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NUTRITION EDUCATION TO PROMOTE CONSUMPTION OF LOW-COST FISH PRODUCTS TO IMPROVE NUTRITIONAL STATUS OF CHILDREN 6-23 MONTHS IN KAMPALA

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NOVEMBER, 2023

DECLARATION

I, Beatrice Anena declare that this study is original and has not been submitted for any other degree award to any other university before.

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APPROVAL

This dissertation has been submitted for examination with the approval of the following supervisors.

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DEDICATION

I dedicate this research, first and foremost, to the almighty God that has brought me this far and to my family, Hadassah Miracle Aber and Manuela Shekinah Aloyo; and lastly, to my parents.

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ABSTRACT

Background: Ugandan children's complementary diets are mainly composed of starchy staples (cereals, roots, tubers, and bananas), with legumes as the main protein source and low consumption of fruits, vegetables, and animal protein sources, hence this study was to educate mothers on the importance of animal source foods in the children's diets .

Methodology: The study was a randomized controlled trial which measured the effectiveness of a new intervention or treatment while reducing bias and provides a rigorous tool to examine cause-effect relationships between an intervention and outcome. The study lasted 8 months. A total of 62 mothers and their children aged 6 to 23 months completed the study. 31 mother- child pairs underwent nutrition education while 31 others did not. Data was collected on knowledge and practices; consumption frequency of low-cost fish products by children, and nutrition status (MUAC-for age, weight-for-age, and haemoglobin status) of children at both baseline and endline.

Results: Analyses were done using independent t-tests to compare means between intervention and control groups at both baseline and endline. Analysis for changes in MUAC- and weight were done using WHO ANTHRO. The intervention mothers exhibited non-significant mean differences in their knowledge (p = 0.000); practices (p = 0.000); and consumption frequency of low-cost fish products (p = 0.000). And there were non-significant mean changes in the children's haemoglobin status (p = 0.153).No changes in the MUAC-for-age and weight-for- age.

Conclusion: Nutrition education did not lead to any significant mean differences in maternal knowledge and practices, consumption frequency of low-cost fish products by children, and did not lead to any changes in the children's MUAC-for-age, weight-for-age and haemoglobin status.

Recommendations: In this study, nutrition education was not effective in promoting consumption of low cost fish products among children. A study longer than 8 months would possibly yield significant mean differences and changes.

CHAPTER ONE

INTRODUCTION

1.1 Background

Malnutrition refers to all deviations from adequate and optimal nutritional status in infants, children, and adults. Undernutrition includes stunting, underweight, wasting, and micronutrient deficiencies like anaemia. The global prevalence of stunting among children aged 6 to 59 months was high at 22.0%, while the global prevalence of wasting was medium at 6.7%. In East and Southern Africa, stunting prevalence was very high at 32.3%, while wasting was medium at 5.3% (UNICEF, 2020). In Uganda, undernutrition is unevenly distributed, with the highest levels in the Karamoja and West Nile regions (Maniragaba et al., 2023). In Uganda, over the years, the trends of undernutrition among children 6 to 59 months have declined except for anaemia, which declined over a period of 5 years between 2006 and 2011 and increased again in 2016. The prevalence of stunting among children declined from 45% in 2000–2001 to 38% in 2006, 33% in 2011, and 29% in 2016 to 26% in 2022; the number of stunted children has been reducing over the years. The prevalence of underweight also declined from 18% in 2000–2001 to 16% in 2006, 14% in 2011, 11% in 2016 (UBOS, 2001, 2006, 2011, 2016) and

to 10.2% in 2022. The number of underweight children has reduced over the years. While the prevalence of wasting did not change much since 2000-01, it reduced from 5% in 2000-01 to 4% in 2016 and 2.8% in 2022, but many children are still wasted. The prevalence of anaemia among children aged 6–59 months declined from 73% in 2006 to 49% in 2011 before increasing slightly to 53% in 2016 (UBOS 2006 & 2011). More than half the children are anaemic. UBOS 2016, which reported an increase in the consumption of meat, fish, and poultry between non-breastfed and breastfed children (43% versus 33%), compared to UBOS 2006, which reported the consumption of meat, fish, poultry, and eggs between non-breastfed and breastfed children to be 34.3% versus 20.1% (UBOS 2006).

1.2 Causes of undernutrition among young children

The causes of undernutrition are complex and multidisciplinary, with the major ones being dietary and environmental factors (Kikafunda et al., 1998). "Child undernutrition in Uganda is caused by a variety of factors, including a high disease burden, inadequate maternal and child care practices, poor access to safe water, suboptimal sanitation and hygiene practices, and underlying environmental and policy factors (FTF 2018 as cited in the Global Hunger Index, 2018)". The causes of undernutrition include reduced dietary intake and malabsorption, especially during illness; increased nutrient losses or altered nutritional requirements; and low energy uptake by the body (Saunders and Smith, 2010). In children, undernutrition is a result of inadequate intake of nutrients and calorie-deficient diets, a disease that affects food intake and nutrient absorption, and preterm delivery (Saeed et al., 2022). Undernutrition is also associated with the age of the child and maternal and paternal education status (Vandana et al., 2022). According to Wamiq et al. (2023), the risk factors for undernutrition include the age of the child, poor maternal education, and the use of cow’s milk before one year of age. The primary cause of the high prevalence of micronutrient malnutrition like vitamin A deficiency is the poor nutritional quality of the diet due to a lack of diversity and low intake of Animal- source Foods (ASF) (Roos et al., 2007). These low intakes cause retarded growth and mental development in children, as well as high morbidity rates and an increased risk of early death (SCN, 2004; as cited in Roos et al., 2007).

The high prevalence of undernutrition in Uganda is attributed to the consumption of bulky staple foods such as bananas (Kikafunda et al., 2003), which are not rich in nutrients. The foods given to children are high in starch and low in fat, making them very bulky with a very low energy density (359 kJ/100 g) compared to the recommended 600–800 kJ/100 g of food

(Kikafunda, 2003). Complementary foods given to children comprise mainly cereal-based porridge with little or no vegetables and often lacking animal-source proteins (Muhimbula & Issa-Zacharia, 2010). This makes the food nutritionally inadequate since children at this age require nutrient-dense foods for proper physical and mental growth.

1.3 Interventions that have been implemented to reduce undernutrition in children under five years of age

In Uganda, undernutrition has been addressed in various ways, including by training mothers of the affected children on the use of diversified diets to reduce undernutrition (USAID, 2018). Other interventions designed to reduce undernutrition are promotion of exclusive breastfeeding among mothers; nutrition education of the mothers in western Uganda on children's diets; provision of supplementary food like eggs to school children in northern Uganda; agricultural interventions like promotion of orange fleshed sweet potatoes have improved vitamin A intake among women and children; animal husbandry of improved breeds which resulted in consumption of more milk in households that embraced it and promotion of improved bean varieties improved household food diversity and food security; cash transfer programmes also led to better nutrition of the children because the mothers were able to provide more animal products like meat, eggs milk, and other foods to their children (Global hunger index, 2018). Other non-nutrition interventions include reductions in malaria through interventions like distribution of ITN. Prevention and treatment of malaria have been seen to reduce stunting in children (Keats et al., 2022).

Nutrition education has been found to be a successful way to promote nutrition and achieve changes in the nutrition status of children and the knowledge of caretakers in different settings, as reported in the following studies: Pietravalle et al. (2022) reported that nutrition education of mothers of acutely malnourished children aged 6–24 months who were fed on RUTF or RUSF led to improved nutrition status (weight gain and weight/height ratio) of the children. As reported by Jardi et al. (2021), generally, nutrition education brought about changes in food

consumption, anthropometry, and the knowledge of caretakers, but only studies that included agriculture, educational workshops, and supplementation achieved the greatest benefits at the end of the study. Awuuh et al. (2019) also reported improved nutrition status (weight, MUAC, and haemoglobin) in undernourished children whose mothers underwent nutrition education. Improved nutritional status (increases in weight, height, mid-upper arm circumference, and reduced morbidity) was seen in the under-fives in many studies, as reported by Majamanda et al. (2014). Khan et al. (2013) reported that nutrition education of mothers led to a reduction of undernutrition among children between 6 months and 8 years in food insecure households. In Uganda, nutrition education in less resourced rural communities led to improved nutritional status (weight-for-age) at low cost (Kabahenda et al., 2013), and nutrition education also led to improved child feeding practises and nutritional status in rural farming communities in Uganda (Kabahenda et al., 2011).

The objective of this study was to use nutrition education to promote the consumption of low-cost fish products by children aged 6 to 23 months in order to increase ASF consumption. This was done by educating their mothers about the importance of ASF, in particular low-cost fish products, in the children's diets. The nutrition education of mothers was necessary because the quality of the diets of Ugandan children is poor, high in starch, and low in ASF. Inclusion of ASF in the children's diets would therefore lead to increased micronutrient intake by the children, especially iron, good-quality protein, zinc, and vitamin A.

1.4 Importance of animal-source foods (ASF) to children

ASF includes meat, milk, eggs, fish, pork, and poultry. Low-cost fish products, just like fish and other animal-source foods, provide high-quality and readily digested protein and energy and are compact and efficient sources of readily available micronutrients (Neumann et al., 2002) for children, which promote growth (Grillenberger et al., 2006). The presence of ASF, like low-cost fish products, in children's diets is an efficient delivery mechanism during periods when micronutrient requirements are high, for example, early infancy and childhood (Lora, 2008). This is because ASF, such as low-cost fish products, are richer sources of riboflavin, vitamin B12, calcium, phosphorus, fat, and protein, which are available at a lower volume of intake. Low-cost fish products also provide multiple micronutrients simultaneously to diets that are marginally lacking in more than one nutrient (Murphy & Allen, 2003). Inclusion of low- cost fish products in children's diets led to increased micronutrient intake and growth in children since they provide energy and nutrients in high amounts and in bioavailable form (Grillenberger et al., 2006).

This study would therefore contribute to increasing the consumption of ASF by children aged between 6 and 23 months by promoting the consumption of low-cost fish products. Low-cost fish products are a combination of Mukene (*Rastrineobola argentea*) and by-catches of juvenile fish that can be used to bridge the gap so that low-income earners are able to provide enough ASF for their children. The most common low-cost fish products include by-products from industrial filleting operations, low-priced pelagic fish such as Mukene *(Rastrineobola argentea)*, and juvenile fish such as Nile perch and Nile tilapia (Kabahenda et al., 2009). These products are rich sources of protein and other micronutrients. For example, Mukene *(Rastrineobola argentea*) has an iron content of between 2.60 mg/100 g and 10.68 mg/100g and a protein content of 15.56 to 58.79 mg/100 g; perch eggs have an iron content of between 5.42 mg and 5.67 mg/100g and a protein content of between 32.06 and 38.74 mg/100 g; and perch head has an iron content of between 2.38 mg and 6.05 mg/100 g and a protein content of between 27.26 and 29.38 mg/100 g (Kabahenda et al., 2011). Per 100g, Mukene *(Rastrineobola argentea)* contains more iron (Kabahenda et al., 2011) compared to ground beef which contained1.64 mg (Kawarazuka and Bene, 2010).

Therefore, mothers were empowered with information and skills to utilise available low-cost fish products in a culturally acceptable manner to improve nutrient intake among the children

(Mcaleese & Rankin, 2007), and this led to improved child feeding practises and better nutritional status (Kabahenda et al., 2011).

1.5 Problem statement

Less than 50% of children aged 6-23 months consumed ASF (UBOS, 2016).Which meant that more than half of children aged 6–23 months in Uganda did not consume ASF, yet these foods are rich sources of both macronutrients and micronutrients that are bio-available and are efficient delivery mechanisms of nutrients during early infancy and childhood when requirements are high (Lora et al., 2008). The consumption of fish protein in Uganda was also reported to be generally low, with less than 10% of households consuming a fish product in a week (Kawarazuka & Bene, 2010). This could be attributed to the very high fish prices, which have generally had an effect on the consumption of fish by households. The low consumption of ASF by children aged 6–23 months can be bridged by consuming low-cost fish products.

At 6 months of age, the iron stores the child was born with are reduced (Lora et al., 2008). This means a child needs nutrient-dense complementary foods to be able to restore their iron stores and get other nutrients needed to grow well. Therefore, inclusion of ASF in the children's diets improves the diet quality because ASF are dense sources of energy, high-quality protein, and rich sources of micronutrients like iron, zinc, and vitamin A from meat; vitamin B12, riboflavin, and calcium from milk; taurine, selenium; and the long-chain polyunsaturated fatty acids, pentaenoic and hexaenoic acids, found in meat, fowl, and fish. ASF are also rich sources of Iron, zinc, vitamin B12, and preformed vitamin A, which are bioavailable and are all necessary for the proper growth of children. Several studies, including Grillenberger et al. (2006), have reported that consumption of meat and fish led to linear growth in children. Meat, fish, and fowl are rich sources of hemoprotein, which enhances iron and zinc absorption from plant food sources. The enhanced absorption of iron by the hemoprotein reduces the risk of anaemia in children. Children are able to meet their daily energy, iron, and zinc requirements by consuming 60 g of meat per day (Neuman et al., 2002). This study therefore focused on nutrition education of the mothers on consumption of low-cost fish products to improve consumption of ASF, increase micronutrient intake, and improve growth among children aged between 6 and 23 months.

1.6 General objective

To promote consumption of low-cost fish products in order to improve the nutritional status of children aged 6–23 months.

1.6.1 Specific objectives

1. To assess the knowledge and practices of mothers in regard to incorporating low-cost fish products frequently in the children's food.
2. To assess of the influence of nutrition education on the frequency of consumption of low-cost fish products by young children (6-23 months)
3. To assess effect of consumption of low-cost fish products on children's nutrition status.

1.6 Hypotheses

It was hypothesized that:

1. The mother's knowledge and practices to incorporate low-cost fish products frequently in children's food would improve after nutrition education.
2. The mothers would be able to frequently incorporate low-cost fish products in the children's food after nutrition education.
3. Consumption of low-cost fish products would improve the children's nutrition status.

1.7 Justification

Nutrition education has been found to be a successful way to promote nutrition and achieve changes in nutrition status of children and knowledge of caretakers. Complementary diets of Ugandan children are bulky, with a lot of starch and limited ASF (Figure 1). Children at this age require nutrient dense foods that will enable them grow well. They require adequate energy, quality protein, and micronutrients such as iron, zinc, vitamin A. These nutrients are sufficiently provided by consumption of small volumes (60 g per day) of ASF in the children's diets. This therefore called for promotion of consumption of ASF by children by educating their mothers on the importance of ASF in the children's diets. Promotion of consumption of ASF by children of this age led to increased macronutrients and micronutrient intake, which led to better nutrition status and growth of children (Kabahenda et al, 2013). Low-cost fish products were seen as an alternative ASF for households that are limited in resources. However, there was need for nutrition education to improve the mother's knowledge of the benefits of low-cost fish to children and how to incorporate them into their children's diets.

1.8 Conceptual framework

The intervention need:
The complementary foods of Ugandan children are bulky with limited ASF making them poor diets and this has led to poor nutritional status (stunting, underweight, wasting) and anaemia in more than half of children aged between 6 months and 59 months. Nutrition education of mothers is expected to improve the mother's knowledge, feeding practices and nutrition status of the children

The target group:
Mothers and their children aged 6 months to 23 months from resource poor settings, who were willing to provide better meals to their children and learned better in a group setting.

Learning goals and program outcomes included
Better mother's knowledge & child feeding practices
Increased consumption frequency of low-cost fish products by children;
Better child nutrition status

Appropriate implementation strategies/approaches:

They included simple messages, visual materials, discussions, cooking demonstrations, meal preparations, use of culturally acceptable foods

Objectives and outcomes achieved:

Mothers better knowledge and practices in regard to feeding children; increased consumption frequency of low-cost fish products by children; better nutrition status of the children compare to the baseline

Figure 1: Conceptual framework

CHAPTER TWO

LITERATURE REVIEW

2.1 General nutritional status of children below five years

The global prevalence of stunting in children below five years of age was at 22.0% while the prevalence of wasting was at 6.7%. While in Africa, the prevalence of stunting was at 30.7% while the prevalence of wasting was at 6.0% (Global nutrition report, 2023). The stunting is Africa was higher than the global prevalence, while the wasting in African is lower than the global prevalence. In Uganda, the prevalence of stunting was at 25.4% while wasting is at 3.6%; both are lower than the prevalence of stunting and wasting in Africa (Global nutrition report, 2023). In Uganda, stunting was at 45% in 1995 and 2001 which declined to 38% in 2006 and further declined to 29% in 2016. While underweight was at 22% in 1995 which declined to 19% in 2001 and further declined to 16% in 2006 and then further declined to 11% in 2016. And wasting was at 7% in 1995, which declined to 5% in 2001 and increased to 6% in 2006 and again declined to 4% in 2016. Generally, there has been a decline in stunting, underweight and wasting among children aged 6-23 months between the years of 1995 and 2016

2.2 Diets of young children

"Globally, young children's diets were worryingly poor, progress to improve them has been slow. Children's diets should be diverse, should include ASF, vegetables, fruits, and breast milk. Between 2010 and 2020, the quality of the children's (6 months to 23 months) diets improved; introduction of solid foods increased from 66% to 72%; minimum meal frequency improved from 51% to 54%; vegetables and or fruits consumption increased from 48% to 53%; eggs, fish and or meat increased from 32 to 36%; while minimum dietary diversity 5+ increased from 21% to 24% "(UNICEF, 2021).

In Eastern and Southern African, introduction of solid foods in 6 months to 8 months old was at 77% higher than the global percentage; minimum meal frequency was at 47% for 6 months to 23 months old lower than the global; vegetable and or fruit consumption in 6 months to 23 months old was at 57% higher than the global; egg, fish and or meat consumption in 6 months to 23 months old's was at 38% higher than the global; minimum dietary diversity in 6 months to 23 months old's was at 24% similar to the global (UNICEF, 2021).

In Uganda, in the last decade 2010 to 2020, no significant change in diversity of children's diets. Children's diets in Uganda are predominantly starch-based and lack the critical nutrients that children's brains and bodies need to grow well" (UNICEF, 2021). "Only 30% of infants and young children aged 6 months to 23 months in Uganda consume a diet meeting the minimum recommended number of food groups, increasing their risk of micronutrient deficiencies and growth faltering (CONGA, 2021). According to CONGA (2021), "the foods sources of micronutrients of concern in Uganda are small, dried fish (calcium, iron), chicken liver (iron), beef liver (iron), beef (iron), amaranth greens (calcium, iron), beans (iron), and whole milk (calcium).

2.3 Anaemia among children below five years of age

"Anemia in children 6–23 months of age is defined as hemoglobin (Hb) concentration in the blood below 11 g/dL. It is further classified as mild (10.0 g/dL <Hb <10.9 g/dL), moderate (7.0 g/dL < Hb <9.9 g/dL) and severe (Hb <7.0 g/dL) based on the concentrations of hemoglobin in the blood." (Gebremeskel and Tirore, 2020).

According to WHO (2023), globally the prevalence of anaemia in children aged 6 to 59 months was mild (5% to 20%) to moderate (20% to 40%) in most of the developed world and severe (more than 40%) in most of Africa (except in Mozambique and North Africa) and in India. According to the World Bank (2019), globally anaemia declined from 48% to 40% between 2000 and 2019. The prevalence of anaemia was 13% in high incomes countries; 43% in low- and middle-income countries; and 59% in low-income countries; 40% in middle income countries; 21% in upper middle-income countries and 61% in sub–Saharan Africa. Anaemia is still a big challenge in Uganda. According to WHO (2023), Uganda had an anaemia prevalence of 51.7% and according to the World Bank (2019), the prevalence of anaemia in Uganda was 52%, more than half the children are anaemic. In Uganda, the prevalence of anaemia in children aged 6 to 59 months declined over the years, from 72.9% in 2001 to 51.7% in (World Bank 2019). According to UBOS, the prevalence of anaemia in children aged 6 to 59 months declined from 73% in 2006 to 58.1% in 2011 and 53% in 2016.

The commonest form of anaemia in children is iron deficiency anaemia because children are introduced to soft foods which are most of the time lacking in iron that is critically needed by the growing children (WHO, 2001). Folate-deficiency anaemia comes as a result of a child eating food that's poor in folate and this leads to megaloblastic anaemia where the red blood cells become larger, oval instead of round and do not live long as normal red blood cells Stanford Medicine (2023). Lack of vitamin A has been reported by Semba et al. (2010) to cause anaemia because vitamin A is reportedly involved in the pathogenesis of anaemia through diverse biological mechanisms, such as the enhancement of growth and differentiation of erythrocyte progenitor cells, potentiating of immunity to infection and reduction of the anemia of infection, and mobilization of iron stores from tissues. Anaemia of inflammation results from chronic illnesses like autoimmune diseases and infections that last more than three months, affecting red blood cell production (Weiss et al., 2019). Parasitic infections like malaria and intestinal parasites have been reported to cause anaemia by destroying red blood cells both infected and uninfected, delaying production of other red blood cells and blood sucking worms (White, 2018).

2.4 Risk factors of anaemia in children

Anaemia is partly attributed to the depletion of iron stores accumulated in while the child was in the womb, coupled with the high growth rate experienced in the first 2 years of life. The risk for anaemia is further aggravated by complementary foods that are limited in iron and other hemopoietic nutrients such as vitamin A, B12 and C. For example, "30% of infants and young children aged 6 months to 23 months in Uganda consume a diet meeting the minimum recommended number of food groups, increasing their risk of micronutrient deficiencies and growth faltering (CONGA, 2021).

Anaemia is also associated with the introduction of cow’s milk as a complementary food. Cow’s milk when introduced early can induce gastrointestinal bleeding and predispose children to anaemia because it’s not modified to suite their level of development. In addition, milk is also low in iron; however, in most cases, milk is often the main food for children 6–24 months of age. In some cases, milk displaces other foods which could potentially serve as iron sources; and this is especially due to late introduction to complementary foods, after 6 months of age (Elalfy et al., 2012). Consumption of unmodified cow’s milk has been related to poor cognitive development. For example, Wolf and colleagues (1999) reported reduced psychomotor development (lower sub-quotient scores, especially on personal and social scales) among children (18 to 24 months) who were fed unmodified cow’s milk.

Poverty leads to reduced access to nutrient-dense foods such as animal-source foods (ASF) and is one of background factors predisposing young children to anemia (Kyong et al., 2009). To reduce the risk of anemia among children in the low resourced households, alternative cheaper sources of nutrient dense foods like low-cost fish products (LCFP) can be used instead of the more expensive ones because they are equally rich in protein and other micronutrients such as iron (Kabahenda et al., 2011).

Another risk factor for anemia in children is sex. In general, males are more prone to anaemia because they have a higher growth rate compared to the females; thus, males require more iron to meet the requirements for the high growth rate (Kyong et al., 2009). According to (Kyong et al., 2009) boys were 40% more likely to develop iron deficiency and 70% more likely to develop iron deficiency anaemia compared to the girl child.

Low daily iron intake (Elalfy et al., 2012) is also one of the risk factors for anaemia in children. In Uganda, children are fed starchy staples like green cooking bananas, sweet potatoes, cassava, maize and beans (Kikafunda, 2003) as complementary food; these foods contain iron inhibitors like phytates (Marfo et al., 1990) that reduce bioavailability of iron to the children thus reducing their daily intake of iron.

Disease like diarrhea, malaria and helminth infections predispose children to anemia by altering iron homeostasis, impairing proliferation of erythroid progenitor cells, blunting erythropoietin response, and decreasing erythrocyte half-life (Semba et al., 2008). When these infections are so frequent and severe, they cause iron loss from the children. For example, when diarrhea is frequent, the child will absorb very little dietary nutrients such as iron and yet these nutrients are being depleted. Frequent episodes of malaria also lead to destruction of red blood cells by the malarial parasites (Kelkar et al., 2004). The high incidences of worm infestations also predispose young children to anemia (Smith & Brooker, 2010).

Lack of consumption of vitamin A rich foods (Semba et al., 2010) also exposes young children to vitamin A deficiency which interferes with iron metabolism by impairing mobilization of iron from the iron stores causing increased iron accumulation in the liver and spleen

(Zimmermann et al., 2006) thus exposing the child to the risk of anemia. Likewise, deficiencies of iron and vitamin A are also risk factors to anemia in children (Gamble et al., 2004) because iron deficiency is the main cause of anemia and vitamin A deficiency impairs mobilization of iron from iron stores to other body parts.

Other risk factors for anemia in children include inadequate intake of vitamin B12 (Gomber et al., 2003) because vitamin B12 is required for red blood cell production in the body. Vitamin C deficiency is also linked to anemia because vitamin C enhances the absorption of dietary iron (Fishman et al., 2000). In a study where vitamin C was combined with iron in fortification of water, children that consumed it had reduced risk for anemia (Rocha et al., 2011).

2.5 Implications of anaemia to child growth and development

In children under 24 months of age, iron deficiency anaemia led to poor outcomes in several areas of the child development that include cognition, motor, social-emotional functioning and locomotor development. Iron deficiency anaemia also led to slower neural transmission, altered rapid eye movement density in active sleep, poorer recognition memory with ERPs, and altered electroencephalographic frontal asymmetry in infants (Lozoff, 2007). The biological basis of cognitive development and behavior development is not completely understood but could include abnormalities in neurotransmitters metabolism, decreased myelin formation and alteration in brain energy metabolism (Batra & Sood, 2005). Hulthen (2003) reported that "iron deficiency causes low brain iron, which leads to a reduction in neurotransmitter levels, impaired transmitter function, hypomyelination and delayed neuromaturation, or the systemic effects of anemia lead to low oxygen delivery to the brain, directly affect cognition". This is because of the involvement of iron in synthesis and packaging of neurotransmitters, their uptake and degradation into other iron containing proteins which may directly or indirectly alter the brain function (Batra & Sood, 2005). Low haemoglobin also results into impaired motor development in children (Sherriffa et al., 2001). Iron is important to the normal development and functioning of dopamineric neurons and those early changes could lead to permanent damage. The significant effects on neurotransmitter receptors during early stages of iron deficiency indicate the deficits in both excitatory and inhibitory pathways of central nervous system (Batra & Sood, 2005). Impaired psychomotor development (failed language capabilities and body control skills) in anaemic infants (Walter et al., 1989); anaemia in children also affects speech development (Hokama et al., 2005), this is because iron deficiency anaemia results in tissue iron deficiency as well as reduction in circulating hemoglobin and causes the most severe functional liabilities in the body (Batra & Sood, 2005).

2.6 Children's diets and risk factors for anaemia

"Minimum dietary diversity (MDD) is the proportion of children 6–23 months of age who receive foods from 4 or more food groups". In Uganda, only 11.4% of children aged 6 to 24 months met the MDD (Nutrition Situation Report 2020). According to Akumu et al, (2003), the diets of Ugandan children aged between 6 and 24 months are mainly composed of starchy staples (cereals, roots, tubers and bananas) with the main protein coming from legumes with low consumption of fruits, vegetables and animal-source foods. Complementary foods given to children comprise mainly cereal-based porridge with little or no vegetables and often lacking animal-source proteins (Muhimbula & Issa-Zacharia, 2010). The foods given to children are high in starch, making them very bulky with very low energy density (359 kJ/100g) compared to the recommended 600-800 kJ/100g of food. This makes the food nutritionally inadequate since children at this age require high amounts of nutrients, especially iron for proper physical and mental growth. Also, in central Uganda, children are introduced to complementary food early, before 4 months of age yet the foods are often dilute with poor energy and nutrient content and are mostly dominated by the green cooking banana (matooke) which is bulky and less nutrient dense (Kikafunda et al., 2003). Animal-source food consumption is very low, which poses a risk to children to various micronutrient deficiencies including anemia. Low-cost fish products just like fish are rich in protein and other micronutrients (Kabahenda et al., 2011), therefore when incorporated into the children's foods, the diet quality will improve and consequently reduce risk of anaemia and poor growth among children between 6 and 24 months of age in Uganda.

2.7 Importance of animal-source foods to children

ASF include meat, milk, eggs, fish, pork and poultry. "They are important as a food-based approach to combat persistent under nutrition among different populations when consumed. They provide many essential micronutrients like iron (haem), zinc, calcium, vitamin A and Vitamin B12" (Schönfeldt et al., 2013). They also supply high quality and readily digested protein, energy and readily available micronutrients (Neumann et al., 2002). Furthermore, they provide high amounts of nutrients in a bioavailable form, which promotes growth in children (Grillenberger et al., 2006). Thus, the presence of ASF in the diet has been cited as an efficient delivery mechanism during periods when micronutrient requirements are high, for example in pregnancy, lactation, early infancy, and childhood (Lora, 2008). They provide all these nutrients at lower volumes of intake, and they simultaneously provide more than one nutrient to diets that are marginally lacking in macronutrients desirable for children (Murphy & Allen, 2003). Inclusion of ASF in children's diets also led to improved micronutrient status and growth (Grillenberger et al., 2006).

It was hypothesized that promotion of low-cost fish products in an ASF is likely to reduce the risk of anemia and promote growth in children because low-cost fish products were reported to be rich in bioavailable protein, and other micronutrients like iron and vitamin A, needed by children (Kabahenda et al., 2011). Vitamin A is important in proper iron metabolism because it helps in mobilizing of iron from iron stores to the body parts where it is required; and also builds children’s immunity to prevent diseases (Roos et al., 2003). Fish is also rich in protein needed for building the children’s bodies (Darnton-Hill et al., 1988 as cited in Roos et al., 2003).

2.8 Interventions that have used fish to increase micronutrient intake and improve growth

ASF include meat, milk, eggs, fish, pork and poultry. "They are important as a food-based approach to combat persistent under nutrition among different populations when consumed. Meat, including fish as well as animal flesh, was shown to prevent a decrease in hemoglobin in 8 month-old infants, possibly by enhancing iron absorption (Engelmann et al., 1998 as cited in Morgan et al., 2004). Several interventions have used different fish products like whole fish like Cray and Kapenta, and other modified fish products like fish biscuits, fish powder to increase micronutrient intake and improve growth in children.

Agbon et al. (2009) reported inadequate amounts of iron in the cereal-based complementary foods that had Cray fish added to them. This led to low iron intake by the children. While another trial where dried kapenta fish powder similar in nutrient composition with fish concentrate type B from Norway was used to complement maize-based diets of children reported that it met most nutrient requirements of children from maize-based diets except for vitamin C, A and E that needed to be got from vegetables. The maize-based children diet supplemented with minor amounts (10-20 g) of dried kapenta fish provided nutrients like calcium, iron, and zinc which are needed in high amounts by children (Haug et al., 2010).
Increase in children’s weight was reported in a study by Greco et al., (2006) after they consumed high-energy porridge that had fish powder and other protein sources added. The high-energy porridge had different ingredients added to it to increases the nutritional value,

for

example the protein sources were from fish powder added 4 times a week; chicken added once a week, cow's meat added once a week and beans added once a week. The rich protein sources collectively led to weight gain in the children. While Lartery et al. (1999) reported some improvement in growth (length and weight) of the children who consumed dehydrated koko (fermented maize dough) with fish powder added, as much as was seen in children who consumed Weanmix cereal-legume blend among Ghanaian infants.

Thompson & Merry (1962) reported that fish biscuits that contained "a mixture of 12% millet flour, 25 % sugar, 20-24% of groundnut press-cake flour, and 12-14% of deodorized fish meal, (made from Clupea pilchardus, which was very similar to a local Malayan fish, ikan tambun (Sardinella clupea). The fish biscuits protein content of was 24%, while the fat content was 10- 13%, moisture content of 5% and lysine content standardized to 3-5 %, with a little lemon flavoring added for palatability." The children who received the fish biscuit showed a greater increase in weight than those who received skim-milk powder alone. The higher lysine content of the fish biscuits and their convenience in use led to weight increase in the children that consumed the fish biscuits compared to those that had only skimmed milk as supplementary food in the Federation of Malaya. Also, and pre-school children who were fed 30g of fish protein concentrate for 9 weeks, showed a decrease in hemoglobin concentration, results that were similar to those showed by children who were fed on milk (Brinkman et al., 1970).

2.9 Studies that have used nutrition education to promote good feeding among different populations

Nutrition education is a key element in promoting sustainable healthy eating behaviours and should start from early stages of life. Maternal nutrition knowledge is an important factor that determines the nutrition status of their children, especially after 6 months of age, when breast milk alone is not sufficient to meet the child's nutritional needs in terms of energy and other nutrient needs. Many intervention studies have used nutrition education and have been successful under different settings. A review of randomized and quasi randomized studies by Imdad et al. (2011) concluded that nutrition education led to improved complementary feeding practices and had a significant effect on children's growth, much as provision of appropriate complementary foods would be sufficient to prevent undernutrition with or without nutrition education.

Under community settings, there was success in proper complementary feeding, which led to improved growth in the children at the end of the study when mothers in Pakistan were educated for 30 weeks on complementary feeding. Growths of the children were monitored in terms of weight, length, MUAC, stunting, wasting and underweight (Saleem et al, 2014). In 2017, Olika from Ethiopia reported that mother's level of education and number of children per mother determined when complementary feeding was initiated and suggested nutrition education should be done especially in rural areas to improve their knowledge, attitudes and practices in regard to complementary feeding. Maternal nutrition knowledge improved after virtually educating mothers from the same education level background (university level) using online platform, though it did not totally compare to the physical nutrition education format (Nadimin et al. 2020). There was also improved maternal nutrition knowledge after an 8 day WhatsApp nutrition education of mothers, where nutritional material was shared on the groups' What's App platform, Rachmah et al, (2023). In the Masai community, it was found that nutrition education alone is not adequate in improving complementary feeding of children aged 6 to 24 months because food insecurity also affected complementary feeding practices in terms of untimely introduction, diet diversity and meal frequency (Binamungu et al, 2023). Complementary feeding practices in terms of what age to introduce complementary foods, frequency of child feeding and feeding consistency of the children improved after nutrition education in rural areas of India (Prajapati et al, 2023). Pakistan rural communities of 12 weeks of nutrition education led to improved maternal nutritional knowledge, which influenced better child growth (Bhatti et al, 2020). Improved caregiver feeding practices, increased dietary diversity and feeding frequency of the children even 1 to 2 months post the study was reported after nutrition education that lasted 4 to 8 weeks (Ickes et al, 2017).

CHAPTER THREE

METHODOLOGY

3.1 Description of population

The study population resided in the barracks of the two prisons. The population comprised of mothers and their children aged between 6 -23 months. One child aged between 6 and 23 months was selected per household. For households that had more than one child in the age bracket (not twins), one was randomly selected to participate in the study by tossing a coin with each side representing one child. The age of the children was determined from the childbirth cards presented by the mothers.

3.2 Geographical description of the study area

The study was conducted at two sites Luzira and Kigo prisons. Luzira was the intervention site while Kigo was the control site (Figure 2). The study was conducted in Murchison Bay prison Luzira located in Nakawa division, Kampala. Murchison Bay prison Luzira has over 600 staff. It houses prisons for men and women, churches, a mosque, a nursery school, a primary school, a staff clinic, accommodation facilities for prison warders, mixed farm and other structures. Luzira prison barrack was selected because it is near Port Bell landing site at the shores of Lake Victoria where LCFP are easily available and accessible to the study population at affordable prices. While Uganda Government Kigo Main Prison is located in Mutungo parish, Makindye Sub-County, Kyadondo County, Wakiso District along Lake Victoria shores. Kigo prison sits on a 328.6-acre piece of land that houses prisons for men and women, a poultry farm, a school, a staff clinic, accommodation facilities for prison warders and other structures. The two study sites were purposively selected because they approximately had similar sociodemographic characteristics. The two sites were chosen because they were far enough from each other to prevent information leakage between the intervention group and control group.

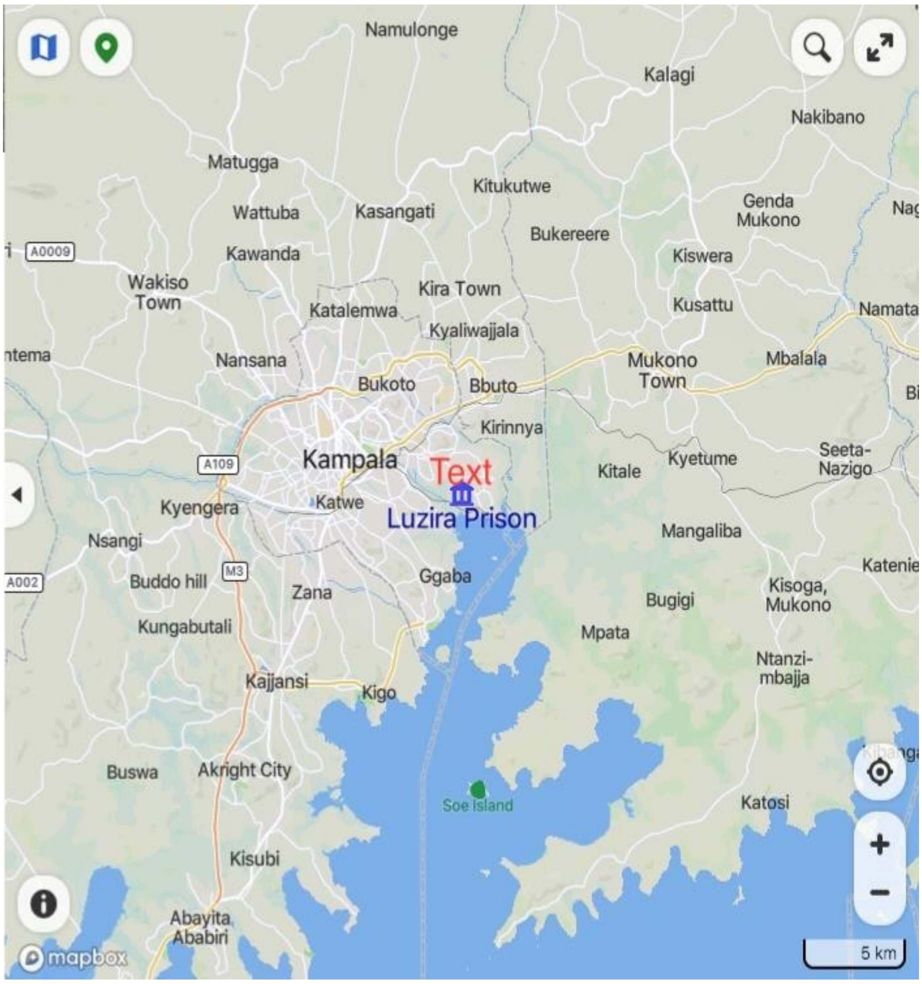

Figure 2: Map of the study area

3.3 Research design

The study was a randomized controlled trial that lasted 8 months (Figure 3). Recruitment of study participants (mother child pairs) for both the intervention and control groups took place between June and July 2013. Baseline data collection for both intervention and control sites was done in August 2013. The baseline data that was collected from the children was age, weight, MUAC, HB. From the mothers, the baseline data collected was on frequency of consumption of LCFP by children and knowledge and practices on consumption of LCFP by the children. Nutrition education was done in August 2013 for the intervention group mothers. Each of the 3 quarters had 3 consecutive days of nutrition education respectively. Follow up 1 for both the intervention and control groups was done a month post intervention, in late September to early October 2013; and follow up 2 for both the intervention and control sites was done 6 months post intervention in late February to early March 2014. One-month post intervention and end line assessments data were collected on children's age, weight, MUAC, HB. While from the mothers, the data collected included frequency of consumption of LCFP by children and knowledge and practices on consumption of LCFP by the children. After the 9 days of training, the mothers were asked to practice what they had learned in their homes.

Enrolment (June to July 2013)	**Intervention group** Enlisted by the chairpersons, n=80	**Control group** Enlisted by the chairpersons, n=50
Dropped off (June to July 2013	40 mother child pairs did not consent to the study (however16 attended nutrition education and 24 were not	19 did not consent to the study
Randomisation (June to July 2013)	40 mother-child pairs were selected by choosing one and skipping the next	31 were selected by selecting one and skipping the next
Allocation (June to July 2013	Allocated to intervention group, n=40	Allocated to the control group, n=31
Baseline assessments (June to July 2013)	Assessed at baseline, n=40	Assessed at baseline, n=31
Nutrition education **(**August, 2013)	Attended nutrition education n=40	Did not have nutrition education, n=31
Follow up 1 after one month (September to October 2013)	Available n=25 Unavailable= 15 (5 had been transferred, 10 were not around had other engagements)	Available n=25 Unavailable, n=6 (6 were not around had other engagements)
Follow up 2 after six months (February to March 2014)	Available, n=31 Unavailable=4 was not around	Available, n=31
Analysis	Analysed, n=31	Analysed, n=31

Figure 3: Research design

3.3 Sampling strategy

Based on Chan (2003), the calculated sample size that gave an effect size of 0.5, power of 80% at $p<0.05$ was 34 children per group. The chairpersons of the intervention and control sites provided lists of households with children aged 6 to 23 months. At the intervention site, each of the 3 chairpersons provided a list of households with children aged 6 to 23 months. Two of the quarters provided each a list of 26 households and the other quarter provided a list of 28 households with children aged between 6 and 23 months. The study participants were then randomly selected from the list by selecting the first and skipping the next. In the end, a total of 40 mother child pairs were selected, with 13 each from two quarters and 14 from one quarter. All the 40 consented to the study and were included in the study. All the 40 mother child pairs in Luzira underwent the baseline assessments; the children's age, weights, MUAC and HB were measured while the mother's knowledge and practices on consumption of LCFP by children was also assessed. The assessments were done per quarters, in quarters', A, B and Owokoby the principal investigator, two trained data collectors and a laboratory technician. A total of 56 mother child pairs in Luzira attended nutrition education, 40 were included in the study, while the other 16 mother child pairs were interested in learning how to feed their children better. The nutrition education was done per quarter, in A, B and Owoko which constituted the intervention group. The nutrition education lasted 3 consecutive days each per quarter, in A, B and Owoko; two of the quarters (A and B) had 18 mother child pairs attending nutrition education in their respective quarters, while 20 mother child pairs from Owoko attended nutrition education . A month later, follow up 1 was done. 25 mother child pairs from all the 3 quarters (A, B and Owoko) participated in the follow-up 1 assessment, their children were assessed on age, weights, MUAC and HB and the mother's knowledge and practices on consumption of LCFP by children was also assessed. Follow up 2, was done 6 months later, 31 mother child pairs from quarters A, B and Owoko participated. Assessments were done on the children's age, weights, MUAC and HB and the mother's knowledge and practices and on consumption of LCFP by children.

At the control site, a total of 50 mother child pairs were listed by the chairpersons. The study participants were then randomly selected from the list by selecting the first and skipping the next. 31 of the mother child pairs consented to the study and underwent baseline assessments on the children's age, weights, MUAC and HB and the mother's knowledge and practices on consumption of LCFP by children. The assessments were done per quarter by the principal investigator, two trained data collectors and a laboratory technician. The assessments were done in one place within the prison quarter where the mother child pairs gathered. The mother child pair did not undergo nutrition education. A month later, follow up 1 was done. 25 mother child pairs participated in the follow-up 1 assessment, their children were assessed on age, weight, MUAC and HB; and the mother's knowledge and practices and consumption of LCFP by children was also assessed. Follow up 2, was done 6 months later, 31 mother child pairs participated. Assessments were done on the children's age, weight, MUAC and HB and the mother's knowledge and practices and on consumption of LCFP by children.

3.5 Nutrition education implementation

The intervention was a 3-day consecutive nutrition education session per quarter for 3 different quarters that constituted intervention group. Through nutrition education, the study promoted consumption of low-cost fish products by children aged between 6 to 23 months. Each nutrition education session was constituted of a 40-minutes lecture session plus cooking demonstrations that lasted 2 to 3 hours. Each nutrition education session had a theme: the first session was learning how to group foods into their respective food groups; the second session was planning and preparing low-cost fish products and other foods for children; and the third session was meal planning in terms of portions and consumption frequency of low-cost fish products by children (see Appendix 1) The intervention was designed to provide mothers with knowledge to select and incorporate a variety of low-cost fish products into children's meals to improve the quality of children's diets. The nutrition education sessions were facilitated by the principal investigator.

Facilitation of nutrition education sessions

This study was adapted from Kabahenda et al. (2011). The adaptations included selection of study sites, where the study sites selected had socio-demographically similar characteristics. Also, the local leaders were involved in the process of recruitment of the study participants through identification of households with children in the study age group (6 to 23 months). The process to conduct nutrition education of the mothers, which included an interactive study sessions and practical sessions in manageable groups, was also adopted for the study. The curriculum (see Appendix 7) used in nutrition education that included food plate used in educating mothers on food groups was adapted from (Kabahenda et al., 2013). After the theory, the mothers were divided into smaller manageable groups and asked to prepare food that included low-cost fish products for a particular age group (6-8, 9-11, or 12–23 months) within 2 to 3 hours. The mothers then assessed each other meals for the appropriateness of the food prepared for the assigned child age groups (see Appendix 8).

3.6 Data collection methods

Data on mother's knowledge and practices about low-cost fish products were collected using a questionnaire (Appendix 6). Data on consumption frequency of low-cost fish products consumed by children in the preceding 7 days were also collected using a 7-day food frequency questionnaire (Appendix 4). While data on child growth, weight and MUAC were collected using a weighing scale and MUAC tape, respectively. Haemoglobin levels were collected using haemocue photometer. Data on household sociodemographic were collected using a structured questionnaire (see Appendix 5).

3.6.1 Assessment of changes in caregivers' knowledge and practices

The knowledge and practices of mothers regarding low-cost fish products were assessed using a questionnaire (see Appendix 6).

3.6.2 Assessment of changes in the frequency of consumption of low-cost fish products by children

The children's frequency of consumption of low-cost fish products was assessed at baseline follow-ups 1 and 2 using a 7-day food frequency questionnaire administered to their mothers (see Appendix 4). The FFQ included nine different LCFPs that the children were expected to have consumed with other foods during the preceding 7 days. The LCFP included on the FFQ were fish frames, fish heads, fish skins, whole fish powder, fish eggs, juvenile tilapia, juvenile Nile perch, *Nkejje,* and *Mukene*. The data was processed by recording the number of times each LCFP was consumed in the preceding 7 days, and the number of times a LCFP was eaten in those 7 days was summed up into one figure of consumption of that particular LCFP. The quality of the diets was quantified as better if they included at least one LCFP. The consumption frequency of low-cost fish products should be at least once a week. The WHO recommendation on fish consumption by children is 28g (FAO/WHO, n.d.).

3.6.3 Assessment of children's nutritional status

Measuring weight

The children's weight was taken using a TINITA HD-662 digital weighing scale (Corporation Tokyo, Japan). Mothers were asked to carry the children, with minimal clothes on the child and their weight taken together. The mother then gave the child to someone to carry and her weight taken. The child's weight was determined by subtracting the mother's weight from the weight of both the mother and child. The mothers were asked to carry the children to avoid inaccurate measurements as a result of excessive child movement when on the weighing scale alone. Weights were recorded to the nearest 0.1 kg.

Measuring MUAC

The mid-upper arm circumference (MUAC) was measured using a non-stretch insertion tape supplied by Teaching Aids at Low Cost (St Albans, United Kingdom). With the child's arm hanging loosely and comfortably at the side. The child's left arm was bent at a 90-degree angle. The top of the shoulder and tip of the elbow were located. The tape was then put on with the support of the right thumb at the top and the left thumb at the elbow end. The whole length between the shoulder and the elbow is taken. The midpoint of the length was marked off using a pen. The arm was then straightened, and tape was wrapped around the arm at midpoint. The arrow end of the tape was placed through the window, and the correct tension was obtained. The measurements were then read in centimetres (cm) in the window where the arrow was pointing inward. The measurements were read to the nearest 0.1 cm.

Measuring the child's haemoglobin level

The puncture site on the finger of the child was cleaned with methylated spirit and cotton wool, and the site was dried with a clean piece of cotton wool. A Haemocue lancet (2.25 mm depth safety lancet) was used to puncture the skin by placing the blade slot surface against the area and pressing the trigger. The free flow of capillary blood was allowed. The first two drops of blood were wiped off using clean cotton wool, and the third blood drop big enough to fill the Haemocue microcuvette was collected. Excess blood was wiped off using cotton wool, and the microcuvette was checked for any bubbles. The microcuvette was then put in its holder and inserted into the Haemocue photometer (Haemocue Hb 201^{+} AB, Angelholm, Sweden), and the hemoglobin level was read off at 0.1 g/DL.

3.7 Data quality control and validity of instruments

Trained enumerators and a laboratory technician collected the data. The data quality was assured by pretesting questionnaires to evaluate the strength of the survey questions; training of the enumerators to ensure consistency in the data collected; good communication with the respondents by ensuring they had a contact person to reach out to when they needed help regarding the study; and back checks to validate survey responses at the end of the day to ensure survey questions were properly responded to.

A pre-test was conducted to evaluate the strength of the survey questions. This was conducted by administering the questionnaire to a community that had mothers and children in the same age group as the study children. 10 mother-child pairs were engaged in the pretesting of the questionnaires. Two enumerators were involved in this exercise. And it was found that the questionnaire was too long and took too much time to complete, since all other ASF were also included in the 7-day FFQ. Completing a questionnaire took a long time and made the respondents bored along the way, and they got impatient because they had other engagements to attend to. Also, quantification of foods given to children was not a practice among many mothers, so the food quantification was left out after the pre-test. These findings led to the elimination of all other ASF from the 7-day questionnaire to shorten it, and food quantification for children was left out.

3.8 Data processing and analysis

The data was collected from the mothers and the children. The data included knowledge and practices regarding low-cost fish products, consumption frequency of low-cost fish products by children (dietary data), nutrition status of the children (anthropometry), and hemoglobin levels. Data were collected from a defined sample size. The data was then cleaned by sorting and filtering to remove unnecessary and inaccurate data while checking for errors, duplication, miscalculations, or missing data, and it was transformed for further analysis. The coded data was then entered into analytical computer packages SPSS version 23 IBM, independent samples t-tests were used to compare differences in means for consumption frequency of LCFP by children, changes in mother knowledge and practices, and changes in hemoglobin levels in the children both in the intervention and control groups. These were processed to generate desirable outputs. The outputs from processing were then transformed into tables and other figures. The data was then stored for continued use.

Descriptive statistics were computed using independent sample t-tests in SPSS version 26 IBM. Independent samples t-tests were run to compare mean differences between the mothers' knowledge and practice scores after nutrition education, to compare mean differences in the consumption frequency scores of low-cost fish products by children after nutrition education of the mothers, and hemoglobin levels of the children. While the changes in weight-for-age and MUAC-for-age were analyses using WHO ANTHRO.

3.9 Ethical clearance

Ethical review was sought from the Mulago Hospital Complex Institutional Review Board **(Ref: 01485972),** and permission was sought from Makerere University Graduate School and Uganda Prisons Service headquarters. The primary carers of the children were informed about the entire study process before the kick-off of the study and asked to consent by signing or using a thumbprint on the consent form.

CHAPTER FOUR

RESULTS

4.1 Characteristics of study participants

The characteristics of the study mothers and children are summarised in (see Table 1). Most of the study participants were married to prison officers, and their mean age was 25±3.9 years for women in the intervention group and 27.5±3.7 years among the controls.

Most household sizes were relatively larger (mean = 5.29 intervention and 4.94 control) than the reported national average of 4.5 people (UDHS, 2016). There were no significant differences in the number of children under 5 years per household (Mean = 1.7±0.7 and 1.5±0.6 in intervention and control groups, respectively). There were more male children compared to female children in the study (ratio of males to females = 5.8 to 4.2). The majority of children (69.3%) were more than 12 months of age, and most (71%) were not being breastfed (see Table 1).

Since the study was conducted within the prison staff community, most households (62.9%) used tap water, and a reasonable proportion (41.9%) used flash toilets. However, a sizeable proportion indicated that their major sources of water were lake water and pond water.

Table 1 Characteristics of study participants

Participant		Intervention		Control		
	N	Mean	Standard deviation	N	Mean	Standard deviation
Mothers						
Age (years)	31	25.00	3.9	31	27.5	3.7
Parity	31	2.4	1.5	31	2.3	1.14
Education	31	2.0	0.9	31	2.1	0.8
Household size	31	5.3	1.5	31	4.9	1.7
Number of Children≤ 5 years	31	1.7	0.7	31	1.5	0.6
Household monthly income						
	31	351451.6	231405.8	31	320600.0	268702.5
Children						
Age (Months)	31	12.3	4.4	31	16.4	4.4
6 -8 months		14.4%				
9-12 months		16.1%				
12-23 months		69.3%				
Breastfeeding						
6 -12 months		71.0%				
12-23 months		29.0%				
Partner's occupation						
Prisons officers (husbands)		74.2%				
Other occupations (teachers, agricultural officers, journalists)		25.7%				
Water source						
Public tap		62.9%				
Pond (lake extensions)		11.3%				
Lake water		25.8%				
Sanitary facility						
Flush toilet		41.9%				
VIP latrine		1.6%				
Pit latrine		56.5%				

4.2 Changes in mothers' knowledge about benefits and utilization of low-cost fish products

As shown in Table 2, at baseline, there were no significant mean differences in the mothers' knowledge regarding low-cost fish products between the intervention (mean= 27.9±6.3 and control mothers (mean= 31.1±5.4); $t_{(1,\ 60)}$ =-2.2 p = 0.035). Even, after the intervention, women in the intervention group exhibited a non-significant mean difference in knowledge of low-cost fish products (mean score = 52.1 ±8.1) compared to the control mothers (mean = 32.3±5.29, $t_{(1,\ 60)}$ = 11.4, p = 0.000).

Table 2: Changes in mothers' knowledge and practices on utilization of low-cost fish products

Variables	End line		Baseline		End line T test	Baseline T test
	Intervention n= 31	**Control n= 31**	**Intervention n= 31**	**Control n= 31**	$t_{(1, 60)}$	$t_{(1, 60)}$
Knowledge	52.1±8.1	32.3±5.3	27.9±6.3	31.1±5.4		
					p = 0.000	p = 0.035
Practices	50.3±2.3	33.8±6.9	14.2±2.3	17.3±4.9		

As shown in Table 2, at baseline, the practices were similar between the intervention and control mothers. There were no significant mean differences between the practice scores of intervention mothers' and control mothers' practices $t_{(1, 60)} = -3.1$, $p = 0.003$) regarding incorporating low-cost fish products. At the end of the study, there was non-significant mean differences in the practices of intervention and control mothers, $t_{(1, 60)} = 12.6$, $p = 0.000$.

There was no significant change in knowledge and practices of the mothers but some changes in knowledge and practices were observed during the cooking demonstrations where mothers were notably able group foods according to food types; to mix low-cost fish products in their different forms like powder, fresh, and smoked products, in foods such as beans, *matooke*, potatoes, and greens to improve the nutritional quality of children's food.

4.3 Changes in utilization of low-cost fish products by children

As shown in Figure 4 and Table 3, at baseline, there was a non-significant mean difference in the number of low-cost fish products consumed by children whose mothers participated in the intervention group and control group during the 7 days preceding the assessment ($t_{(1, 60)} = 3.4$, $p = 0.001$; < 0.05). The intervention group consumed some low-cost fish products at baseline compared the control group because they were closer (in availability and accessibility) to the fish factory than the control group.

At the end of the study, children whose mothers received nutrition education reported consuming a non-significantly higher mean variety of low-cost fish products compared to children of the controls ($t_{(1, 60)} = 7.8$, $p = 0.000$; <0.05).

Nutrition education caused the intervention group to consume some more low cost fish products at the end of the study though consumption wasn't significantly different from the consumption of the control group.

Table 3 Changes in utilization of low-cost fish products by children

Variables	End line		Baseline		End line	Baseline
	Intervention n= 31	**Control n= 31**	**Intervention n= 31**	**Control n= 31**	$t_{(1, 60)}$	$t_{(1, 60)}$
	1.7±0.9	0.3±0.6	0.4±0.55	0.3±0.2	p=0.000	p=0.001;

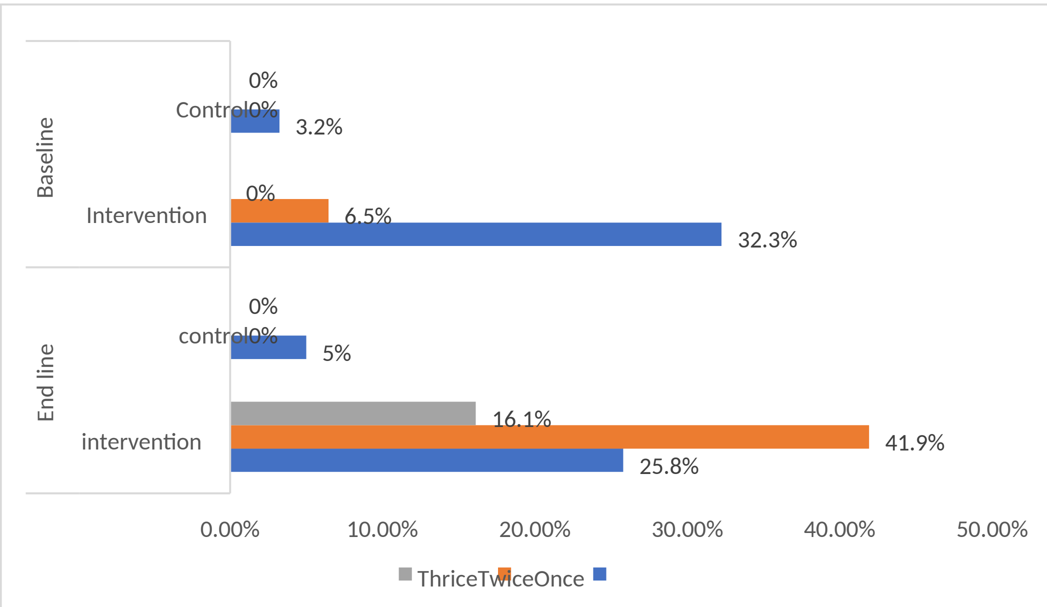

Figure 4: Consumption of low-cost fish products by children the past 7 days

Where: Intervention, n=31, control, n=31

4.4 Changes in children's nutrition status

At baseline (table 4), there was no mean difference in the haemoglobin levels of the children intervention versus control group (9.3±1.5 vs10.0±1.5) respectively.Likewise, at endline (table 4), there was no significant mean differences in the and haemoglobin levels of the children in intervention versus control (9.3±1.6 vs. 9.9±1.9), respectively.

Weight-for-age indicates low weigh for age. At baseline, both of children in the intervention and control group were moderately underweight. Likewise at end line, both intervention and control children were still moderately underweight. MUAC-for-age a good indicator of nutrition. At Baseline and end line both intervention group children had similar MUAC-for-age. There were no significant differences in the MUAC-for-age and weight-for-age in both groups at the end of the study.

Table 4: Changes in children's nutrition status

	End Line				**Baseline**				**End line means**		**Baseline mean**	
	Intervention		**Control**		**Intervention**		**Control**		Intervention	Control	Intervention	C
Sample size, n	**31**		**31**		**31**	**31**			**31**	**31**	**31**	**31**
	≥ -3SD	**≥ -2SD**	**≥ -3SD**	**≥ -2SD**	**≥ -3SD**	**≥ -2SD**	**≥ -3SD**	**≥ -2SD**		**means**	**means**	
Weight-for-age	0	9.7	0	0	0	6.5	0	0	10.5±1.9	10.5±1.3	9.1±1.5	10 3
MUAC-for –age	0	0	0	0	0	0	0	0	14.8±1.4	15.4±0.1	14.5±1.2	15 1
Haemoglobin									9.3±1.6	9.9±1.9	9.3±1.5	10 5

At the end of the study, there were no significant mean differences in the mother's knowledge and practices regarding low cost fish products; no significant mean differences in the children's frequency of low cost fish consumption and no significant mean differences in the children's haemoglobin status. And no significant changes in the children's MUAC-for-age and weight- for-age.

CHAPTER FIVE

DISCUSSION OF RESULTS

5.1 Changes in mothers' knowledge and practices on utilization of low-cost fish products

At baseline, the control group and intervention group knowledge about low cost fish products was similar. After the intervention, the intervention group mother's knowledge and practices about low cost fish products was not significantly different from the baseline knowledge and practices. Hence, the intervention did not bring about changes in the intervention mother's knowledge and practices about low cost fish products. At the end of the study, the mothers did not show significant mean changes in knowledge and practices about low cost fish products and this resulted in no significant mean change in consumption of low cost fish products by the children.

Mothers' nutrition knowledge influences dietary diversity and quality of children's meals. Improving mother's nutrition knowledge also influences change in child feeding practises. This study used nutrition education to improve the mother's knowledge and practices but registered no improvement in consumption of low-cost fish products. The trend of this study was contrary to what Christian et al. (2015) reported that carer's knowledge determined dietary diversity and consumption of animal-source foods by children. It was also contrary to what Bidira et al. (2022) reported about better dietary diversity scores and increased animal-source food consumption after nutrition education. Likewise, the study was contrary to Ludwig-Borycz et al. (2022) who reported improved diet diversity and more consumption of animal-source foods after an intervention that involved change in mother's behaviour. The study was also contrary to Sethi et al. (2003) who also reported improved infant feeding practises after the nutrition education of the mothers.

5.2 Changes in utilization of low-cost fish products by children after nutrition education of the mothers

At baseline, the consumption of low cost fish products by children in the intervention and control group was similar. After the intervention, there were not significant mean differences in the consumption of low cost fish products between the two groups. Hence, the lack of changes in knowledge and practices in the intervention mothers did not lead to increased consumption of low cost fish products by children. This study was contrary to what was reported by (Mahmudiono et al., 2022) that nutrition education led to increased fish consumption. This study likewise was contrary to (Lee et al., 2013) who reported increased fish consumption after nutrition education. It also was contrary to what was reported by (Fretes et al., 2013), about increased fish consumption among children and their parents after nutrition education. And it was also contrary to what was reported by (Rahmawaty et al., 2021) of increased fish consumption among children after nutrition education.

5.3 Changes in children's nutrition status after consumption of low-cost fish products

At baseline, the children's nutrition status was similar between the intervention and control groups. After, the intervention there was still no significant change in the MUAC-for-age and weight-for-age and no significant mean differences in haemoglobin status among the intervention children. This resulted from having non-significant mean differences in the maternal knowledge and practices after the intervention. There was no change in the nutritional status (MUAC-for-age and weight-for-age and haemoglobin status) among of both the intervention and control group children.

The findings from this study are in line with what was reported by Bbaale (2014) that lower maternal education was associated with poor child nutrition status. The findings about haemoglobin status in this study were similar to what was reported by Lartery et al. (1999) that haemoglobin status did not improve in children that consumed complementary foods that had fish powder added to them. The findings of this study were also in line with what was reported by Armo-Annor et al. (2021) that women and children who consumed more fish had a higher anaemia prevalence compared to those who consumed more of other animal-source foods.

Limitations to the study

However, there were some limitations to this study, which included the following: late turn-up of study mothers and their children for the nutrition education trainings and other activities of the study. The late turn-up delayed the collection of baseline data from the children and the mothers, causing it to end very late in the evening; it also delayed the commencement of the nutrition education trainings, shortening the training time and making cooking demonstration activities drag up until late in the evening. The other challenge was the dropout rate of study mothers from the study as a result of duty transfers and personal reasons. The high dropout rate caused the number of study mothers and their children to reduce the sample size, which became so small that it could not allow me to disaggregate data by children's age group and sex and also could not allow consideration of covariates in the analysis of the data.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Overall, the intervention was not effective because there were no significant mean differences and changes. Much as many studies have reported nutrition education to be an effective way to improve consumption of different foods by different populations, this study was contrary because there were no significant mean differences and changes in any of the parameters measured, mothers knowledge and practices; frequency of consumption of low cost fish products by children, the children's MUAC-for-age, weight-for-age and haemoglobin status.

6.2 Recommendations

Nutrition education was not effective in promoting consumption of low cost fish products by children aged 6 -23 months. This is because there were no mean significant differences and changes in maternal knowledge and practices which lead to non-significant mean difference in low cost fish product consumption frequency; and no mean changes in haemoglobin levels and no changes in MUAC-for-age and weight-for-age among the children. I therefore recommend a longer period of nutrition education so as to realise significant changes and differences among both mothers and children.

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APPENDIX 1: NUTRITION EDUCATION SESSIONS

Nutrition education sessions	**Content**	**Activities**
Session 1: Learning how to group foods into their respective food types	-Using a food guide plate (Kabahenda *et al*,2013) -Mothers were taught how to group foods into their respective groups i.e. energy giving, body building foods and protective foods. -Body building foods were taught in more detail i.e. plant and animal sources; with emphasis on Animal Source Foods (ASF) especially Low-cost fish products Products (LCFP), their importance, how equally good they are when compared to other ASF and are a cheaper option of ASF	-Mothers were divided into groups of 4-5 each, for easy management and to increase involvement. -Mothers chose foods from all the 3 food groups and prepared different types of enriched porridges using rice flour, milk, mukene powder, cooking oil, sugar, maize flour, cowpea flour, Tamu cooking fat, millet flour, peanut butter, ghee, Nkejje powder, blue band, cassava flour, egg, soybean flour, and cooking oil; and food including at least one LCFP**.** -Mothers then tasted the different snacks, porridges and food, one at a time and evaluated themselves and corrections were made accordingly.
Session 2: Planning meals for young children	-Mothers began with a recap of session 1 -Mothers were taught that children need foods from all 3 food groups to grow well. -Mothers were encouraged to prepare age appropriate foods so that the children can get the most out of the food that they eat.	- Mothers were again divided into manageable groups and each group was tasked to prepare food for different age group and make it age appropriate i.e. 6-8months, 9- 11months and 12-24months. - Mothers selected foods from 3 food groups including a least one LCFP from body building foods. - Mothers served food into two plates for every age group, then one plate was either mashed or chopped to make it age appropriate. - A piece of net was used to demonstrate how the child's intestines handle food prepared differently i.e. mashed or chopped. -Mothers evaluated themselves for age appropriateness of the food

		prepared for the different age groups.
Session 3: Meal planning in terms of meal frequency and food portions	-Mothers began with a recap of session 2. -Mothers were taught meal planning skills, in terms of meal frequency and food portions - The mothers were taught how to plan meals for young children using a meal planning sheet which had slots for the type of meal, energy giving foods, body building foods and protective foods. - Mothers were encouraged to frequently feed their children and give adequate amounts of food from the 3 food groups. -Mothers were taught that more than two colours of food on the same plate represented variety	-Mothers were divided into manageable groups with at least one person who could write. -Mothers planned a whole days' meals using the foods on display, placing them into their respective groups before cooking the foods and they included at least one LCFP (fish frames, skins, guts, eggs) that they had not prepared the previous sessions -Mothers prepared the foods for the same age groups as in session 2 so as to correct the wrongs in the previous sessions. -The foods were evaluated by their peers for age appropriateness - Mothers also made soup using fresh fish frames; made snacks using fried chicken eggs mixed with Mukene (*Rastrineobola Argentea*) and made Mukene (*Rastrineobola Argentea*) as a snack by frying with some cooking oil.

APPENDIX 2: INFORMED CONSENT FOR INTERVENTION GROUP

Hello! My name is____and I am a student from the school of food technology, nutrition and bioengineering in Makerere University. We are conducting a study about fish and good health. We would very much appreciate your participation in this study. The study will take 8 months to complete. it will consist of taking some measurements on your child like taking of some little blood from a finger prick to measure some minerals, asking some questions about your child and household, short teachings of about 1 hour, cooking demonstrations and taste-tasting of our cooked snacks, porridge and food.

Risks or discomforts

No risk is expected by eating the snacks, porridge and food. No risk is expected, but I may experience some discomfort or stress when the researchers ask me questions about my child's food intake, nutrition status, and health. I may choose not to answer any question or questions that may make me uncomfortable**.**

Benefits

The study will help me improve my child's feeding habits. This study will also help the investigators learn more about good ways to help mothers improve their children's feeding habits.

Confidentiality

All of the answers you give will be confidential. No information concerning my child during this study will be shared with others, unless law requires it.

For further information

If I have any further questions about the study, now or during the course of the study I can call the head of department Dr. Ivan Mukisa.

A statement that participation is voluntary

I understand that I do not have to take part if I do not want to. I can stop taking part without penalty. If we should come to any question you don't want to answer, just let me know and I will go on to the next question. My pictures will only be used to promote this nutrition program. **Sponsors of the research project and the institutional affiliation**

The sponsor is HENNA- Network for Applied Human Nutrition and the University of Affiliation is Makerere University, Uganda.

Signature /thumbprint of Participant	Participant's Name	Date	Participant Address and Phone
Signature of Investigator	Name of Investigator	Date	
	Anena Beatrice		

APPENDIX 3: INFORMED CONSENT FOR THE CONTROL

Hello! My name is____and I am a student from the SCHOOL OF FOOD TECHNOLOGY, NUTRITION AND BIOENGINEERING IN MAKERERE UNIVERSITY. We are conducting a study about GOOD HEALTH. We would very much appreciate your participation in this study. The study will take 8 months to complete. It will consist of taking some measurements on your child like taking of some little blood from a finger prick to measure some minerals, asking some questions about your child and household.

Risks or discomforts

No risk is expected by eating the snacks, porridge and food. No risk is expected, but I may experience some discomfort or stress when the researchers ask me questions about my child's food intake, nutrition status, and health. I may choose not to answer any question or questions that may make me uncomfortable**.**

Benefits

The study will help me improve my child's feeding habits. This study will also help the investigators learn more about good ways to help mothers improve their children's feeding habits.

Confidentiality

All of the answers you give will be confidential. No information concerning my child during this study will be shared with others, unless law requires it.

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If I have any further questions about the study, now or during the course of the study I can call the head of department Dr. Ivan Mukisa.

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I understand that I do not have to take part if I do not want to. I can stop taking part without penalty. If we should come to any question you don't want to answer, just let me know and I will go on to the next question. My pictures will only be used to promote this nutrition program. **Sponsors of the research project and the institutional affiliation**

The sponsor is HENNA- Network for Applied Human Nutrition and the University of Affiliation is Makerere University, Uganda.

Signature /thumbprint of Participant	Participant's Name	Date	Participant Address and Phone
Signature of Investigator	Name of Investigator	Date	
	Anena Beatrice		

APPENDIX 4: FOOD FREQUENCY QUESTIONNAIRE FOR REFERENCE CHILD

1. Household number
2. Date
3. Name of interviewer
4.Name of interviewee (child's caregiver) 1. Father 2. Mother 3. Grandmother 4. Other relative 5. Housemaid 6. Neighbour

5. *Question: Please tell me how many times in the past 7 days this child ate each of the following foods.*

Name of food item								
	1time	**2times**	**3time**	**4times**	**5times**	**6times**	**7times**	**Don't know**
Fish frames								
Fish heads								
Fish skins								
Whole Fish powder								
Fish eggs (roe)								
Juvenile tilapia								
Juvenile Nile perch								
Mukene								
Nkejje								

APPENDIX 5: HOUSEHOLD CHARACTERISTICS

(Tick/ put an X where applicable)	
Maternal level	
Mother's age	
Parity	
Mother's education	1. Primary
	2. 'O' level
	3. 'A' level
	4. Tertiary
	5. University
Household size	
Number of children less than five years of age in the household	
Partner's occupation	1.Agriculture officer 2.prisons Officer 3. Engineer 4. Driver 5. Military officer 6.Causual worker 7.Fitter 8.Lab technician 9. Estate Officer 10. Accountant 11. Businessman 12.Communications officer 13. Civil servant 14. Journalist 15. Other.................................

APPENDIX 6: KNOWLEDGE AND PRACTICES

Knowledge	
1. Do you know low cost fish products? A) list at least 3 -Frames -Skins -Heads -Eggs -Guts -Mukene	1. Yes 2. No
2. have you heard of any benefits of consuming low-cost fish products? What are the benefits? -Build and repairs bodies -Provides iron -Provides vitamin A -Source of good protein -Proper growth	1. Yes 2. No
3. Do you know the food type low-cost fish products belong? -Body building -Energy giving -Protective foods	1. Yes 2. No
4. Have you ever mixed any low-cost fish products with other foods? A) in which form? -powder -fresh -Smoked -Salted -Sundried	1. Yes 2. No
5. Are these low-cost fish products beneficial to the children? List the benefits -Protein source -Mineral source e.g. calcium -Vitamin A source -Source of iron	1. Yes 2. No
Practices	
1. Have you ever included low cost fish products in your food? Which food? Porridge, snacks and food List the procedure of preparation e.g. sprinkling of powder, adding low cost fish to food	1. Yes 2. No
2. How often do you feed your children with low-cost fish products in a week? And how e.g. Five times	1. once 2. twice 3. thrice 4. other specify

APPENDIX 7: MESSAGE

SESSION 1

Food groups (Food variety and meal quality for children)

Today, we will learn about the different food groups

Ask participants to name the 3 food types and give examples of each

In order for you to prepare adequate meals for your children, you need to:

1. understand the needs of young children
2. select and prepare meals that are appropriate for each child's level of development
3. serve children adequate amounts from each food group
4. make sure that children eat the food you are providing for them

Inform the participants that there are 3 food types (energy giving, body building and protective foods) but we are going to discuss body building food in particular animal source foods like fish

Giving your child food from only one food type is like giving your child a partially empty plate.

Always prepare meals that are appropriate for your child's level of development.

Mixing foods can help you provide a variety of foods in a single meal.

Mixing foods also increases the amount of food available for a meal.

Mixing food from different food groups improves the nutritional quality of your children's meals.

ANIMAL SOURCE FOODS

Meat, fish, poultry, milk are the richest sources of protein

They belong to the body building foods

Just like beans and nuts, these foods help build and repair our bodies

Animal protein sources also give us iron and many other nutrients such as vitamin A which protect children from diseases like measles, diarrhoea. So, they are very important to growing children.

Children need these foods to grow well.

Milk, meat, eggs and fish are all important to your children.

Ask participants if they provide milk, meat, fish, or eggs to their children

Each of these foods has its own nutritional value.

Children need these foods regularly because their bodies are growing at a fast rate.

You can provide all these foods to your children if you plan well and if you are willing to try new ways of preparing children's food.

FISH:

It has good protein

Its rich in iron which is needed for blood formation

Ask participants if they give their children fish and to name types of fish they provide to their children.

There are many types of fish e.g. Nkejje, Mukene, mud fish, cat fish Nile perch, tilapia

Fish tends to be very expensive

Other fish includes fish heads, frames, skins, eggs

You can easily provide your children with enough fish if you try a variety of fish

You can provide more fish to your children if you: 1. Buy small quantities of fish on a frequent basis. *Example: buy small quantities of fish every week instead of buying a lot of fish once a month.* It is not healthy to buy large amounts of fish and consume it in one day and go without fish for days or weeks. ***Ask participants to give examples of how small quantities of fish can be prepared for children.*** *Example:* Mix smaller quantities of fish with other foods to makes soups and snacks. 2. Buy the cheaper cuts of fish. *Explain how some of the less desirable cuts of fish can be used. Example:* fish heads and frames can be used to make soups. 3. Try other less desirable types of fish. ***Draw participants' attention to the fish samples***. All this fish has nutrients that are needed by your children. Do not restrict your children's food choices. Your children should be given a chance to try all kinds of fish and fish products. When you prepare fish, how much do you give to your children? ***Give participants time to answer this question.*** Children need a serving of about 28 g of fish. ***Use fake fish to show what counts as a serving of fish*** It is your responsibility to provide your children with enough fish. You can provide enough fish to your children by trying out different types of fish. Fish is softer compared to other meats. It is appropriate for children. Whether fish is fresh, dried or smoked. Fish can be ground and added to soups or sauces. Keep on hand some dried or smoked fish to add in your young children's food. How much protein do children need? ***Give participants time to answer*** Children less than five years of age need 4 servings from body building food group every day Children of this age should be provided with 2 servings of milk or milk products (i.e. 1 cup) and 2 servings of fish ***Show recommended serving of fish*** Always remember animal source protein have better quality protein than beans and nuts We know that animal source proteins are expensive. But young children do not need large quantities. **Try to give your child at least 4 servings of two types of animal source proteins every day.** ***Ask each participant to name 2 animal source proteins they can provide to the child every day*** **GIVE THEM TO TEST A SAMPLE OF A MIXTURE OF MATOOKE AND LOW-COST FISH PRODUCTS**
SESSION 2
Planning meals for young children How do you select and prepare foods for children? Always, start by visualising the food you would like to see on your child's plate**.** ***Ask the participants to take out plates they brought. Ask each participant to think of the foods she would put on that plate.***

Think about the foods that you would like your children to eat in the morning meal, lunch and supper.

Group participants and give them 5 minutes to discuss their 'ideal meals' with their partners.

(Emphasise) Your children's health depends on what you put on that plate.

What you put on that plate will determine how your children grow.

Always, make an effort to provide your children with adequate amounts of a variety of foods. Think of all the foods that are available to you.

You may not like to prepare the foods that are available to you.

(Emphasise) Always, keep in mind that young children need a variety of foods to grow well. This includes foods that you do not like that may be inferior in your culture.

You may be one of those people that do not like fish (think of other foods that are not widely consume)

It is still your responsibility to provide fish to your children even if you do not like fish.

Remember that the foods that you do not like or do not consume may be essential to your child's health.

Make sure that your child gets food from all the food groups.

Giving your child food from only one food group is like giving your child a partially empty plate.

Mixing foods can help you provide a variety of foods in a single meal.

Mixing foods also increases the amount of food available for a meal.

Mix foods from different food groups to improve the nutritional quality of your children's meals.

Ask participants to suggest mixed dishes that are appropriate for children.

Remember that children need food from each food group to grow well.

Children develop at different rates.

But the qualities of the meals you provide also determine the rate at which your child grows. Always prepare meals that are appropriate for your child's level of development.

Randomly select food items from foods on display and ask participants to:

a) Indicate how they would prepare each item.

b) State the age of the child they would prepare it for.

Emphasise: The intestines of young children are not yet developed.

Children need foods that can easily be broken down, digested and absorbed by their 'weak' intestines.

When foods are not well prepared and processed, it just passes through the body and is passed out as faeces.

a) Illustrate how food is absorbed using a piece of muslin cloth or net and mashed food. Try to squeeze /sieve food through cloth

b) Divide participants into manageable groups and let each group try to strain the mashed foods through the cloth.

Comment on which foods will be difficult or will take longer to digest.

Ask participants to prepare an appropriate lunch meal for a 6 months old child that breastfeeds.

Inform participants that the meal should be well balanced and should have appropriate texture and be acceptable to a 6 months old child.

After participants have prepared the assigned meal, ask each group to prepare 2 plates with appropriate serving portions for a 6 months old child.

Was it easy for you to select foods for a 6 months old child?

Did you get all the foods you wanted to use?

Do you think the meals you are presenting here (what they have dished out) are appropriate for a 6 months old child?
Ask each group to mix and mash all the food items on one of the plates they have presented. Have participants judged each group's meal (mashed and unmashed)
The mashed meal will be easier to digest.
Children are likely to absorb more nutrients in this softer meal (mashed) than from solid food that is prepared for the entire family.
(Use inappropriate meals as examples) Would you give your 6 months old child this kind of meal?
Always, ensure that you have food that is appropriate for your child every meal.
PREPARE SOME OF THE COMMON FOODS EATEN BY CHILDREN WHILE INCORPORATING LOW-COST FISH PRODUCTS

SESSION 3

Meal frequency and food portions

Always, select foods from all the 3 food groups and prepare food for your child.
Always make sure that your children get enough food from each food group.
Today, we will focus on serving children.
It is your responsibility to ensure that each child gets adequate amounts of food from each food group.
The food types are energy yielding, body building and protective foods group.
Assuming that I asked you to prepare a mid-day meal for a 1-year old child, what are the foods you would select for each section of the plate you have drawn.
Ask each pair to give examples of foods they would select for each section of the plate. Ask each pair to indicate the amount per serving for food or food group. Participants can use food models or foods on display.

One serving for 1-2 years

- Fruits ¼ (4 tablespoons) cup juice or fruit; Serving per day 2-4 times
- Vegetables ¼ (4 tablespoons) cups; Servings per day 3-5 times
- Bread, cereal and pasta ½ slice bread, 1/4 (4 tablespoons) cup of dry cereal, ¼ cup (4 tablespoons) cooked rice or pasta; Servings per day 6-11 times
- Meat, poultry, fish, eggs, dried beans and peas 60g meat, 2 tablespoons peanut butter, 4table spoons cooked dried beans or peas, 1 egg; Serving per day 2-3 times
- Milk ½ cup (8 table spoons), ½ cup yogurt, 3/4 (12 table spoons) cup ice cream; Serving per day 4-6 times

If you provide your children with **3 meals or less**, you might not be able to provide them with enough food.
Your children will never get the amounts of nutrients they need to grow well.
Remember that children have small stomachs, and need to eat frequently.
Young children need to eat at least 5 meals a day. The meals you plan for your young children should always include: **morning meal; mid-morning meal; mid-day meal; mid-afternoon meal and supper**

Ask participants to work in groups. Make sure that each group has a member that can write. Ask each group to make a meal plan for a day. Use the meal planning sheet below to help participants include foods from all food types.
Meal planning sheet:

Meal	Energy yielding food	Body building foods	Protective foods
Morning meal (Breakfast)			
Mid-morning snack			
Afternoon meal (Lunch)			
Mid afternoon snack			
Supper			

When you plan meals, it is easy to provide children with diets that are adequate in nutrients. Planning meals can also save you time.
Your meal plan should always include snacks.
Be creative and make snacks for your child. (Give examples of foods that are easy to fix as snacks)
Give your children a variety of snacks in between meals to ensure that your children get enough energy and nutrients.
Ask participants to suggest foods that can provide to children as snacks.
You can use fruits, vegetables, nut, milk, eggs, bread, biscuits (cookies), porridge and other foods as snacks.
As you see, snacks can be made from any food.
You can also make snacks by improving left over from the previous meal.
Ask participants to suggest leftover food that can be used as snacks.
Use leftover that have been stored safely (well cover and at the right temperature).
Do not serve young children food that has been left at room temperature for more than 2 hours.
You can reheat leftover food and add other ingredients to improve the nutritional value.
Examples:
Rice can be mixed with fish eggs and fried without oil.
Show examples of actual foods and ask participants to indicate how that food can be improved to make a snack for a small child. Ask participants to work in groups they were in the last meeting. Each group should improve the meal they prepared last time to make it more appropriate for a 9 months old child.
Activity
After participants have prepared the food:

1. Ask each participant to prepare a plate for a 9 months old child. Each participant should use the plate they brought from home.
2. Ask each participant to present the plates as they normally would present it to their child (i.e. include a drink and side dishes where appropriate).
3. let group judge each participants meal based on:
   - ✓ Food variety
   - ✓ texture
   - ✓ serving sizes
   - ✓ physical appeal (i.e. colour and smell)

PREPARE SOME OF THE COMMON FOODS EATEN BY CHILDREN WHILE INCORPORATING LOW-COST FISH PRODUCTS *****

APPENDIX 8: STUDY PICTURES


FRESH FISH GUTS


FRESH FISH EGGS


FRESH FISH SKINS


FRESH FISH FRAMES AND SKINS


FRESH FISH SKINS, FRAMES, EGGS AND GUTS


JUVINILE TILAPIA


SMOKED JUVINILE NILE PERCH AND FISH POWDER


MUKENE AND NKEJJE POWDER


MUKENE


OTHER FOOD STUFF


OTHER FOOD STUFF


MOTHERS ATTENDING NUTRITION EDUCATION SESSION


MORE MOTHERS ATTENDING A NUTRITION SESSION


MOTHERS COOKING ENRICHED PORRIDGES

MOTHERS PREPARING FOOD