (19)	94.4 (17)	0	0	16.5 (3)	5.5 (1)	.39
Finishes their meal	90.9 (20)	83.3 (15)	0	16.5 (3)	9.1 (2)	0	.06
Avoidant phrases							
Turns head away	100 (22)	100 (18)	0	0	0	0	
Pushes food away	100 (22)	100 (18	0	0	0	0	
Cries/ screams	95.5 (21)	94.4 (17)	0	0	4.5 (1)	5.5 (1)	.86
Holds food in mouth for too long	95.5 (21)	100 (18)	0	0	4.5 (1)	0	.30
Spits out food	100 (22)	100 (18	0	0	0	0	
Meals often last more than 30 mins.	72.7 (16)	100 (18)	4.5 (1)	0	22.7 (5)	0	.05
Meals sometimes last more than an hr	77.3 (17)	100 (18)	0	0	22.7 (5)	0	.03

Table 2.5 Phrase allocations agreement with behaviour shown in Video 3 (n = 22 English-Speaker, 18 Urdu-Speaker)

Video 3- Bad Eater	Agree with the Child shown in Video %(n)		Disagree with the Child shown in Video %(n)		Can't tell %(n)		P VALUE (Pearson chi-square)
Avidity Phrases:	English	Urdu	English	Urdu	English	Urdu	
Loves food	9.5 (2)	0	90.5 (19)	100 (18)	0	0	.17
Is interested in food	0	0	90.5 (19)	100 (18)	0	0	.40
He is always asking for food	4.8 (1)	0	52.2 (11)	94.4 (17)	42.9 (9)	5.6 (1)	.01
Enjoys a wide variety of foods	9.5 (2)	0	57.1 (12)	100 (18)	33.3 (7)	0	.007
Eats quickly	4.8 (1)	0	95.2 (20)	100 (18)	4.8 (1)	0	.34
Is willing to try new foods	14.3 (3)	0	61.9 (13)	100 (18)	23.8 (5)	0	.01
Finishes their meal	9.5 (2)	0	81.0 (17)	100 (18)	9.5 (2)	0	.18
Avoidant phrases							
Turns head away	90.5 (19)	100 (18)	9.6 (2)	0	0	0	.17
Pushes food away	90.5 (19)	100 (18)	9.6 (2)	0	0	0	.17
Cries/ screams	90.5 (19)	100 (18)	9.6 (2)	0	0	0	.17
Holds food in mouth for too long	85.7 (18)	100 (18)	14.3 (3)	0	0	0	.99
Spits out food	85.7 (18)	100 (18)	9.6 (2)	0	0	0	.24
Meals often last more than 30 mins	76.21 (16)	94.4 (17)	0	0	23.8 (5)	5.6 (1)	.11
Meals sometimes last more than an hr	76.21 (16)	94.4 (17)	0	0	23.8 (5)	5.6 (1)	.11

Table 2.6 Phrase allocations agreement with behaviour shown in Video 4 (n = 22 English-Speaker, 18 Urdu-Speaker)

Video 4- Very Bad Eater	Agree with the Child shown in Video %(n)		Disagree with the Child shown in Video %(n)		Can't tell %(n)		P VALUE (Pearson chi-square)
Avidity Phrases:	English	Urdu	English	Urdu	English	Urdu	
Loves food	4.5 (1)	0	95.5 (21)	100 (18)	0	0	.36
Is interested in food	4.5 (1)	0	95.5 (21)	100 (18)	0	0	.36
He is always asking for food	4.5 (1)	0	90.9 (20)	100 (18)	4.5 (1)	0	.42
Enjoys a wide variety of foods	4.5 (1)	0	86.4 (19)	100 (18)	9.1 (2)	0	.26
Eats quickly	4.5 (1)	0	95.5 (21)	100 (18)	0	0	.36
Is willing to try new foods	4.5 (1)	0	86.4 (19)	100 (18)	9.1 (2)	0	.26
Finishes their meal	4.5 (1)	0	95.5 (21)	100 (18)	0	0	.36
Avoidant phrases							
Turns head away	95.5 (21)	77.8 (14)	4.5 (1)	16.7 (3)	0	5.6 (1)	.22
Pushes food away	95.5 (21)	83.3 (15)	4.5 (1)	16.7 (3)	0	0	.20
Cries/ screams	66.2 (15)	44.4 (8)	4.5 (1)	11.1 (2)	27.3 (6)	44.4 (8)	.30
Holds food in mouth for too long	54.5 (12)	50 (9)	31.8 (7)	16.7 (3)	13.6 (3)	33.3 (6)	.26
Spits out food	81.8 (18)	72.2 (13)	9.1 (2)	5.6 (1)	9.1 (2)	22.2 (4)	.49
Meals often last more than 30 mins	54.5 (12)	94.4 (17)	22.7 (5)	0	22.7 (5)	5.6 (1)	.01
Meals sometimes last more than an hr	54.5 (12)	94.4 (17)	22.7 (5)	0	22.7 (5)	5.6 (1)	.01

2.5 Discussion

2.5.1 Main findings

Data collected from participants, usually mothers in the case of this study, confirmed that identified set of phrases to describe aversive and avoidant eating behaviours were consistently used to describe respective eating behaviours. The overall allocation of phrases to corresponding videos was accurate and consistent among both language groups, with more than 80% of agreement among both language groups. Still, some phrases were less clearly recognised as reflecting avidity or refusal, and the English-speaking mothers were less certain in their classifications than the Urdu speakers. Agreements of less than 80% across groups were seen for "Is always asking for food", "Eats quickly", and "Meals often last more than 30 minutes".

A combined analysis of data from studies validating the same tool (a total of 149 participants, 22 spoke English, 18 Urdu, 32 Cantonese, 50 Indonesian and 27 Greek) reported overall high agreement between all language groups for selected phrases and corresponding videos. Participants from all language groups reported high levels of agreement in their understanding of the phrases used to describe both eating avidity and food refusal. Specifically, agreement levels ranged from 87% to 100% for the phrases related to eating avidity and from 73% to 91% for the phrases related to food refusal. (Wright *et al.*, 2021). Urdu-speaking participants reported showing less agreement for "Is always asking for food", phrases associated with time referring to avoidance of food. Overall Urdu speaking mothers were more certain about avidity-related phrases compared with other language groups. Based on the findings, ICFET was revised, and phrases with linguistic uncertainty were rephrased, "loves food" into "likes food a lot", "Is always asking for food" into "enjoys eating", "Meals sometimes last more than an hour" into "Meals lasts more than an hour. Three of the phrases, "Is willing to try new foods", "Hold food in mouth for too long", and "meals often last more than 30 minutes", were omitted due to the highest ambiguity among language groups.

2.5.2 Consistency with existing literature

The frequently used eating and feeding behaviour assessment tool developed and validated for the assessment of childhood eating behaviour is the Child Eating and

behaviour questionnaire (CEBQ), which has subsequently been widely translated and used globally (Wardle *et al.*, 2001). However, the key limitation of CEBQ is that this tool has not been adopted in low-middle-income settings and contains lengthy details, which makes it difficult to apply in a community setting. Our tool used some of the avidity-related phrases from CEBQ (Wright *et al.*, 2021).

Our study reported moderate to good agreement on all phrases describing eating avidity and refusal among both language groups, which is consistent with the validation of CEBQ (Carnell and Wardle, 2007) with a lesser agreement with relevance to behavioural measures of eating, particularly with reference to overweight and obesity. Our study found a discrepancy between the English and Urdu language groups regarding their perceptions of a child who eats food quickly and always asks for food, perceived as eating avidity by a higher number of English-speaking mothers in contrast to Urdu-speaking mothers taking it as bad eating behaviour.

Addressing care factors, such as feeding practices, is crucial for preventing and managing child malnutrition. This highlights the importance of availability of validated tool to assess the eating and feeding practices of these mothers. The findings of the first study validating the tool used to assess eating avidity and food refusal behaviours among participants, primarily mothers, provide valuable insights into the cross-cultural understanding and interpretation of the selected phrases. Overall, the data from participants in different language groups demonstrated a consistent use of phrases to describe respective eating behaviours. The allocation of phrases to corresponding videos was accurate and consistent among both language groups, with over all high level of agreement exceeding 80%. However, there were some variations in the recognition and classification of certain phrases, particularly among English-speaking mothers compared to Urdu speakers. This indicates potential linguistic and cultural influences on the understanding and interpretation of eating behaviours.

Our additional analysis of data from English, Urdu, Cantonese, Indonesian and Greek speaking participants further supported the overall high agreement in understanding the phrases related to both eating avidity and food refusal (Wright et al., 2021). The agreement levels ranged from 87% to 100% for phrases related to eating avidity and from 73% to 91% for phrases related to food refusal. These results suggest a consensus among participants from diverse linguistic backgrounds in comprehending the intended meanings of the phrases used in the assessment tool (Wright et al., 2021). However,

the findings of current study also revealed some specific areas of uncertainty in the interpretation of certain phrases. Phrases such as "Is always asking for food," phrases associated with time referring to avoidance of food, and "Meals often last more than 30 minutes" demonstrated lower levels of agreement across Urdu and English language groups, indicating a need for further refinement and clarification. These linguistic uncertainties led to the revision and rephrasing of some phrases in the tool to improve clarity and consistency in interpretation. Additionally, three phrases, including "Is willing to try new foods," "Hold food in mouth for too long," and "Meals often last more than 30 minutes," were omitted due to the highest ambiguity among the language groups.

This study found a discrepancy between the English and Urdu speakers about always asking for food and 'eating quickly' and their perceptions of a child who is 'always asking for food; food'. A higher percentage of Urdu speakers found the phrase ambiguous. Wright et al. reported that parentally perceived eating problems are associated with eating a limited variety of food and subsequently have an impact on growth (Wright *et al.*, 2007).

This may also reflect cultural differences in their perception of associating eating speed and demanding food; however, a combined analysis of data from Pakistan, the UK and Cantonese reflected higher internal consistency for all phrases for Avidity (Cronbach Alpha (CA) 0.88) and moderate for Avoidance (CA 0.72) with little variation between countries (Wright *et al.*, 2021). A study conducted to assess the sociocultural factors in the development of eating disorders reported that there are important psychological differences between second-generation migrants from different countries on the Indian subcontinent. The study further reported that consistent with previous studies, significant differences were found between the four ethnic groups and parenting styles (Furnham and Adam-Saib, 2001).

Parental perception has a larger influence on child eating and feeding behaviours; a qualitative study conducted in the UK among different ethnic groups reported that regardless of background, all parents were aware of good nutrition and a healthy diet. However, they perceived fruits and vegetables as less palatable for children, and this subsequently affected the type of food children were offered and consumed (Cook *et al.*, 2021). A study conducted to compare the eating and feeding practices of Pakistani mothers in the UK and Pakistan reported that children reject family food and they are,

therefore, difficult to feed. Subsequently, these children then resort to sweet-tasting foods often preferred by infants (Sarwar, 2002). Considering this fact, it is important that mothers/caretakers are aware of the importance of dietary diversity. Thus, they should encourage children to limit sweet feeds and introduce different tastes, textures and smells so that the child can consume foods from all food groups.

For phrases describing eating avoidance, "Meals often last more than 30 minutes" is reported to have less than 80% agreement among both language groups – a higher percentage of Urdu speakers found the phrase as describing eating avoidance, in contrast to a significant number of English-speaking mothers who perceived it as eating avidity.

Overall, the inclusion of participants from different language backgrounds enhances the generalizability and cross-cultural validity of the findings. Although the larger group analysis of 149 participants from different language groups supported the findings and also strengthens the reliability of the results. However, the cultural and linguistic variations in understanding and expressing caring practices could have influenced the agreement levels observed among different language groups.

Future research could explore the underlying factors contributing to the linguistic and cultural variations in interpreting eating behaviours. Conducting qualitative interviews or focus group discussions may provide deeper insights into participants' perspectives on the cultural nuances influencing their understanding. Additionally, assessing the impact of cultural values, beliefs, and parenting practices on eating behaviours could further enhance the understanding of cross-cultural differences.

While for videos, almost both the language groups showed agreement to the associated behaviours; however, Urdu speakers are observed to be more definite about food avoidance-related videos.

2.5.3 Limitations, strengths and conclusion

2.5.3.1 Strengths

- One of the key strengths of our study is that in addition to phrases, videos were also used to test the validity of the phrases to measure avidity. This ensured phrases used were concrete measures that can be clearly categorised into either

demonstrating high or low avidity, as ambiguous phrases are likely to introduce errors in avidity measures. Moreover, as this was a study to test linguistic validity, allocating the phrases to a worded description of a good/bad eater would have introduced bias from the descriptive words used, thus affecting the face validity of phrases used.

- Existing literature focuses heavily on the measurement of low avidity, such as pickiness/fussiness, leaving little information on parental perceptions towards measures of high avidity. Our study was able to give an overview of both.
- A strength of this study is that it is the first to evaluate the reliability and validity of the linguistic aspect of the feeding assessment tool.

2.5.3.2 Limitations

Limitations of the study included,

1. The videos showed few behaviours associated with aversion and avidity, so some participants' perceptions might be involved in reporting.
2. The children in the videos were of British origin, which might differ in reflection; therefore, in future research, it is recommended to include local children showing responses towards local foods.
3. Due to time constraints, we conducted the survey using a purposive sampling technique; nevertheless, the two language groups and phrase validation in the analysis make up for this limitation.
4. The study had a limitation related to its setting. It was conducted in Glasgow, a more affluent setting, whereas the tool was planned to be used in less privileged settings with varying levels of literacy and understanding towards eating and feeding behaviours in lower middle-income settings of Pakistan. This means that the findings from the study may not be directly applicable to these different settings and populations. Therefore, the tool may need to be further adapted and validated for use in this context.

2.5.3.3 Conclusion

The 11 best-performing phrases (likes food a lot, is interested in food, enjoys eating, enjoys a wide variety of foods, eats quickly, and finishes meals) for eating avidity and (comprising turns head when offered food, pushes food away, cries and screams during

meals, spits out food and meals last more than one hour) for food refusal are incorporated in ICFET for further use.

This set of identified phrases to describe infant eating avidity and avoidance are validated and showed consistent intercorrelation among language groups. So will be used in ICFET to identify eating and feeding behaviours among Pakistani children 6-23 months of age.

Chapter 3 Study 1: Eating and feeding behaviours of healthy and malnourished Pakistani children aged 6-24 months of age from September to November (2018)

This study, referred to as study 1 in Pakistan, in this thesis was carried out on the outskirts of Lahore, the capital of Punjab, Pakistan. This study aimed to assess the prevalence of food refusal and avidity among healthy and malnourished children.

The study was conducted in collaboration with the Integrated Reproductive Maternal New-born Child Health and Nutrition (IRMNCH &N) Programme, one of the largest vertical programmes functioning under the Department of Health Punjab, Pakistan. Vertical health programs refer to specific healthcare programs that focus on a particular disease or health issue rather than providing comprehensive health services. Examples of vertical health programs include immunisation programs and programs for the control of specific diseases such as tuberculosis or malaria. In this case, the IRMNCH programme focuses on mother and child health and nutrition through community health workers and primary health care facilities in Punjab, Pakistan.

Mother-child pairs from the community were referred by lady health workers to primary healthcare facilities, where these participants were recruited for this study. ICFET was used for the first time in a Pakistani setting, mainly to assess the characteristics of the Pakistani set of population and the prevalence of different eating and feeding behaviours among 6–24-month-old infants.

3.1 Introduction and background

In developing countries, more than a third of deaths in children younger than five years of age are attributed to different types of undernutrition (Black *et al.*, 2008a). According to UNICEF, World Bank and WHO global joint estimates for 2017, 155 million children under five years were stunted, and in 2016, nearly 52 million were wasted (UNICEF, WHO and Group, 2017). Malnutrition prevalence in Pakistan is among the highest globally, with 44% of children under five years of age stunted (UNICEF, 2015), one-third underweight and 15% wasted (4% Severe Acute Malnutrition –SAM- and 11% Moderate Acute Malnutrition –MAM (Government of Pakistan & UNICEF, 2018b).

Infant and young child feeding (IYCF) practices are an essential determinant of the nutritional status of children. Childcare practices, where mothers or other caretakers provide the food, healthcare, stimulation and emotional support, are critical for child growth, development and survival (WHO, 2004). Age-appropriate feeding, as per WHO guidelines for IYCF, along with appropriate hygiene protocols for food preparation and child feeding, are important determinants of child growth and development.

WHO recommends just after birth (early initiation) of breastfeeding, with exclusive breastfeeding till the age of six months. While standard guidelines for IYCF further recommend the introduction of appropriate, safe and adequate complementary foods at the age of six months, along with continued breastfeeding till two years of age (WHO, 2009). There is a strong association between poor infant and young child feeding practices with malnutrition. The quality and quantity of complementary foods are also important during this critical time of rapid growth. In resource-poor settings, complementary foods are often introduced too early, or foods given are often of poor quality (Vossenaar and Solomons, 2012).

Child feeding practices that include how food is offered and fed to children are also of key importance for nutrient intake and its related health outcomes, but there is very limited literature available in the context of undernutrition and childcaring and feeding practices. An intervention study in the UK found that children with growth faltering showed a less demanding attitude towards food than their healthy counterparts (Wright C, 2000). Aligned with literature, an observational study in Managua conducted for Nicaraguan caregivers' and children's feeding behaviours showed food refusal is one of the commonly reported eating problems (Garcia, Kaiser and Dewey, 1990; P L Engle, Bentley and Pelto, 2000). A causal pathway of undernutrition developed by UNICEF places feeding and caring practices as an underlying cause of undernutrition. Feeding during infancy depends on complex interactions between the child and their caregiver, so it is important to understand how these child and caregiver interactions relate to outcomes of successful feeding.

A study from the UK reported that moderately malnourished children (with weight faltering) were found to have lower appetites with increased food refusal (Charlotte M. Wright, Parkinson and Drewett, 2006). However, there is a gap in the literature to assess the prevalence of eating aversion among the undernourished population in developing countries, where undernutrition remains an area of public health concern.

Limited literature is available about how children, particularly those who are undernourished in low-middle income settings, eat and their parental response towards the eating behaviours of these children (Moore, Akhter and Aboud, 2006; Abebe, Haki and Baye, 2017).

Thus, it is important to investigate the role of problematic feeding and caring practices in a child's nutritional outcomes. A study to assess mother-child feeding styles and their associations with linear growth and accepted food in rural Ethiopia found low food intake is associated with caregivers' feeding style and stunting (Abebe, Haki and Baye, 2017). A PhD study conducted in Kenya showed undernourished children were more likely to exhibit low interest in food and high food refusal, compared with their healthy counterparts, thus making their mothers more likely to be anxious about feeding them, and mothers were found to force-feed their children (Mutoro A, 2017).

On the other hand, repeated infections result in appetite loss leading to the consumption of fewer meals (less than three a day), which, in turn, makes children more prone to become malnourished in comparison with children who consumed meals at least thrice a day (Frozanfar *et al.*, 2016).

There is evidence that repeated episodes of infectious diseases can lead towards compromised nutritional status, while undernutrition is thought to be the underlying cause of death due to these diseases (Kavosi *et al.*, 2014). Repeated diarrheal infections are linked with poor WASH practices. Similarly, the literature supports a consistent relationship between nutritional status and acute lower respiratory infection-associated health risks (Rice et al., 2000).

Early childhood development is another important milestone that provides a foundation for the development of human capital. A cross-sectional observational study in Malawi was conducted to assess the prevalence and severity of developmental and behavioural disorders among children admitted to an inpatient nutritional rehabilitation centre. It reported that children with SAM experienced profound delays in the gross and fine motor, language and social domains (van den Heuvel *et al.*, 2017). Another narrative review study reported "that just after recovery from acute malnutrition, poor development was reported compared with controls (Grantham-McGregor, 1995). Most of the literature in the Pakistani settings has considered some aspects of complementary feeding eating, breastfeeding, minimum dietary diversity, minimum meal frequency, and minimum acceptable diet(Khan *et al.*, 2017; Ali, Arif and Shah,

2021). These studies used 24-hr recall or secondary data analysis of the survey; none of the studies used specialised tools to identify eating aversion and avidity and their relationship with nutritional status.

Therefore, this study aimed to explore the prevalence and correlates of food refusal by using a range of eating and caring behaviours of mother and child pairs to create scores to identify low appetite, food refusal and force-feeding in children aged 6–24 months in Lahore and then test the extent to which these behaviours are associated with undernutrition. This will further provide the basis to design a Cluster Randomized Control Trial study to assess the effects of ready-to-use foods (RUF) on the eating behaviours of malnourished children.

This study aimed to:

1. What are healthy and malnourished Pakistani children's common feeding and caring characteristics?
2. What is the prevalence of these eating and childcaring behaviours, and how do these differ among healthy and malnourished groups?

3.2 Material and Methods

3.2.1 Ethics approval

Ethics approval granted from Glasgow University Ethics committee (Project No: 200170181) (Appendix 5). Furthermore, to get ethics clearance to work with human subjects in Pakistan, an ethics permission study was sought from the Punjab provincial chapter of the National Bioethics Committee (NBC) of Pakistan (Appendix 5). Access to health facilities was granted by the Primary and Secondary Healthcare Department Punjab (P&SHD) through Integrated Reproductive Maternal Newborn and Child Health and Nutrition Programme (IRMNCH). At the facility level, the medical superintendents were first approached for approval, and then I worked with Lady Health Visitors (LHVs), who were responsible for providing routine nutrition care for my data collection.

3.2.2 Study sites

Both studies (1 & 2) were conducted in Lahore, Pakistan. Lahore is the capital of the Punjab Province of Pakistan, with 274 union councils (UCs). A UC is the smallest administrative unit of the city, with a population of approximately 2500 to 30000 inhabitants. Primary Healthcare Facilities (PHCF), including Basic Health Units (BHU)

and Rural Health centres (RHCs), are located at a Union Council level. Services provided at these primary care health facilities are preventive, curative, and referral. Outreach/community-based services are part of a health package provided by the BHU. There are 37 BHUs in Lahore, of which 22 were providing nutrition services at that time. For study 1, three BHUs and one RHC, and for study 2, four BHUs and two RHCs (three BHUs & one RHC in each cluster) were selected. These Public Health facilities were selected based on the service delivery, number of malnourished children coming to health facilities and LHWs coverage around these health facilities.

Table 3.1 Characteristics of primary healthcare facilities (PHCF) from where samples were recruited (study 1 n=108) (study 2 n=90 RUSF group n=48 MMS group n=42)

Study/Intervention		Name of PHCF	Number of Children recruited	Staff at PHCF
Study 1 (n=75)		**BHU Ali Raza Abad** **BHU Kacha** **BHU Minhala** **RHU Awandhaywala**	37 31 07 33	• Medical officer/HF in charge (1) • Lady Health Visitors (3) • Dispenser/Medical Technician (1) Outreach team • LHS (LHWs) • Sanitary Petrol officer (1) • Communicable Disease Officer (1)
Study 2 (n=56)	**MMS (n=29)**	**BHU Umerkot** **BHU Kacha** **BHU Maraqa**	10 10 9	
	RUSF (n=27)	**BHU Ali Raza abad** **BHU Arrian** **BHU Shamkay Bhatian**	4 14 9	
				• Medical officer/HF in charge (1) • Gynaecologist (1) • Paediatrician (1) • Lady Health Visitors (3) • Midwife (2) • Dispenser/Medical Technician (1) Outreach team • LHS (LHWs) • Sanitary Petrol officer (1) • Communicable Disease Officer (1)
Study 2 (n=34)	**MMS (n=13)**	**RHC Chohng**	13	
	RUSF (n=21)	**RHC Raiwind**	21	

3.2.3 Structure of primary and secondary healthcare facilities and working modalities

The health department in Punjab, responsible for health service delivery in Punjab, includes preventive and curative healthcare services through primary to tertiary healthcare levels. Two major wings of the health department are involved in direct service Figure 3.1.

1. The Primary and secondary healthcare department (P&SHD) mainly comprises primary healthcare facilities and attached community-level services, including Lady Health Workers (LHWs).
2. Specialised healthcare and medical education (SHC&ME), all the Autonomous medical institutes and Specialised hospitals are covered under this segment of the health department. This department is also responsible for ensuring the quality of medical education provided by medical colleges in the province.

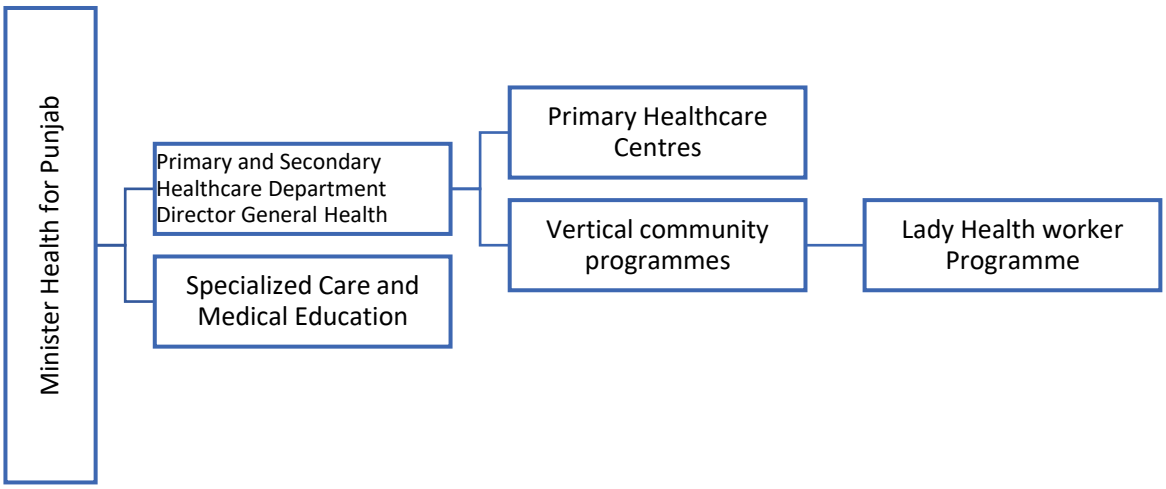

Figure 3.1 Structure of Health Department in Punjab

LHWs work to link Primary healthcare facilities (BHUS & RHCs) with communities by delivering basic screening, referral, follow up and advocacy services at the community level.

Outpatient therapeutic programme centres (OTPs), which treat severely malnourished children without any medical complication at the primary level, are established at 30% of all 2,470 BHUs and 313 RHCs in all 36 districts of Punjab. LHWs are responsible for screening every child in their catchment population through mid-upper arm circumference (MUAC) measurement for acute malnutrition. All the identified wasted children are referred to health facilities with OTPs, where LHVs conduct a detailed assessment of the child and register the child in the OTP programme. In addition to routine medicines child received Ready to use therapeutic food (RUTF) as part of the malnutrition treatment plan. Malnourished children attend the OTP clinic on a weekly basis for routine follow-up; in case of absenteeism, the LHW of the respective catchment areas is notified to follow up with the children.

3.2.4 Target population, sample size estimation and sampling procedure

The study targeted mothers or legal guardians accompanying children aged 6 to 24 months to the outpatient department (OPD) of Primary Health Care Facilities (PHCFs). The term "legal guardian" referred to either the mother or father who brought the child to the health facility.

A sample size of 150 community-sampled children (50 healthy, 50 severely and 50 moderately acutely malnourished) was planned. Sample estimation was done based on findings from a previous study in Kenya, which showed 63% of the undernourished children had displayed some eating behaviour problems compared to 41% of the healthy children and were roughly twice as likely to show either low interest in food (34 vs 14%) and food refusal (31 vs 10%) (Mutoro A, 2017). The study was designed to have 80% power at a 95% significance level to replicate the findings of this study for later in CRTC.

3.2.5 Recruitment

The fieldwork for Study 1 took place from September 2018 to November 2018, while Study 2 was conducted between December 2020 and March 2020 until the onset of the COVID-related lockdown. The randomisation process involved creating two groups of Primary Health Care Facilities (PHCFs). A list of PHCFs was compiled, and each facility was assigned a unique identification number. The selection of PHCFs for recruitment was then done randomly, giving preference to those closer to access.

The Lady Health Workers (LHWs) in the selected Union Councils were instructed by the program administration to screen children within their assigned catchment population actively. The screening process involved using Mid Upper Arm Circumference (MUAC) measurement to identify cases of malnutrition. If a child was identified as Severely Acute Malnourished (SAM) or Moderately Acute Malnourished (MAM), the LHWs were instructed to refer them to their respective primary healthcare centres on specific days of the week. The researcher visited the designated health facility on a prearranged day of the week and conducted interviews with the mothers of children who were identified for the first time as SAM or MAM, as well as with mothers of healthy children who voluntarily agreed to participate in the study.

3.2.6 Data collection

The researcher conducted all interviews herself and was supported by LHVs to measure weight, length and mid-upper arm circumference (MUAC) according to standardised procedures (WHO, 2008). All the mothers who were referred by LHWs to health facilities were approached. One mother at one time was provided with the information sheet; if the mother reported herself as illiterate, a detailed verbal brief of the study in the local language was provided. If the mother agreed to participate in the study, consent forms were only signed, or a thumb impression was taken before proceeding. Mothers were interviewed using a translated version of the questionnaire described below.

3.2.7 Anthropometry

Initially, the anthropometric measurement was done using health facility equipment. During the field visit, my supervisors pointed out that I should have a separate set of anthropometric equipment to avoid any variations between health facility equipment. When requested IRMNCH&N programme provincial office provided me with a separate

set of anthropometric equipment, and later I used the same equipment for measurements, which resulted in improved data quality of anthropometric measurements.

Children were initially weighed naked, but as data collection was done between September and November, during late October and November, the child was allowed to wear light clothing. Diaper use was uncommon among the population, but if any child was found wearing a diaper, it was removed before weighing the child. Weight was measured using a digital weighing scale (S0145520 Scale, infant, clinic, beamtype,16kg x 10g) to the nearest 0.1 kg. The length of each child was measured to the nearest 0.1cm using a length board (S0114520 Portable baby/child/adult L-hgt mea. syst)

For measuring length, mothers were requested to lay the baby straight on the length board and the health facility staff was asked to support the researcher by holding the baby's head in position (Frankfort plane position). The researcher held down the child's legs with one hand and moved the footboard with the other hand while applying gentle pressure to the knees to straighten the child's legs (WHO Multicentre growth reference study group, 2006). Mid-upper arm circumference was measured using MUAC tapes (S0145620 MUAC, Child 11.5 Red). The tape was placed on the left arm at the midpoint between the elbow and shoulder. The researcher then read the measurements from the tape window and recorded them to the nearest 0.1 cm.

At the end of the interview, all malnourished children were referred to LHV for the provision of routine services; no extra advice was given to mothers. We planned to provide a small gift, a toy or coloured pencils at the end of the interview; however, later, we had to stop offering the incentive as it caused a huge crowd and disturbance during the visit to a health facility.

3.2.8 Questionnaire Development

A questionnaire was developed using a validated set of phrases from a study in Glasgow (Chapter 2), and some sections related to 24hrs food recall and dietary diversity were adopted from the previously used tools in Kenya (Mutoro A, 2017).

3.2.9 Child Illness & nutrition supplementation

Under this section, mothers were asked whether their child had any major health problems since birth and recent hospitalisation history. In addition, mothers were asked

about any other vitamin supplementation currently being given to children and if the child has been given Vitamin A or Multiple Micronutrient sachet (MMs).

3.2.10 Child feeding and care practices

Child feeding and care practices included information related to breastfeeding, introduction of complementary foods, food frequency and food diversity. In addition to this, child eating avidity and aversion were recorded. Questions pertaining to maternal response towards feeding behaviours of children and maternal anxiety were also included in the tool to assess childcare characteristics.

For child feeding practices, the World Health Organization guidelines on feeding a breastfed child were taken as standard (WHO and UNICEF, 2003). Breastfeeding practices were assessed by following questions

1. Was your child ever breastfed?
2. Is your child still breastfeeding?
3. If yes, how many times in a day?
4. If no, what age did you last give breast milk to your child?

For breastfeeding frequency, we had to rely on maternal recall, plus we could not find any standardised method to estimate breastfeeding frequency; we used four options to estimate the breastfeeding frequency that was comprised of more than three feeds, two to three feeds, one feed and less than one feed per day.

Two questions related to the introduction of complementary feeding were included,

1. At what age did you feed your child first solid food?
2. What was the first solid you fed your child?

A structured questionnaire was used to obtain data on dietary diversity. The tool was adopted from (Thompson, FE and Byers, 1994), also used in a previous study of our group (Mutoro A, 2017) and revised in the light of the food frequency tool used by the national nutrition survey in Pakistan (Government of Pakistan, 2011). These responses were recorded against different food groups, while response categories included never/rarely, at least once a month but not weekly, at least once a week but not daily,

once daily and more than once daily. Dietary diversity was assessed using the following food groups:

1. Meat/ fish/ poultry/ organ meats
2. Eggs
3. Dairy (breast milk not included)
4. Legumes (beans, lentils, mung beans, and dried peas)
5. Fruits and leafy vegetables
6. Oil/fats/margarine
7. Sweet and savoury snacks

Feeding frequency was assessed using a 24-hour recall method. Caregivers were given the option of different types of food, which included (i) Plated foods, (ii) Dry finger foods, (iii) Moist finger foods, (iv) Milk and (v) Any other drinks. The caretakers were asked about the frequency of consumption of specific foods by their child in the past 24 hours. The frequency was recorded for each time period of the day, including morning, mid-morning, afternoon, evening, and night.

3.2.11 Eating avidity and food refusal

Phrases to describe eating avidity and aversive eating behaviours were adopted from the first study conducted in Glasgow (Chapter 2). While questions related to maternal stress and anxiety were adopted from a tool called "What matters to me feeding and eating difficulties in children and young people" used in Great Ormond Street Hospital for Children.

A pretested set of phrases to describe different behaviours predictive of eating avidity and aversion was used to collect data on the eating behaviours of the sampled population. Phrases describing behaviours to assess eating avidity and refusal were adopted from previous studies conducted by (Mutoro *et al.*, 2020)(Wright *et al.*, 2021).

Using a scale of 1 (very likely) to 5 (not at all likely), participants were then asked to rate the applicability of each phrase describing a particular behaviour for their child. The score of the caregiver's reported behaviours was divided into four different behavioural subscales: avidity, refusal, force-feeding and feed anxiety. Each sub-scale was summarised using the mean score for all items in that group. The ICFET asks parents

to provide data on the frequency of food groups the child has consumed usually. Parents were asked to select one of the following options to describe their child's food consumption: Never/ rarely (1), Once a month or more (2), Once a week or more (3), Once daily (4), More than once daily (5). The consumption of food groups consumed per day was then calculated and compared with WHO standards.

Table 3.2 Phrases used to describe eating avidity and refusal in ICFET

Eating avidity	Food refusal
Loves food	Turns Head away
Is interested in food	Pushes Food away
Enjoys eating	Cries/Screams
He is always asking for food	Hold food in mouth for too long
Enjoys a wide variety of food	spits out food
Eats quickly	Meals often last more than 30 minutes
Is willing to try new foods	Meals sometimes last more than an hour
Finishes their meal	

3.2.12 Maternal anxiety about feeding and prevalence of force-feeding

The questionnaire also contained a segment related to maternal anxiety and stress about feeding, the prevalence of force-feeding and maternal perception towards force-feeding. This section was adapted from a study conducted in Kenya (Mutoro, 2017). This section included questions related to maternal response towards food refusal, maternal anxiety towards feeding the child and maternal perception about force-feeding. Questions include:

1. The maternal response towards food refusal
    1. Encourages to eat
    2. Offer something else
    3. Leave them alone & try again
    4. Restrain by holding their hands
    5. Try to force open their mouth
    6. Pour food into their mouth
2. Maternal anxiety/stress towards child feeding

1 Find feeding my child stressful
2 Worry that my child is not eating enough
3 Feeding my child causes significant anxiety
4 Concerned about the amount my child eats
5 Concerned about the variety of food my child eats
6 Concerned about my child's behaviour at mealtime
7 Concerned about my child's lack of interest
8 Concerned about my child's eating speed

3. Maternal perception towards force-feeding

1 He starts crying and becomes upset
2 He tries to resist by using their hands and nodding their head
3 He starts eating and becomes normal
4 Starts disliking food time and it became difficult to feed him
5 Does it help your child to eat more?

Mothers were given options from 1 to 5, with one all the time and five never or least likely, for each of the above questions.

3.2.13 Child Development

Child development milestones were used from the WHO Multicentre Growth Reference Study (MGRS) (De Onis, 2006).

In the child development assessment, mothers were asked to report the age at which their child achieved each of the eight milestones. These milestones included rolling over, sitting without support, standing with assistance, walking with assistance, saying words, combining words, following simple instructions, and problem-solving. The mothers were provided with a chart that described each milestone and its corresponding age range. They were asked to report their age in months or weeks, whichever they felt comfortable with. The information provided by the mothers was then used to assess the child's developmental status. Milestones included in the questionnaire are:

1. Smile/Socially responsive
2. Reached out and touched objects
3. Reached out for objects and took them to their mouth

4. Sit for at least 10 seconds without using the hand or arm to support
5. Stand holding on to a stable object with hands only for 10 seconds.
6. Stand alone without contact with a person or object for at least 10 seconds.
7. Walk at least ten steps with back straight and no contact with a person or object.
8. While standing, stoops and picks up objects from the floor without falling

As part of the interview, mothers were told about every milestone one by one and were asked to report the exact age of the child when they achieved the milestone. The reported age in months was then recorded in the data collection tool. During analysis mean age to achieve child development milestones was stratified by age when the child was surveyed.

3.2.14 Socioeconomic

For the socioeconomic component, the country-specific Equity Tool was used. The Equity Tool is a short, country-specific questionnaire developed by a collaborating panel of experts in the field of wealth measurement and the Demographic and Health Survey (DHS) wealth index, including USAID, Population Services International (PSI), Marie Stopes International (MSI), Results for Development, Broad Branch, and Metrics for Management (Http://www.equitytool.org/pakistan/, 2015). To ensure the quality of translation, the survey tool, initially developed in English, was translated to Urdu and then back-translated to English by a native Urdu speaker, an expert in both languages.

Data were collected on socioeconomic indicators as described in the equity tool. The equity tool included 12 questions with yes and no options for the first 9 questions and multiple choices for three questions related to the type of fuel and material for walls and roofs.

Does your household have:

1. a refrigerator?
2. a washing-machine?
3. a sofa?
4. a chair?
5. an Almirah/cabinet?
6. a computer?

7. an internet connection?
8. a bed?
9. Does any member of this household have a bank account?
10. What type of fuel does your household mainly use for cooking? (Wood/other)
11. What is the main material of the roof in your household? (Cement/ Reinforced Cement Concrete (RCC) Other)
12. What is the main material of the walls in your household? (Cement/RCC Other)

Mothers were asked these questions one by one and asked to respond accordingly by the end of the interview. Analysis was done using the standard plan given with the tool (Http://www.equitytool.org/pakistan/, 2015).

3.2.15 Data Analysis

Data was collected using hard copies of the questionnaire, recorded by the researcher. Then data was entered in SPSS and analysed (version 27; IBM Corporation, USA). Data were cleaned for any duplicate entries or wrong entries. Using WHO software (Anthroplus), Weight for Age Z score (WAZ), Weight for Height Z score (WHZ) and Height for Age Z scores (HAZ) were calculated. Children were then subcategorised into healthy and malnourished using MUAC cut-off points (>12.5cm) as healthy and less than 12.5cm as malnourished. Responses across a range of variables are summarised to form continuous scores for avidity, aversion, concern, and anxiety. The score of the caregiver-report questionnaire was divided into three different behavioural subscales: avidity, refusal, and feed anxiety. Each sub-scale was summarised using the mean score for all items in that group. Then means and standard deviations were found in normative data from UK children to standardise the score of the caregiver-report questionnaire: the data from questionnaires subscales minus the means of UK children's normative data. Finally, the result was divided by the standard deviations of UK children's normative data. The equation is shown as follows.

$$\text{Avidity's} = (\text{Avidity} - 3.8740) / 0.71138.$$

Dietary diversity scores were calculated, and an acceptable diverse diet was defined as at least four or more four food groups offered daily.

For analysis of socioeconomic indicators, each respondent was given a national wealth index score for each question, depending on the reported option by the participant. The scores were added together for each respondent, giving each respondent a national

score. The respondent was then assigned a national wealth quintile based on their score. Based on the individual score, quantiles were assigned when scores were greater than or equal to the lower limit of a quintile and less than the lower limit of the next quintile up.

3.3 Results

3.3.1 Child and Family Characteristics

3.3.1.1 Child Characteristics

A total of 109 mother-child pairs from four primary healthcare facilities were recruited. Out of the originally planned 150, mainly due to time constraints. In nearly all the cases, it was the mother who brought the child to the health facility; in one case, where it was the grandmother, the subject was excluded from the analysis. Of the recruited children (n=108) of the study, 52% (n=57) were female. The age distribution of the study group was categorised into three groups, with 13% from 6-9 months of age, 22% from 10-12 months and the majority (64%) from the age group of 13-24 months. Most of the children enrolled in the study were 3rd (29%) and 4th or subsequent (26%) children. With respect to the MUAC measurements, 50% of the children had >12.5 cm MUAC and were classified as normal, 32.2% of the children had mild malnutrition, and 17.6% of children had severe malnutrition (<11.5 cm MUAC). According to the weight for age z scores, these children were categorised into healthy (41.6%) and malnourished (58.3%) Weight for Height z scores were not used for analysis as errors were found in the recorded heights of children during data analysis.

The mean weight, height, and age of mothers at the time of recruitment were 60.16±10.7kg, 160.44±10.35cm and 28.54±5.24years respectively. While on average, there were three children born to every mother, and more than half (65%) of households had more than one under-five child. The average age of the eldest and youngest child was observed as 64.3±40.2 and 15.3±8.6 months, respectively. The number of children less than five years was between the range of 1-4, with a median of 3 children in the study

Table 3.3

Only four mothers identified themselves as employed, where the nature of employment included lady health workers, beauty business and working as maids.

Most of the fathers were reported to be alive and living with the family, except for a family where the father had passed away and one where the father worked abroad. Half the fathers (46%) were reported as employed, and the nature of employment included factory work, religious, tailoring, driving and government employment.

Table 3.3 Child Characteristics % (n)

Child characteristics	% (n) N=108
Gender	
Female	52.8 (57)
Male	47.2 (51)
Age group	
6-9 months	13.0 (14)
10-12 months	22.2 (24)
13-24 months	64.8 (70)
Nutritional status (MUAC&/WHZ)	
Healthy	41.7 (45)
Undernourished	58.3 (63)
Nutritional status (MUAC only)	
Healthy	50.0 (54)
Undernourished	50.0 (54)
Severely Acute Malnourished (SAM)	17.6 (19)
Moderately Acute Malnourished MAM	32.4 (35)
Type of malnutrition	
Wasted+/-stunted	31.1 (34)
Stunted only	25.0 (27)
Normal	43.5 (47)

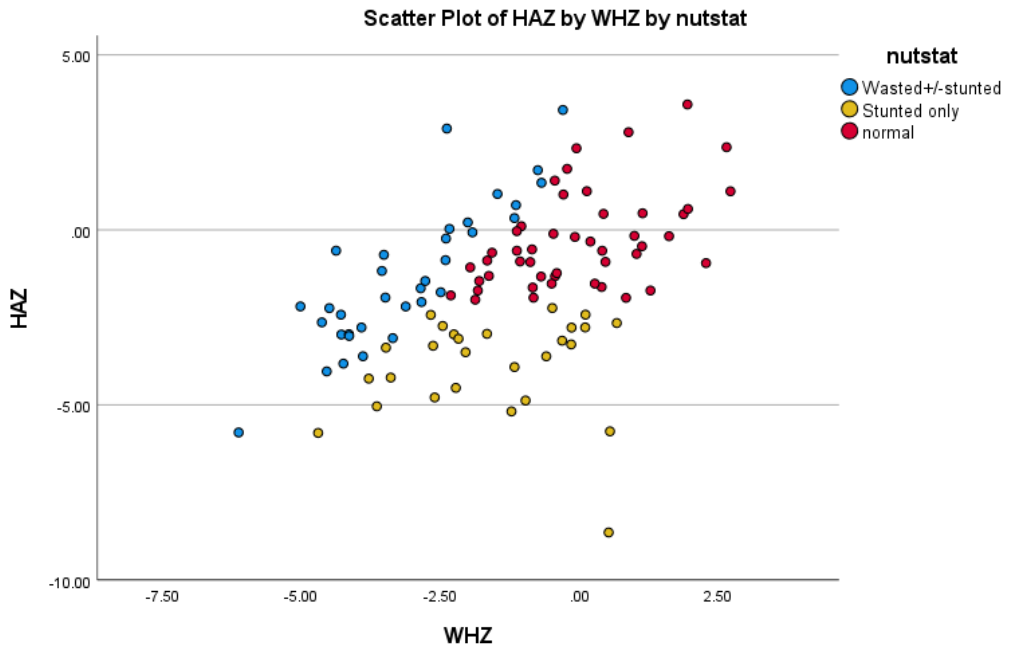

Figure 3.2 Distribution of children based on their weight for length and length for age z Scores.

Table 3.4 Nutrition status: healthy vs undernourished; anthropometry; family characteristics

Child Characteristics	Nutritional Status		
	Healthy (n=45)	Undernourished (n=63)	Chi-Square p-value
	% (n)	% (n)	
Age groups			
6-9 months	13.3 (6)	12.7 (8)	
10-12 months	24.4 (11)	20.6 (13)	0.878
13-24 months	62.2 (28)	66.7 (42)	
Number of children under five in HH			
More than one child in a family under 5	64.4 (29)	63.5 (40)	0.474
Maternal Education			**Independent t-test P value**
Primary and below	68.9 (31)	76.2 (48)	0.178
Secondary and above	31.1 (14)	23.8 (15)	
Age in months Mean (95%CI)	16.6 (6-24)	16.6 (7-24)	0.795
Weight for age Z score Mean(min-max)	-1.99(-6.54 - 2.65)	-.945(-4.54 – 2.72)	0.004
Height for age Z score Mean(min-max)	-1.61(-5.80-3.59)	-1.44(-8.64-3.43)	0.690
MUAC Z scores Mean (min-max)	-1.61(-5.80-3.59)	-1.44 (-4.34-.68)	0.346
Mother's age in years Median (min-max)	28 (19-39)	28 (20-40)	0.334
Father's age in years Median (min-max)	32 (24-45)	30(20-62)	0.467

Data are presented as % (n), Pearson chi-square and independent T-test P value; age is presented as Median (min-max)

3.3.2 Child Illness & nutrition supplementation

Very few, 5.6% (n=6) mothers, reported that their child had a major illness since birth, while only 2.8% (n=3) mothers reported that their child was hospitalised recently. Reasons for recent hospitalisation included meconium aspiration at birth, pneumonia, and diarrhoea.

For nutritional supplements (other than RUTF, RUSF or MMS), 47.2% (n=51) of mothers reported already giving vitamin supplements. While 52.8% (n=57) reported that they were not using any nutritional supplements. Most mothers, 74.1% (n=80), reported that

their children received routine vitamin A supplementation. For MMs, 26.9% of mothers reported that they were giving micronutrient supplements to their children, mainly due to the availability of MMS, as the Department of Health was not providing MMS to all MAM children at the time of data collection.

3.3.3 Breastfeeding and complementary feeding practices

3.3.3.1 Breastfeeding

Almost all mothers (n=107) reported that their children received breastfeeding for some time since they were born. More than half of mothers (n=69) 64% reported that their child was still breastfeeding. Of all those who reported their children were still breastfeeding, 50 mothers (72%) responded that their child is breastfed more than thrice a day, while 18 mothers (26%) said they feed their child breast milk 2-3 times in a day and one mother reported that their child receives only one breastfeed per day. Of all the 39 (36%) children not breastfeeding on the day of the interview, 26% stopped breastfeeding before six months, but 18% were older children who had stopped before 18 months.

No significant association was found between breastfeeding history and nutrition status Table 3.5. Moreover, from the study population, the ones still breastfeeding were significantly higher among the healthy group (78.6%) compared to the malnourished ones (54.5%) (p=.01).

Further analysis by logistic regression showed that the odds of a child being malnourished who is not breastfeeding increases 3.5 times more than those who are still breastfeeding (p=.011). In the equation, age was used to address the confounding factors, and age was found to be a non-significant variant in determining nutritional status.

Table 3.5 Breastfeeding Practices among Healthy and malnourished Children

Variable		Healthy (n=45) % (n)	Undernourished (n=63) % (n)	P Chi^2	6-12 months (n=34) % (n)	13-24 months (n=74) % (n)	P Chi^2
	Ever breastfed?						
Yes **No**		100 (45) 0	98.5 (62) 1.5 (1)	0.42	100 (34) 0	98.6 (73) 1.4 (1)	0.49
	Still breastfeeding?						
Yes **No**		78.6 (35) 21.4 (10)	54.5 (33) 45.5 (30)	0.01	88.2 (30) 11.8 (4)	52.7 (39) 47.3 (35)	<.001

Data presented as % (n), *Pearson chi-square

3.3.3.2 Complementary Feeding

Maternal responses ranged for at what age the child was first introduced to solid food, from 3 months to 15 months. Children who received their first solid before the age of 6 were 11% (n=12). More than half, 62% (n=67) of children received their first solid between the ages of 6 to 7 months. At the same time, 27% (n=29) of children received their first solid food delayed from 8 to 24 months.

When asked for the type of food given as the first solid food, 71% of mothers (n=65) responded that their child was fed plated food for the first time, which included rice, cereals (a packaged cereal), kheer (milk and rice pudding) and sagodana (a milk pudding with tapioca starch). Around one-third of mothers (n=28), 26% reported that their child was offered dry finger food as the first solid, which included roti/bread, rusk, and biscuit. At the same time, 8.3% of mothers (n=9) fed their children moist finger food or fruit as their first complementary food, usually bananas.

There was a significant delay observed in starting the complementary feeding for undernourished children compared to the healthy ones in the study population Table 3.6. In healthy children, 11% of the children started complementary feed after the age of 7 months, compared to 40% of the undernourished started the feed after the 7th month of age. More than half of children, both healthy and malnourished, reported having plated foods (61.9% for healthy and 68.2% for undernourished) as their first solid food.

Table 3.6 Complementary Feeding Practices among healthy and malnourished Pakistani children

Variable	Healthy (n=42) % (n)	Undernourished (n=66) % (n)	Total (n=108) % (n)	P Chi^2
Age when complementary feeding started.				
>6 months	9.8 (4)	12.1 (8)	11.2 (12)	0.100
6-7 months	75.6 (32)	53.0 (35)	61.7 (67)	
8-11 months	12.2 (5)	27.3 (18)	21.5 (23)	
12-24 months	2.4 (1)	7.6 (5)	5.6 (6)	
By 7 m	88.9 (37)	60.3 (41)		0.001
After 7m	11.1 (5)	39.7 (25)		

Data presented as % (n), *Pearson chi-square

3.3.3.3 Food frequency during the past 24 hours

Table 3.7 below describes the types of foods children ate during the past 24 hours. Around half of healthy (n=25, 46.3%) and two-thirds (n= 36, 66.7%) of malnourished children were not given any plated foods or had one during the past 24 hrs. More than half of the undernourished children (60%) had dry finger food twice a day. Moist finger food was also found to be uncommon, as the majority of mothers (83% of healthy & 91% of malnourished) reported that they had either not been given any moist finger food or offered one that included fruit to their children. Milk drinks were the most common foods to be fed to children during the past 24 hours. More than half (57.6%) of malnourished children were fed milk drinks twice or thrice a day. The frequency of milk feeding was higher among younger children, as 71% of 6 to 9 months old children were fed milk thrice in the last 24hrs.

Other drinks were not at all common. 72% of mothers of undernourished children reported that they have either not given any other drink or given just one to their child during the past 24 hours.

Table 3.7 Meal Frequency (type of foods children ate during the past 24 hours)

Types of foods children eat during	Nutritional status			Age groups			
	Healthy (n=42) (%)	Under nourished (n=66) (%)	P Chi^2	6-9 (n=14) months % (n)	10-12 (n=24) months % (n)	13-24 (n=70) months % (n)	P Chi^2
Plated Foods							
Not given	14.3 (6)	19.7 (13)	0.17	35.7 (5)	16.7 (4)	14.3 (10)	0.35
Once a day	33.3 (14)	42.4 (28)		35.7 (5)	50 (12)	35.7 (25)	
2-3.>3 times a day	51 (20	38.4 (25)		4 (28.6)	33.3 (8)	50 (35)	
Dry finger foods							
Not given	6 (7)	13.9 (9)	0.86	14.3 (2)	12.5 (3)	14.3 (10)	0.73
once a day	33.3 (14)	30.3 (20)		50 (7)	33.3 (8)	27.1 (19)	
2-3/> three times a day	52.4 (22)	55 (37)		35.7 (5)	54.2 (13)	58.5 (41)	
Moist finger foods							
Not given	50 (21)	53 (35)	0.93	71.4 (10)	50 (12)	48.6 (34)	0.64
Once a day	35.7 (15)	34.8 (23)		21.4 (3)	37.5 (9)	37.1 (26)	
2-3 times a day	14.3 (6)	12.1 (8)		7.1 (1)	12.5 (3)	14.3 (10)	
Milk (all milk, including breast milk)							
Not given	0	3 (2)	0.58	0	0	2.9 (2)	0.13
Once a day	7.1 (3)	4.5 (3)		0	8.3 (2)	5.7 (4)	
2-3 times a day	52.4 (22)	57.6 (38)		28.6 (4)	54.2 (13)	61.4 (43)	
>thrice a day	40.5 (17)	34.8 (23)		71.4 (10)	37.5 (9)	30 (21)	
Any other drink							
Not given	71.4 (30)	59.1 (39)	0.09	78.6 (11)	75 (18)	57.1 (40)	0.14
Once a day	16.7 (7)	33.3 (22)		7.1 (1)	12.5 (3)	35.7 (25)	
2-3 times a day	11.9 (5)	7.6 (5)		14.3 (2)	9.2 (3)	5.6 (6)	

Data presented as % (n), * Trend test Pearson chi-square

3.3.4 Feeding Practices (who feeds the child)

Mothers were asked about feeding practices in response to "Who usually feeds the child?" all but five mothers reported they usually feed the child. Two mothers reported that grandmothers usually feed their children, while three of the remaining mothers responded that the father, aunt, or sibling fed their child.

When asked who usually feeds the child when the mother is away, 68% of mothers reported that grandmothers feed the children, but 10% of mothers reported that they are always present. In comparison, 9% of fathers fed their children in the absence of their mother, as well as 4% of siblings, 6% of aunts and 4% of friends.

3.3.5 Dietary Diversity

Dietary diversity was assessed by asking for the number of foods consumed by different food groups in the past month. In the current study, it was found that 57% of healthy children and 60% of malnourished children fulfilled the criteria of consuming a minimum of four food groups per day, indicating a moderate level of dietary diversity. However, most children did not receive food from animal sources; 99% and 96% of children did not receive meat or egg, with no significant difference among healthy and malnourished groups Table 3.8. Older children from 10 to 24 months significantly consumed more food groups in a day compared with younger ones from 6-9 months.

Table 3.8 Dietary Diversity and its relationship with nutritional status and age

Nutritional status					Age groups			
Food groups consumed per day?		Healthy (n=42) %(n)	Malnourished (n=66) % (n)	*p*-value	6-9 m (n=14) %(n)	10-12m (n=24) %(n)	13-24m (n=70) %(n)	*p*-value
	<3	11.9 (5)	12.3 (9)		57.1 (8)	8.3 (2)	4.3 (3)	
	3	31.0 (13)	27.7 (18)	0.93	28.6 (4)	45.8 (11)	23.2 (16)	0.00*
	≥4	57.1 (24)	60.0 (39)		14.3 (2)	45.8 (11)	72.5 (51)	

Chi-Square *significant difference

3.3.6 Prevalence of eating avidity and aversion among sampled population

3.3.6.1 Eating avidity

This section focused on investigating the eating habits of the children. A set of phrases that had been pretested was used to inquire about their eating behaviour, which included all the phrases that described how much the child enjoyed eating. Among these phrases, "Loves food" and "Interested in food" were reported more frequently at 37% and 31%, respectively, for all the children. On the other hand, "Eats quickly" was the least commonly reported behaviour, at only 5.6% among all the children. The figure below shows there was a small number of mothers (37% to 5.6%) who ranked their children for all the eating avidity behaviours for all or most of the time, meaning that there were few children (both healthy and malnourished) who were keen in eating all the time.

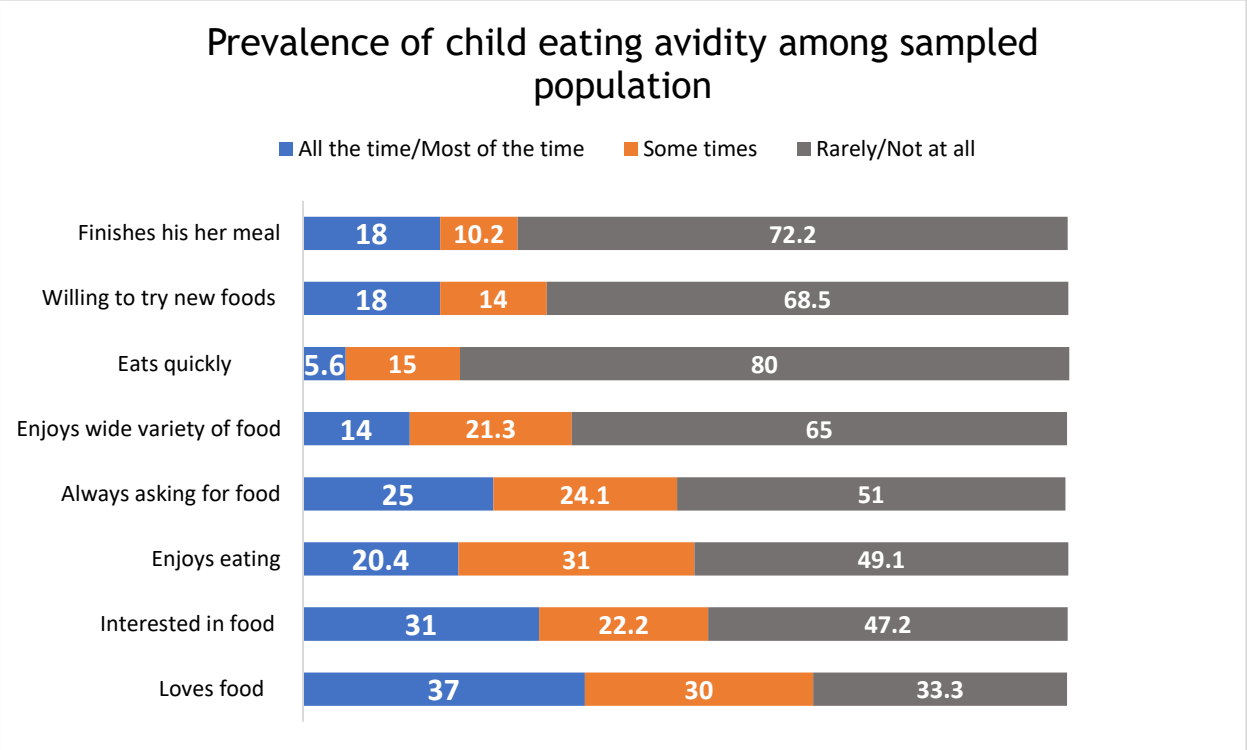

Figure 3.3 Prevalence of child eating avidity among sampled population

3.3.6.2 Eating Aversion

Food aversion was again not very common among the sampled set population. However, some of the behaviours like "turning head away" (22.4%), "pushing food away" (22.5) and "holding food in mouth for too long" (26%) were relatively more common behaviours reported by mothers in the sampled population.

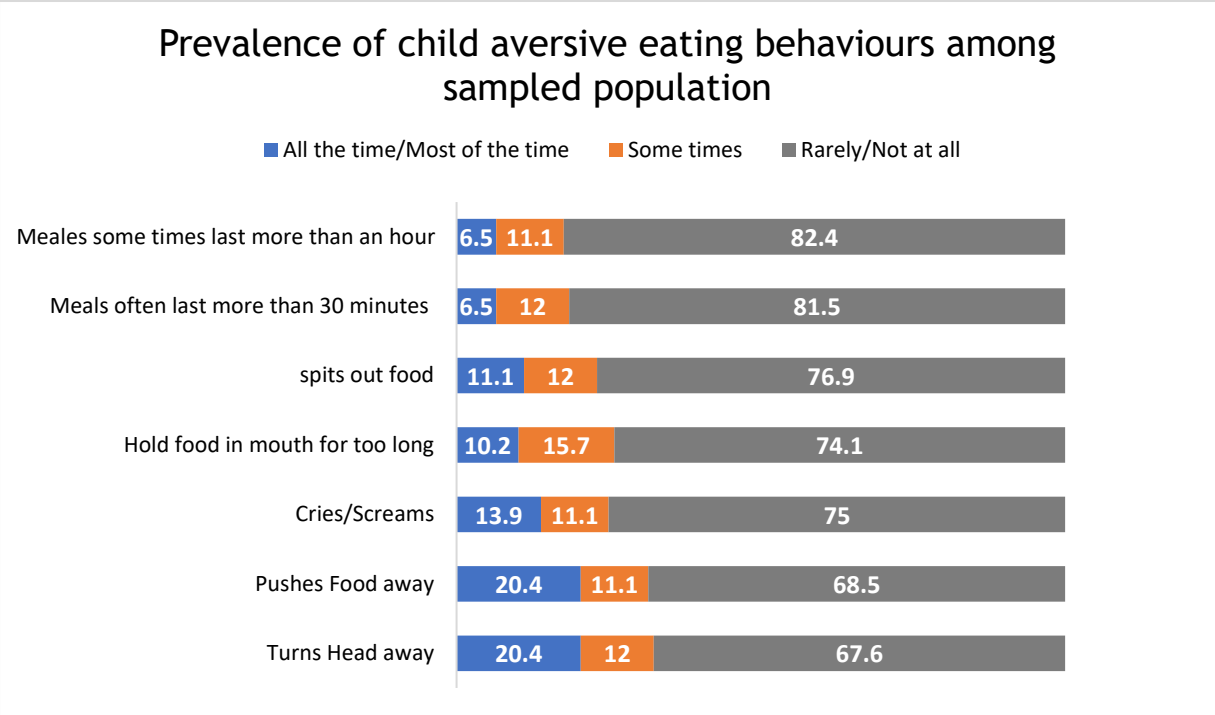

Figure 3.4 Prevalence of child aversive eating behaviours among sampled population

Table 3.9 and Table 3.10 below compare the prevalence of food avidity and refusal among healthy and malnourished children. Both healthy and malnourished children are found to have a similar prevalence of avidity and food aversion; no significant difference was observed among both groups.

Table 3.9 Prevalence of eating avidity among sampled population (n=108)

Food Avidity	Healthy (n=42)			Malnourished (n=66)			P (chi sq.)
	All/Most of the time (%)	Time (%)	Rarely/Not at all (%)	All/Most of the time (%)	Time (%)	Rarely/Not at all (%)	
Loves food	33.3	30.0	37.0	41.0	30.0	30.0	0.66
Is interested in food	33.3	14.2	52.0	28.0	30.0	43.0	0.18
Enjoys eating	22.2	26.0	52.0	18.5	35.2	46.3	0.57
He is always asking for food	28.0	22.2	50.0	22.2	26.0	52.0	0.78
Enjoys a wide variety of food	15.0	18.5	67.0	15.0	18.5	67.0	0.77
Eats quickly	3.70	15.0	81.5	7.40	15.0	78.0	0.70
Is willing to try new foods	17.0	17.0	67.0	18.5	11.5	70.4	0.70
Finishes their meal	22.2	6.00	72.2	13.0	15.0	72.2	0.17

Data presented in percentages & Chi-Square

Table 3.10 Prevalence of food refusal among Sampled population

Aversive eating behaviours	Healthy			Malnourished			P (chi sq.)
	All/Most of the time (%)	Sometimes (%)	Rarely/Not at all (%)	All/Most of the time (%)	Sometimes (%)	Rarely/Not at all (%)	
Turns Head away	20.4	17.0	63.0	20.4	7.40	72.2	0.32
Pushes Food away	20.4	16.7	63.0	20.4	7.40	72.2	0.05
Cries/Screams	13.0	13.0	74.1	14.8	9.30	75.9	0.18
Hold food in mouth for too long	14.8	18.5	66.7	5.6	13.0	81.5	0.17
spits out food	9.30	16.7	74.1	13.0	7.40	79.6	0.31
Meals often last more than 30 minutes	9.30	13.0	77.8	3.70	11.1	85.2	0.46
Meals sometimes last more than an hour	7.40	13.0	79.6	5.60	9.30	85.2	0.75

Data presented in percentages & Chi-Square

3.3.7 Correlation and Internal consistency

3.3.7.1 Food Avidity

All the phrases included in the questionnaire to describe feeding avidity showed positive correlations with each other. The phrases were analysed for significant associations, and all were found to be significantly associated at a 0.01 level, except for the correlation between "eats quickly" and "loves food" and between "eats quickly" and "interested in food". The strongest positive correlation was observed between "Interested in food" and "Loves food" (r = .750**), while the weakest correlation was found between "eats quickly" and "interested in food" (r = 0.08).

Internal consistency among phrases selected to describe food avidity was high, with an overall Cronbach Alpha (CA) = 0.83. '"Eating food quickly" tended to show a weaker correlation with other phrases in this group, as the CA rose slightly when excluded.

3.3.7.2 Food refusal/aversion

Below is a correlation between phrases used in the questionnaire to describe food refusal. There was a positive, strong association found between most of the phrases describing aversive feeding behaviours, except for those related to the timing of meals. "Meals sometimes last more than an hour" showed a negative association with "Turns Head away" and "Pushes Food away" with r=-0.004 and r=-0.024. "Pushes food away" is found to be strongly associated with "turns head away" with r=.707**. For food refusal, there was moderate internal consistency among phrases with an overall Cronbach CA = 0.74, The two phrases related to meal length showed the weakest internal correlation, and when either was excluded, CA rose slightly Table 3.11 & Table 3.12

Table 3.11 Correlation between phrases used in the questionnaire to describe food avidity and effect on Cronbach's Alpha if individual items are deleted

Eating Avidity	Loves food	Interested in food	Enjoys eating	Always asking for food	Enjoys a wide variety of food	Eats quickly	Willing to try new foods	Finishes meal	CA2
Loves food	1								0.81
Interested in food	.750	1							0.80
Enjoys eating	.660	.697	1						0.80
Always asking for food	.535	.540	.583	1					0.80
Enjoys a wide variety of food	.356	.405	.499	.574	1				0.80
Eats quickly	.106+	.080+	.139+	.324	.388	1			0.84
Willing to try new foods	.230*	.228*	.234*	.447	.632	.605	1		0.82
Finishes meal	.378	.454	.374	.417	.419	.330	.442	1	0.82
Cronbach's Alpha, when all included									0.83

All Correlations are at the 0.01 level (2-tailed) unless marked.

Table 3.12 Correlation between phrases used in the questionnaire to describe food refusal

Eating Aversion	Turns Head away	Pushes Food away	Cries/Screams	Hold food in mouth for too long	spits out food	Meals often last more than 30 minutes	Meals sometimes last more than an hour	CA2
Turns Head away	1							0.70
Pushes Food away	.707	1						0.66
Cries/Screams	.524	.592	1					0.69
Hold food in mouth for too long	.379	.312	.489	1				0.70
spits out food	.383	.394	.522	.598	1			0.69
Meals often last more than 30 minutes	0.029[+]	0.094[+]	0.094[+]	.262	.284	1		0.75
Meals sometimes last more than an hour	-0.004[+]	0.084[+]	-0.024[+]	0.05	.201*	.597	1	0.76
Cronbach's Alpha, when all included								0.74

* Correlation is significant at the 0.05 level (2-tailed). [+]Correlation not significant
** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

3.3.7.3 Association of food refusal, avidity, force-feeding and maternal stress parameters and nutrition status and age groups

Scores of food refusal, eating avidity, force-feeding, and maternal stress showed no significant association between healthy and malnourished groups. Avidity scores are higher among the malnourished group though non significantly different. These eating behaviours and caring practices are different in various age groups; in older children 13 to 24 months, maternal stress was more common compared to younger groups.

Table 3.13 Association of food refusal, avidity, force-feeding and maternal stress parameters and nutrition Status and age groups

Parameter	Malnourished (n=64)	Healthy (n=42)	P, Mann-Whitney U	6-9 months (n=14)	10-12 months (n=24)	13-24 months (n=70)	P Kruskal-Wallis
Refusal	-0.27 (-.81 to -1.1)	-0.27 (-.70 to .59)	0.11	-0.27 (-1.2 to 59)	0.16 (-.71 to 1.0)	0-.27 (-.81 to 1.4)	0.53
Avidity	-2.2 (-2.8 to -1.7)	-2.4 (-2.8 to -1.83)	0.74	-2.8 (-3.4 to -2.3)	-2.2 (-2.8 to-1.8)	-2.3 (-2.8 to -1.5)	0.06
Force-feeding	0.28 (-.36 to.93)	0.2 (-.0 to .60)	0.62	-0.03 (-.36 to .04)	0.28 (-.36 to1.4)	0.28 (-.36 to .60)	0.07
Maternal stress	0.50 (-.14 to1.1)	0.71 (.28 to .98)	0.31	0.17 (-.79 to.55)	0.50 (.07 to1.1)	0.71 0.01to1.20)	0.06

Data presented as Median of standardised scores against British data & * Q1&

3.3.8 Child Development

The first four development milestones, "smile/social responsiveness" (59.3%), "reaching out to touch objects" (67.6%), "taking objects into the mouth" (72.2%), "sitting for at least 10 seconds without help" (42.6%) were achieved by the majority of the study population between the age of 6-8 months. Discrepancies were observed in maternal reports against child development milestones, as the first milestone, which is likely to be achieved between the age of 4-6 months, has been reported from 0 to 21 months by mothers in the sample group. However, the median age to achieve the first four milestones is six months, six months, 7 and 9 months, respectively.

Child development milestones which are more likely to be achieved in later months include "holding onto the table object by hand for 10 seconds", "standing alone for 10 seconds without contact", "walking ten steps without contact", "while standing, steeping and picking an object without falling" were reported to be achieved by between (7-21), (8-18), (9-18), (), (16-24) months respectively. No significant differences were found among both groups for child development milestones.

Table 3.14 Child development millstones with Mean (SD) age attained, and percentage attained

Child development milestones	n (min-max age)	Not yet % (n)	Total Mean (SD) age	Healthy Mean (SD) age	Malnourished Mean (SD) age	P-t test
Smile/Socially responsive	108 (0-21)	0 (0)	5.3±1.5	5.3±1.6	5.3±1.4	.29
Reached out and touched objects	108 (0-18)	1.9% (2)	6.3±1.8	6.5±1.8	6.1±1.9	.37
Reached out for objects and took them to their mouth	108 (0-18)	0.9 (1)	6.8±1.7	6.7±1.6	6.9±1.7	.57
Sit for at least 10 seconds without using a hand or arm to support (7-9 months)	105 (4-24)	2.8 (3)	8.3±2.9	8.7±2.3	10.6±1.7	.60
Stand holding on to a stable object with hands only for 10 seconds. (10-12 months)	77 (7-21)	27.8 (30)	10.7±2.3	10.6±2.5	10.9±2.6	.58
For children >12 months (n= 69)						
Stand alone with no contact with a person or object for at least 10 seconds (12 months)	55 (8-18)	49.1 (53)	12.6±2.3	12.7±2.3	12.5±2.3	.75
Walk at least ten steps with back straight and no contact with a person or object (13-18 months)	47 (9-18)	56.5 (61)	13.7±2.2	15.0±1.5	15.0±1.5	.90
While standing, stoops and picks up objects from the floor without falling (19-24months)	10 (16-24)	86.7 (62)	19.3±3.1	18.4±3.0	21.3±3.0	.20

3.3.9 Socio Economic Status

There were differences found among groups for socioeconomic status. Most of the respondents were from the highest (4th and 5th) quintile of the national population; this indicates that those surveyed are not poorer than the general population in Pakistan. Further analysis of socioeconomic questions revealed that 81.5% (n=88) of households had a refrigerator in the house Table 3.15.

Data related to sanitation showed that 96.3% (n=104) had a flush toilet system in their household, with no difference among groups, mainly because data were collected from the peri-urban areas around Lahore. Sanitation facilities in Punjab are relatively better in urban settings than in rural settings.

Table 3.15 Socioeconomic status of the sample's population

National Quantile	Healthy (n=42) % (n)	Undernourished (n=66) % (n)	Chi-sq. p value
1st & 2nd 3rd 4th& 5th Richest	28.6 (12) 11.9 (05) 59.5 (25)	28.8 (19) 30.3 (20) 40.9 (27)	 0.06
Flush toilet	97.6 (41)	95.5 (63)	0.56
Refrigerator	78.6 (33)	83.3 (55)	0.53

Data presented in % (n)

3.4 Discussion

This study was planned to assess the prevalence of modifiable risk factors for undernutrition among malnourished children. The study programme overall aimed to provide local evidence for better planning of preventive and therapeutic interventions as part of nutrition programmes in lower-income settings. For those childcare practices, the eating and feeding behaviours of children from 6 to 24 months were assessed in addition to anthropometric assessment. Data was collected with the support of healthcare providers in the facility, and there were some discrepancies found in length/height data; for this reason, WAZ scores were used to categorise the children into healthy and malnourished groups. Some incorrect measurements were found during data processing and cleaning, possibly due to gaps in the training of healthcare providers on measuring height or the anthropometric equipment used for data collection. During this study, we relied on the equipment

available in these health facilities and health facility staff supported the researcher in data collection.

3.4.1 Comparison with national survey and literature

3.4.1.1 Family characteristics

Half of the sampled children were females, 51.9% (n=56), and 79% were second or subsequent children. The census of 2017 Pakistan also reports a 50.8 male and 49.2 female ratio in the country (United Nations, 2019). One-quarter of the sampled mothers in the present study had more than three children, with a 0.9 male-to-female ratio, which correlates with the findings of the SMART survey conducted in Sindh, where the survey reported 1.0 boys to girls' ratio among under five years old children (Sutv, 2016). Census report for Pakistan 2017 reports male to female ratio as 1.05 (Pakistan Bureau of Statistics, 2017). More than half of the mothers in the current study sample reported having no formal education or primary education. In contrast, as per the latest survey of the province, 42% of mothers under five years of age have no education or primary education (Beuro of Statistics Punjab Pakistan, 2018). These findings align with the results of the current study; however, the present study's sample is not representative of the overall Pakistani population.

3.4.1.2 Nutritional Status

Only half of the children in the current study had healthy MUAC levels (> 12.5). The higher number of malnourished children in the current study is because of the purposive sampling for the study included, referring first time identifies malnourished and healthy children from the community. There are very few studies found using Mid Upper Arm Circumference (MUAC) as criteria for malnutrition. A narrative review, including 28 studies conducted between 200 and 2016 in Pakistan, reported that 20 studies used the World Health Organization (WHO) weight for age, the age for height, and height for weight Z-score; in four studies, body mass index (BMI), two authors used to weight and height through Jelliffe's classification, one paper used Harvard standard, and two papers used the rapid assessment approach mid-upper arm circumference (MUAC) for assessing the malnutrition among children. (Asim and Nawaz, 2018).

Findings of a SMART survey conducted by Concern Worldwide Pakistan in 12 Union Councils of district Umerkot, Sindh province, to assess the severity of under-nutrition among children aged 6-59 months reported that based on MUAC, malnutrition (MUAC >12.5) rate was 19.1 %. Interestingly analysis of the prevalence of acute malnutrition based on MUAC by age group showed that 41.2% of 6-17 months old children were malnourished (MUAC>12.5). Further analysis of the report describes that out of the total caseload, almost 82% of malnourished children fall between the ages of 6 to 29 months (Sutv, 2016).

Umerkot is a district located in Sindh where acute malnutrition is more prevalent, with wasting at 23%, compared to the provincial average of Punjab (15.3%) (Government of Pakistan & UNICEF, 2018c). The higher number of malnourished children reported in our study may also be attributed to the sampling strategy, as the present study was conducted to compare the prevalence of problematic eating, feeding and caregiving behaviours among healthy and malnourished children. Thus, a conscious effort was made to recruit malnourished children for the study.

A recent systematic literature review following PRISMA guidelines reported that the cumulative incidence of wasting in children under 24 months was 33%, more than five times higher than the prevalence, which was 6% (Thurstan et al., 2021). The target population for the present study was children 6 to 24 months of age because wasting begins from the early months of life; this could be indicative of multiple factors, including inappropriate Infant and Young Child Feeding (IYCF) practices that contribute towards malnutrition, specifically among this age group.

3.4.1.3 Child Development

Early childhood development is critical to monitor normal growth and development and, thus, important to assess productivity over the later years of life. An estimated 43% of the under-five population in low-income and middle-income countries (LMICs) are estimated to be at risk of not attaining their full developmental potential (Ertem *et al.*, 2018). The importance of assessing and improving early childhood development has grown since The Lancet published the landmark Series Child Development in Developing Countries in 2007, followed by Child Development in Developing Countries in 2011. Subsequently, The Lancet issue 2017 reported that the

overall prevalence of poor child development is underestimated because the risk to health outcomes extends beyond stunting and poverty. The same paper suggests that early childhood development interventions are now feasible for integration into existing health, education and social and child protection systems (Richter *et al.*, 2017).

Early childhood development monitoring in developed countries has resulted in the early identification of children at risk of developmental delays and subsequently improved delivery of intervention to prevent impaired development (Guevara *et al.*, 2013)(Moore *et al.*, 2015). Children with developmental delays and malnutrition can result into serious complications. A study conducted in Pakistan has reported a high prevalence (two third of participants) of suspected developmental delay among children under the age of five years with acute malnutrition in rural areas of Pakistan (Saleem *et al.*, 2021a). The study suggested that the first two years of life with poor IYCF practices are at higher risk of getting developmental delays. Given the magnitude of malnutrition, poverty and poor health-seeking practices, it is critically important to integrate early identification of children with developmental difficulties through existing programmes such as community health workers, MNCH and immunisation programmes (Richter *et al.*, 2017)(Milner *et al.*, 2019) (Dua *et al.*, 2016)(Saleem *et al.*, 2021b).

Our study aimed to assess the early childhood development milestone among the sampled populations in lower middle-income settings of Lahore. We used the key standardised developmental milestones developed by WHO and assessed the millstone development by asking mothers the exact age when the child achieved a certain milestone. Discrepancies were observed in maternal reports against actual attained child development milestones, as the first milestone, which is likely to be achieved between the age of 4-6 months, was reported by mothers in the samples between 0 to 21 months. However, the mean age of achieving the first four milestones was inconsistent, with some mothers reporting an early age and others reporting a delayed age. These findings are consistent with the literature, which suggests that parents have poor recall memory when reporting the exact age at which their child achieved specific childhood developmental milestones.

A retrospective study conducted in Quebec suggested that neurologists should consider the developmental information reported by parents with caution as there could be significant misreporting (Majnemer and Rosenblatt, 1994).

Furthermore, there are programmatic gaps in Pakistan, as there are no programmes using child developmental milestones in primary healthcare settings; even referral between primary healthcare and specialised care was observed to be missing during our data collection. Several children with developmental impairment were found during data collection and referred to The Children's Hospital because this research was planned in collaboration with both institutions. The study did not include children with obvious developmental delays, as the study criteria were to recruit children without any medical complications. Similarly, a literature review emphasised the need for developmental surveillance at every level in Pakistan to minimise the delays in the identification of developmental delays among the country's child population (Aly, Taj and Ibrahim, 2010). Child development milestones are more likely to be achieved in later months and were reported to be more accurate, as the researcher could observe whether the child has attained the milestone.

3.4.1.4 Breastfeeding and its Association with nutritional status

Our study reported no significant association between breastfeeding history and nutrition status. However, from the study population, the proportion of children who were still breastfed was significantly higher among the healthy children (78.6%) compared to the malnourished ones (54.5%). Continued breastfeeding was good among the sampled population, as 68% of the children were still breastfeeding, while ideally, all children below 24 months of age should have been breastfeeding. Children who are not breastfeeding are more likely to get wasted as breastmilk in younger children is a significant source of energy, particularly in lower-middle-income settings and during illness, as otherwise there is low dietary diversity and meal frequency (Brown *et al.*, 1990). However, age-appropriate complementary feeding is equally important and should be considered important to assess overall nutritional outcomes.

In the current study, all mothers reported that their children received breastfeeding for some time since they were born. More than half of mothers reported that their child was still breastfeeding. Which majority of children were taken breastfed more than thrice a day. However, from (36%) of children who were not breastfeeding on the day of the interview, 26% of children stopped breastfeeding before the age of 6 months. Although the findings from our sampled set are plausible, there is a chance that the rate of breastfeeding was overreported, as studies in similar settings have reported impaired breastfeeding rates (Senarath and Dibley, 2012). Overreporting related to breastfeeding in the current study might have been because the study took place in a health facility, and mothers felt pressure to report positive behaviour in front of health facility staff as health facility staff was found rigorously involved in delivering advocacy related to breastfeeding.

These findings are confirmed by NNS 2018 as it reports a steady increase in the proportion of children receiving breastmilk during the first hour after birth between 2011 and 2018. However, the trend for exclusive breastfeeding is not linear. As initially, it decreased from 50% in 2001 to 37.7% in 2011 and now again increased to 48% in 2018 (Government of Pakistan & UNICEF, 2018c). These impaired breastfeeding practices are further confirmed by the Global Nutrition Report 2018, as global trends of breastfeeding practices reported by the Global nutrition report 2018 are not very different from what was found in our study. The report states that globally only 41.2% of children were exclusively breastfed. While using the UNICEF database, the same report states that 47.5% of infants under six months in Pakistan are exclusively breastfed, which is quite below the South Asian average of 53.9% (Global Nutrition Report, 2020).

Most of the data on breastfeeding rates come from national surveys. The challenge with the methodology of these surveys is that they are cross-sectional, retrospective and mostly rely on maternal recall of the timing of initiation of breastfeeding and duration of exclusive breastfeeding. Thus, there are high chances of over or under-reporting. In low-middle-income countries where strong nutrition advocacy messages are being delivered by nutrition programme implementors, maternal responses can be influenced by the messages.

3.4.2 Complementary feeding practices and their association with nutritional status

Appropriate complementary feeding along with breastfeeding is proven to be key determinants of undernutrition during the first 1000 days, along with demographic, socioeconomic, WASH and other related factors. Early and late introduction of complementary foods are reported to be associated with poor nutritional outcomes. In the current study, a small proportion (12%) of mothers reported earlier introduction of solid food before six months. Early introduction of complementary foods, especially in poor WASH situations, can result in increased infections such as diarrhoea which seriously affects the child's nutritional outcomes (Kramer and Kakuma, 2012; PAHO, 2013). In the present study, a significant number of mothers (21%) reported the delayed introduction of solid foods between 8-11 months and a significant difference in starting complementary feeding among healthy and malnourished groups. Delayed weaning is also associated with undernutrition (Teshome *et al.*, 2010).

The current study found that initiation of complementary feeding among participants ranged from 3 months to 15 months. A small number of children, 11%, received their first solids before the age of six months. Most children receive their first solids between the ages of 6 to 7 months. At the same time, less than a quarter of children received their first solid food from 8 to 24 months. The findings of our study are comparable with a recent multiple cluster indicator survey, which reports that 61% of 6-8 months old children had already received their first solid foods (Beuro of Statistics Punjab Pakistan, 2018).

For the type of foods used as complementary foods, in our study, 71% of mothers reported that their child was fed plated food for the first time, which included rice, Cerelac, kheer and sagodana. Around one-third of mothers (26%) reported that their child was offered dry finger food as the first solid, which included roti/bread, rusk, and biscuit. In contrast, 8.3% of mothers fed their children moist finger food or fruit as the first complementary food, usually bananas. Aligned with findings from our study, studies conducted in local settings highlighted the gaps in standard complementary feeding practices. Contradicting our findings regarding age for initiation of complementary, a study conducted in Lahore reported that the mean

age for starting semi-solid food was 4.4±0.9 months, while 14% were given semi-solid food as early as the third month. The same study reported that fruits, mainly bananas were the most popular weaning food (given during the first month of weaning), followed by (commercially prepared cereal) Cerelac, which was given to 40% of children (Kulsoom and Saeed, 1997). Another qualitative focus group design study conducted in Lahore reported that mothers were not clear about the importance of age-appropriate introduction of solid foods. While the majority of mothers perceived rusk, roti, commercially available foods, bananas, and biscuits as are best options to start with (Salim, Kalsoom and Humayun, 2016).

Also, evidence related to the type of complementary foods is growing with relevance to nutritional outcomes. Significantly, cereal-based foods used as complementary foods in Ethiopia resulted in an association with higher rates of stunting. On the other hand, use of good-quality protein (animal-sourced foods) and iron-rich food (was reported to be associated with reduced stunting rates (Petrikova, 2022).

3.4.3 Food Frequency (24hr recall) and its association with malnutrition

Poor feeding frequency of complementary foods is very common in the Pakistani context, as the recent MICS survey reports that half (52%) of 6 to 23 months old children who were breastfeeding received minimum meal frequency (Beuro of Statistics Punjab Pakistan, 2018). Among the children not breastfed during the survey period, a higher proportion (84%) received the minimum meal frequency recommended for their age. In our study, (69%) of children were breastfeeding at the time of the survey. Thus, a higher number of children receiving less than recommended meal frequency is in line with survey findings.

In our dataset, around (67%) of malnourished children were not given any plated foods or had once during the past 24 hrs. More than half of the undernourished children (60%) had dry finger food twice a day. Fruits (Moist finger food) are also uncommon, as the majority of mothers (83% of healthy & 91% of malnourished) reported that they have either not given or offered even once to their children. The frequency of milk feeding was higher among younger children, as 71% of 6 to 9 months old children were fed milk more than thrice in the last 24hrs.

Poor meal frequency can be associated with a lack of maternal knowledge about appropriate IYCF practices. A study conducted in Sindh, Pakistan, reported that maternal awareness about the quantity and frequency of complementary feeding is as low as 62.2% and 90.0%, respectively (Memon *et al.*, 2010). Similarly, another study conducted locally in Lahore reported that even if complementary feeding was started in timely, infrequent feeding, the use of expensive commercial cereals instead of home-prepared foods and malpractices in preparing complementary foods were observed (Chaudhry and Humayun, 2007). A multilevel analysis study of the Pakistan Demographic and Health Survey 2012-2013 reported that the proportion of children meeting minimum meal frequency, dietary diversity (MDD), and acceptable diet criteria were 63%, 22% and 15%, respectively.

Our finding of low feeding frequency of appropriate complementary foods to healthy and malnourished children is very much comparable with other studies conducted in South Asian countries. Younger children were reported to be fed inappropriately in terms of both frequency and diversity in Bangladesh (Kabir *et al.*, 2012), India (Patel *et al.*, 2012), and Sri Lanka (Senarath *et al.*, 2012).

3.4.4 Dietary Diversity

Dietary Diversity is assessed based on the number of foods consumed by different food groups in order to ensure adequate nutrient intake required for growth and development (Nti, 2011)(Kant, 1996). Dietary diversity is assessed using a simple tool to capture the intake of different foods in a specific given duration. Dietary diversity does not capture the quantity consumed but the variety of foods consumed.

In our sampled population, this appeared to be low as around 40% of both healthy and malnourished children did not meet the criteria of consuming at least four food groups per day. The majority of children did not receive animal-source food; 99% and 96% of children did not receive meat or egg at all, with no significant difference among healthy and malnourished groups. Older children from 10 to 24 months significantly consumed more food groups in a day compared with younger ones from 6-9 months. Study findings are comparable with findings from lower-income settings (Kenya) as low intake of animal sources food has been reported by other studies

(Mueni, 2007)(Korir, 2013). A recent data analysis of the latest nationally representative data from the Pakistan Demographic and Health Survey (2017–18) presented that only 21% of children consumed at least four food groups to meet minimum dietary diversity, 12% of children consumed minimum acceptable diet, and 38% reach minimum meal frequency (Ali, Arif and Shah, 2021). The same study suggested that addressing poverty, improved awareness, access to media, and MNCH services can improve complementary feeding practices in the country.

3.4.5 Prevalence of eating avidity, aversion, maternal stress, and force-feeding among sampled population

Child eating and feeding behaviours are important factors in assessing the actual intake of children. However, there is a lack of literature on it, particularly in the Pakistani context. For this study, we built on previously conducted research by our group (Mutoro A, 2017) to describe and quantify child eating behaviour and caring practices. Phrases were refined and made more culturally pure (Wright *et al.*, 2021) as part of this research project. Regarding who feeds the child, the majority of mothers reported that children are given autonomy to self-feed, mostly for snacks only, and plated meals are fed by a carer. These findings were consistent with (Mutoro A, 2017), as well as other studies in developing countries (Moore, Akhter and Aboud, 2006) and (Oni *et al.*, 1991).

In the current study, no differences in eating and feeding behaviours among both groups are reported. However, mothers of malnourished children seem less likely to be anxious about feeding their children and subsequently more likely to force feed. All children in the present study group were found to have very low avidity, slightly lower food refusal and slightly higher force feeding if compared to data from UK children and less food refusal than found in Kenya. As Kenyan children had the highest avoidance (2.4; 1.8–3.0) compared with Pakistani children's lowest avidity (2.2; 2–2.8) (Wright *et al.*, 2021). In our data set, force-feeding was prevalent as 76% of mothers reported using a force-feeding behaviour to their child, compared with the UK (17%) and Guatemala (15%). These findings were in accordance with reported force-feeding by mothers in Kenya (82%)(Wright *et al.*, 2021).

3.4.6 Socioeconomic situation and interview settings

No significant difference in socioeconomic indicators was found in the current study. The majority of the respondents were from the highest (4^{th} and 5^{th}) quintile of the national population Results indicate that those surveyed are not poorer than the general population in Pakistan. However, these findings contradict what was observed in the health facility during data collection. It is concerning that the data on socioeconomic indicators reported by the mothers may not be entirely reliable; this might be due to the setting of interviews. As for this study, data collection was done in the room of the primary healthcare worker, with other mothers present at the time of the interview. This might have affected maternal reporting because this could be embarrassing to report the non-availability of different items in the household due to peer pressure. The majority of the households reported having a flush toilet system at their household with no difference among groups. A multiple cluster indicator survey of Punjab, 2018 reported that 88% of households in urban settings have flush toilets compared with 54% in rural settings of the province.

3.4.7 Strength and Limitations

This study aimed to assess the key determinants of malnutrition using ICFET in Pakistani settings.

Strengths of the design included that interviews were conducted with mothers only, and no other family member bringing a child to FC was included in the study, as mothers are the primary caretakers and can respond more accurately than any other family member. Interviews were conducted in the local language at the primary care facilities to make mothers feel comfortable and avoid misinterpretation. Another strength of the study is that data collection was done using the Department of Health staff and structure, so it required minimum resources, and the idea was to make participants comfortable as they trusted their local health staff.

However, some limitations identified at this stage were data analysis particularly relevant to socioeconomic indicators, and significant misreporting was observed, which might be because of the presence of other staff members and mothers in the

same room. It is felt that the interviews should have been conducted in a private place to ensure confidentiality. Other limitations of this study included that we could not interview the mothers in a private place due to lack of space. Another limitation observed with relevance to the developmental milestones is that for data collection, the study relied on maternal recall, so during analysis, it was observed that misreporting by mothers about child development milestones impacted the overall study findings. On the one hand, data collection by health facility staff helped participants to participate in the study because they trusted the local staff, but on the other hand capacity of health facility staff compromised the quality of anthropometric measurements. As in the current study, significant errors were observed in length measurements. Therefore, for the RCT, one anthropometric equipment was used for data collection and data collectors were trained with close monitoring.

3.4.8 Conclusions

The study findings suggest that the ICFET (Infant and Child Feeding Evaluation Tool) is a valuable tool for identifying eating and feeding practices among young children. It successfully identified key modifiable practices that can be targeted for intervention and improvement. The study highlights the importance of improving the study setting, including enhancing the training of data collectors to ensure data quality and consistency. Additionally, using one standardised anthropometric equipment can help avoid discrepancies in anthropometric data, enhancing the reliability and accuracy of measurements.

Furthermore, the study emphasises the need to improve the reporting and monitoring of developmental milestones in relation to nutritional status in future research. This suggests the importance of considering developmental factors when assessing and addressing nutritional needs in young children.

By identifying areas for improvement, such as study setting, data collection procedures, and developmental monitoring, the study provides valuable insights for researchers and practitioners to enhance the effectiveness and validity of future research in the field of child nutrition.

Chapter 4 Effect of Ready to Use Foods (RUF) on feeding, caregiving, and behaviour characteristics of 6- 24 months old moderately malnourished Pakistani children - A Cluster Randomised Control Trial/ Pre and Post study.

4.1 Background

In the Pakistani context, malnutrition treatment policy includes the treatment of severe acute malnutrition, while management of moderate malnutrition remains challenging in the absence of clear guidelines. This trial was designed to assess the impact of protein-energy supplementation on eating behaviours and anthropometric outcomes of moderately malnourished children from 6 to 24 months and assess the feasibility to deliver cost effective sustainable solution to treat malnutrition.

4.2 Introduction

Moderate acute malnutrition affects around 10% of the under-five population in South Asia and Africa (UNICEF, WHO, and Group, 2017). However, MAM children are less likely to die but are higher in number. Also, another critical consideration to focus on MAM is the transition to SAM; in addition, there is a lack of standardised treatment guidelines for MAM (Government of Pakistan & UNICEF, 2012). Malnutrition prevalence in Pakistan is among the highest globally, with 44% of children under five years of age stunted (UNICEF, 2015), one-third underweight, and 15% wasted (4% Severe Acute Malnutrition –SAM- and 7% Moderate Acute Malnutrition –MAM-) (Government of Pakistan & UNICEF, 2018b).

Moderate acute malnutrition (MAM) is defined as a low weight-for-height (between-2SD and -3SD) z-scores of the median WHO growth standards or a mid-upper arm circumference between 11.5 and 12.5cm without any medical complication, including oedema (WHO Multicentre growth reference study group, 2006). Moderate acute malnutrition is estimated to be responsible for 10% of under-five mortality, and if left untreated, MAM children are likely to progress to SAM. Thus, effective treatment and

prevention of MAM is very important. MAM treatment in LMIC is widely done by providing Ready to Use Supplementary Foods (RUSF), while SAM treatment relies on Ready to Use Therapeutic Food (RUTF). Both are effective in treating malnutrition compared to blended flours, provided to families to be prepared at home (Valid Nutrition Report, 2016).

RUSF is effective in the short treatment of MAM (Gera *et al.*, 2017), but there are several reservations about its use globally. These include the cost involved for these products and the risk that RUSF could displace the family diet and affect eating behaviours in the long term (Greiner, 2014). A recent systematic review has reported that randomised controlled trials (RCTs) for MAM conducted in low- and middle-income countries (LMICs) found an average increased weight gain of only 120g (0.15 weight for age Z scores (WAZ)) over a period of six months (Kristjansson *et al.*, 2015). There could also be adverse effects caused by the high lipid content of the product (Dewey and Arimond, 2012; Greiner, 2014). It is also unclear whether all children meeting the criteria for MAM are truly malnourished. Children who are genetically short or with a narrow bony build may be misclassified as MAM (Myatt *et al.*, 2009).

Infants and young children naturally self-regulate their dietary intake, but various factors influence eating habits in early childhood (Scaglioni *et al.*, 2018). Studies reported in the USA that bottle-feeding significantly affects an infant's self-regulation of food intake compared to children who were only breastfed (Li, Fein, and Grummer-Strawn, 2010). Children typically prefer foods with a sweet taste; thus, feeding young children one food like RUSF/RUTF, which is sweet, can affect the child's eating behaviours and future taste preferences (Bazzano *et al.*, 2017). As the extensive use of RUFs may affect the feeding practices of malnourished children, it is crucial to promote locally available healthy family food options to address moderate acute malnutrition in a more sustainable manner (Ashworth and Ferguson, 2009a). In the first pilot study, Chapter 3, information on the eating and feeding behaviour of 6 to 24-month-old Pakistani children was collected, and the main finding was that prevalence of aversive eating behaviour was less common compared with Kenyan malnourished infants. Overall feeding frequency and 24-hr energy intake in Pakistani children were quite low compared with WHO-prescribed standards. Thus, it is

important to investigate the impact of RUSF on feeding and caring practices and relate this to a child's nutritional outcomes.

Several factors affect nutrient intake among children. Besides food insecurity and poor healthcare, child feeding practices, including how food is offered and fed to children, are also important for nutrient intake and related health outcomes. However, very limited literature is available in the context of undernutrition and childcaring and feeding practices, especially in the Asian context. An intervention study in the UK found that children with growth faltering showed a less demanding attitude towards food than their healthy counterparts (Wright C, 2000). Pathway of undernutrition developed by UNICEF place feeding and caring practices at an underlying cause of undernutrition, but effective feeding depends on complex interactions between the child and their caregiver. For example, we showed that undernourished Kenyan children were more likely to exhibit low interest in food and high food refusal compared with their healthy counterparts. Additionally, their mothers reported being anxious about feeding them. Also, mothers were found to force-feed their children if they had low interest in food or high food refusal (Mutoro, Garcia, and Wright, 2019). Thus, it is important to understand caregiver and child interactions during a meal; an area under-studied in the Pakistani context. Nutrition counselling has been traditionally part of all nutrition programs in Pakistan. However, the expected outcomes remained challenging as protein energy supplementation remains the focus of nutrition programs and recipients. A systematic review comparing nutrient supplementation and nutrition advocacy reported that nutrition supplements are superior to nutrition counselling in LMIC (Lelijveld *et al.*, 2020b). Also, nutrition counselling for mothers/caretakers of malnourished children is another important area to consider for the treatment and prevention of malnutrition. Nutrition counselling has been part of all nutrition programs in LMICs; A systematic review reported that the majority of complementary feeding practices of Pakistani families were not meeting WHO Infant and Young Child Feeding (IYCF) standards, and the most frequent family-level barriers reported were cultural beliefs and lack of maternal knowledge regarding complementary feeding (Manikam, Prasad, *et al.*, 2018).

Targeted nutrition counselling, if delivered in the right manner, can be a cost-effective solution to address malnutrition in LMICs (Kulwa *et al.*, 2014). Provision of appropriate complementary food, with or without nutritional education, and maternal nutritional counselling alone can lead to a significant increase in weight and height in children 6-24 months of age. Efficacy trials included in this study reported infant growth by 0.05 to 0.46 SD. (Caulfield, Huffman, and Piwoz, 1999). Targeted advocacy interventions can help to reduce the risk of malnutrition in developing countries, as the literature suggests that culturally-appropriate group nutrition education, individual counselling, interpersonal communication, home visits, and mass media advocacy campaign has resulted in positive outcomes with regard to child nutrition (Bhandari, Mazumder, Bahl, Martines, Robert E Black, *et al.*, 2004; Zhang *et al.*, 2013). However, the content and delivery mechanisms of the messages have not been thoroughly evaluated. A systematic review to assess the effectiveness of nutrition training of healthcare providers towards improvement of nutritional outcomes of 6 to 59 months old children reported that nutrition training resulted in modest improvement in feeding frequency, diversity, and energy intake, however no changes in growth outcomes (Sunguya *et al.*, 2013). A study from Bangladesh assessed the effect of nutritional counselling with reference to MAM and reported slow weight gain, with estimates of 1-2g/kg/day (Roy *et al.*, 2005). Although studies reported nutritional counselling resulted in behaviour change, there is a lack of evidence that nutrition counselling results in catch-up in length among stunted children (Ashworth and Ferguson, 2008).

Under the Integrated Reproductive Maternal Child Health & Nutrition (IRMNCH & N) Programme of the Government of Punjab state, nutrition interventions are being delivered across 36 districts of Punjab (*http://www.irmnch.gop.pk/overview/*, 2018). These have a main objective to improve the nutritional status of the children and pregnant and lactating mothers through treatment of SAM and preventive services in all 36 districts of Punjab. Under Punjab Government's program, SAM children with and without medical complications are being treated according to WHO guidelines in stabilisation centres and outpatient therapeutic program centres, respectively, with the provision of ready-to-use therapeutic foods (RUTF, F75 and F100) (World Health Organization 2013). However, in the absence of any guidelines

for the treatment of MAM, the program currently provides MAM children only with micronutrient supplementation (MMS) in the form of sachets for a period of two months with nutrition advocacy messages (P&D, 2016).

This study is planned to assess the feasibility of comparing RUSF to a targeted counselling study and to assess the characteristics of malnourished children recruited through the existing primary care services.

We plan to use validated ICFET to assess the impact of RUSF and other interventions on diet and eating behaviours.

4.3 Objectives

This study aimed to use ICFET to assess the impact of RUSF and other interventions on diet and eating behaviours. The study further explored the following research questions:

- Does ready-to-use supplementary foods improve weight gain among moderately malnourished children?
- Is the appetite for and intake of family foods reduced when RUSF is given?
- Is food refusal worsened by treatment with RUSF?

4.4 Material and Methods

4.4.1 Ethics approval

Ethics approval was first sought from Glasgow University Ethics committee (Project No: 200190018) (appendix 7) . Further to this, to get ethics clearance to work with human subjects in Pakistan, ethics permission study was sought from the Punjab provincial chapter of National Bioethics Committee (NBC) of Pakistan (appendix 7). Access to health facilities was granted by Primary and Secondary Healthcare Department Punjab (P&SHD) through, Integrated Reproductive Maternal New-born and Child health and Nutrition programme (IRMNCH).

4.4.2 Study Setting and Population

This study was carried out in Lahore, Pakistan. The study area is explained in detail in Chapter 1. The target population was moderately malnourished children aged between 6 and 24 months who had previously not been treated for MAM. They were identified and referred by community lady health workers (LHWs) to these primary healthcare facilities' outpatient departments (OPD).

4.4.3 Study design

In Pakistan, MAM children are treated by providing only micronutrient supplementation and nutritional counselling. Thus, this was an opportunity to run a cluster RCT without creating ethical concerns regarding standard treatment interruption. A cluster RCT was conducted to assess the impact of RUSF on the eating and feeding behaviours of malnourished children. The participants were newly identified MAM (Weight -3 to -2 SD and/or mid-upper arm circumference (MUAC) 11.5 – 12.5 cm) cases. The unit of randomisation was the healthcare centre.

Six conveniently selected healthcare centres were labelled as A to F, and three healthcare centres were randomised to provide RUSF and 3 to give micronutrient supplements (MMS) with no ready-to-use foods to all MAM children coming to health facilities. LHWS was involved in that active community screening and referral to complete the recruitment and follow-up within four months' time. Which worked during the recruitment phase; however, later, during the follow-up phase COVID outbreak significantly affected the study. As per the original plan for two healthcare facilities (A & E), the researcher (AK) was also to target counselling based on the ICFET at the end of the follow-up period to assess the feasibility and time taken to do this. But this, too, could not be completed due to the COVID-associated lockdown. This study involved one interview session for mothers/caregivers and child's anthropometric measurements at the time of recruitment and provision of RUSF or MMS one sachet/day. Mothers of children recruited at PHCs A & E were also provided targeted nutrition counselling based on their responses to ICFET. After one month, one follow-up visit was carried out by repeating the anthropometry, the same interview questionnaire, and follow-up with the counselling group to record the

behavioural changes. However, due to the pandemic, only 30 children from RUSF and ten from the MMS group could be followed up, and no focus group interviews could be conducted.

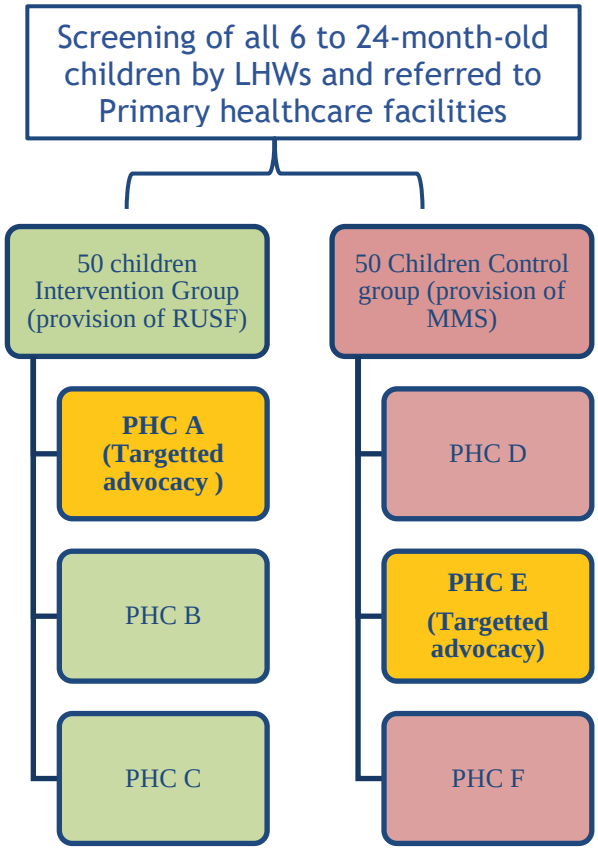

Figure 4.1 Study Design of Cluster RCT

4.4.4 Sample size

Given the time frame and incident of malnutrition, the sample was calculated as 120 children to be realistic. With allowance for loss to follow-up (10%) and an ICC of 0.03, this gives us 80% power at p=0.05 to detect a standardised difference of >0.66. Using our existing cross-sectional ICFET data from Pakistan and a small pilot longitudinal study from Kenya, this suggests this would give us sufficient ample power to detect a difference of 0.5 points between intervention and controls in avidity or food refusal and marginal power to detect a difference of 0.5 points for force-feeding.

4.4.5 Recruitment

Prior to the study, the LHWs attached to each health facility were briefed about the study and about the treatment to be offered in their cluster and asked to identify children in their caseload who meet the inclusion criteria. LHWs approached the mothers and asked them about their willingness to participate in the study. Mothers who agreed to participate in the study were then referred to the PHCs.

LHWs were trained to screen children 6 to 24 months old in their catchment area and refer all those mothers whose child is moderately malnourished and has not started any treatment. Mothers referred by LHWs to attend health facilities when the survey teams were at respective health facilities. Initially, the plan was to recruit two data collectors at each facility; however, due to the unavailability of data collectors, one data collector for each facility could be engaged. Data collectors selected children screened and confirmed as MAM by either a MUAC between 11.-12.5CM or weight for height below -2SD but >-SD. Malnourished children who received treatment for SAM or MAM were excluded from the study.

The participants were recruited from December 2019 to February 2020. Mothers who agreed to participate were provided with information sheets specific to that cluster translated into the local language, Urdu. These were translated by a native Urdu speaker and back-translated by another native Urdu speaker to check and perfect the fidelity of the translation.

Every mother was given an opportunity to ask questions before signing two consent forms. Mothers/caregivers who are illiterate were asked to provide a thumbprint. One copy of the consent form was kept by the researcher the other was a participant copy.

4.4.5.1 Identification and consent

Those eligible were given full details about the study. Participation in this study was entirely voluntary. Mothers who agreed to participate were provided with information sheets about the study and were also given an opportunity to ask questions before signing two consent forms. The information sheet (appendix 12) was read out to

illiterate mothers. Subjects who agreed to participate in the study were asked to sign a consent form (appendix 13). Illiterate mothers/caregivers were asked to provide a thumbprint.

4.4.5.2 Anthropometric measurements

The data collectors met the mothers of referred children and measured weight, length, and MUAC to check their eligibility. Weight, recumbent length, and mid-upper arm circumference (MUAC) were measured according to standardised procedures (Lohman, Roche, and Martorell, 1988)(WHO, 2008). Weight was measured using a digital weighing scale (SECA 384) to the nearest 0.1 kg. The spine length of each study participant was measured to the nearest 0.1cm using a portable length meter (infantometer) with the help of an assistant who placed the baby on the length board and held the baby's head in position (Frankfort plane position). The data collector held down the child's legs with one hand and moved the footboard with the other hand while applying gentle pressure to the knees to straighten the legs.

Mid-upper arm circumference was measured using MUAC tapes placed on the left arm at the midpoint between the elbow and shoulder. The data collector then read the measurements from the tape window and recorded them to the nearest 0.1 cm.

Skinfold thickness of the triceps and subscapular were measured to the nearest 0.1 mm using a skinfold calliper.

4.4.6 Standardisation of Anthropometric measurement

During the initial standardisation session in Lahore, Pakistan, a group of 10 children (6-24 months of age) were measured at a health facility. The session consisted of two phases: first, the leading researcher (AK) demonstrated the correct measurement technique (weight, length, MUAC, skinfolds and bone frame measurements). AK and each data collector measured the weight and length of each baby and recorded their results independently. The same ten children were then measured by the health facility staff using the same methodology, and inter-measurable variabilities were calculated.

4.4.6.1 Interview and advice

After completing the anthropometric measurements, the interview was carried out at PHCs by trained data collectors supported by the lead researcher (AK). A revised validated ICFET (in the light of results of study 1) was used to conduct mother's interviews (appendix 6). It took approximately 20-25 minutes to complete one interview.

Children recruited at the two (A&E) facilities 'highlighted in yellow" were also provided with targeted counselling based on their ICFET responses delivered by AK. Mothers coming to the rest of the facilities receive standard messages from health facility staff.

4.4.6.2 Treatment

All mothers were then provided with either RUSF or MMS sachets based on cluster. Supplementation was given for one month, one sachet per day. Then the recruited participants were asked to visit the facility after one month for follow-up.

4.4.6.3 Follow-up after four weeks:

On follow-up, all the steps apart from taking consent were repeated. Mothers of children were provided with one month more supply depending on the nutritional status of the children. Health facility staff further advised on whether there is a need for follow-up after this visit.

4.4.7 Data Management & Analysis

Consent forms and hard copies of questionnaires containing the child's name and date of birth and age, LHW name and their BHU, and a unique ID were stored securely for ten years. The contents of the questionnaires were entered into appropriate statistical programs (SPSS/EXCEL) in an anonymised form, identified only by the ID and their health facility.

4.4.8 Analysis

After data cleaning, responses across a range of variables are summarised to form continuous scores for avidity, aversion, concern, and anxiety. The change in these variables over the first month was compared between those receiving RUSF and MNS. Data analysis utilises SPSS (version 27; IBM Corporation, USA). The score of the caregiver-report questionnaire was divided into three different behavioural subscales: avidity, refusal, and feed anxiety. Each sub-scale was summarised using the mean score for all items in that group. The means and standard deviations found in normative data from UK children were used to standardise the score of the caregiver-report questionnaire (described in methods of Chapter 3).

The ICFET asks parents to provide data on the frequency of food groups the child has consumed usually. Parents were asked to select one of the following options to describe their child's food consumption: Never/ rarely (1), Once a month or more (2), Once a week or more (3), Once daily (4), More than once daily (5). The consumption of food groups consumed per day was then calculated and compared with WHO standards.

The changeover times between mean scores for feeding and caring practices were calculated and were to be compared between the intervention groups. Pearson's chi-square test was used for binary variables, and chi-square for linear trend was used to test for trends in ordinal data. Mann U Whitney test was used to assess differences in two independent groups in ordinal or continuous data, Kruskal Wallis test was used to test for differences in more than two independent groups. The level of significance was set at $P<0.05$.

4.5 Results

4.5.1 Effect of the pandemic on recruitment

Initially, the plan was to enrol 50 children in each intervention group and conduct a follow-up assessment after four weeks. Unfortunately, due to COVID-related lockdowns, it was not possible to complete the follow-up for all the children as intended. Furthermore, the scheduled focus group discussions (FGDs) with mothers,

intended to be conducted at the study's conclusion, could not be carried out as planned.

During the baseline registration, 48 children were registered in the Ready-to-Use Supplementary Food (RUSF) group, while 42 children were enrolled in the Micronutrient-Multiple Micronutrient Supplements (MMS) group. However, during the follow-up period, only 34 children from the RUSF group and 11 children from the MMS group were successfully tracked and included in the analysis. Despite challenges, the available data from the followed-up children can still provide valuable insights for analysis and interpretation. It should be noted that due to the incomplete follow-up, the study's findings may be subject to limitations in terms of generalizability and overall statistical power.

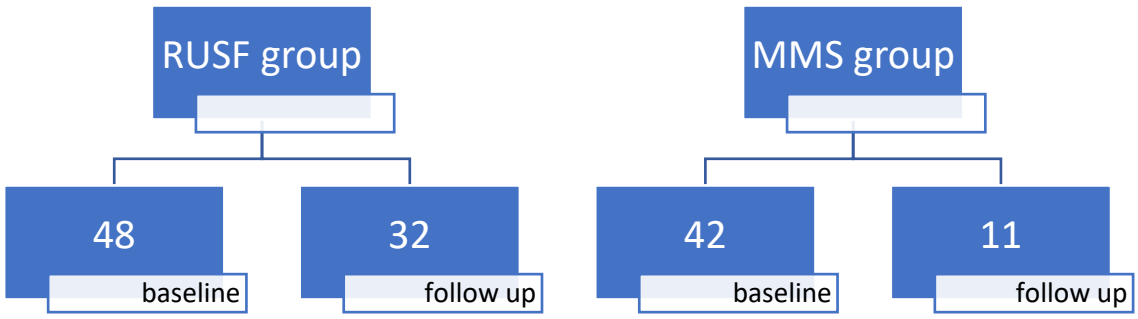

Figure 4.2 Number of Children recruited and completed follow-up in both intervention groups

4.5.2 Child and family characteristics

Child characteristics at baseline are presented in Table 4.1. A total of 48 and 42 mother-child pairs were recruited in RUSF and MMS groups subsequently at the time of baseline. Both groups at baseline are reported to have similar characteristics, except for differences in the father's age (p=.011), mother's age (p=0.70), and birth order (p=0.10). The population is also reported to have some mild to severe food poverty as well. A quarter of children in both groups reported not having any food for consumption due to having no resources (p=0.070).

Table 4.1 Child characteristics for both RUSF and MMS groups

Parameters		RUSF (n=48)	MMS (n=42)	*p*-value
Gender	Female	41.7 (20)	42.6 (18)	0.53
	Male	58.3 (28)	57.4 (24)	
Age (month)	6-9	10.0 (7)	11.9 (5)	0.47
	10-12	17.5 (11)	21.4 (9)	
	13-24	22.5 (30)	66.7 (28)	
Birth Order	1st	18.8 (9)	19.0 (8)	0.01
	2nd	11.9 (11)	22.9 (5)	
	3rd	27.5 (11)	24.0 (12)	
	4-8th	55.5 (22)	24.0 (12)	

Data presented as % (n), *Pearson chi-square, Age data presented in Median & Q1&Q3

Table 4.2 Family characteristics of both RUSF and MMS groups

Child Characteristics		Intervention groups		
		RUSF(n=48) % (n)	MMS(n=42) % (n)	Chi-Square p-value
Age groups				
6-9 months		14.6 (7)	11.9 (5)	
10-12 months		22.9 (11)	21.4 (9)	0.99
13-24 months		62.5 (30)	66.7 (28)	
Number of children under five in HH				
More than one child in a family under 5		77.1 (37)	73.8 (31)	0.19
No. of children born to this mother		3.67 ± 1.49	2.78 ± 1.46	0.71
Maternal Education				**Independent t-test P value**
Primary and below		85.5 (41)	62.0 (24)	0.03
Secondary and above		15.0 (7)	38.0 (18)	
Age in months Mean (95%CI)		15.94±4.94	15.20±4.65	0.91
Weight for height Z score Mean(min-max)		-2.53±0.90	-2.40±1.25	0.58
Height for age Z score Mean(min-max)		-2.21±1.58	-2.22±1.82	0.97
MUAC Z scores Mean (min-max)		-2.35±0.41	-2.34±0.42	0.24
Mother's age in years Median (min-max)		28 (25-32)	27 (24-30)	0.07
Father's age in years Median (min-max)		38 (30-40)	30 (26-34)	0.01
Was there ever no food to eat in your house because of a lack of resources to get food? If so, how often did this happen?	Never	75 (36)	78.6 (33)	0.70
	Rarely (once or twice in the past 30 days)	10.4 (5)	14.4 (6)	
	Sometimes (three or ten times in the past 30 days)	2.1 (1)	7.1 (3)	
	Often (more than ten times in the past 30 days)	12.5 (6)	0	

4.5.3 Vitamin supplementation

If compared among study groups for study 2, RUTF and MMS arms, no significant differences (2.1% RUSF & 7.1% MMS) were reported for giving the child vitamin supplementation (p=.245). For vitamin A supplementation, 43.8% and 40.5% of mothers, respectively, from RUSF and MMS arms, reported that their child had not received vitamin A supplementation (P=.754). No significant difference among both groups for the provision of MMS is reported. Only 10.4% (n=5) and 7.1% (n=3) of mothers from both RUSF and MMS groups reported that they were giving MMS to their children (P=.586).

4.5.4 Breastfeeding and complementary feeding practices

Most children in the present study received breastfeeding at some point (98% RUSF and 95.2% MMS) with no significant differences P=.480. No significant differences among both groups were reported on questions related to if the child was still breastfeeding (58.3% RUSF vs 69%MMS) P=.293. Similarly, both study arms reported that 58.3% (n=28) from RUSF and 69% (n=29) from the MMS group are still breastfeeding their child (p=.29)Table 4.3.

Both groups at baseline reported having similar complementary feeding practices with no significant differences (Table 4.4). Although non-significant, buy in MMS arms, 4.8% (n=2) children started complementary feeding before the age of six months, while none of the children in the RUTF arm started solids before the age of 6 months.

Table 4.3 Breastfeeding practices among both groups at the time of baseline

Variable	RUSF(n=48) % (n)	MMS (n=42) % (n)	P Chi^2
Ever breastfed?			
Yes **No**	97.9 (47) 2.10 (1)	98.2 (40) 1.80 (2)	0.48
Still breastfeeding?			
Yes **No**	58.3 (28) 41.7 (20)	69.0 (29) 31.0 (13)	0.29

Data presented as % (n), *Pearson chi-square

Table 4.4 Complementary feeding practices among both groups at the time of baseline

Variable	RUSF (n=48) % (n)	MMS (n=42) % (n)	P Chi2
Age when complementary feeding started.			
>6 months	0	4.8 (2)	0 .27
6-7 months	14.6 (7)	7.1 (3)	
8-11 months	45.8 (22)	40.5 (17)	
12-24 months	39.6 (19)	47.6 (20)	
First food given			
Plated Food	58.3 (28)	57.1 (24)	0.50
Dry finger foods	39.6 (19)	35.7 (15)	
Moist finger foods/fruits	2.1 (1)	7.1 (3)	

Data presented as % (n), *Pearson chi-square

4.6 Baseline and Follow-up analysis

On follow-up, indicators of dietary diversity, eating avidity, refusal, maternal stress, and force-feeding were tracked. Analysis was done to see the change over time of 4 weeks on these variables. A follow-up for all recruited participants could not be completed due to COVID-related restrictions. So, for further analysis, only those children were included, whose follow-up was completed over the period of four weeks.

4.6.1 Anthropometry at the time of baseline and follow-up

Follow-up could be completed for 43 Children (RUSF=32 and MMS=11). The analysis is done for the combined group for follow-up as well as for the RUSF group to assess the change. No change in anthropometry is reported at the time of follow-up (follow-up at four weeks). Despite consumption of one sachet of RUSF, which provided around 500Kcal, no significant improvement in weight, MUAC, WAZ, and HAZ are reported in our study group.

Further analysis was done to assess the extent of change in anthropometric variables. WAZ score and HAZ score also remained modest as, in most cases, a very small change is reported for both anthropometric measures Table 4.6.

Scores for eating avidity, food refusal, force-feeding, and maternal anxiety towards child feedings were standardised against British data. Although significant for food refusal (change median -.43) and maternal anxiety change median (-.28), the change is reported to be small among both study groups over the period of four weeks. While force-feeding and avidity remained the same from baseline to follow-up. Further analysis of the RUSF group only (as follow-p of the RUSF group could be completed and very few children from the RUSF group) also reported the same change as combined groups Data presented are %(N) unless otherwise specified
Table 4.7.

Table 4.5 Change in anthropometry over the period of four weeks among the merged group

Merged group (RUSF 32 & MMS 11) (n=43)	Baseline	Follow up	P value
Weight	7.64±.98	7.72±.99	0.62
Height	73.2±4.8	73.2±4.8	0.90
MUAC	12.04±.24	12.05±.21	0.84
WAZ	-2.46±1.02	-2.54±.978	0.62
HAZ	-2.20±1.64	-2.22±1.65	0.91
BAZ	-1.54±.799	-1.64±.690	0.38
RUSF only (n=32)			
Weight	7.51±0.97	7.60±0.99	0.71
Height	72.0±4.46	72.10±4.41	0.98
MUAC	12.07±0.26	12.08±0.26	0.92
WAZ	-2.52±0.93	-2.55±0.88	0.86
HAZ	-2.20±1.59	-2.22±1.51	0.95
BAZ	-1.63±0.82	-1.66±0.71	0.86

Independent sample t-test (*significance)

Table 4.6 Change in WAZ and HAZ over the period of four weeks

Anthropometry	Difference in weight	Range in change		
	Median & Q1&Q3	<0.33	<-0.33	>0.33
WAZ	-.10 (-0.23-.00)	7.0 (3)	79.1 (34)	14 (6)
HAZ	.00 (-0.40-0.00)		100 (43)	

Data presented are %(N) unless otherwise specified

Table 4.7 Change in food refusal, avidity, force-feeding, and maternal stress parameters over the period of four weeks

Merged group (n=43)	Baseline	Follow-up	P, t test	P, Mann-Whitney U	Change Median (Q1&Q3
Avidity	-2.63 (-3.5 to -2.1))	-3.10 (-3.59 to -2.16)	.521	.581	
Refusal	1.89 (1.89-1.89)	1.45 (1.02 to 1.89)	.008	.001	-0.43 (-0.86 to 0.00)
Maternal anxiety	-2.56 (-1.37- (-.256))	-1.37 (- 2.77 to -.535))	.048	.005	-0.28 (-0.84 to 0 .00)
Force-feeding	-.847 (-2.44- (-.847))	-.846 (-2.44 to -.847)	.339	.292	
RUSF only (n=32)					
Avidity	-2.63 (-4.04 to -1.23)	-2.86 (-4.04 to -1.46)	0.47	0.52	0.00 (-1.17 to .00)
Refusal	1.85 (1.46 to 1.89)	1.45 (0.16 to 1.89)	0.00	0.00	-0.59 (-1.73 to 0.43)
Maternal anxiety	-0.25 (-3.61 to -0.26)	-1.37 (-3.05 to -0.26)	0.02	0.00	-0.56 (-2.79 to 0.84)
Force-feeding	-0.84 (-4.05 to -0.85)	-0.80 (-4.05 to -0.80)	0.93	0.71	0.04 (-1.60 to 1.60)

Data presented as Median of standardised scores against British data & * Q1&Q3

4.6.2 Dietary diversity before and after

The dietary recall was recorded for various foods, and then the daily consumption of different food groups was estimated. The number of food groups taken over the period of 24 hrs at the follow-up remained the same.

Table 4.8 Change over four weeks in dietary diversity

Merged group (n=43)				***p*-value**
(Food groups consumed/ day)	**Frequency**	**Baseline (n=43)**	**Follow-up (n=43)**	
		%(n)	**% (n)**	
	< 3	4.7 (2)	0	0.33
	3-4	30.2 (13)	36.6 (15)	
	≥4	63.4 (28)	61.1 (26)	

4.7 Discussion

The study was designed as a cluster randomised control trial; however, due to the pandemic, follow-up of all children in both arms could not be completed, so before and after analysis was undertaken for merged data from both groups. To further evaluate the change in the RUSF group, change in anthropometry and eating and feeding behaviours was assessed for the RUSF group only as well.

The data from before and after the study in subjects shows no change in anthropometry, dietary diversity, or appetite but some improvement in food refusal and increased maternal anxiety about their child's nutrition; the change was more among the RUSF group.

Although humanitarian organisations, particularly UNWFP, have been advocating for supplementary feeding strategies to treat moderate wasting among lower middle-income settings (UNWFP, 2012). Ready-to-use supplementary food, providing around 500 to 550 Kcal, is traditionally used to treat moderate malnutrition (Manary and Sandige, 2008). A cluster-randomised controlled trial as part of the UNWFP food assistance program with a sample of 1,038 children between the ages of 6 to 36 months conducted in Chad concluded no difference in the incidence of wasting (incidence rate ratio: 0.86; 95% CI: 0.67, 1.11; p=0.25) or mean change in WHZ (−0.002 WHZ/month; 95% CI: −0.032, 0.028; p=0.89) between both groups. The difference in weight among both groups is reported as 0.02 kg/month (95% CI: −0.01, 0.04; p=0.10). Despite the difference in the duration of supplementation between our study, which involved a 4-week follow-up, and the referenced study, which provided supplementation for four months, the findings from both studies are consistent. Both studies reported modest changes in weight and height, and no significant difference was observed in Mid Upper Arm Circumference (MUAC) (Huybregts *et al.*, 2012). However, a systematic review, including ten randomised controlled trials and a prospective cohort study, reported that seven out of the total included studies reported food products as effective in terms of anthropometric improvements (weight, height, or MUAC) compared with nutrition counselling and/or micronutrient supplementation. While two studies reported no significant benefit of food supplementation intervention compared with control, and two of the studies

were inconclusive (Lelijveld *et al.*, 2020a). In all of the studies, follow-up was done for more than three months; only in one study were participants followed after 14 days, and that reported that incidents of SAM from MAM remained the same in all three interventions, micronutrient, and no intervention groups. (Kam, 2017). In our study, we could only do the follow-up after four weeks, mainly due to COVID implications. However, we later planned to do the follow-up after eight weeks, but that could not be completed. As per the Fanta guidelines, if a child consuming ready-to-use supplements continues to gain weight > 5 g/kg/day, it is considered a good recovery (FANTA, 2017). In our study group, none of the children met the criteria, indicating that these RUSFs might not be equally effective for all children getting malnourished. For feeding behaviour, food refusal reduced significantly among our study group, while maternal anxiety towards feeding the child also improved. Improved maternal anxiety scores towards feeding the child may attribute to targeted counselling messages delivered to these mothers at the time of recruitment. However, a significant decrease in food refusal can highlight the increased appetite when given high-energy supplementation to these children. But the reported food intake from family food remained the same in our study, which is indicative that these children were consuming more ready-to-use foods.

Ready-to-use foods, due to their very sweet taste and energy-dense also considered to affect the consumption of local foods and the child's eating behaviour. Work in affluent settings has suggested that oral therapeutic feeding is associated with feeding aversion, as well as affecting the appetite for family foods (Poustie *et al.*, 2006; Wright and Chillingworth, 2015) and is not associated with significant anthropometric improvements (Walker *et al.*, 2006). Although very few studies in lower middle-income settings on eating behaviour, a study in moderately affected children reported very little impact of food supplements on weight gain and displacement of family foods (Fatima *et al.*, 2015). This is similar to the findings of our study, as children reported to have no difference in aversive eating behaviour in our study group.

Feeding behaviours are an example of childcaring practices for good growth and development. Feeding behaviours are key to determining children's nutrient intake and subsequent growth. Also, it highlights the importance of interventions to improve feeding practices on a larger scale with nutrition programs. Feeding practices are

referred to the broad scope of dietary, behavioural, and physiological processes involved in feeding the child (UNICEF, 1998).

Interest in caring practices stems from investigations in the late 1980s and early 1990s, as studies reported regardless of the socio-economic situation, maternal behaviours towards child feeding were significantly associated with a child's nutritional outcomes (Patrice L Engle, Bentley and Pelto, 2000).

Also, leading UN agencies working on nutrition, like UNICEF, have been strong advocates for the importance of care to improve nutritional outcomes of children under five years of age. UNICEF proposed conceptual framework suggests that in addition to food security and healthcare services, care for women and children is equally important to get desired nutritional outcomes (Engle, Menon and Haddad, 1999).

In the present study, maternal anxiety towards child eating increased over the period. This might be affected because these mothers were visiting health facilities and were being asked about child-feeding practices. Also, mothers coming to two facilities received targeted messages. So, mothers were sensitised to the importance of feeding their children and were more concerned at the time of follow-up. We assume that this sensitisation is healthy in terms of mothers realising the importance of their child's actual food consumption and behaviours.

However, force-feeding remained unchanged. Our own research group further analysed the use of ICFET and its performance in different countries to assess eating and feeding behaviours among wasted and healthy children. For this, data from Kenya (n = 157), peri-urban Lahore, Pakistan (n = 108), rural Retalhuleu, Guatemala (n = 125), and playgroups in Glasgow, United Kingdom (UK, n = 97), was included with total 487 children. Our analysis found that force-feeding was rare in the UK (17%) and Guatemala (15%) but common in Pakistan (76%) and Kenya (82%) (Wright *et al.*, 2020).

4.8 Strengths and Limitations

This study had several strengths. Firstly, the data collection tool was refined based on insights from the first study conducted in a similar setting, ensuring its relevance and effectiveness. Additionally, the data collection setting was modified to prioritise privacy, and data were collected in the local language, enhancing participants' understanding and engagement. The data collectors underwent thorough training and were closely supervised throughout the data collection period to maintain the quality and accuracy of the data.

However, the study also had limitations. One limitation was the incomplete follow-up of all children due to time constraints and the impact of the pandemic; further follow-up at eight weeks could not be completed, which may have affected the ability to capture the full extent of the intervention's impact. Furthermore, considering the potential influence of other interventions, the study's statistical power may have been limited in evaluating the effectiveness of nutritional supplements as a standalone intervention.

4.9 Conclusions

Although the pandemic-related restriction significantly impacted the study, the study's findings affirm that ICFET is a reliable tool to assess the eating behaviours and caring practices of children in LMIC. The study findings indicated that, despite the energy consumption provided through the intervention, no significant change was observed in anthropometric measurements. Therefore, the study suggests that further evaluation is needed to explore potential factors affecting the intake of ready-to-use supplementary food (RUSF). Other factors influencing the outcomes may include repeated infections or the practice of food sharing, which might influence the effectiveness of the intervention. Similar to the findings of the present study, it is reported that ready-to-use foods have a modest effect on child growth when used for the treatment of moderate acute malnutrition (Lazzerini, Rubert, and Pani, 2013). Therefore, it is important to address other risk factors; these malnourished children are exposed. The present study suggests that intervention was helpful to sensitise mothers towards feeding their children, and supplementation showed a positive change in appetite improvement in moderately malnourished children.

4.10 Combined analysis (Study 1 and Study 2)

This chapter consists of combined data analysis from Study 1 and Study 2. Given that the sample size in both studies remained small, we decided to do a combined analysis to assess whether wasting or stunting had different associations.

For this analysis, we combined data from Study 1 Pakistan, conducted in (2018) and study 2, conducted in (2019-20), involving 108 subjects from Study 1 (Chapter 3) and 90 from the first data collection round of (Chapter 4).

4.10.1 Nutritional status of the sampled population

Using BMI z score & HAZ, in the combined set of 198 children, we categorised them as normal 42.3% (n=85), stunted only 30% (n=60), or wasted 26.8% (n=53) (Figure 4.3).

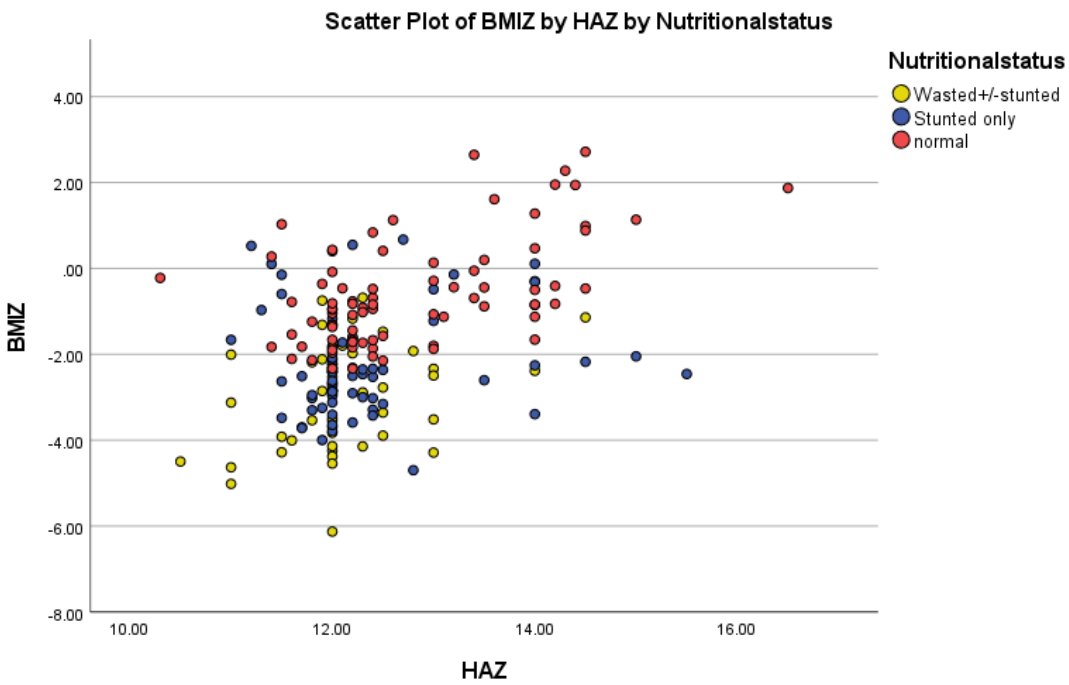

Figure 4.3 Distribution of children based on their weight for length and length for age z-scores

4.11 Association between Nutritional Status and Child Development

There was no significant association observed between child development parameters and nutrition status. Still, there were some possible trends for malnourished children to be less advanced for the achievement of development millstones.

Table 4.9 Relationship of child's development parameters and nutrition status

Parameter	Healthy (n=85)	Wasted (n=53)	Stunted only (n=60)	Kruskal Wallis test, (p value)
Reached out to objects and took them to their mouth	6 100 (85)	6 100 (53)	5.5 100 (60)	0.27
Sit for at least 10 seconds without using the hand or arm to support	8	8	8	0.67
Stand holding onto a table with the hands for at least 10 seconds.	12	11	10	0.44
Stand alone with no contact with a person or object for at least 10 seconds.	14	13	12.5	0.47
Walk at least ten steps with a straight back and no contact with a person or object.	15	14.5	15	0.97

Data presented as Median age the milestone is achieved, P value Kruskal Wallis test,

Table 4.10 Relationship of child's development parameters and nutrition status

Parameters	Status	Wasted (n=53)	Stunted only (n=60)	*p*-value
Stand holding onto a table with hands for at least 10 seconds	Achieved	67.9 (36)	74.1 (43)	0.470*
	Not Achieved	32.1 (17)	25.9 (15)	0.472**
Stand alone with no contact with a person or object for at least 10 seconds	Achieved	41.5 (22)	46.6 (27)	0.593*
	Not Achieved	58.5 (31)	53.4 (31)	0.593**
Walk at least ten steps with a straight back and no contact with a person or object	Achieved	37.7 (20)	31 (18)	0.457*
	Not Achieved	62.3 (33)	69 (40)	0.459**

4.12 Association between food frequency (past 24hrs) and nutritional status

Plated meals were the least consumed meals among both groups. However, more than 60% of wasted children received one or less than one plated food, in comparison to 41.2% of stunted. Malnourished children were consuming dry finger foods around 70 %, moist finder foods (13-20 %), and milk (81.4%) for periods of >2 times per day. On the other hand, normal children were consuming dry finger foods (63.5%), moist finger foods (10.6%), and milk (70.6%) twice a day. Moreover, in the detailed analysis of the malnourished group, consumption of foods was found to be higher among the stunted group than the wasted group. But again, this association was also non-significant.

Table 4.11 Association of % eating different types of food more than once in the past 24 hours and nutrition status

Parameter		Healthy (n=85)	Wasted (n=53)	Stunted (n=60)	Pearson chi-square
Plated Foods	≥2 / day	40.4 (43)	36.9 (21)	56.6 (34)	0.59
Dry finger foods	≥2 / day	63.5 (54)	67.9 (36)	67.2 (39)	0.96
Moist foods	≥2 / day	10.6 (9)	13.2 (7)	27.6 (16)	0.05
Milk	≥2 / day	29.4 (25)	26.4 (14)	12.1 (7)	0.52
	≥3 / day	70.6 (60)	73.6 (39)	87.9 (51)	
Other drinks	≥2 / day	18.8 (16)	18.9 (10)	22.4 (13)	0.93

Data presented as % (n),

4.13 Association between Dietary diversity and nutritional status

The association of dietary diversity and nutrition status was found non-significant for malnourished/ healthy groups as well as for wasted and stunted groups. 38.1% of malnourished and 43.5% of healthy children consumed four or more food groups. The stunted-only group showed better dietary diversity than the wasted group. Only 30.2% of the children were consuming four or more food groups if compared with stunted-only children (44.8%).

Table 4.12 Association of dietary diversity and nutrition status

Parameter		Malnourished (n=113)	Healthy (n=85)	*p*-value	Wasted (n=53)	Stunted (n=60)	*p*-value
Dietary diversity (Food groups consumed/ day)	<3	26.5 (30)	22.3 (19)		24.5 (13)	27.6 (16)	
	3	35.4 (40)	34.1 (29)	0.695*	45.3 (24)	27.6 (16)	0.130*
	≥4	38.1 (43)	43.5 (37)	0.396**	30.2 (16)	44.8 (26)	0.443**

Data presented as % (n), *Pearson chi-square, **Linear by linear association

4.14 Association of food refusal, avidity, force-feeding, maternal stress, and nutritional status

Refusal and avidity scores were comparable in the malnourished and healthy children of the study. Maternal stress towards child feeding was more common among the malnourished group as maternal anxiety scores were higher among the malnourished group (healthy; 0.93 vs wasted 1.14, stunted 1.36)). Scores for food refusal were higher among stunted only (2.97) compared with wasted and healthy 0.08 and 1.17, respectively).

Table 4.13 Association of food refusal, avidity, force-feeding and maternal Stress Parameters and nutrition Status

Parameter	Healthy (n=85)	Wasted (n=53)	Stunted (n=58)	Mann-Whitney U test (*p*-value)
Refusal	1.17	0.08	2.97	0.063
Avidity	-1.93	-2.16	-1.94	0.523
Force-feeding	1.50	1.58	0.28	0.216
Maternal stress	0.93	1.14	1.36	0.559

Data presented as median

4.15 Discussion for combined analysis

4.15.1 Key findings

Both study groups appeared to be similar regarding child and family characteristics and child development milestones. No differences were observed. However, when combined, some malpractices related to breastfeeding and complementary feeding are highlighted in the dataset, as most malnourished children never received breastfeeding in their lives compared to healthy children. Most malnourished and unhealthy study participants were introduced to complementary foods at the age ≤6 months. However, it is important to consider that around 15-16% of children in every group started complementary feeding before the age of 6 months, regardless of

nutritional status. Plated foods were more common to be fed to healthy groups than the malnourished children. Although non-significant, these malpractices indicate the prevailing poor caring and feeding practices among this population, which reflects overall poor IYCF indicators in the province reported by provincial surveys from 2011-2018. The age-appropriate breastfeeding in the province is reported as 35% in 201, 41% in 2014, and 46% in 2018; similarly, the age-appropriate introduction of solids is reported as 38% in 2011 and 61% in 2014 and 18 (Beuro of Statistics Punjab Pakistan, 2018).

Plated meals were the least consumed meals among both groups. Malnourished children consumed milk more frequently than any other food in the last 24 hours. On the other hand, more than half of healthy children were consuming dry finger foods and milk. Fruits were the least common food to be consumed by both groups. The association between dietary diversity and nutrition status was insignificant for malnourished/ healthy groups. Over a quarter of malnourished and healthy children consumed four or more food groups. The stunted-only group showed better dietary diversity if compared with the wasted+/ stunted group.

These findings of our study with relevance to meal frequency are different to those reported by provincial multiple indicator cluster surveys, as minimum meal frequency and minimum acceptable diet reported by these surveys are 60% and 12-14% in 2014 and 18 (Beuro of Statistics Punjab Pakistan, 2018). This might be because our sample from 2nd study was intestinally selected as a moderately malnourished group. And feeding practices of malnourished children are found to be different from healthy children in our own data set, as children who are both wasted and stunted appeared to have less dietary diversity than those who are wasted only.

In the combined data set, refusal and avidity scores are found to be similar among all groups. However, force-feeding was more common among the malnourished group if compared to the healthy. A similar trend was observed in the case of maternal stress, as maternal anxiety scores were higher among the malnourished group; this is reflective of maternal anxiety increasing when a child is malnourished, leading to force feed. However, refusal being not common among the malnourished group in our data set, is contradictory to a similar study conducted in Kenya, which reported

higher food refusal aligned with maternal stress and force-feeding among the malnourished group (Mutoro, 2017).

4.16 Future research implications

Given that both data sets were collected with differences in time and different targeting approaches, further research using the same tool, including a larger sample size, is suggested to assess the implications of these caring practices on nutritional outcomes in a more concrete manner. Also, data from the study suggest using more robust indicators for socio-economic and child development milestones. As reflected in our data set, relying on maternal recall has implications for these variables. Also, data collection methodology and setting affect the quality of data. Therefore, it is suggested that data collection through trained data collectors in a community setting with robust monitoring will result in better data quality. It is further suggested that in future research, an online tool with a provision to have checked for inclusion/exclusion and wrong entries will improve the overall data quality.

Chapter 5 Diagnostic ability of mid-upper arm circumference (MUAC) measurement to identify truly wasted cases among Pakistani Children of 6 to 24 months of age.

5.1 Introduction and background

Anthropometric measurements are the quantitative body measurements that are used more often in children to assess their nutritional status, growth, and development (Fryar *et al.*, 2021). Body measurements are considered a useful and easy measure to assess the nutritional status in epidemiological studies due to their non-invasive nature. Although the number of wasted children in low-middle-income countries is decreasing, it is still important to have a reliable method to assess true acute malnutrition – that is, low body fat - in community settings.

Some of the sophisticated methods to assess body composition, direct (neutron activation analyses) and indirect (underwater weighing, DXA) in vivo methods, are considered highly precise and accurate methods(Fogelholm and Van Marken Lichtenbelt, 1997)(Deurenberg and Schutz, 1995)(Ellis, 2001); however, the technical expertise and cost implications required to perform these methods make them difficult to use in community settings. Skinfold measurements, including triceps and subscapular measurements, are quite good predictors of body fat mass (Fogelholm and Van Marken Lichtenbelt, 1997), but it has been suggested that bony circumference combined with the sum of skinfold measurements might give a better estimate of body fat mass among adults (Garcia *et al.*, 2005).

5.1.1 Mid-upper arm circumference

Mid-Upper Arm Circumference (MUAC) is the circumference of the left upper arm, measured at the mid-point between the tip of the shoulder and the tip of the elbow (olecranon process and the acromium). In 1969 for the first time, a humanitarian organisation, the International Committee of the Red Cross (ICRC), used a MUAC to conduct an extensive survey during the Nigerian Civil War (1967–70) (Glasman, 2018). An earlier systematic review of the literature showed that children with MUAC <11.0 cm had a significantly elevated risk of mortality (Myatt et al. 2006), however in 2009, WHO and UNICEF published revised guidelines that MUAC cut-off of <11.5 cm as one

of three screening criteria for identifying and managing severe acute malnutrition in infants and children 6–60 months (WHO and UNICEF 2009). This recommendation of a slightly higher cut-off was aimed at increasing the sensitivity of the measure while maintaining high specificity (Tang *et al.*, 2013). Due to EHO and UNICEF recommendations on standard cut-off points for MUAC, it has become a widely used method in community settings to screen and identify eligible children in nutrition programs (Nyirandutiye *et al.*, 2011)(Brown, Nyirandutiye and Jungjohann, 2009). MUAC is now commonly used to assess nutritional status. It is a good predictor of mortality, and in many studies, MUAC predicted death in children better than any other anthropometric indicator. (Nutrition Mother and Child, 2017). Also, MUAC is now being used to assess nutritional status and identification of eligibility for nutrition support among the adult population, including adolescents and pregnant women in low-middle income settings (Tang *et al.*, 2013).

MUAC has been widely used to detect acute malnutrition in the community setting. MUAC is clearly cost-effective and easy to use, but is it a robust method to be used in a community setting if compared with other anthropometric measurement methods? One of the strengths of using MUAC as an identification tool is that it is relatively independent of age from 6 months to five-year-old children; however, the age independence of MUAC is disputed (I and FS, 1982). MUAC is used as a proxy to identify early acute malnutrition (weight for height), but the disagreement of two indices can result in an increased risk of missing the actual wasted children and also the inclusion of those who are not acutely malnourished (Dairo, Fatokun and Kuti, 2012). Variation between MUAC and weight for age also has been reported (Berkley *et al.*, 2005).

MUAC is easy to perform and requires only basic measurement skills; thus, is used as a tool to screen malnutrition in a community in Pakistan. Studies have also been conducted to validate MUAC against weight for length method (Grellety, L. Kendall Krause, *et al.*, 2015; Das *et al.*, 2018; Kumar *et al.*, 2018; Zehra *et al.*, 2021). Studies from India and Bangladesh reported MUAC cut-off of <11.5 cm as an appropriate measure for identifying children with severe acute malnutrition and suggested MUAC as a single assessment tool for case finding of SAM in children <5 years of age (Aguayo *et al.*, 2015)(Ali *et al.*, 2013). But on the other hand, discrepancies have been reported in considering MUAC vs WFH as a reliable measure for diagnosing acute

malnutrition in infants ≤6 months old (Grellety, L Kendall Krause et al., 2015; Kumar et al., 2018). All these validation studies focused on the validation of the MUAC cut-off for SAM which is 11.5cm. What is lacking is the validation of the MUAC cut-off 12.5CM to detect moderate wasting among 6 to 24 months old children. It is also not clear the extent to which skin folds or bony frames explain variability in MUAC.

5.1.2 Data available for this analysis

In study 1, anthropometric data included MUAC, height, and weight only, but healthy as well as malnourished children were included. In Pakistan, Study 2 (P2), skinfold and bony width measurements were recorded, but this only included children with a MUAC of 12.5cm, in addition to the above.

This study is therefore planned to compare the validity of MUAC among two different types of datasets to determine its usefulness for the identification of acute malnutrition among 6 to 24 months old children.

Research questions to cover.

1. How sensitive and specific is MUAC <12.5 cm to detect wasting (low weight for height) in the Pakistan data set where healthy and malnourished children were studied?

5.2 Materials and methods

5.2.1 Anthropometric Measurements

Data were collected by two trained data collectors under the supervision of the researcher. The training was one video recording, recorded in the lab under the supervision of researchers, using standard methods.

The methodology of measuring the data and recording was similar in both data sets. When one researcher was measuring, the other would record the numeric values. All anthropometric data were obtained using standard techniques (Garcia *et al.*, 2005; dos Anjos *et al.*, 2021)

Weight was measured after removing all the clothing and sitting using a digital TANITA & SECA scale to the nearest 0.1kg. Recumbent length was measured to the nearest 0.5cm with the child in the Frankfort plane position with heels together and legs straight using a SECA portable infantometer. All arm and leg anthropometry were measured on participants' left limbs; two measurements were taken, with a third added if the two did not correspond (Poh *et al.*, 2016). Mid-upper arm circumference was measured to the nearest 0.1cm using a standard MUAC tape at a marked point between the olecranon and acromial processes. Skinfold measurements were reported to the nearest 0.1mm using a Holstein skinfold calliper that was checked for calibration for every participant. The Triceps skinfold was taken between the olecranon and acromial processes (previously marked for the MUAC) on the back of the arm, where a vertical line was used as the measurement site. Subscapular skinfold was taken below the scapula with a line marked from the spine toward the hipbone following the angle of the scapula at a 45-degree angle.

5.2.2 Statistical Analysis

Both data sets from Pak were merged in an SPSS version 26 (IBM), and a new sheet was created. Descriptive statistics of the participants, including anthropometric measurements, were calculated as mean values plus standard deviation with an independent t-test used to check for significant differences between genders. Nutritional status was predefined as WHZ and/or WAZ below –2SD as wasted, HAZ below –2 as stunted and otherwise normal as set by the World Health Organization (WHO Multicentre growth reference study group, 2006) (WHO Multicentre growth reference study group, 2006) (WHO Multicentre growth reference study group, 2006) BMI, WHZ, WAZ, HAZ, triceps skinfold and subscapular skinfold z scores were calculated in using WHO Anthro software version 3.2.2. Skinfolds were summarised via the mean of the two z scores. Cross-tabulation to validate the MUAC for identification of wasting and stunting was made. The sensitivity, specificity, and positive predictive values for the MUAC were determined against WHZ as standard in Study 1 and specificity, and positive predictive values against both WFH and mean skinfolds for study 2.

5.3 Results

5.3.1 Descriptive Analysis

Descriptive statistics of the study participants can be seen in Table 5.1. 108 Children from Study 1 and 90 children from Study 2 were used for this analysis.

Of all recruited participants, 52% were female in Study 1, while 42% of participants recruited in Study 2 were females.

Table 5.1 Nutritional status, age group, and gender descriptive analysis

Variables	Pakistan study 1 n (%)	Pakistan study 2 n (%)	p-value
Gender			
Male	52 (48.1)	53 (58.9)	0.25
Female	56 (51.9)	37 (41.1)	
Age group			
6-12 months	38 (35.5)	32 (35.6)	
13-19 months	40 (37.4)	40 (44.4)	0.62
20-24 months	29 (27.1)	18 (20)	
Nutritional Status			
Wasted	34 (31.5)	19(21.1)	
Stunted	27 (25.0)	33 (36.7)	0.12
Normal	47 (43.5)	38 (42.2)	

Data are presented as frequency (percentage), Pearson chi-square (p-value 0.05)

Table 5.2 Anthropometric measurements of the study population from study 1 and study 2

Variables	**Pakistan Study 1**	**Pakistan Study 2**	***p*-value**
Age (Months)	15.7 ±5.4	15.1 ± 4.8	0.66
Weight (kg)	8.8 ± 2.1	7.80 ± 1.0	0.00*
Height (cm)	75 ± 8.1	73.6 ± 4.8	0.22
MUAC (cm)	12.7 ± 1.1	12.1 ± 0.3	0.00*
BMI		14.3 ± 0.4	
WHZ	-0.8 ± 2.3	-2.20 ± 0.9	0.00*
HAZ	-1.5 ± 2.1	-1.80 ± 1.4	0.48*
BMIZ	-0.7 ± 2.4	-1.62 ± 0.6	0.00*
Skinfolds	N/A		
Triceps		4.91 ± 0.6	
Sub-scapular		4.92± 0.7	
SDS Triceps		-2.51 ± 0.7	
SDS Sub-scapular		-1.60 ± 1.0	

Data are presented as mean ± SD, WHZ; weight for height z score, HAZ; height for age z score, BMIZ; weight for age z score.

5.3.2 Validity of MUAC using weight for height (wasting) standard

In the Table below, the sensitivity of MUAC<12.5 is presented to identify the wasting in both Pakistani datasets. MUAC cut off <12.5 showed more than 65% sensitivity for wasting in Pakistani dataset 1. However positive predictive value to identify truly wasted children was 46%.

Table 5.3 MUAC in relation to nutrition status stratified by country (For Pakistan Study 1 and before and after study) Data is row % (N)

Pakistan study 1	**Wasted**	**Stunted**	**Normal**	**p-value**
MUAC <12.5cm	45.8 (22)	29.2 (14)	25.0 (12)	0.001
MUAC >12.5cm	20.0 (12)	21.7 (13)	58.3 (37)	
To detect wasting (BMIZ<-2SD)				
Sensitivity	65%			
Positive predictive value	46%			
Pakistan study 2				
MUAC <12.5cm	21.8 (19)	36.8 (32)	41.4 (36)	0.001
MUAC >12.5cm	0	66.7 (2)	33.3 (1)	
To detect wasting (BMIZ<-2SD)				
Positive predictive value	21.8%			

5.4 Discussion

5.4.1 Principal findings

This study assessed the diagnostic performance of MUAC to identify acute malnutrition in two sets of populations aged 6–24 months from Pakistan. Within both data sets, the current MUAC cutoff for wasting captured more than two-thirds of truly malnourished children, but for every true case, it also identified a false positive case.

In study 2 we further found that only 22% of these children identified as MAM using MUAC suggesting that 78% of those offered treatment were not truly malnourished.

Relying on MUAC only to identify malnutrition in the community remains arguable, as more high-risk wasted children would be missed from early identification and, subsequently, treatment in underdeveloped settings. It also means that many children who are not truly malnourished are being put into treatment, which is a waste of resources.

5.4.2 Comparison with Prior Research

Previous studies have informed the use of traditional anthropometric measurements among children to understand the nutritional status of children in low-and-middle-income countries (De Onis and Habicht, 1996)(WHO Multicentre growth reference study group, 2006)(Picot *et al.*, 2012). This study provides information on the yield and the determinants of MUAC in Pakistani children. Asim et al. (2018) review paper on child malnutrition in Pakistan reported that most studies used the World Health Organization (WHO) weight for age, age for height, and height for weight Z-score method to assess malnutrition among children in Pakistan (Asim and Nawaz, 2018).

With respect to SAM, morbidity is strongly associated with both MUAC<11.5 and WHZ-3 (Briend *et al.*, 2012a), and therefore it is critical to have a valid measure for early identification of both states. As per the treatment guidelines for wasting, MUAC measurements have been considered a valid and simple screening tool to identify wasted (SAM & MAM) children under five years of age. This means that with the current guidelines of WHO, updated in 2013, using only MUAC at the community level

to screen for wasting, around a third of children with a WHZ<- two are missed and left without treatment. If these findings are representative of other populations, the implementation of the current guidelines on a global scale would mean that a significant number of children with WHZ-2 could be missed by screening with MUAC only. These findings are aligned with literature that tested the validity of MUAC in some other population sets, which found an even more extreme lack of agreement. Laillou et al. l. Conducted a secondary data analysis of different surveys, which included more than 11,000 Cambodian children, to assess the sensitivity of using MUAC to identify waste. The study reported that relying on the WHO cutoff for identifying acute malnutrition can miss 90% of children with severe wasting (Laillou *et al.*, 2014).

Similarly, Lamsal et al. research on the accuracy of using mid-upper arm circumference to detect wasting among children aged 6–59 months in Nepal reported that the MUAC has a lower sensitivity compared to weight-for-height z-score (WHZ), indicating it can detect only a small proportion of the total number of children aged 6–59 months who are wasted (Lamsal *et al.*, 2021).

Chomtho and colleagues reported that MUAC showed a strong association with fat mass among children but a poor association with fat-free mass or overall weight (Chomtho *et al.*, 2006), which is desirable as it is a fat mass that best reflects low nutritional reserve. WHZ cannot discriminate between fat and lean body mass and therefore reflects association with both fat mass and lean body mass (Wells *et al.*, 2006). In our study two, we found that a quarter of children with a low MUAC were stunted rather than wasted, which is supported by literature as study results from Guatemala highlight the need to include MUAC and WHZ as diagnostic criteria for wasting with a high prevalence of stunting, due to MUAC identifying stunted cases as wasted (López-Ejeda et al., 2022).

MUAC is easier to use in community settings than other anthropometric measurement methods. However, it has three problems when used with MAM children 1/It misses many truly wasted children 2/ It identifies some children who are stunted but not wasted who are less likely to benefit from intervention 3/ It also identifies children who are not stunted or wasted who are very unlikely to benefit from intervention. If

many children are incorrectly considered thin, this leads to unnecessary nutritional support, poor use of resources and an overburdened healthcare system.

For screening of acute malnutrition at the community level, we propose a two-step screening procedure, which includes using MUAC to identify cases in the community and later weight for height at the health facilities to ensure only acutely malnourished children are offered treatment. Higher cutoff values may be further assessed as this will screen out normal children but still improve the sensitivity of MUAC screening.

Researchers in low-middle-income countries should consider further exploring how bony width varies by country in healthy children, height, age, sex, MUAC and nutritional status as predictors.

Chapter 6 Feasibility assessment of the provision of targeted nutrition advocacy messages through primary healthcare in Punjab, Pakistan

6.1 Introduction

A systematic review including sixty-four cross-sectional, seven cohorts, one qualitative and one case–control study with a total of 125,326 children and 5705 mothers or caregivers reported that the majority of complementary feeding practices of Pakistani families were not meeting WHO Infant and Young Child Feeding (IYCF) standards and the most frequent family-level barriers reported were cultural beliefs and lack of maternal knowledge regarding complementary feeding (Manikam, Sharmila, *et al.*, 2018). Thus, nutrition counselling for mothers/caretakers of malnourished children is an important area to consider for the treatment and prevention of malnutrition. Nutrition counselling has conventionally been part of all nutrition programmes in lower-middle-income countries (LMIC).

Nutritional counselling generally aims to interpret nutritional assessment and the nutritional requirements of the population. This is two-way communication, where healthcare providers share information related to nutritional assessment/nutritional requirements with patients and discuss the possible behaviour changes required to improve nutritional outcomes. Despite the importance of nutritional advocacy, it remained weak, particularly with a focus on the utilisation of locally available nutritious foods to improve complementary feeding practices, when compared with advocacy for improved breastfeeding practices (Piwoz, Huffman and Quinn, 2003).

A study conducted to evaluate the dietary advice being delivered by United Nations and other international organisations, paediatric associations and national programmes globally quoted that one of the respondents reported, "We are facing a capacity crisis in nutrition as nutrition programmes are not given priority at policy and implementation level. There is negligible emphasis given to preventive programmes. Donors prefer quick-fix solutions favouring micronutrient supplementation and ready-to-use foods, spreads, and sprinkles instead of addressing the root causes of undernutrition." (Ashworth and Ferguson, 2009b). Similarly, another influential narrative review reported that growth monitoring along with

nutrition counselling in several small-scale studies from Nigeria, Jamaica, India (Narangwal and Jamkhed), and from large programmes in Tanzania (Iringa), India (Tamil Nadu Integrated Nutrition Project), Madagascar and Senegal had improved nutritional outcomes compared to those who were not part of these interventions (Ashworth, Shrimpton and Jamil, 2008a). The same review reported that large-scale programmes from India (Integrated Child Development Services) and Bangladesh (Bangladesh Rural Advancement Committee and Bangladesh Integrated Nutrition Project) found that without a strong nutritional counselling component, other interventions like growth monitoring has found to be not significantly affecting nutritional outcomes among the malnourished population (Ashworth, Shrimpton and Jamil, 2008a). To make counselling effective, caregivers must be exposed to frequent, simple, uniform, age-appropriate messages and an opportunity for interaction between caregiver and counsellor. The study further suggested that in order to make a mother actually spare her time to follow the instruction, it requires expertise in counselling skills for healthcare staff.

Targeted nutrition counselling, if delivered appropriately, can be a cost-effective solution to address malnutrition in LMICs (Kulwa *et al.*, 2014). Provision of appropriate complementary food, with or without nutritional education, and maternal nutritional counselling alone can lead to a significant increase in weight and height in children 6-24 months of age. Targeted counselling interventions can help reduce the risk of malnutrition in developing countries, as the literature suggests that culturally appropriate group nutrition education, individual counselling, interpersonal communication, home visits and mass media advocacy campaign has resulted in positive outcomes regarding child nutrition. Bhandari et al. reported small but significant improvements in length gain among groups receiving counselling (mean difference 0.32 cm); although weight gain was not affected, energy intake from complementary foods was reported to be significantly higher in the intervention group children at nine months (Bhandari, Mazumder, Bahl, Martines, Robert E Black, *et al.*, 2004; Zhang *et al.*, 2013). However, the content and delivery mechanisms of the messages have not been evaluated. A systematic review including RCTs and CRTS to assess the effectiveness of nutrition training of healthcare providers towards improvement of nutritional outcomes of 6 to 59 months old children reported that nutrition training resulted in a modest improvement in feeding frequency, dietary

diversity, and energy intake. However, no changes in growth outcomes are reported (Sunguya *et al.*, 2013). An RCT in Bangladesh assessed the effect of nutritional counselling with reference to the management of MAM (Roy *et al.*, 2005). The study reported that both mean weight-for-age length-for-age z-score of the intervention group were significantly increased after intervention) (Roy *et al.*, 2005). In summary, while studies reported nutritional counselling resulted in behaviour change, there is a lack of evidence that nutrition counselling results in catch-up in length among stunted children (Ashworth and Ferguson, 2008).

As part of our research project, an International Complementary Feeding and Eating Tool (ICFET) was developed to assess the feeding and behavioural characteristics of 6 to 24-month-old children. This tool has been designed to identify areas of concern about young children's eating and feeding behaviours in different settings. The tool contains parameters to assess food refusal and avidity as feeding behaviour outcomes. As nutrition counselling is being delivered by the IRMNCH programme in Punjab, we have planned to use this opportunity to assess the feasibility of using the ICFET for delivering targeted nutritional advice through a primary healthcare setting. This study was therefore planned to assess:

1. The current nutrition counselling practices of primary healthcare workers and
2. The feasibility of delivering targeted nutrition counselling using ICFET in primary care health facilities

6.2 Material and methods

6.2.1 Study setting and population.

This feasibility study was carried out in primary healthcare facilities of Lahore, Pakistan (detail provided in Chapter 3). The primary healthcare structure consists of two types of health facilities. A Basic Health Unit (BHU) serves up to 25,000 people with basic medical and surgical care, preventive services, and maternal and child healthcare services. A Rural Health Centre (RHC), with an additional facility of 10-20 inpatient beds, dental and ambulance services, serves a catchment population of up to 100,000 people. The table below represents the service delivery model of these facilities (P&SHD, 2022).

In primary healthcare facilities, the Lady Health Visitors (LHVs) is a cadre responsible for delivering curative and promotive nutrition services. Skilled Birth Attendant (SBA), who is also a Lady Health Visitor (LHV), is often referred to as a "Skilled Birth Attendant LHV" or "Skilled Birth Attendant Lady Health Visitor." However, it's important to note that terminology and job titles may vary across different regions and healthcare systems. In Pakistan, LHVs receive training in midwifery for the 2-year training programme and are registered skilled healthcare providers, known as skilled birth attendants (PNC, 2014). For the feasibility study, the target population was LHVs working in primary healthcare facilities.

6.2.2 Study Design

This study was conducted in collaboration with P&SHD Punjab and IRMNCH&N programme Punjab. The interview guide for this study was meticulously designed through a collaborative process involving consultation with the Integrated Reproductive, Maternal, Newborn, and Child Health (IRMNCH) programme. Additionally, we thoroughly reviewed the training modules and health facility staff job descriptions to ensure the guide's relevance and comprehensiveness.

The primary objective of the interview guide was to evaluate the routine practices employed by health facility staff in delivering nutrition-related messages to mothers of malnourished children. Simultaneously, we aimed to explore the feasibility of implementing Integrated Child Feeding and Engagement Therapy (ICFET) to provide targeted nutritional messages to mothers attending these health facilities. Through this interview guide, we sought to obtain valuable insights into the current approaches utilised in conveying nutrition-related information to mothers. Additionally, we aimed to assess the potential for integrating the ICFET into existing practices. The questions within the interview guide were carefully crafted to gather in-depth data, allowing for a comprehensive analysis of the effectiveness and viability of adopting the ICFET approach in this context. By conducting these interviews, we aimed to gain a holistic understanding of the challenges and opportunities associated with implementing such a strategy, ultimately contributing to the enhancement of nutrition-related interventions and maternal education in health facilities.

The selection criteria included LHVs, who are involved in nutrition-related service delivery and received training on nutrition designed by UNICEF. The provincial office of the programme nominated all healthcare providers to be included in the study.

For interviews, nominated LHVs by the programme at their respective health facilities or in their monthly meeting at the provincial office were approached by the researcher and were asked to participate in interviews related to the feasibility of targeted nutrition counselling.

Potential study participants were approached information sheets were shared for consent after a verbal account of the study by the researcher in the local language (Appendix 10 & 11). An information sheet in the local language was also provided to the participants for future reference. LHVs who agreed to participate in the study were required to sign a consent form. All participants were provided with a copy of the information sheet and consent form. LHVs were given time to ask any questions related to the study.

After obtaining the consent, participating LHVs were taken to a separate private place, where an in-depth session of the interview was conducted.

6.2.3 Questionnaire Development

The structured predesigned questionnaire used to interview the Lady Health Visitors (LHVs) was developed through a comprehensive process. This process involved reviewing the existing policy document of the Department of Health, analysing job descriptions of the staff members, conducting observational visits to health facilities, and engaging in discussions with program managers.

The initial step in questionnaire development was a thorough review of the policy document issued by the Department of Health. This document provided valuable insights into the guidelines and recommendations pertaining to nutrition counselling practices within primary healthcare settings. By aligning the questionnaire with the policy document, the researchers ensured that the questions were relevant and addressed the key areas of existing practices.

To gain a deeper understanding of the roles and responsibilities of the staff members, the researchers carefully analysed the job descriptions defined by the Department of Health for LHVs working in primary healthcare facilities in Punjab. This analysis helped identify specific aspects of nutrition counselling and the scope of their duties. The information obtained from these job descriptions further informed the development of the questionnaire, ensuring its alignment with the LHVs' roles and expectations.

Observational visits to various health facilities were conducted to directly observe the existing practices and interactions between LHVs and patients. These visits provided valuable insights into the current nutrition counselling practices, including strengths and limitations. By observing real-life scenarios and interactions, the researchers were able to tailor the questionnaire to capture the relevant information effectively. Additionally, discussions with program managers played a crucial role in shaping the questionnaire. These discussions allowed for a comprehensive understanding of the program's objectives, challenges, and potential areas for improvement. The insights gained from these conversations were integrated into the questionnaire to ensure its relevance and effectiveness. By incorporating information from the policy document, job descriptions, observational visits, and discussions with program managers, the researchers developed a structured predesigned questionnaire that covered existing nutrition counselling practices and explored the strengths and limitations of using the Infant and Child Feeding Questionnaire (ICFET) in primary healthcare settings.

6.2.4 Sample size and recruitment

Originally it was planned to conduct in-depth interviews with primary healthcare staff before the start of the planned trial described in Chapter 4. Pre-pandemic, three interviews were conducted, and later, after revision of the tool further, five interviews were completed in the post-pandemic phase resulting in a total of 8 interviews.

The decision to record the interviews in writing instead of using voice recordings was made due to the staff members' reluctance to be recorded. Despite the initial plan to conduct voice recordings, the staff members did not agree to this method. As a

result, the researcher adapted by ensuring that every response was meticulously documented in writing. In this case, the researcher chose to type the answers directly into a laptop. Although the staff members understood both English and Urdu languages, they were more comfortable expressing themselves in Urdu. To accurately capture their responses, the researcher translated their answers into English before transcribing them. However, some parts of the interviews were recorded in Urdu to preserve key terminology and phrases in their original form.

The decision to adopt this method was driven by the necessity to respect the preferences and comfort levels of the staff members. By accommodating their language preferences and ensuring their responses were accurately recorded, the researcher aimed to create a conducive and respectful environment for data collection.

6.2.5 Ethics Approval

Ethics approval was first sought from Glasgow University Ethics committee (Project No: (200190020) (appendix 9). Further to this, to get ethics clearance to work with human subjects in Pakistan, ethics permission study was sought from the Punjab provincial chapter of National Bioethics Committee (NBC) of Pakistan (appendix 7).

6.2.6 Data Management

Data was recorded in hard and soft copies. The data was accessible to the researchers (PhD students) for her project and the PI for research purposes. All data generated in a soft form was kept in a password-secured computer by the student during the period of data analysis and will be eliminated by the student when the project is finished. The PI will keep the data in the password-protected university server password secured and will be accessed just by the PI. All paper-generated questionnaires and consent forms will be kept in a locked cabinet. All data will be stored for ten years and then deleted.

After interviews were completed, subjects were allotted unique ID numbers. Interviews were transcribed in English direct onto a laptop while the participants responded.

6.2.7 Data Analysis

After data collection, the collected responses were subjected to a data-cleaning process, which involved reviewing the responses for accuracy, completeness, and relevance. Any irrelevant or incomplete responses were rectified or removed to ensure the data's quality and reliability. After cleaning the responses, thematic analysis was used for analysing the cleaned data. The process of thematic analysis involved a systematic examination of the responses to identify recurring patterns, themes, and underlying meanings.

6.2.7.1 Familiarisation with the Data

The researcher began by immersing themselves in the data, reading and re-reading the collected responses to comprehensively understand the content. This familiarisation made the researcher acquainted with the participants' perspectives and experiences.

6.2.7.2 Coding and Theme Generation

The responses were labelled and categorised into different themes. The coding process involved assigning descriptive codes to sections of the responses that represented similar ideas or concepts. These codes were then grouped together to form initial themes. The generated themes were reviewed, refined, and revised through an iterative process. The researcher compared the codes and themes to ensure they accurately reflected the data and captured the essence of the participants' viewpoints relevant to the questions asked. Once the themes were established, the responses were organised against each theme and involved grouping relevant responses together and summarising the participants' key points and perspectives under each theme.

6.2.7.3 Analysis and Interpretation

The researcher analysed the organised themes to explore the relationships between them, identify variations within each theme, and interpret the findings considering the research objectives. This involved considering the context, content, and underlying meanings of the responses. Data was analysed systematically and

anonymously, building on predefined thematic areas as per the interview tool. Quotes and phrases in italic were stated by participants and are presented to strengthen the paraphrasing.

Based on the analysis and interpretation of the themes, the researcher concluded and generated insights relevant to the research question. The conclusions reflected the major findings, emerging patterns, and significant aspects identified through the thematic analysis.

6.3 Results

Results of the study will be presented in respective themes drawn from the interviews. A total of eight interviews were completed in the agreed timeframe of the study. Participating LHVs reported that they worked in primary healthcare facilities. The duration of their experience working at primary healthcare facilities ranged between 3 to 12 years. Participants reported that they had been working in primary healthcare facilities for the last three to twelve years. All of them were reported to be responsible for delivering nutrition services, including nutrition advocacy and behaviour change messages. Seven out of eight shared that they received specific nutrition training organised by IRMNCH and UNICEF. Three of the seven also received refresher training on nutrition. The duration of training described by LHVs ranged between 3 to 5 days.

6.3.1 The capacity of delivering counselling/training received

All of them believed that their capacity to deliver nutrition messages is limited as they have not studied technical nutrition content as part of their midwifery course. However, they further shared that the training they received provided them with basic skills to deliver key nutrition messages. They all shared that they received training on basic nutrition and Infant Young Child Feeding (IYCF) organised by IRMNCH & N programme Punjab in collaboration with UNICEF. Topics mentioned by participants for training included basics of nutrition, nutrients/deficiencies, breastfeeding including right attachment positions, treatment of infections, Community management of acute malnutrition (CMAM) which included anthropometry, treatment of SAM and MAM, and delivering nutritional counselling on

a one-to-one basis. On a question about the capacity to deliver targeted nutritional advice, one of the participants shared,

> *"To be honest, we never get enough time to use those skills, as usually there are loads of patients for us to see. Mothers are also in a rush and are more interested in getting nutritional supplements rather than advice".*

On further discussion, it was shared that the training manual contained detailed information on how to deliver effective counselling.

6.3.2 Routine Nutritional Advice Healthy vs Malnourished Children

LHVs were asked to describe the content of their routine nutritional advice to understand the current practice for delivering nutrition counselling. All of them shared similar topics as their existing practice for nutritional advice. The routine nutritional advice delivered by these healthcare providers included the following topics.

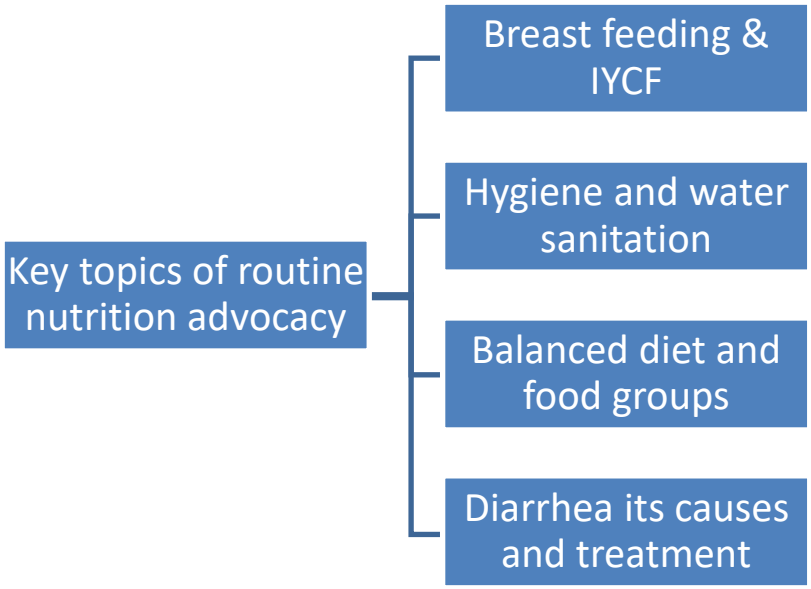

Figure 6.1 Key topics that are included in current nutrition advocacy practice of LHVs

Under this thematic discussion, all LHVs mentioned that breastfeeding-related counselling includes all major components in accordance with WHO guidelines. These are reported as early initiation of breastfeeding, exclusive breastfeeding for six months and continued breastfeeding till two years of age.

A few of them also mentioned mothers reporting sore nipples with relevance to breastfeeding. LHVs further reported that some taboos related to breasts are common in local settings. During the discussion, LHVs shared that they are aware of some of these misbeliefs associated with breastfeeding. For example, one of them stated,

> *"Mothers often report that their breast milk is poisonous as if an ant is put into milk, it dies".*

On further discussion about addressing taboos, it was shared that, as per their routine practice, they did not address these taboos unless a patient came up with any particular questions related to misbelief.

A balanced diet was mentioned by LHVs as part of their nutrition counselling; however, none of them could describe the balanced diet. For instance, one of them shared that,

"Balanced diet ka matlab hay her tarah ke khorak"

which means a balanced diet is a mix of diets; moreover, it was observed that the staff themselves were not clear about the concept of food groups or balanced diet; thus, the message was not clear enough for illiterate mothers to understand the term balance diet. Similarly, hygiene and sanitation were mentioned as part of routine nutrition counselling. Key messages related to hygiene included hand washing and boiling water before drinking. On further probing related to the use of feeding bottles and their hygiene, the participants responded that we encourage mothers to breastfeed, but they do use bottles. One of the LHVs said,

"*Ghurbat bohat hay mothers jub kam k liay kahi jati hay to oper ka dodh zarori hay*".

Translation: most mothers coming to this health facility here come from poor backgrounds; when they go out for work, bottled milk is given to babies.

On further discussion around the difference between nutritional messages for healthy and malnourished children, it was observed that participants were not clear about different topics to be delivered to mothers of healthy and malnourished children. Topics mentioned under these areas by the participants are presented in the figure below.

Treatment of diarrhoea with zinc and oral rehydration salts is also mentioned by them. All of them believed that diarrhoea is one of the key reasons for malnutrition.

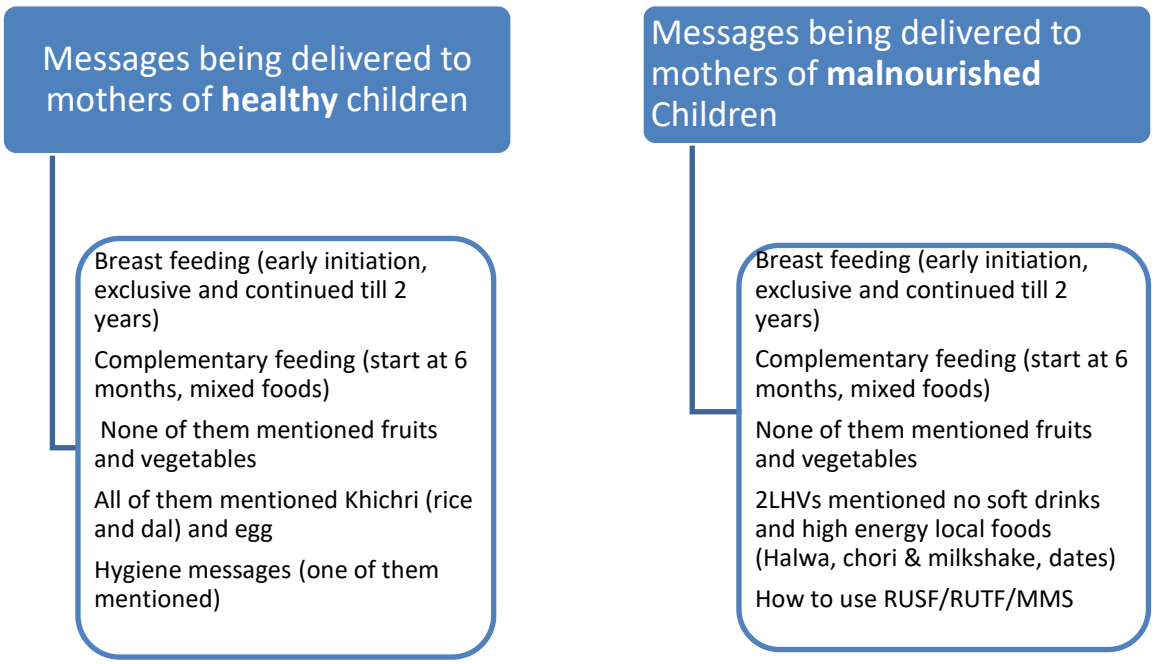

Figure 6.2 Messages being delivered to mother by lady health visitors

6.3.3 Assessment of eating and feeding problems

Under this section, participants were asked if they ever came across any eating and feeding-related behavioural problems. From the discussion, it was observed that "Eating and feeding behaviours" appeared to be a new terminology for participants. However, participants' responses included the following broader themes.

6.3.4 Why do you think your child got malnourished?

Participants reported that to assess the eating and feeding behaviours, they ask mothers coming to a health facility what they think are responsible factors contributing to their child's nutritional status. The respondents then reported that, as a response majority of mothers share that repeated episode of infections is the main factor responsible for their child's nutritional status. Therefore, participants believed that treatment for prevalent infections or referring the child to the hospital could prevent getting malnourished.

6.3.5 Age-appropriate feeding

Another respondent reported that the foods that the child consumes are helpful for her to understand eating and feeding problems. She further elaborated that, for example, if the child is already six months old, questions about the initiation of solid foods will be helpful in understanding the feeding problems. Subsequently, the respondent shared that if the mother has not, a message to start a soft diet is given. Sometimes mothers share that their child is not eating anything or eating clay and other non-food substances, indicating micronutrient deficiency, so MMS is given.

6.3.6 Not aware of feeding problems

One of the respondents reported, "Usually, there are no feeding problems, or at least I am not aware of any problems in this community". She further believed that the population around this health facility are labourers in factories here and are very poor. So, they have limited choices to feed the child.

6.3.7 Pica (urge to eat non-food items)

Participants reported that one of the common problematic eating behaviours reported by mothers of malnourished children is the child's urge to eat non-food substances. These included complaints of children eating mud, tissues, chalk, and cement.

6.3.8 Poor complementary feeding behaviours

Participants reported that poor complementary feeding practices are common among mothers visiting these health facilities. One of the respondents reported that the majority of mothers shared that their child is only being offered tea and roti (a piece of bread). Respondent further stated,

"Akser main apnay bacho ko roti ka tukra day deeti hain bacha wo kha e nai skta"

Translation: "It is very common among mothers to give a piece of bread in the hand of a child as a complementary food, which child usually cannot eat".

Participants of the study further briefed that mothers coming to health facilities receive information about locally available nutritious food options for complementary feeding.

6.3.9 Poor hygiene practices

Participants of the study shared that the hygiene practices of the majority of the mothers coming to facilities are observed to be very poor. During the discussion, it was further shared that although water and sanitation facilities are available in surrounding areas of health facilities, however not washing hands while preparing food or feeding the child is a common practice of mothers.

6.3.10 Information, education, and communication (IEC)/guiding material to deliver nutrition counselling.

There was a mixed response on the availability/following of any standard IEC material for delivering nutrition counselling.

A pictorial booklet called "Sehat ke Dastak" (Translation: Knock for Health) was available with some of the LHVs at health facilities; in this booklet, there are messages for antenatal care, postnatal care, breastfeeding, maternal nutrition (that covers taking iron folic acid tablets, food diversity and taking care of lactating and pregnant mothers). There are messages on complementary feeding from 6 months onwards. The booklets contain messages on food groups and recipes to start with solid foods. However, the subjects shared they do not use any IEC/guiding material to deliver nutrition counselling. They further shared they do not deliver any planned sessions of advocacy but only give advice to those who they think need it. One of the participants stated,

"We are told by our provincial office that we must tell mothers about good nutrition, breastfeeding and a balanced diet. I don't have any material specifically for counselling".

Further, if mothers ask any specific question related to feeding children, the respondents stated that they respond as per their knowledge and capacity.

6.3.11 Time spent delivering nutrition messages to mothers of malnourished children

Participants were further asked about the time, on average, they spent on nutrition counselling. One of the participants stated that,

"To be honest, there is a very short time for us to assess, give medicine and tell mothers how to take care of the child. But even if we have time, mothers are keener to get RUTF or any other nutrition supplement than advice".

Usually, it does not take long, as usually mothers come for their own antenatal and bring the child with them and share their concerns regarding the health of their child. Because most of the children who are even severely malnourished coming to these facilities are presented without any medical complication. On the other hand, sick children come to see doctors only, while doctors are not trained in the provision of nutrition services.

The overall impression shared by staff was that they do not deliver any planned counselling sessions. Instead, they just deliver standard messages related to 1. Breastfeeding 2. Complementary feeding 3. Use of RUTF/RUSF 4. Washing hands and cleanliness, 5. and how to use RUTF and other nutritional supplements. One of the staff members elaborated,

"When malnourished children come to our facility, we screen them and see if they are SAM or MAM. Once identified, then they are registered as severally acute malnourished (SAM) children in Outpatient Therapeutic Programme (OTP), and mothers are provided with RUTF".

Messages for RUTF are:

1. Wash your hands before feeding RUTF

2. Give loads of boiled water with this food

3. Continue breastfeeding

4. Only feed this RUTF until the child recovers completely

For Moderately acute malnourished (MAM) children, if MMS is available, mothers are given 14 packets of MMS for 14 days and are told to mix the powder in purees, for example, yoghurt, custard and chori (mashed bread in oil) or Halwa (cooked semolina with oil and sugar). (This whole process takes around 30 minutes)".

6.3.12 Maternal response to advice provided by health facility staff

There was a general agreement that mothers do listen to the advice provided by health facility staff, but following the advice varies with type of advice mainly due to poverty, lack of time due to big family size, social issues, and lack of education were the reasons mentioned by LHVs for non-compliance. One of them mentioned that advice related to making local foods to improve their child's health is one of the advices that has been followed by mothers. But in general, advice related to stopping bottle feeding is less likely to be followed mainly due to their individual circumstances. For example, if a mother has to work in fields or in a factory, she must leave the baby for several hours. None of them mentioned any training/information/messages related to breast milk expression/storage or utilisation. But if they are told to make (chori and halwa) local nutritious foods, they will usually follow it. Also, various other factors, including maternal education, HH poverty, family size (more than three under-five children), and maternal health, influence maternal practice to follow nutritional advice. One of the participants mentioned,

"Majority of women living in surrounding areas of this health facility cannot follow my advice because they are very poor, and their husbands don't let them opt for family planning, and they have on average 4 to 5 children, which makes it hard to manage time".

Another example quoted by a participant related to family planning messages,

"Mothers listen attentively but follow as per their own circumstances; one good example is messages related to family planning; usually, mothers listen and appreciate the key messages related to the benefits of healthy timing and spacing

between pregnancies, but then their decision is strongly influenced by their husbands or mother-in-law".

6.3.13 Opportunities to follow up with mothers regarding nutrition messages delivered.

Without any existing record-keeping mechanisms, follow-up of nutritional counselling delivered to mothers is almost impossible in primary healthcare settings in Punjab, Pakistan. Subjects mentioned that for malnourished children record for medicine is maintained at a health facility, but otherwise record of every child to follow-up is not maintained.

Participants mentioned that follow-up related to nutritional messages is usually done based on our memory. Generally, mothers 'response is that whatever advice was given is being followed. However, no formal record or verification can be done at this level. So, participants believed it is challenging to get the right information from mothers in this regard.

One of the participants mentioned that,

"We do not do any systematic follow-up, but in any specific case which repeatedly comes to the health facility, we ask them why they don't follow the advice, and they will always have this answer, that mothers-in-law or husbands are not letting them change the practice".

6.3.14 Feasibility of delivering individualised, tailored nutrition advocacy with the help of (the ICFET) tool/training material

A general agreement among all participants was that delivery of targeted nutrition advice is quite possible but will require further capacity building, additional human resources and record-keeping mechanisms.

They believed once the system is designed and introduced, this will ultimately be less time-consuming, too, as ICFET will be helpful in identifying the exact key messages to be delivered to any specific mother. But it will be equally important to have a better record-keeping mechanism. Otherwise, every time child turns up is a new child

for health facility staff, as most of the time, mothers do not bring medical records or documents.

Subjects also mentioned their limited capacity to deliver technical nutrition advocacy; they believed that technical nutrition training related to key nutritional problems is required to be designed and delivered to this level of staff. One of the staff members mentioned that she believes that

“I think I know problems, but I don’t know what I should exactly tell mothers that will help them”.

Staff members were of the opinion that due to multiple tasks, including overall OPD, ANCs, PNCs, and normal delivery,

"If a patient for normal delivery comes to the health facility, this usually takes us to be engaged in the labour room for around 3 to 5 hrs."

making it challenging to deliver nutrition counselling based on individual requirements. So, the provision of extra trained HR support can be a practical solution to deliver targeted nutrition counselling, as usually there are long waiting ques and even if some more time is spent on counselling one mother, patients do not like waiting so an extra staff will be required to make it possible. As my job description includes outpatient services and assisting normal deliveries. Provision of reproductive health services, including antenatal, postnatal, and assisted skilled birth deliveries, are very time-demanding services.

6.3.15 Feasibility of using ICFET in a local setting to deliver targeted nutrition messages

When showed unfilled and filled ICFET to participants and inquired about the feasibility of using the tool in a primary healthcare setting, generally, the response was that ICFET could be a great tool to identify the key areas of concern for the delivery of nutrition counselling. However, they shared the following concerns:

1. The tool is too long and complex to be filled in a busy health facility in the absence of a queue system.

2. 24 hrs recall and how often the child eats different foods is helpful. As that will enable me to understand the child's intake, however right information about portion size is hard to get.

3. Questions about food refusal and food liking were reported to be new for staff. Subsequently, they share uncertainty about how to help mothers identified with food refusal/overeating.

4. Participants shared they are not sure how helpful questions related to maternal stress and actions of children when food is offered for them to deliver nutritional messages. There was a strong perception among participants that communities coming to these facilities are very poor and hardly have any food to offer. Also, in common, there are mostly more than three under-five children, so they wonder if even mothers will have reliable information based on their observations.

5. Subjects shared their concerns regarding record keeping of this tool mainly due to lack of time and system.

6. One of the main reasons for poor nutrition is not following healthy timing and spacing between pregnancies. This tool does not ask about this.

7. Questions related to sleeping hungry are very insensitive, and mothers will feel bad if that is being asked at health facilities; also, if there are patients coming from food-insecure households, there is no support a health facility can offer in this regard.

8. Information related to cultural traditional taboos (like they don't give an egg to a child till he/she is one year. (They won't even if they are being asked by a healthcare provider; there is the possibility that one out of 10 women will try it).

9. Concerns regarding food refusal and food liking questions, such as if a child is not eating enough, there could be multiple reasons. This can be because the child may simply have less appetite due to repeated infection or usually anaemia in case of malnutrition. So, it will be challenging to identify exactly one message to give the mother who shares that her child starts crying (or any of the other refusal-related behaviours asked in the questionnaire).

6.3.16 Suggestion to adopt ICFET in a local setting

One of the common suggestion participants shared for the adoption of ICFET in a local setting was to shorten the tool. Participants also suggested improving 24hr recall by adding local measures, as otherwise, it is hard for the healthcare provider to estimate the amount of food the child has consumed. Three of the staff members further shared that a flow chart with visual and key messages to guide facility staff will be helpful in identifying the critical issues highlighted by ICFET and delivering targeted nutritional advice. As otherwise, staff at this level has varying capacities, and this will limit the overall impact of counselling.

6.4 Discussion

This chapter assesses the feasibility of delivering targeted nutritional counselling to urban poor women by primary healthcare workers to improve their breastfeeding, child feeding and child caring practices. Nutrition counselling integrated into primary healthcare settings may be an important, sustainable, and cost-effective intervention; however, it is not yet clear which strategies to deliver nutritional counselling are the most effective. Studies have indicated the effectiveness of counselling programs within primary healthcare improves breastfeeding and other infant feeding practices (Haider *et al.*, 2000; Santos *et al.*, 2001; Kimani-Murage *et al.*, 2013). Therefore, nutritional counselling and health education services offered to mothers/caregivers of under two years old children are recommended as effective interventions to improve infant and young child feeding (IYCF) practices, address child undernutrition and therefore reduce the risk of child mortality (Smith and Haddad, 2015; Agbozo, 2016; S Kohli, 2017).

The study was conducted in Lahore, Pakistan, where a routine nutrition programme is being implemented through primary healthcare centres (*http://www.irmnch.gop.pk/overview/*, 2018). Lady Health Visitors (LHVs) are responsible for delivering nutritional services and counselling to the mothers coming to these facilities. Participants of the study shared that although they received training designed by UNICEF and the Department of Health, they are not sure to deliver nutritional counselling on various topics. They further elaborated that in addition to limited capacity, they are also responsible for delivering outpatient and reproductive services, which leaves them with very short time to deliver nutrition-related counselling. Staff further highlighted challenges related to the unavailability of guiding/IEC material, recording mechanisms for follow-up and tools to identify the factors affecting the nutritional status of the child.

A qualitative study conducted by United Nations World Food Programme (UNWFP) in Ethiopia reported. That although most mothers/caretakers reported that they did receive nutrition information from health workers, however, the advocacy did not include how to address the challenges to improve nutritional practices. The same study highlighted the barriers, like traditional feeding practices and socioeconomic factors (Arriola *et al.*, 2020).

Participants, when shown ICFET, shared that they believe this could be a useful tool. But suggested that if a detailed capacity building of staff on ICFET along with guiding material to deliver messages can be provided with additional staff only, then this intervention can translate into desired results. As expressed by the present study participants, the literature reported similar findings about health workers reporting frustration towards behaviour change of women regarding dietary practices (Mangham-Jefferies *et al.*, 2014).

Nutrition counselling is mostly delivered through healthcare workers (Sunguya *et al.*, 2013). However, there are several gaps in the capacity development of staff. In addition, few studies have been done to evaluate healthcare providers' skills in delivering nutritional counselling (S Kohli, 2017).

Participants of the current study highlighted the capacity gaps of primary healthcare to deliver nutrition counselling to mothers of malnourished children coming to primary healthcare facilities in the urban peripheries of Lahore. Similarly, a study conducted in India to assess the capacity, including knowledge and skills, to deliver nutritional counselling of Anganwadi Workers' reported a significant contradiction between the nutritional knowledge and their capacity to translate the technical knowledge into counselling (A Chaturvedi, 2014). In addition, consist to the current study findings, evidence from lower middle-income settings suggests that generally, capacity gaps of staff responsible for delivering nutrition counselling lack the consistency of complementary foods and energy/ nutrient density of complementary foods (A Chaturvedi, 2014; Samuel, Olaolorun and Adeniyi, 2016). As Chaturvedi et al. reported, less than 40 % of staff members could deliver key nutritional messages up to the required level, as very few (12%) portion sizes of complementary foods, 37% on complementary food consistency, 20% on age-appropriate feeding frequency, and 30% on improving energy/ nutrient density of complementary foods in Gujrat.

Participants of the current study reported that in routine similar messages are delivered to mothers of all children coming to primary healthcare facilities regardless of their child's nutritional status. However, mothers registered with treatment programmes for malnutrition also receive messages about the consumption of ready-to-use supplementary foods. Studies to assess the content of nutritional messages for healthy and malnourished children could not be found. Most of the existing literature shows that uniform nutrition advocacy is delivered as part of nutrition programmes in LMIC.

A study assessed the content of the existing nutritional counselling guidelines for managing moderate malnutrition(Ashworth and Ferguson, 2009b). For this, 10 United Nations agencies or donors, 20 international nongovernmental organisations, three paediatric associations, and six national programs were requested to share the information related to dietary advice being delivered through their programmes. Consistent with the findings of our study, they reported that the major focus of the nutrition programmes is on providing food supplements, and counselling messages are unclear and, therefore, likely to be less effective (Ashworth and Ferguson, 2009b). Therefore, it is generally believed that the quality of nutrition counselling is often

inadequate in nutrition programmes (Haider *et al.*, 2000; Ashworth, Shrimpton and Jamil, 2008b).

Participants shared that messages related to early initiation of breastfeeding, exclusive breastfeeding and continued breastfeeding were part of routine nutrition counselling. However, none of the participants in the current study mentioned the expression of breastmilk and other problems and their solutions related to breastfeeding. Similar findings were reported from a cross-sectional study, with an observation checklist to examine Growth Monitoring and Promotion activities and educational/counselling activities undertaken by health workers in Ghana. The study reported that most (95%) health workers shared messages about exclusive breastfeeding, 89% stressed the importance of breastfeeding, and 59% touched on hygiene-related topics. However, only 20% were taught and received guidelines on breastfeeding techniques. None of the caregivers with children below six months were educated on how to express breast milk.(Nsiah-Asamoah, Pereko and Intiful, 2019).

Participants of the current study reported that there are gaps in the availability of comprehensive guiding/IEC material at primary healthcare facilities. Which then results in the delivery of non-consistent message delivery by staff members. Studies evaluating the effectiveness of IEC-supported intervention reported improved timely introduction of complementary food. However, both of the studies did not include an intervention comparison group (Kushwaha *et al.*, 2014; Collison *et al.*, 2015). Similarly, IEC-supported interventions showed improvement in the quantity of food fed to children and the time mothers spent feeding their children was also reported to be increased (Kimmons *et al.*, 2004; Collison *et al.*, 2015).

Consumption of solids has been reported to be at least four times a day in addition to breastmilk after receiving ICE-supported counselling (78% vs 51%) (Kilaru *et al.*, 2005). Similarly, (Roy *et al.*, 2007) reported that the frequency of complementary feeding was significantly higher in the intervention group than in the control group (from 30.4% to 83.8% in the intervention group vs. 31% to 19.4% in the control group.

Another key theme that emerged from the discussion with participants was related to the urge of children to consume nonfood substances. Staff members reported that these included complaints of children eating mud, tissues, chalk, and cement. As per medical definition. urge or habit of eating items that are not food is called pics (Advani *et al.*, 2014). Although pics are reported to occur in patients with iron deficiency, however, causes can include zinc or calcium deficiency too (Advani *et al.*, 2014). Studies report that patients with these habits are reported to consume items such as laundry starch, ice, and soil clay. All these nonfood items, including clay and starch, can potentially bind iron in the gastrointestinal tract, resulting in worsening the deficiency (Roselle, 1970). Similarly, the soil is reported to contain compounds that are responsible for binding iron and zinc (Advani *et al.*, 2014). LHVs are also reported to be unaware of eating and feeding behaviour and force-feeding. However, our earlier studies highlighted that these problems prevail in the country.

Respondents of the present study shared that they only get a short time to deliver counselling services. One of the respondents stated that it usually takes them 30 minutes to complete the registration process for admission to nutrition outpatient, and then they deliver the messages alongside.

Participants of the present study reported that mothers coming to these facilities are keen to get nutrition advice, but then they tend to follow only those messages that are convenient to them. Similarly, a study conducted to assess the quality of care to treat wasting by community health workers reported that mothers/caretakers followed the advice related to the consumption of LNS. But consistent with to present study findings, mothers were reported to find it difficult to follow the advice related to responsive feeding, and in case of complication, despite referral, mothers did not go to the hospital (Puett *et al.*, 2013). The present study reported that participants could not follow up on the messages delivered to mothers, as there are no record-keeping or follow-up mechanisms available at health facilities; This is one of the key gaps that no formal record-keeping mechanism for counselling messages exists in a current primary healthcare setting in Pakistan.

6.5 Limitations and strengths of the study

The present study had several notable strengths. One strength was the collection of data directly from primary healthcare workers in a primary healthcare setting, which ensured that the information obtained was first-hand and reflected the experiences and perspectives of those directly involved in providing healthcare.

However, there were certain limitations in the study. One limitation was the small number of participants recruited, primarily due to restrictions imposed by the ongoing pandemic. These restrictions hindered the ability to reach a larger sample size and may have impacted the generalizability of the findings. Additionally, due to apprehensions expressed by the provincial office, the selection of Lady Health Visitors (LHVs) could not be conducted randomly. The study could only include a selected group of participants based on the guidance and limitations imposed by the provincial office. This limitation should be considered when interpreting the results, as it may affect the representativeness of the findings. Furthermore, although LHVs acknowledged poverty as a significant contributing factor to malnutrition in the area, the participants expressed unease about delving into poverty-related issues in detail. This reluctance to explore poverty in-depth may have limited the comprehensive understanding of the factors influencing malnutrition in the study area.

It is essential to consider these limitations when interpreting the study findings and recognising the potential impact they may have on the breadth and depth of the conclusions drawn from the research.

6.6 Conclusion

The in-depth interviews with primary healthcare service providers in Punjab, Pakistan, revealed significant gaps in delivering nutritional counselling to mothers attending primary healthcare facilities. The absence of rigorous training, informative materials, and clear guidelines raised uncertainties about the effectiveness of nutrition advocacy in both treating and preventing malnutrition.

A strong consensus among primary healthcare workers emerged, emphasising the need for a comprehensive tool to identify the precise causes of malnutrition.

Additionally, there was a call for capacity development to enable the delivery of targeted nutrition counselling at primary healthcare facilities. These findings underscore the importance of empowering healthcare providers with the knowledge and skills to address malnutrition effectively. However, it is essential to note that further evidence from local settings and additional research is needed to understand better how primary healthcare workers can enhance their capacity, allocate sufficient time, and cultivate an interest in engaging in nutrition counselling, particularly in the context of the complex trends of undernutrition, overnutrition, and the double burden of malnutrition. Strengthening these aspects will contribute to more effective and targeted interventions to combat malnutrition.

In conclusion, the study findings highlight the gaps in nutritional counselling delivery at primary healthcare facilities. They emphasise the need for comprehensive tools, capacity development, and additional research to enhance the primary healthcare workers' ability and motivation to provide targeted nutrition counselling, considering the multifaceted nature of malnutrition.

Chapter 7 General Discussion

This research programme was the first in Pakistani settings to assess the multi-dimensions of risk factors for moderate malnutrition. The study aimed to quantify modifiable caring and eating behaviour among malnourished children and assess the feasibility of delivering sustainable, cost-effective solutions. The study design was developed with the hypothesis that ready-to-use foods have the potential to replace home foods. Also, given the taste and energy density of ready-to-use food, child eating behaviours towards home foods will likely be affected.

A series of studies were conducted as part of the research programme. During the literature search, a gap was identified regarding the availability of a standard tool to assess the eating and feeding practices of malnourished children in resource-poor settings (Wright *et al.*, 2021). The first study described in (chapter 2) was conducted in Glasgow among Urdu and English-speaking mothers to identify the best phrases to describe eating avidity and aversion to be used in a new assessment tool.

The phrases showed overall good consistency among different language groups. Thus, most were made part of ICFET, a new tool to identify the modifiable risk factors among infants in low-middle-income settings.

This tool was then used to assess the prevalence of risk factors among healthy and malnourished infants in the peripheries of Lahore, Pakistan. The findings from the study conducted in Lahore, Pakistan, revealed several interesting issues.

7.1.1 Breastfeeding practices

Breastfeeding is widely recognised as a critical factor in promoting optimal growth and development in infants and young children (Corsi, Mejía-Guevara and Subramanian, 2016). It provides essential nutrients, antibodies, and bioactive components that prevent infectious diseases and the child's overall well-being (Li, Fein and Grummer-Strawn, 2010). The combined analysis of data from Pakistan Study 1 and the Cluster Randomized Control Trial (CRCT) revealed no significant association between feed frequency, dietary diversity, and the nutritional status of the children, suggesting that the frequency of feeding and types of food being consumed by children are the same among both healthy and malnourished groups in the study

population. It indicates that there are other factors affecting one set of populations, which might be related to caring practices and feeding behaviours.

However, in the first study, the prevalence of breastfeeding was higher among the healthy group than the malnourished group. The observed difference in breastfeeding rates between the two groups raises important implications for child nutrition and health. The early stop of breastfeeding among the malnourished group may indicate potential barriers or challenges that hinder breastfeeding practices in this population. Several factors could contribute to this discrepancy. Firstly, malnourished children often come from disadvantaged socioeconomic backgrounds with limited access to healthcare services, nutrition education, and support for breastfeeding (Michaelsen, 2000). These barriers may result in decreased knowledge and awareness about the importance and benefits of breastfeeding, leading to a lower likelihood of initiating and sustaining breastfeeding practices.

Furthermore, malnutrition itself can negatively impact breastfeeding rates. Malnourished mothers may experience physiological challenges such as poor lactation, insufficient milk production, or difficulties in breastfeeding initiation and maintenance (Greiner, 1994). These challenges can be exacerbated by maternal undernutrition, which can impair the mother's ability to meet the infant's nutritional needs through breastfeeding.

The early cessation of breastfeeding among some of the malnourished group highlights the need for targeted interventions and support to improve breastfeeding practices in this population. Strategies should address the underlying factors contributing to the lower rates, including improving access to healthcare services, providing nutrition education and counselling to mothers and families, and ensuring adequate support for breastfeeding initiation and continuation. Nutrition programmes to target breastfeeding practices should also consider the cultural and social context in which breastfeeding takes place. Addressing misconceptions, cultural beliefs, and social norms that may influence breastfeeding practices is crucial for promoting and normalising breastfeeding among the malnourished population.

7.1.2 Complementary feeding practices

Our study 1 in Pakistan reported that among the malnourished group, complementary feeding started after seven months was more common compared to the healthy group. The delayed initiation of complementary feeding among the malnourished group raises concerns about the potential impact on these children's nutritional status and growth. The timely introduction of complementary foods is crucial for meeting the increasing nutritional needs of infants, as breast milk alone may no longer provide sufficient nutrients. The World Health Organization (WHO) recommends starting complementary feeding at around six months of age to ensure the child's optimal growth, development, and nutritional status (Kramer and Kakuma, 2002). The findings indicating delayed initiation of complementary feeding among the malnourished group are consistent with previous research highlighting the challenges vulnerable populations face in adhering to recommended feeding practices (Black *et al.*, 2013). Various factors may contribute to this delay, including inadequate knowledge and awareness about appropriate feeding practices, food insecurity, cultural beliefs and practices, and socioeconomic constraints. These factors can lead to suboptimal feeding practices, which can negatively impact the nutritional status of infants and contribute to malnutrition. A study was conducted using data from the Pakistan Demographic and Health Survey (PDHS) 2012–2013, including a nationally representative sample of 14,000 reported poor child-feeding practices are prevalent in Pakistan. Aligned with current study findings, the analysis of the PDHS survey reported the delayed introduction of complementary foods and insufficient feeding frequency, affecting one in three children across the country. Furthermore, the data analysis supports the findings of the current study in terms of the consumption of nutrient-rich food groups consumed rarely. The findings further reported poverty and poor access to health and nutrition services in the community as common risk factors for poor child feeding (Na *et al.*, 2017).

Interestingly, the study found that the frequency of food consumption was similar between the healthy and malnourished groups, suggesting that once complementary feeding was initiated, both groups were providing meals at a similar frequency. However, it is important to note that the frequency of food consumption alone may not explain the overall quality and diversity of the foods consumed. These are important factors in ensuring adequate nutrient intake and healthy growth.

7.1.3 Eating and feeding behaviours

Avidity scores were calculated based on the child's eagerness or enthusiasm for eating. A study using data from this study compared avidity scores among children from various countries found that children in Pakistan had the lowest avidity (Wright et al.,2020) and that the strength of correlations with weight among the avidity scores varied across countries, with the strongest correlation observed in the UK and the weakest in Pakistan and Guatemala (Wright *et al.*, 2021).

The findings of the first study conducted in Pakistan showed no significant difference in avidity scores between malnourished and healthy children in a similar setting, suggesting that malnutrition may not be directly associated with a decreased interest in food or lack of appetite. However, it is essential to acknowledge that various factors, including cultural, environmental, and dietary influences, maternal perceptions and feeding practices, could influence variations in avidity scores across different studies and populations.

One crucial aspect to consider is the possibility that the lack of difference in avidity scores between the groups might reflect the presence of a more significant underlying issue within the entire population. If all children, regardless of their malnutrition status, demonstrate low appetite or weakly signal their hunger, or if parents are not sufficiently responsive to their hunger cues, it could pose a considerable risk for the population.

In such a scenario, other external factors, such as food scarcity and limited access to nutritious food, could exacerbate the vulnerability of the population to malnutrition and related health complications. Even if the malnourished children do not show significantly reduced avidity scores compared to their healthy counterparts, the collective low appetite or inadequate hunger signalling within the entire population might amplify the impact of these external factors, leading to an increased risk of malnutrition for all children of this age.

These findings underscore the critical importance of considering the broader context when interpreting avidity scores and their implications for malnutrition. A comprehensive understanding of the cultural, environmental, and social determinants that influence feeding behaviors and appetite signalling is crucial for

designing effective interventions and strategies to address malnutrition in populations at risk. Moreover, promoting parental awareness and responsiveness to children's hunger cues can play a pivotal role in ensuring adequate nutrition and overall health outcomes in vulnerable populations.

Interestingly findings from before and after the study reported that, despite the lack of significant improvements in anthropometric measures, there was no change in eating avidity in the intervention study. Instead of discovering an anticipated increase in food refusal after the treatment, our observations revealed a remarkable improvement in food acceptance. These findings suggest that RUSF provision may have beneficial effects beyond direct nutritional impact.

In addition, the combined analysis of data from both studies in Pakistan revealed that scores for food refusal were much higher among stunted children compared to wasted and healthy children. Food refusal can be a challenging behaviour that affects nutrient intake and can contribute to malnutrition in children. A review suggests that 25% of toddlers exhibit food refusal, as per the parental reporting. Consequently, this can result in compromised nutritional outcomes (Chatoor and Ganiban, 2003). If replicated in further studies, a higher prevalence of food refusal among stunted children might suggest a need for targeted interventions and strategies to address this specific issue in this population. Addressing food refusal can contribute to better dietary diversity and increased nutrient intake. Maternal anxiety increased at the one-month follow-up, while increased maternal anxiety levels may positively impact the overall well-being of both mothers and children.

Force-feeding refers to the practice of coercing or pressuring children to eat, often against their will (Dettwyler, 1987). Force-feeding is much more common in Pakistan than in the UK or Guatemala (Wright et al.,2020). Still, the before and after study reported no changes in force-feeding from baseline to follow-up among the study participants.

Strategies that promote responsive feeding, respectful feeding practices, and positive mealtime environments have been shown to be effective in improving feeding behaviours and nutritional status among children (Engle, Bentley and Pelto, 2000). Further supporting evidence comes from Farrow and Blissett (2008), who conducted a study on controlling feeding practices and their relationship with early

child weight, highlighting the importance of a balanced and responsive feeding approach (Farrow and Blissett, 2008).

7.1.4 Maternal anxiety

The first study did not find differences in maternal stress between the malnourished and healthy groups, indicating that maternal stress levels were not significantly different between the two groups in the context of the study. These findings contradict previous studies that have shown a significant relationship between child weight-for-height z-score (WFHZ) and maternal emotional and external eating behaviours in relation to concern about a child undereating or being underweight (Singh *et al.*, 2023).

However, in the 2nd study, there were higher levels of maternal anxiety among the malnourished group compared to the healthy group. This finding aligns with previous research showing a link between maternal anxiety and child nutritional status (Saeed *et al.*, 2017).

The unexpected finding of no significant difference in maternal stress levels between the two groups in the context of the first study is both surprising and concerning. In many cultures and societies, it is a common expectation that parents, particularly mothers, would experience heightened anxiety and concern about feeding their underweight children. The absence of such a difference in maternal stress levels may have important implications for understanding and addressing malnutrition in children.

One possible interpretation of this finding is that mothers in both groups might not be fully aware of the severity of their malnourished child's condition or the potential consequences of malnutrition. It is plausible that in some communities, malnutrition has become normalised to a certain extent, leading to a lack of perceived urgency or concern among mothers. As a result, they may not be making extra efforts to feed their malnourished child or seeking appropriate interventions to address the issue.

Another potential explanation could be related to maternal response in the face of challenging circumstances. Mothers in both groups may have developed strategies to cope with stress and maintain a sense of normalcy despite the presence of

malnutrition in their children. This resilience might contribute to the lack of significant differences in maternal stress levels between the two groups.

Furthermore, cultural factors and social norms may significantly influence maternal stress levels related to child feeding and malnutrition. Some cultures may strongly emphasise maintaining a positive outlook and not expressing negative emotions, which could contribute to a lack of apparent stress among mothers, even in the presence of malnutrition.

The absence of significant differences in maternal stress levels raises questions about the effectiveness of current awareness and education programs regarding malnutrition in the studied population. It suggests that efforts to raise awareness about malnutrition and its consequences may not adequately reach or resonate with mothers in the community. As a result, targeted interventions aimed at addressing maternal stress and providing support and education on appropriate feeding practices for malnourished children may be necessary.

Maternal anxiety can further impact feeding practices and the overall caregiving environment, potentially leading to suboptimal feeding behaviours and inadequate food intake by the child. This could also be attributed to the counselling message delivered through data collection, where mothers were sensitised about the nutritional status of their children.

Furthermore, the assessment of maternal stress in this study may have limitations. The measurement of maternal stress is multifaceted and can encompass various dimensions, including psychological, emotional, and socioeconomic stressors. The tools utilised in this study heavily relayed on maternal reporting and may not have fully captured all aspects of stress that could be related to eating behaviours and child malnutrition.

7.1.5 The Effect of Supplementary Foods on Growth and Eating Behaviour

The before and after study indicated that the consumption of ready-to-use supplementary food (RUSF), providing approximately 500Kcal, did not result in significant improvements in weight, mid-upper arm circumference (MUAC), weight-for-age z-score (WAZ), and height-for-age z-score (HAZ) among the study

participants. These findings align with previous studies, such as the one conducted by Das et al. (2020), which also reported a limited impact of RUSF on nutritional outcomes in malnourished children (Das *et al.*, 2020). Similarly, a systematic review and meta-analysis conducted by Lenters et al. (2013) also highlighted the challenges in achieving significant improvements in nutritional status with RUSF alone in low- and middle-income settings (Lenters LM *et al.*, 2008). On the other hand, a clinically controlled trial conducted in Malawi comparing home-based therapy with RUSF in treating malnourished children reported that RUSF was effective in promoting weight gain and reducing mortality rates (Ciliberto *et al.*, 2005). A cluster-randomised controlled pragmatic intervention study in a sample of 1,038 children aged 6 to 36 months in Chad reported that providing RUSF as part of a general food distribution resulted in improvements in haemoglobin status and small improvements in linear growth (Huybregts *et al.*, 2012). A cluster randomised trial in Niger examined the effect of preventive supplementation with RUSF and found that although there was a reduction in the incidence of malnutrition, it did not result in a significant improvement in nutritional status (Isanaka *et al.*, 2009).

The lack of significant improvements in anthropometric measures such as weight, MUAC, WAZ, and HAZ suggests that the provision of RUSF alone may not be sufficient to bring about improvement in nutritional status within a short time frame and that addressing other factors in conjunction with RUSF provision may be necessary to achieve meaningful improvements in nutritional outcomes. The current study highlights the need to explore additional factors that may contribute to the effectiveness of RUSF in improving nutritional outcomes. One possible explanation for the lack of significant weight gain is the issue of compliance and consumption. The success of RUSF as a supplementary food heavily relies on the participants' consistent and adequate consumption. This non-compliance might have resulted in a less-than-optimal intake of nutrients from RUSF, ultimately impacting the expected weight gain.

Moreover, introducing RUSF might have influenced the children's routine dietary behaviours, leading to alterations in their regular food consumption. If the complementary foods were substituted with RUSF or reduced their overall food intake because of the supplementary food, this could have affected their total caloric

intake. Such dietary changes could potentially offset the weight gain that was anticipated from RUSF consumption.

To address the limitations and further investigate the factors influencing the efficacy of RUSF, future research should consider implementing strategies to enhance compliance and consumption. Additionally, incorporating a more extended intervention and follow-up period may provide a more comprehensive understanding of the sustained effects of RUSF on weight gain and overall nutritional status.

7.1.6 The Feasibility of Delivering a Non-Food-Based Targeted Intervention

The findings of the qualitative study conducted as part of the research programme shed light on significant gaps in delivering nutritional counselling to mothers attending primary healthcare facilities. The study identified several areas that require attention and improvement to effectively address malnutrition in the local context. These areas include training, provision of Information, Education, and Communication (IEC) materials, and clear guidelines for treating and preventing malnutrition.

One of the key insights from the study was the need for comprehensive tools to identify the exact causes of malnutrition: suggesting that there is a lack of standardised and systematic approaches to assess and diagnose malnutrition in the primary healthcare setting. A comprehensive tool would enable healthcare providers to accurately identify the underlying factors contributing to malnutrition in individual cases, facilitating targeted and tailored interventions.

Furthermore, the study emphasised the importance of capacity development among primary healthcare workers to deliver effective and targeted nutrition counselling. These findings are supported by literature, as the effectiveness of nutrition education programmes depends on the knowledge and capacity of health workers to deliver the messages (Mbuya *et al.*, 2013), maternal knowledge and understanding to translate the information into action (Zaman, Ashraf and Martines, 2008), and availability of resources so mothers can practice the recommendations (Abebe, Haki and Baye, 2016). The findings also highlight the participants' strong opinions regarding the availability of clear guidelines for treating and preventing malnutrition.

7.1.7 Validation of MUAC Vs WHZ as Identification Measure of Acute Malnutrition

In order to achieve early identification of children with acute malnutrition, there is a need for a simple, accurate, and cost-effective measure to be used in community settings in LMIC. The established gold standard for identifying acute malnutrition is weight-for-height z-scores (WHZ) (Fiorentino *et al.*, 2016). However, in lower middle-income settings, the availability of scales and height boards for community-level screening is challenging. Consequently, mid-upper arm circumference (MUAC) is a popular method used for screening acute malnutrition, as it decreases subcutaneous fat and muscle mass in undernourished children. Furthermore, MUAC has also been reported to predict child mortality on par with WHZ (Briend *et al.*, 2012). The World Health Organization (WHO) guidelines for the management of severe acute malnutrition in 2013 recommended cut-offs of 11.5cm and 12.5cm for admission and discharge criteria, respectively, in children under five years of age (WHO, 2013). However, there is evidence indicating that MUAC and WHZ identify distinct groups of malnourished children, and employing a cut-off of 13.3cm, rather than 11.5cm, would enhance the sensitivity of MUAC in identifying children with WHZ <-2 or <-3 (Laillou *et al.*, 2014).

The findings of the study conducted in Pakistan to assess the diagnosability of malnutrition using mid-upper arm circumference (MUAC) revealed that using a MUAC cut-off of less than 12.5 to detect moderate malnutrition captured around two-thirds of truly wasted children, which indicated that some truly wasted cases were missed, while out for every true case it also included a false positive case. Consequently, putting these children on energy supplementation may have adverse effects. This study highlights the difficulty of selecting appropriate cut-off values for MUAC measurements in identifying wasting in Pakistani children. The use of a cut-off of less than 12.5 demonstrated reasonable performance in terms of sensitivity and specificity. However, the moderate PPV suggests that caution is necessary when interpreting MUAC measures.

7.1.8 Limitations

It is important to acknowledge the significant limitations of the study, including the interruption caused by the pandemic, leading to delayed and partial completion of

the trial and limited sample screening. A four-week follow-up period and the focus on a single component, i.e., RUSF, may have limited the potential for significant changes in anthropometric outcomes and feeding behaviours. The lack of a fully randomised controlled methodology means that we cannot be sure that any changes seen were caused by the treatment. Also, the specific population may limit the generalizability of the findings to other contexts.

The small sample size and short duration of the follow-up will have reduced our power to detect any change. In addition, nutritional status is also influenced by other factors, including overall food security, access to clean water and sanitation facilities, and the presence of underlying health conditions.

The lack of significant associations between feed frequency, dietary diversity, and nutritional status reported by the present study may be attributed to various factors, such as cultural practices, socioeconomic conditions, or other unmeasured variables that were not accounted for in the analysis. Additionally, the study relied on maternal-reported data, which may be subject to recall or maternal perception bias. It is important to acknowledge that the study's findings are context-specific to the local setting in Pakistan.

7.1.9 Future research

Understanding the complex relationship between eating behaviors and malnutrition is crucial, especially in low- and middle-income (LMI) settings, where childhood nutrition is a critical concern. To design effective interventions, future research should explore the interplay between various factors such as cultural beliefs, socioeconomic status, feeding practices, and child eating behaviors. This comprehensive understanding will shed light on the mechanisms contributing to malnutrition and guide the development of appropriate strategies.

This study provides valuable insights into the intricate relationship between avidity scores and malnutrition. Future research should delve deeper into understanding the underlying factors influencing appetite regulation and feeding behaviors to combat malnutrition and improve the well-being of affected populations. This approach will enable the development of targeted and context-specific interventions.

Furthermore, it is essential for future studies to consider broader socioeconomic factors and access to nutritious food sources to craft comprehensive and sustainable solutions to address malnutrition on a global scale.

Moreover, it is necessary to investigate the effectiveness of supplementary interventions and their translation into growth outcomes across different settings and populations.

In conclusion, further research is needed, preferably using a larger sample size and extended follow-up periods. Adopting an online tool with checks for inclusion/exclusion and incorrect entries will enhance the overall data quality in future research.

Additionally, studying the feasibility of targeted interventions in similar settings will provide additional evidence on the capacity, time constraints, and interest of primary healthcare workers in engaging in nutrition counselling; this is relevant in the context of the complex trends of undernutrition, overnutrition, and the double burden of malnutrition. Such research will enable the development of support systems and interventions that align with the specific needs and challenges faced by healthcare workers, promoting the effective delivery of nutrition counselling.

7.1.10 Public Health Implications

A unique aspect of this study was its attempt to assess the impact of Ready-to-Use Supplementary Foods (RUSFs on dietary diversity, meal frequency, and eating and feeding behaviours in the context of the treatment of moderate acute malnutrition in Low- and Middle-Income Countries (LMICs). RUSFs have been considered a promising intervention, providing essential energy and micronutrient supplementation to affected populations. However, the current study's findings present contradictory evidence, raising concerns about the impact of RUSFs on anthropometric outcomes and actual consumption of supplementary food.

These contrasting results underscore the complexity of addressing moderate acute malnutrition and the need for further research to better understand the underlying mechanisms at play. Future studies should explore potential interactions between RUSFs and other complementary interventions, as well as the influence of the broader socioeconomic and environmental context on the overall impact of the treatment.

Moreover, it is essential to consider the long-term effects of RUSFs on the nutritional status and well-being of the target population. Sustainable solutions may require a multifaceted approach that combines nutritional interventions with interventions addressing socioeconomic factors, access to clean water, and education on proper feeding practices.

The MUAC study's findings have implications for public health programs targeting wasting in Pakistan. The relatively low PPV suggests additional strategies, such as incorporating other anthropometric measurements, to enhance the accuracy of wasting identification and ensure that resources are effectively allocated to those who truly need intervention. At the same time, there is a chance of those children receiving supplementation who are not wasted and can face adverse effects of aggressive treatment of malnutrition.

This feasibility study highlights the need for comprehensive training programmes and continuous refresher training systems to enhance the knowledge and skills of healthcare providers in delivering evidence-based nutrition counselling interventions. By equipping healthcare workers with the necessary knowledge and tools, they can effectively address the complex trends of undernutrition, overnutrition, and all forms of malnutrition.

There is also a need for standardised protocols and guidelines that provide healthcare providers with clear steps and recommendations for managing malnutrition at the primary healthcare level. Clear guidelines can help streamline and improve the consistency and quality of care for mothers and children, ultimately contributing to better nutritional outcomes.

7.1.11 Conclusions

The research programme has demonstrated that many modifiable risk factors, including low appetite, meal frequency and dietary diversity, are present in Pakistani infants of 6 to 24 months, but that while RUSF did not have any noticeable effect on the eating behaviour of moderately malnourished children, equally it did not show any significant improvements in anthropometry. MUAC is an increasingly common screening tool in community settings but using it as the only screening tool for MAM

children will identify healthy children as MAM who are very unlikely to benefit from intervention and miss many truly wasted children.

The feasibility study provides valuable insights to policymakers for delivering targeted nutrition counselling to mothers of malnourished children by identifying gaps, challenges, and opportunities. This research contributes to the growing body of evidence on caregiver-child interaction in low- and middle-income countries (LMICs) and its impact on children's nutritional outcomes.

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Appendices

Appendix 1 ICFET validation tool used in Glasgow

Video : 1 Mario						
A child like this:	**Very likely**	**Likely**	**Can't tell**	**Not very likely**	**Not at all likely**	**Description GE (good eater) or BE (bad eater)**
Loves food	**1**	**2**	**3**	**4**	5	
Is interested in food	**1**	**2**	**3**	**4**	5	
Is always asking for food	**1**	**2**	**3**	**4**	5	
Enjoys a wide variety of foods	**1**	**2**	**3**	**4**	5	
Eats quickly	**1**	**2**	**3**	**4**	5	
Is willing to try new foods	**1**	**2**	**3**	**4**	5	
Meals often last more than 30 minutes	**1**	**2**	**3**	**4**	5	
Meals sometimes last more than an hour	**1**	**2**	**3**	**4**	5	
When offered Food to Child:						
Turns head away	**1**	**2**	**3**	**4**	5	
Pushes food away	**1**	**2**	**3**	**4**	5	
Cries/screams	**1**	**2**	**3**	**4**	5	
Hold food in mouth for too long	**1**	**2**	**3**	**4**	5	
Spits out food	**1**	**2**	**3**	**4**	5	
Finishes his/her meal	**1**	**2**	**3**	**4**	5	

Participant Identifier:

Video : 2 Jack						
A child like this:	**Very likely**	**Likely**	**Can't tell**	**Not very likely**	**Not at all likely**	**Description GE (good eater) or BE (bad eater)**
Loves food	**1**	**2**	**3**	**4**	5	
Is interested in food	**1**	**2**	**3**	**4**	5	
Is always asking for food	**1**	**2**	**3**	**4**	5	
Enjoys a wide variety of foods	**1**	**2**	**3**	**4**	5	
Eats quickly	**1**	**2**	**3**	**4**	5	
Is willing to try new foods	**1**	**2**	**3**	**4**	5	
Meals often last more than 30 minutes	**1**	**2**	**3**	**4**	5	
Meals sometimes last more than an hour	**1**	**2**	**3**	**4**	5	
When offered Food to Child:						
Turns head away	**1**	**2**	**3**	**4**	5	
Pushes food away	**1**	**2**	**3**	**4**	5	
Cries/screams	**1**	**2**	**3**	**4**	5	
Hold food in mouth for too long	**1**	**2**	**3**	**4**	5	
Spits out food	**1**	**2**	**3**	**4**	5	
Finishes his/her meal	**1**	**2**	**3**	**4**	5	

Participant Identifier:

Video : 3 Jenni						
A child like this:	**Very likely**	**Likely**	**Can't tell**	**Not very likely**	**Not at all likely**	**Description GE (good eater) or BE (bad eater)**
Loves food	**1**	**2**	**3**	**4**	5	
Is interested in food	**1**	**2**	**3**	**4**	5	
Is always asking for food	**1**	**2**	**3**	**4**	5	
Enjoys a wide variety of foods	**1**	**2**	**3**	**4**	5	
Eats quickly	**1**	**2**	**3**	**4**	5	
Is willing to try new foods	**1**	**2**	**3**	**4**	5	
Meals often last more than 30 minutes	**1**	**2**	**3**	**4**	5	
Meals sometimes last more than an hour	**1**	**2**	**3**	**4**	5	
When offered Food to Child:						
Turns head away	**1**	**2**	**3**	**4**	5	
Pushes food away	**1**	**2**	**3**	**4**	5	
Cries/screams	**1**	**2**	**3**	**4**	5	
Hold food in mouth for too long	**1**	**2**	**3**	**4**	5	
Spits out food	**1**	**2**	**3**	**4**	5	
Finishes his/her meal	**1**	**2**	**3**	**4**	5	

Participant Identifier:

Video : 4 Jacob						
A child like this:	**Very likely**	**Likely**	**Can't tell**	**Not very likely**	**Not at all likely**	**Description GE (good eater) or BE (bad eater)**
Loves food	**1**	**2**	**3**	**4**	5	
Is interested in food	**1**	**2**	**3**	**4**	5	
Is always asking for food	**1**	**2**	**3**	**4**	5	
Enjoys a wide variety of foods	**1**	**2**	**3**	**4**	5	
Eats quickly	**1**	**2**	**3**	**4**	5	
Is willing to try new foods	**1**	**2**	**3**	**4**	5	
Meals often last more than 30 minutes	**1**	**2**	**3**	**4**	5	
Meals sometimes last more than an hour	**1**	**2**	**3**	**4**	5	
When offered Food to Child:						
Turns head away	**1**	**2**	**3**	**4**	5	
Pushes food away	**1**	**2**	**3**	**4**	5	
Cries/screams	**1**	**2**	**3**	**4**	5	
Hold food in mouth for too long	**1**	**2**	**3**	**4**	5	
Spits out food	**1**	**2**	**3**	**4**	5	
Finishes his/her meal	**1**	**2**	**3**	**4**	5	

Participant Identifier:

Video :

اس بچے کے بارے میں درست نہیں ہے					اس بچے کے بارے میں درست ہے۔	
1	2	3	4	5		یہ بچہ (جو ابھی دکھایا گیا ہے)
1	2	3	4	5		کھانے کو بہت پسند کرتا ہے۔
1	2	3	4	5		کھانے میں دلچسپی لے رہا ہے۔
1	2	3	4	5		ہمیشہ کھانا مانگتا رہتا ہے۔
1	2	3	4	5		انواع و اقسام کے کھانوں سے لطف اندوز ہوتا ہے۔
1	2	3	4	5		تیزی سے کھانا کھاتا ہے۔
1	2	3	4	5		نت نئے کھانے / ذائقے چکھنا چاہتا ہے۔
1	2	3	4	5		اکثر اوقات کھانا 3 منٹ سے زیادہ (اسکرین آگے) پڑا رہتا ہے۔
1	2	3	4	5		بعض اوقات کھانا ایک گھنٹے سے زیادہ (اسکرین آگے) پڑا رہتا ہے۔
						جب اس بچے کو کھانا دیا جاتا ہے۔
1	2	3	4	5		منہ (سر) دوسری طرف پھیر لیتا ہے
1	2	3	4	5		کھانے کو پیچھے دھکیلتا ہے۔
1	2	3	4	5		روتا / چیختا ہے۔
1	2	3	4	5		کھانا منہ میں بہت دیر تک بیٹھا رہتا ہے۔
1	2	3	4	5		کھانا تھوک دیتا ہے۔
1	2	3	4	5		اپنا کھانا ختم کرتا ہے۔

Appendix 2: ICFET development paper

nutrients

MDPI

Article

Development of a Scale to Measure Infant Eating Behaviour Worldwide

Charlotte M. Wright [1,*], Jessica Megan Gurney [2], Antonina N. Mutoro [2,3], Claudia Shum [2], Amara Khan [2], Beatrice Milligan [2], Widya Indriani [2], Loukia Georgiou [2], Stephanie Chambers [4], Rachel Bryant-Waugh [5] and Ada L. Garcia [2]

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Abstract: In order to create a short, internationally valid scale to assess eating behaviour (EB) in young children at risk of undernutrition, we refined 15 phrases describing avidity or food refusal (avoidance). In study one, 149 parents matched phrases in English, Urdu, Cantonese, Indonesian or Greek to videos showing avidity and avoidance; 82–100% showed perfect agreement for the avidity phrases and 73–91% for the avoidant phrases. In study two, 575 parents in the UK, Cyprus and Indonesia (healthy) and in Kenya, Pakistan and Guatemala (healthy and undernourished) rated their 6–24 months old children using the same phrases. Internal consistency (Cronbach's α) was high for avidity (0.88) and moderate for avoidance (0.72). The best-performing 11 items were entered into a principal components analysis and the two scales loaded separately onto 2 factors with Eigen values > 1. The avidity score was positively associated with weight ($r = 0.15$ $p = 0.001$) and body mass index (BMI) Z scores ($r = 0.16$ $p = 0.001$). Both high and low avoidance were associated with lower weight and BMI Z scores. These scales are internationally valid, relate to nutritional status and can be used to inform causes and treatments of undernutrition worldwide.

Keywords: undernutrition; global nutrition/health; feeding problems; eating behaviour; appetite; complementary feeding

1. Introduction

Eating and feeding behaviour (EB) problems in preschool children are common [1,2], cause great anxiety [3] and may also cause or complicate undernutrition [4,5]. Studies in low- and middle-income countries (LMIC) have observed higher refusal of food in stunted growth compared to healthy infants [6] and reduced appetite associated with common illnesses, leading to lower food intake [7]. Food refusal in some children can be attributed to an inherently lower drive to eat [8], appetite suppression caused by illness or stress [7], unresponsive feeding styles [9] or a combination of these factors; thus, assessing EB is important, but there are few suitable tools to assess these in young children [10] who are most at risk of undernutrition.

The World Health Organization (WHO) treatment protocol for severe acute malnutrition (SAM) includes an 'appetite test', an observation of the child's immediate willingness

Appendix 3: Linguistic Study poster

University of Glasgow

Developing a measure of eating behaviour in preschool children, applicable worldwide

Jessica Megan Gurney[1], Amara Khan[2], Claudia Shum[2], Ada L. Garcia[2], Stephanie Chambers[3], Charlotte Wright[1]
[1]Child health and [2]Human Nutrition, [3]MRC/CSO Social and Public Health Sciences Unit, University of Glasgow

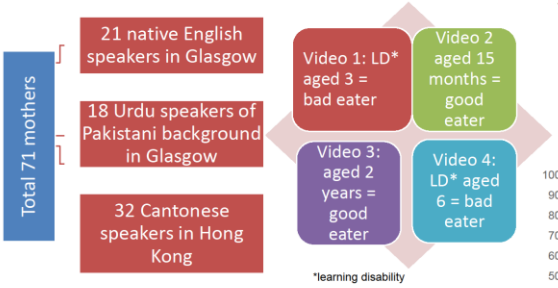
Overall aim:
To develop a measure of eating behaviour in infants and toddlers for use throughout world in different languages

Problem:
Many descriptions of eating are culture specific & have different meanings when translated.

Work leading up to this study:
English phrases describing enthusiasm & food refusal identified from previous research (Wright et al., 2006, Carnell and Wardle, 2007) and modified iteratively via use in surveys.

Aim of this study
To test resulting 15 phrases with mothers in three languages in order to compare their face validity in translation.

Fig 1. Methodology



Method
- Mothers shown 15 behaviour descriptions translated into native language (Fig. 1)
  - Rated how well each phrase reflected 'good' or 'bad' eating, using Likert scale
  - Rated how well each phrase applied to child shown in each video

Results:
Rating of how well each phrase reflected 'good' (Fig. 2) or 'bad' eating (Fig. 3)
- 10 phrases showed >80% agreement in all languages, but 5 were less consistent

Rating of how well each phrase applied to child shown in each video (Fig. 4)
- Extremely high agreement in all languages

Conclusion:
- All 15 descriptions of feeding behaviour were understood consistently in translation.
- Meal duration, speed of eating and asking for food not consistently associated with enthusiasm for eating.

Future work
Test whether these phrases discriminate between children with and without under-nutrition.

Fig 2. Agreement on whether phrases represent good eating, by language groups

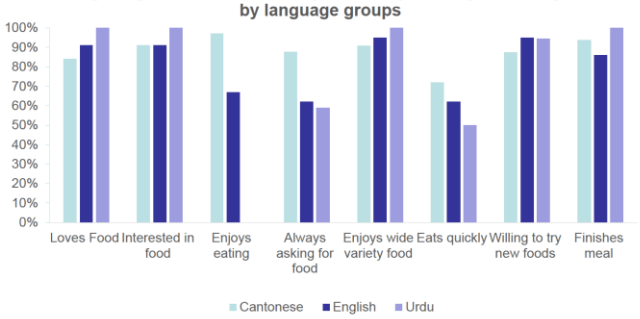


Fig 3. Agreement on whether phrases represent bad eating, by language groups

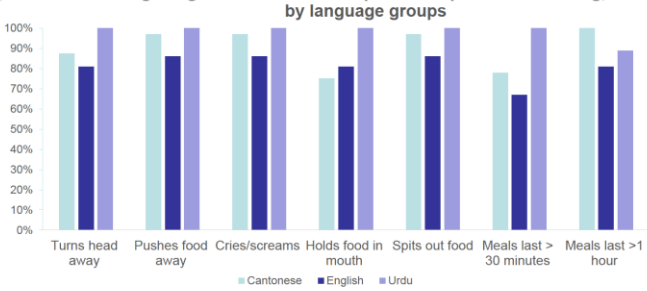
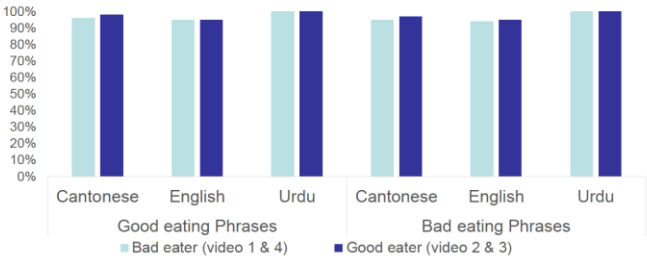


Fig. 4. Proportion of phrases that were rated as matching behaviour shown in video



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WRIGHT, C. M., PARKINSON, K. N. & DREWETT, R. F. 2006. How does maternal and child feeding behavior relate to weight gain and failure to thrive? Data from a prospective birth cohort. Pediatrics, 117, 1262-1269.

Appendix 4: ICFET used for study 1 in Pakistan

University of Glasgow College of Medical, Veterinary & Life Sciences

Date: ___/___/2018

Eating and feeding behaviors of healthy and malnourished Pakistani children aged 6-24 months of age

(6-24ماہ کے صحت مند اور غذائی کمی کا شکار پاکستانی بچوں کے کھانا کھانے/کھلانے اور دیکھ بھال سے متعلق ریسرچ)

Child characteristics (circle appropriate answer)

1: بچے کے بارے میں معلومات (درست جواب پر دائرہ لگائیں)

Child's I D: (بچے کی ID)_____ Age:(عمر) _____ Date of Birth:(تاریخ پیدائش) _____

Gender: Male / Female (جنس: لڑکا/لڑکی) Birth order:(بہن بھائیوں میں نمبر) _____

What relation are you to the child? *Mother /Father / Other* _____

آپ بچے کے کیا لگتے ہیں؟

1. **Anthropometry:**

Weight (kg):(وزن)_____ Height (cm):(قد)_____MUAC (cm):(مواک)_____ BMI(بی ایم آئی) _____

WAZ SDS_____ BMI (SDS) _____ WHF SDS_____ Height SDS_____ MUAC SDS _____

Who measured the child? Researcher/ Health staff/ Other (specify)_____

بچے کی پیمائش کس نے کی؟

2. **Child illness (بچے کی بیماری)**

a. Has your baby had any major health problems since birth? Yes / No If yes please describe them

A کیا بچے کو پیدائش کوئی بڑا صحت کا مسئلہ رہا ہے؟ ہاں نہیں (اگر ہاں تو براہ مہربانی تفصیل بتایئے)

b. In the past month has your child been admitted to hospital? Yes/No

B کیا پچھلے مہینے آپ کا بچہ ہسپتال میں داخل رہا ہے ہاں نہیں (اگر ہاں تو وجہ اور دورانیہ بتایئے)

Reason for admission? (وجہ)_____

Duration:(دورانیہ) _____

c. Are you giving any vitamin supplements? Yes/no

C کیا آپ اپنے بچے کو کوئی وٹامن یا سپلیمنٹ دے رہے ہیں؟ ہاں نہیں

Routine vitamin A Yes/no

روٹین وٹامن A ہاں/نہیں

Micro nutrient powders Yes/no

مائیکرو نیوٹرینٹ سپلیمنٹ پاؤڈر ہاں/نہیں

Other: specify_____

کچھ اور _____

Appendix 5: Study 1 in Pakistan Ethics approvals from GU and Pakistan

nutrients

MDPI

Article

Development of a Scale to Measure Infant Eating Behaviour Worldwide

Charlotte M. Wright [1,*], Jessica Megan Gurney [2], Antonina N. Mutoro [2,3], Claudia Shum [2], Amara Khan [2], Beatrice Milligan [2], Widya Indriani [2], Loukia Georgiou [2], Stephanie Chambers [4], Rachel Bryant-Waugh [5] and Ada L. Garcia [2]

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Abstract: In order to create a short, internationally valid scale to assess eating behaviour (EB) in young children at risk of undernutrition, we refined 15 phrases describing avidity or food refusal (avoidance). In study one, 149 parents matched phrases in English, Urdu, Cantonese, Indonesian or Greek to videos showing avidity and avoidance; 82–100% showed perfect agreement for the avidity phrases and 73–91% for the avoidant phrases. In study two, 575 parents in the UK, Cyprus and Indonesia (healthy) and in Kenya, Pakistan and Guatemala (healthy and undernourished) rated their 6–24 months old children using the same phrases. Internal consistency (Cronbach's α) was high for avidity (0.88) and moderate for avoidance (0.72). The best-performing 11 items were entered into a principal components analysis and the two scales loaded separately onto 2 factors with Eigen values > 1. The avidity score was positively associated with weight ($r = 0.15$ $p = 0.001$) and body mass index (BMI) Z scores ($r = 0.16$ $p = 0.001$). Both high and low avoidance were associated with lower weight and BMI Z scores. These scales are internationally valid, relate to nutritional status and can be used to inform causes and treatments of undernutrition worldwide.

Keywords: undernutrition; global nutrition/health; feeding problems; eating behaviour; appetite; complementary feeding

1. Introduction

Eating and feeding behaviour (EB) problems in preschool children are common [1,2], cause great anxiety [3] and may also cause or complicate undernutrition [4,5]. Studies in low- and middle-income countries (LMIC) have observed higher refusal of food in stunted growth compared to healthy infants [6] and reduced appetite associated with common illnesses, leading to lower food intake [7]. Food refusal in some children can be attributed to an inherently lower drive to eat [8], appetite suppression caused by illness or stress [7], unresponsive feeding styles [9] or a combination of these factors; thus, assessing EB is important, but there are few suitable tools to assess these in young children [10] who are most at risk of undernutrition.

The World Health Organization (WHO) treatment protocol for severe acute malnutrition (SAM) includes an 'appetite test', an observation of the child's immediate willingness

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24 – Cooper Road, Lahore.
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NO. 1781 /PA Dated: Lahore the 24th September, 2018

CERTIFICATE OF CLEARANCE

This is to certify that project proposal No. PBC-008, Dated: 01-08-2018 titled "Eating and Feeding Behavior of Healthy and Malnourished Pakistan Children (6-24 months)" has been reviewed and cleared by the Research Ethics Subcommittee (REC) of the Provincial Bio-ethics Committee(PBC) Punjab.

2. Any Query regarding the Ethical Clearance process undertaken by the REC of PBC may be addressed to Mr. Muhammad Abid ( ) as Chair REC.

Secretary
Provincial Bioethics Committee Punjab

Counter Signed
Chairperson Provincial Bioethics Committee Punjab/Director General Health Services, Punjab.

Appendix 6: ICFET used for CRCT Study 2 in Pakistan

Effect of Ready to Use Foods (RUF) on feeding, caregiving and behaviour characteristics of 6- 24 months old malnourished Pakistani children-A Cluster Randomised Trial.

Name of Health facility **:** _____

Child characteristics

1: بچے کے بارے میں معلومات(درست جواب پر دائرہ لگائیں)

Age:(عمر) _____ Date of Birth:(تاریخ پیدائش) _____

Gender: *Male / Female*(جنس: لڑکا/لڑکی) Birth order:(بہن بھائیوں میں نمبر) _____

Anthropometry:

Weight (kg):(وزن)_____ Height (cm):(قد)_____MUAC (cm):(مواک)_____ BMI (بی ایم آئی) _____

(Skinfolds) triceps (mm)_____ subscap (mm)_____

(Bone breadth) Elbow (cm)_____ Knee (cm)_____

WAZ SDS_____ BMI (SDS) _____ WHF SDS_____ Height SDS_____ MUAC SDS _____

Nutritional Oedema: Yes No (if yes please circle as appropriate)

Grade + Grade ++ Grade +++

نیوٹریشن اوڈیما (سوجن) ہاں نہیں

اگر ہاں تو گریڈ + گریڈ++ گریڈ +++

Who measured the child? Researcher/ Health staff/ Other (specify)_____

بچے کی پیمائش کس نے کی ؟

_____

Child illness **(بچے کی**

بیماری)

a. Has your baby had any major health problems since birth? Yes / No If yes please describe them

A کیا بچے کو پیدائشی کوئی بڑا صحت کا مسئلہ رہا ہے؟ ہاں نہیں

(اگر ہاں تو براہ مہربانی تفصیل بتایئے)

b. Has your child ever been admitted to hospital? Yes/No

B کیا آپ کا بچہ ہسپتال میں داخل رہا ہے ہاں نہیں (اگر ہاں تو وجہ بتایئے)

Reason for most recent admission? (آخری دفعہ داخلے کی وجہ)_____

c. Are you giving any vitamin supplements? Yes/no

C کیا آپ اپنے بچے کو کوئی وٹامن یا سیپلمنٹ دے رہے ہیں؟ ہاں نہیں

Routine vitamin A Yes/no

روٹین وٹامن A ہاں/نہیں

Micro nutrient powders Yes/no

مائیکرو نیوٹرینٹ ساشے پاؤڈر ہاں/نہیں

Other: specify_____

کچھ اور _____

Child Developmental History

3: بچے کی نشوونما

Can your baby do any of the following? **کیا آپ کا بچہ یہ کرسکتا ہے؟**	How old was your baby when they first did this? **آپ کے بچے کی عمر کیا تھی جب اس کی مندرجہ ذیل نشوونما ہوئی؟**
Reach out for objects and took them to their mouth چیزوں کو پکڑ کر منہ میں ڈال لیا	
Sit for at least 10 seconds without using hand or arms to support them کم از کم 10سیکنڈ تک بیٹھا رہا بغیر کسی مدد کے	
Stands holding on to a stable object (e.g. furniture, not a person) with hands only for at least 10 seconds میز/چارپائی پکڑ کر 10سیکنڈ تک کھڑا رہا	
Stands alone with no contact with a person or object for at least 10 seconds اکیلا کھڑا رہا بغیر کسی چیز کو پکڑے	
Walks at least 10 steps with back straight and no contact with a person or object کم از کم 10قدم چلا بغیر کسی سہارے کے	

*'not yet' if not yet attained

Child care and feeding

4: بچے کی دیکھ بھال اور کھانا کھلانا

a. Breastfeeding (A۔ماں کا دودھ)

Was your child ever breast fed? Yes No

کیا آپ کے بچے نے کبھی ماں کا دودھ پیا ہے؟ ہاں نہیں

Is your baby still breastfeeding? Yes No

کیا آپ کا بچہ ابھی بھی ماں کا دودھ پی رہا ہے ہاں نہیں

If yes how many times in a day ? >3 feeds per day / 2-3 feeds per day/ 1 feed per day /<1 feed per day

اگر ہاں تو کتنی مقدار میں ایک یا ایک

سے کم بار 2سے3بار 3سے زیادہ بار

If not breastfeeding now at what age did you last give breast milk? _____ Months

اگر بچہ ابھی ماں کا دودھ نہیں پی رہا آخری بار کب پیا تھا _____ عمر مہینوں میں

b. Complementary feeding

B: اضافی خوراک

At what age did you feed the child his/her first food? _____

کس عمر میں آپ کے بچے نے پہلی بار کچھ کھایا تھا _____عمر مہینوں میں

کیا کھانا کھایا تھا؟ _____

What sort of food did you give your child during the past 24 hours did you give your child? (tick as given at these times)

5:آپ اپنے بچے کو کس قسم کے کھانے کھلاتی ہیں؟

	Plated foods requiring feeding by hand or spoon پلیٹ والے کھانے جو ہاتھ یا چمچ سے کھائے جائیں	**Dry Finger foods** (e.g. biscuits, crisps, bread) خشک کھانے بسکٹ/ چپس/ڈبل روٹی	**Moist finger foods** (e.g. Fruit) نم کھانے پھل	**Milk drinks** (e.g. formula milk, cow/ buffalo milk, milky tea, yoghurt) دودھ اور دودھ سے بنی چیزیں ڈبے کا دودھ/گائے /بھینس/چائےدودھ سے بنی/دہی /لسی	**Other drinks*** (e.g. juice, , porridge) کوئی اور پینے کی اشیاء جوس/بوتل	**RUTF**
Morning صبح ناشتہ						
Mid-morning صبح اور دوپہر کے درمیان						
Afternoon دوپہر کا کھانا						
Evening شام کے وقت						
Night رات کا کھانا						

*not including water

How often does the child eat following?

آپ کا بچہ کتنی مرتبہ مندرجہ ذیل کھانا کھاتا ہے؟

اس میں پانی شامل نہیں ہے۔

How often does the child eat following? **آپ کا بچہ کتنی مرتبہ مندرجہ ذیل کھانا کھاتا ہے؟** (*please tick one answer for each*): **ایک کھانے کے لئے ایک جواب کے نیچے نشان لگائیں**	**Never/ rarely** **کبھی نہیں کبھی کبھار**	**once a month but not weekly** **مہینے میں ایک دفعہ ہر ہفتے نہیں**	**once a week but not daily** **ہفتے میں ایک دن لیکن روزانہ نہیں**	**Once daily** **دن میں ایک مرتبہ**	**More than once daily** **دن میں ایک سے زیادہ مرتبہ**
Bread (chapatti, roti, paratha, naan) روٹی (چپاتی/روٹی پراٹھا نان)					
Potatoes (boiled, mashed, Chips) آلو (ابلے ہوئے/بھرتا/چپس)					
Rice (kichri, boiled) چاول (کھچڑی/ابلے ہوئے/پلاؤ)					
Meat/fish/poultry گوشت(مچھلی/ مرغی)					
Eggs انڈے					
Dairy products (milk, yoghurt, paneer) دودھ اور دودھ سے بنی اشیاء(دودھ/دہی/ پنیر/ کھیر/سویاں)					
Legumes/nuts (dhal, beans, peas, chick peas, green grams**)** دالیں /میوہ جات(دال/لوبیا/مٹر/چنے/ سبز چنے/ بادام)					
Fruits (bananas, oranges, melons, mango, peach, apple, Guava, grapes, **)** پھل (امرود/آڑو/کیلا/مالٹا/ خربوزہ/ آم/ ناشپاتی/ انگور)					
Leafy Vegetables (spinach, cabbage,) سبز پتوں والی سبزیاں(پالک/ساگ/ بند گوبھی)					
Savoury snack foods (crisps, chips, nuts, popcorn, savoury biscuits, slanty) نمکین چپس/سلانٹی/ نمکین بسکٹ					
sweet snack foods (chocolates, sweets, sweet biscuits) میٹھے چاکلیٹ/ ٹافی/ مٹھائی					
Food cooked in oil OR GHEE (vegetable curry, meat curry, egg fried, potato chips,) گھی/تیل میں پکے کھانے سالن/ انڈا/ چپس					

Feeding practices (Who feeds the child)

کھانا کھلانے کے بارے میں معلومات (بچے کو کون کھانا کھلاتا ہے)

a. *Does mother usually feed the child?* Always / *Mostly* / *Sometimes* / *Never*

b. *When the mother is not there, who usually feeds the baby? Specify*

_____

A۔ کیا ماں عام طور پر بچے کو کھانا کھلاتی ہے؟ **ہمیشہ. اکثر اوقات. کبھی کبھار کبھی نہیں**

B۔ جب ماں موجود نہ ہو تب کون کھانا کھلاتا ہے؟ _____

How your child does eats

آپ کا بچہ کیسے کھانا کھاتا ہے؟

Would you say your child: (میرے بچے کو) (*please tick one answer for each*)	Not at all **بالکل نہیں**	Rarely **کبھی کبھار**	Sometimes **کچھ اوقات**	Most of the time **اکثر اوقات**	All the time **ہمیشہ**
Likes food a lot کھانا بہت پسند ہے					
Is interested in food کھانے میں دلچسپی لیتا ہے					
Enjoys eating کھانے سے لطف اندوز ہوتا ہے					
Enjoys a wide variety of food انواع و اقسام کے کھانوں سے لطف اندوز ہوتا ہے					
Eats quickly تیزی سے کھانا کھاتا ہے					
Finishes his/her meals اپنا کھانا ختم کرتا ہے					

How often does your child do the following when offered food?

کتنی دفعہ آپ کا بچہ مندرجہ ذیل ردعمل کرتا ہے جب اس کو کھانا دیا جاتا ہے؟

	Not at all **بالکل نہیں**	Rarely **کبھی کبھار**	Sometimes **کچھ اوقات**	Most of the time **اکثر اوقات**	All the time **ہمیشہ**
Turns head away when offered food سر/منہ دوسری طرف پھیر لیتا ہے					
Pushes food away کھانے کو پرے دھکیلتا ہے					
Cries/ screams روتا/چیختا ہے					
Spits out food کھانا تھوک دیتا ہے					
Meals last more than an hour کھانا اس کے آگے ایک گھنٹے سے زیادہ پڑا رہتا ہے					

How you feed your child?

آپ اپنے بچے کو کھانا کیسے کھلاتی ہیں؟

Who usually feeds your child? **بچے کو اکثر کھانا کون کھلاتا ہے؟**	Entirely self feeds **مکمل طور پر خود کھاتا ہے**	Mostly self feeds **اکثر خود کھا لیتا ہے**	Half and half **کبھی میں اور کبھی خود**	Carer mostly feeds **اکثر میں کھلاتی ہوں**	Carer always feeds **ہمیشہ میں کھلاتی ہوں**	Not given solid food **ابھی کھانا نہیں کھاتا ہے**
Meals (foods that are served on a plate and eaten with a spoon/hand)? وہ کھانے جو پلیٹ میں ہوتے ہیں اور ہاتھ یا چمچ سے کھلائے جاتے ہیں						
Snacks (finger foods pieces of fruit, biscuits)? وہ کھانے جو ہاتھ میں پکڑے جاسکتے ہیں جیسے بسکٹ/پھل						

What sort of things do you do if your child refuses to eat?

جب بچہ کھانا نہیں کھا رہا ہوتا تو آپ کیا کرتی ہیں؟

	Not at all **بالکل نہیں**	Rarely **کبھی کبھار**	Sometimes **کچھ اوقات**	Most of the time **اکثر اوقات**	All the time **ہمیشہ**
Restrain him by holding his/her hands اس کے ہاتھ پکڑ کر روکتی ہوں					
Try to force open his/her mouth زبردستی کھلانے کی کوشش کرتی ہوں					
Pour food in to his/her mouth اس کے منہ میں کھانا ڈال دیتی ہوں					

اپنے بچے کو کھانا کھلانا آپ کو کیسا محسوس ہوتا ہے؟

How do you feel about feeding your child?

	Not at all **بالکل نہیں**	Rarely **کبھی کبھار**	Sometimes **کچھ اوقات**	Most of the time **اکثر اوقات**	All the time **ہمیشہ**
I worry that my child is not eating enough مجھے پریشانی ہوتی ہے کہ میرا بچہ تھوڑا کھا رہا ہے					
My child's feeding causes significant anxiety to me بچے کو کھانا کھلانا مجھے کافی تشویشناک لگتا ہے					
I am concerned about the variety of foods my child eats					

مجھے فکر ہے کہ میرا بچہ صحیح قسم کے کھانے کھا رہا ہے					
I am concerned about my child's behaviour at mealtimes مجھے اپنے بچے کے کھانا کھانے کے دوران رویے کے بارے میں فکر ہے					
I am concerned about my child's lack of interest and/or enjoyment of food مجھے اپنے بچے کے کھانے میں دلچسپی نہ لینے/کھانے سے لطف اندوز ہونے کے بارے میں فکر ہے					
I am concerned about my child's eating speed مجھے اپنے بچے کے کھانے کی رفتار کے بارے میں پریشانی ہے					

Household hunger score

Household hunger score	**0=Never بالکل نہیں**	**1 = Rarely (once or twice in the past 30 days) کبھی کبھار (پچھلے 30 دنوں میں ایک یا دو بار)**	**2 = Sometimes (3–10 times in the past 30 days) کچھ اوقات (پچھلے 30 دنوں میں 3 سے 10 بار)**	**3 = Often (more than 10 times in the past 30 days اکثر اوقات (پچھلے 30 دنوں میں 10 سے زیادہ بار)**
Was there ever no food to eat of any kind in your house because of lack of resources to get food? If so, how often did this happen? کیا آپ کے گھر میں کبھی بھی کھانا کھانے کے لئے وسائل کی کمی کی وجہ سے کسی بھی طرح کے کھانے کے لئے کھانا نہیں تھا؟ اگر ایسا ہے تو ، یہ کتنی بار ہوا؟				
Did you or any household member go to sleep at night				

hungry because there was not enough food? If so, how often did this happen? کیا آپ یا کوئی گھر کے فرد کافی کھانا نہ ہونے کی وجہ سے رات کو بھوکے سوئے تھے؟ اگر ایسا ہے تو ، یہ کتنی بار ہوا؟				
Did you or any household member go a whole day and night without eating anything because there was not enough food? If so, how often did this happen? کیا آپ یا گھر کے کسی فرد نے کافی دن کھانے کی وجہ سے بغیر کچھ کھائے پورے دن رات گذارے؟ اگر ایسا ہے تو ، یہ کتنی بار ہوا؟				

Is there anything else you would like to say about feeding your baby?

کوئی اور ایسی بات جو آپ اپنے بچے کو کھلانے کے حوالے سے بتانا چاہیں۔

Family characteristics

خاندان کے متعلق معلومات

a) What is the employment status of Mother? _____

c۔ کیا ماں کام /نوکری کرتی ہے؟ _____

b) (If mother works) what type of employment it is? _____

d۔ اگر ماں نوکری کرتی ہے تو کس قسم کا کام کرتی ہے؟_____

c) Mother age: _____

e۔ ماں کی عمر_____

d) Mother education level: *None/ less than 5 years of primary /more than 5 years of primary education /Secondary education/ Tertiary/ Other* _____

f۔ ماں کی تعلیم_____کچھ بھی نہیں /5سال سے کم ۔ 5سال سے زیادہ پرائمری، سیکنڈری، تعلیم F.A, B.A

e) Number of children born to this mother (including this child) _____

g۔ اس ماں کے ٹوٹل بچے جو پیدا ہوئے ہیں اس بچے سمیت _____

f) Age of eldest child: _____

h۔ سب سے بڑے بچے کی عمر _____

g) Age of youngest child:_____

i۔ سب سے چھوٹے بچے کی عمر _____

h) How many children are under the age of 5 years_____?

j۔ اس گھر میں کتنے بچے 5سال سے کم عمر کے ہیں؟ _____

i) Is father alive? (Yes) (No) *(if no end here)*

k۔ کیا بچے کا باپ زندہ ہے؟ ہاں نہیں

j) Father's age: _____

l۔ باپ کی عمر _____

k) *Resident / non resident and contributing to household / no contact*

m۔ کیا بچے کا باپ ساتھ رہتا ہے دور رہتا ہے لیکن خرچہ دیتا ہے
رابطہ نہیں ہے

l) Education level: *None/ less than 5 years of primary /more than 5 years of primary education /Secondary education/ Tertiary/ Other* _____

n۔ باپ کی تعلیم کچھ نہیں 5سال سے کم پرائمری 5سال سے زیادہ سیکنڈری میٹرک
میٹرک FA/BA MA

m) What is the employment status of Father? _____

o۔ کیا باپ نوکری/کاروبار کرتا ہے؟
ہاں نہیں

n) (If Father works) what type of employment it is? _____

p. اگر باپ کام/کاروبار کرتا ہے تو کس قسم کا کام کرتا ہے؟

Appendix 7: Ethics approval for CRTC from GU and Pakistan

University of Glasgow

28th October 2019

MVLS College Ethics Committee

Project Title: Effect of Ready to Use Foods (RUF) on feeding, caregiving and behaviour characteristics of 6- 24 months old malnourished Pakistani children-A Cluster Randomised Trial

Project No: 200190018

Dear Prof Wright,

The College Ethics Committee has reviewed your application and has agreed that there is no objection on ethical grounds to the proposed study. It is happy therefore to approve the project.

- Project end date: As outlined in application.
- The data should be held securely for a period of ten years after the completion of the research project, or for longer if specified by the research funder or sponsor, in accordance with the University's Code of Good Practice in Research: (http://www.gla.ac.uk/media/media_227599_en.pdf)
- The research should be carried out only on the sites, and/or with the groups defined in the application.
- Any proposed changes in the protocol should be submitted for reassessment, except when it is necessary to change the protocol to eliminate hazard to the subjects or where the change involves only the administrative aspects of the project. The Ethics Committee should be informed of any such changes.
- You should submit a short end of study report to the Ethics Committee within 3 months of completion.

Yours sincerely,

Jesse Dawson
MD, BSc (Hons), FRCP, FESO
Professor of Stroke Medicine
Consultant Physician
Clinical Lead Scottish Stroke Research Network / NRS Stroke Research Champion
Chair MVLS Research Ethics Committee

Institute of Cardiovascular and Medical Sciences
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Tel:9201139
9201140
FAX:9201142
DIRECTOR GENERAL HEALTH SERVICES-PUNJAB
24 – Cooper Road, Lahore 54000

No. 2257 /PA
Dated Lahore the 29 November, 2019

To

Amara Khan
PhD Student
University of Glasgow

Subject: **REQUEST FOR ETHICS APPROVAL**

Refer to the subject cited above.

Your application along with copy of Ethics approval by University of Glasgow has been received and examined. The proposal of research to be conducted in collaboration with IRMNCH & Nutriton Program, it seems to be ethically approved. Therefore, you are allowed to start data collection, meanwhile will let you know, if we have any query or required any further documentation in this regards.

1. **Feasibility assessment of provision of targeted nutrition advocacy messages through primary health care in Punjab, Pakistan**

2. **Effect of Ready to Use Foods (RUF) on feeding, caregiving and behaviour characteristics of 6- 24 months old malnourished Pakistani children-A Cluster Randomised Trial**

DIRECTOR GENERAL HEALTH SERVICES /
Chairman Provincial Bio –Ethically Committee
Punjab, Lahore/

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Appendix 8: Interview tool used for LHV in feasibility study

University of Glasgow | College of Medical, Veterinary & Life Sciences

Guiding Questions for In-depth interviews of LHVs

Study title: <u>Feasibility assessment of provision of targeted nutrition advocacy messages through primary healthcare in Punjab, Pakistan</u>

Introductory questions to allow participants to warm up for the interview

<u>After introducing myself, will ask some question like, "How long you've worked in thus role & employment background etc"</u>

Q.1 Can you tell me about the type of nutrition advice, if any, you provide to mothers of healthy as well as malnourished children coming to health facility? Can you describe any differences in advice for healthy compared with malnourished children?

Q.2 Can you describe any training on delivering nutrition advice that you have undertaken? [probe topics, duration, who provided training]

Q.4 How do you assess the eating and feeding problems that the mother or child may be facing?

Q.5 Do you have any IEC/guiding material available with you to help you to deliver nutrition messages? If yes what topics does it cover?

Q.6 How long does it take you to deliver nutrition messages to mothers of malnourished children?

Q.7 In your experience, how do mothers response to advice provided by health facility staff?

Q.8 What opportunities do you have to follow-up with mothers regarding nutrition messages delivered to them?

Q.9 If you will be provided with tool/raining/material to deliver tailored/individualized how feasible it is in current setting to deliver individualized tailored nutrition advocacy to mothers coming to primary healthcare facilities?

Q.10 LHVs will be shown ICFE page by page and asked,

- What is your opinion about this tool? Will it be help full for you to decide what exact nutrition messages should be delivered to mothers?
- How feasible it is to use this tool in local setting (describe benefits, and any shortcomings/challenges)
- keeping in view your experience what are your suggestion to further improve this tool.

Appendix 9: Ethics approval for qualitative study

University of Glasgow

19th November 2019

MVLS College Ethics Committee

Project Title: Feasibility assessment of provision of targeted nutrition advocacy messages through primary health care in Punjab, Pakistan

Project No: 200190020

Dear Professor Wright

The College Ethics Committee has reviewed your application and has agreed that there is no objection on ethical grounds to the proposed study. It is happy therefore to approve the project.

- Project end date: As stated in application
- The data should be held securely for a period of ten years after the completion of the research project, or for longer if specified by the research funder or sponsor, in accordance with the University's Code of Good Practice in Research: (http://www.gla.ac.uk/media/media_227599_en.pdf)
- The research should be carried out only on the sites, and/or with the groups defined in the application.
- Any proposed changes in the protocol should be submitted for reassessment, except when it is necessary to change the protocol to eliminate hazard to the subjects or where the change involves only the administrative aspects of the project. The Ethics Committee should be informed of any such changes.
- You should submit a short end of study report to the Ethics Committee within 3 months of completion.

Yours sincerely,

Jesse Dawson
MD, BSc (Hons), FRCP, FESO
Professor of Stroke Medicine
Consultant Physician
Clinical Lead Scottish Stroke Research Network / NRS Stroke Research Champion
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Appendix 10: Information sheet used for LHV interview

University of Glasgow | College of Medical, Veterinary & Life Sciences

PARTICIPANT INFORMATION SHEET

Study title: <u>Impact of COVID-19 on routine nutrition advocacy and feasibility assessment of provision of targeted nutrition advocacy messages through primary health care in Punjab, Pakistan</u>

You are being invited to take part in a research study. Before you decide it is important that you understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

What is the purpose of the study?

This study is being carried out to assess how feasible it is to deliver targeted nutritional advice to mothers of malnourished children coming to primary health care facilities. The results of this study will be helpful to improve nutrition advocacy for nutrition programmes.

Why have I been invited to participate? You have been chosen to participate in the study as you are nutrition manager/primary health care provider working with nutrition programme Punjab. you do decide to take part, you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part, you are still free to withdraw at any time and without giving a reason.

Do I Have to Take Part?

Participation in the study is completely voluntarily and it up to you to take part in the study or not. If you agree to take part in the study initial but then change your mind, you can leave the study at any time. Please note that information that you will provide before leaving will be used in the study.

What will happen to me if I take part?

You will be invited to participate in the study, and once you agree to participate you will be taken to a separate/private room/Place. The study will involve one interview lasting for 40 to 45 min. The researcher will ask 8 to 10 open ended question related to your current practice of delivering nutritional advice, and your opinion about individualised nutritional counselling. Your responses will be recorded by researcher on paper as well as using mobile phone microphone.

What do I have to do?

The researcher will approach you and ask you for your consent. All you will have to do, is to answer 8 to 10 questions related to your current practices for delivering nutrition advocacy and your opinion about targeted, individualized nutrition counselling to mothers of malnourished children. The data collector will provide details about the study. The interview will last around 3 to 40 minutes, and all of your responses will be recorded on paper, as well as in mobile phone voice recorder.

What are the possible disadvantages and risk of taking part?

There are no risks associated with this study.

What are the possible benefits of taking part?

Hopefully you will find this interesting and informative.

Will my taking part in this study be kept confidential?

All information which is collected about you, or responses that you provide, during the course of the research will be kept strictly confidential. You will be identified by an ID number, and any information about you will have your name and address removed so that you cannot be recognised from it. Your participation will be completely anonymised within the data. Please note that assurances on confidentiality will be strictly adhered to unless evidence of risk of serious harm, is uncovered.

Any data in paper form will be stored in locked cabinets in rooms with restricted access. All data in electronic format will be stored on secure password–protected computers. No one outside of the research team or appropriate governance staff will be able to find out your name, or any other information which could identify you.

Researchers from the University of Glasgow collect, store and process all personal information in accordance with the General Data Protection Regulation (2018). The data will be stored in archiving facilities in line with the University of Glasgow retention policy of up to 10 years. After this period, further retention may be agreed, or your data will be securely destroyed in accordance with the relevant standard procedures.

What will happen to the results of the research study?

The results of the study will be reported to the department of health Punjab, University of Glasgow as well as being published in a thesis and in a scientific journal.

Who is organising and funding the research?

This research is carried out by the Glasgow University in collaboration with Department of Health Punjab.

Who has reviewed the study?

The project has been reviewed by the College of Medical, Veterinary & Life Sciences Ethics Committee of Glasgow University U.K and Provincial bio ethics committee Punjab.

Contact for Further Information

The researcher is a Pakistani student Amara Khan. You can ask any question you have now. If you have questions, concerns or complaints later, you can call Amara Khan at the cell phone number given below. You can also contact supervisors of this research programme on given email addresses.

You will be given a copy of this form, for any future reference.

You may have questions about your rights as a participant, you can call Amara Khan to ask any questions related to this research.

Researcher: Amara Khan Email:

Supervisors:

Prof. Charlotte Wright Email:

Dr. Ada Garcia Email:

Thank you for taking out to time to read the information sheet.

Appendix 11: Consent form used for LHV interview

University of Glasgow | College of Medical, Veterinary & Life Sciences

Name of BHU:

Participant Identification Number for this study:

Title of Project: **Impact of COVID on routine nutrition advocacy and feasibility assessment of provision of targeted nutrition advocacy messages through primary health care in Punjab, Pakistan**

Name of Researcher(s): **Amara Khan, Prof. Charlotte Wright, Dr. Ada Garcia**

CONSENT FORM

Please initial box

I confirm that I have read and understand the information sheet version 2 Dated 11th June 2021 for the above study and have had the opportunity to ask questions.	☐
I have had the opportunity to think about the information and ask questions and understand the answers I have been given.	☐
I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my legal rights being affected.	☐
I confirm that I agree to the way my data will be collected and processed and that data will be stored for up to 10 years in University archiving facilities in accordance with relevant Data Protection policies and regulations.	☐
I understand that all data and information I provide will be kept confidential and will be seen only by study researchers and regulators whose job it is to check the work of researchers.	☐

I agree that my name, contact details and data described in the information sheet will be kept for the purposes of this research project. ☐

I understand that if I withdraw from the study, my data collected up to that point will be retained and used for the remainder of the study. ☐

I agree to take part in the study. ☐

Name of participant	**Date**	**Signature**
Name of Person taking consent (if different from researcher)	**Date**	**Signature**
Researcher	**Date**	**Signature**

(1 copy for participant; 1 copy for researcher)

Appendix 12: Information sheet used in CRCT

University of Glasgow | College of Medical, Veterinary & Life Sciences

PARTICIPANT INFORMATION SHEET

Study title: Effect of special foods on eating behaviour in babies in need of nutritional support

You are being invited to take part in a research study. Before you decide it is important that you understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part

What is the purpose of the study?

This study is testing how supplementary food affect the way babies eat and how mums feed them when they are malnourished. We will compare, food that is used in some places for treatment of underweight with micronutrient supplementation. We want to find out what are good ways to treat thin children in the future.

Why have I been invited to participate? You have been chosen to participate in the study as you are mother of a child who is moderately underweight. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part, you are still free to withdraw at any time and without giving a reason.

Do I Have to Take Part?

Participation in the study is completely voluntarily and it is up to you to take part in the study or not. If you agree to take part in the study initially but then change your mind, you can leave the study at any time. Please note that information that you will provide before leaving will be used in the study.

What will happen to me if I take part?

To participate in the study, you will have two visits at your nearest primary health care centres with OTP. On your first visit, measurements will be taken of your child's height, weight, upper arm, body fat and bone size.
We will also ask you questions about your child's eating and about family characteristic, like income and information about parents. This will take almost 35 to 40 minutes on your first visit.
You will then be asked to feed your child one packet of the food supplement every day for one month.

After recruitment you will be asked to visit the same health facility after one month, and on your this visit the same interview and your child's body measurements will be repeated, you should expect this visit too will be of 35 to 40 minutes.

What do I have to do?
If you agree to participate in the study, you will be required to answer questions about your child feeding and also some personal questions about your household, employment and income. Team of two data collectors will be asking the question and record your answers. There are no right or wrong answers. Additionally, researchers will ask for your assistance while taking measurements of your child. For feeding observation you will be given a sachet of ready to use food to feed child, the food given will be only for the child and the researcher will observe you and record the observation.

What are the possible disadvantages and risk of taking part?
There is no risk in the interview or during taking measurements of your child's body (weight, height, skin folds and diameters). The skin fold can be uncomfortable for the child, but it is not painful. If your child has allergies to peanuts, or any other food allergy, please let the researchers know and then you will not be asked to participate in the food observation experiment.

What are the possible benefits of taking part?

Hopefully you will find this interesting and informative, if any important issues come up in discussion, and you wish we can report these to your Lady Health visitor or to the medical staff. We will also explain you if your child is growing well or if your child is at risk of malnutrition after we measure your child. We will refer you to a local nutrition programme if we consider it necessary. We will bring a small toy for your child to play and keep busy while you are asked to participate in interview. This study is designed so that we can knows more about food practices in children aged 6-24 months in the Pakistan. This study is not designed to treat any disease or to improve your health.

Will my taking part in this study be kept confidential?

All information which is collected about you, or responses that you provide, during the course of the research will be kept strictly confidential. You will be identified by an ID number, and any information about you will have your name and address removed so that you cannot be recognised from it. Your participation will be completely anonymised within the data. Please note that assurances on confidentiality will be strictly adhered to unless evidence of risk of serious harm, is uncovered. In such cases we might have to inform your Lady Health visitor or the medical staff looking after your child.

Any data in paper form will be stored in locked cabinets in rooms with restricted access. All data in electronic format will be stored on secure password–protected computers. No one outside of the research team or appropriate governance staff will be able to find out your name, or any other information which could identify you.

What will happen to my data?

Researchers from the University of Glasgow collect, store and process all personal information in accordance with the General Data Protection Regulation (2018). The data will be stored in archiving facilities in line with the University of Glasgow retention policy of up to 10 years. After this period, further retention may be agreed, or your data will be securely destroyed in accordance with the relevant standard procedures.

What will happen to the results of the research study?

The results of the study will be reported to the department of health Punjab, University of Glasgow as well as being published in a thesis and in a scientific journal.

Who is organising and funding the research?

This research is carried out by the Glasgow University in collaboration with Department of Health Punjab.

Who has reviewed the study?

The project has been reviewed by the College of Medical, Veterinary & Life Sciences Ethics Committee of Glasgow University U.K and Provincial bio ethics committee Punjab.

Contact for Further Information

The researcher is a Pakistani student Amara Khan. You can ask any question you have now. If you have questions, concerns or complaints later, you can call Amara Khan at the cell phone number given below. You can also contact supervisors of this research programme on given email addresses.

You will be given a copy of this form, for any future reference.

You may have questions about your rights as a participant, you can call Amara Khan to ask any questions related to this research.

Researcher: Amara Khan Email:

Supervisors:

Prof. Charlotte Wright Email:

Dr. Ada Garcia Email:

Dr. Muhammad Nawaz Email:

Thank you for taking out to time to read the information sheet.

Appendix 13: Consent form used in CRCT

University of Glasgow | College of Medical, Veterinary & Life Sciences

Name of BHU:

Participant Identification Number for this trial:

Title of Project: **Effect of Ready to Use Foods (RUF) on feeding, caregiving and behaviour characteristics of 6- 24 months old malnourished Pakistani children-A Cluster Randomised Trial.**

Name of Researcher(s): **Amara Khan, Prof. Charlotte Wright, Dr. Ada Garcia**

CONSENT FORM

Please initial box

I confirm that I have read and understand the information sheet version 1 Dated 2nd September 2019 for the above study and have had the opportunity to ask questions. ☐

I have had the opportunity to think about the information and ask questions and understand the answers I have been given. ☐

I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my legal rights being affected. ☐

I confirm that I agree to the way my data will be collected and processed and that data will be stored for up to 10 years in university archiving facilities in accordance with relevant Data Protection policies and regulations. ☐

I understand that all data and information I provide will be kept confidential and will be seen only by study researchers and regulators whose job it is to check the work of researchers. ☐

I agree that my name, contact details and data described in the information sheet will be kept for the purposes of this research project. ☐

I understand that if I withdraw from the study, my data collected up to that point will be retained and used for the remainder of the study. ☐

I agree to take part in the study. ☐

Name of participant	**Date**	**Signature**
Name of Person taking consent (if different from researcher)	**Date**	**Signature**
Researcher	**Date**	**Signature**

(1 copy for participant; 1 copy for researcher)