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Faculty of Community and Health Sciences

Title: Effectiveness of a Complementary Feeding Promotion Program for Care givers of Infants Using Trained Agriculture Extension Workers in a Rural Area of Ethiopia: A Randomized Control Trial

Student Name: Boltena, Sisay Sinamo (MD & MPH)

Student Number: 2521031

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Department/School: School of Public Health, University of the Western Cape (South Africa).

Supervisor: Professor Thandi Puoane B (Cur), MPH, Dr PH

Co-Supervisor: Dr. Nelia Steyn RD (SA), MPH, PhD

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PREFACE

I would like to confirm that this thesis is my original work and it has not been presented for a degree in any other University. The study was registered on an internationally recognized register (ISRCTN30704933 at <https://doi.org/10.1186/ISRCTN30704933>). The thesis is presented in monograph format in eight chapters. This thesis was written jointly with my supervisor Professor Thandi Puoane and co-supervisor and Dr. Nelia Steyn.

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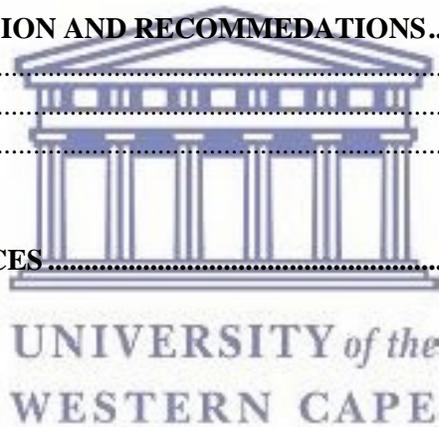
My wife, Yideneku Tefera, and our three sons, I thank you for kindly allowing me to spend the special family time and the limited income we earn for this study. You are a hero and I am proud of you. My Almighty God, thank you for your guidance, strength and inspirations to go through this long journey of PhD study successfully.

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DEFINITION OF TERMS

Exclusive breastfeeding under six months: refers to infants 0 to 5 months who are fed exclusively with breast milk the previous day. It allows the infant to receive drops and syrups such as vitamins, minerals and medicines (WHO 2007).

Complementary feeding for infants: refers to the timely introduction of safe and nutritional foods in addition to breastfeeding i.e. clean and nutritionally rich foods introduced at about six months of age (WHO 2012a).

Introduction of solid, semi-solid or soft foods: refers to the proportion of infants 6 to 8 months of age who received solid, semi-solid and soft foods (WHO 2007).

Complementary foods: refers to any locally prepared foods suitable as a complement to breast milk when breast milk becomes insufficient to satisfy the nutritional requirements of the infant (WHO 2002a).

Appropriate complementary feeding: refers to complementary food that is:

- timely – meaning that foods are introduced when the need for energy and nutrients exceeds what can be provided through exclusive and frequent breastfeeding;
- adequate – meaning that foods provide sufficient energy, protein and micronutrients to meet a growing child's nutritional needs;
- safe – meaning that foods are hygienically stored and prepared, and fed with clean hands using clean utensils and not bottles and teats;
- properly fed/responsive feeding – meaning that foods are given consistent with a child's signals of appetite and satiety, and that meal frequency and feeding method – actively encouraging the child to consume sufficient food using fingers, spoon or self-feeding – are suitable for age.

Minimum dietary diversity: refers to the proportion of children 6–23 months of age who daily receive foods from 4 or more food groups out of the seven food groups. The seven food groups are grains, roots and tubers, legumes and nuts, dairy products (milk, yoghurt and cheese), flesh foods (meat, fish, poultry and liver/organ meats), eggs, vitamin A rich fruits and vegetables and other fruits and vegetables (WHO 2007).

Minimum meal frequency: refers to the proportion of breastfed and non-breastfed children 6–23 months of age who receive solid, semi-solid, or soft foods (but also including milk feeds for non-breastfed children) the minimum recommended number of times or more; two times for breast fed-infants 6 to 8 months, 3 times for breastfed children 9-23 months and four times for non-breastfed children 9-23 months (WHO 2007).

Complementary feeding promotion: refers to the provision of recommended complementary feeding messages on meal frequency, amount, thickness, variety, active feeding and hygienic preparation, by trained agriculture extension workers to care givers of infants 6 to 12 months.

Infant: refers to a child aged between 0 to 11 months.

Young child: refers to a young child aged between 12 months to 24 months.

Infants' nutritional status: refers to the level of nutrition status measured by weight-for-age and length-for-age.

Infants' growth: refers to an increase in infants' body measured by weight or length gain.

Weight gain: refers to an increase in body weight. This can involve an increase in muscle mass, fat deposits, excess fluids such as water or other factors.

Length gain: refers to an increase in body size measured from head to foot in lying position.

Stunting: according to World Health Organization (WHO) stunting is defined as height-for-age or length-for-age value less than two standard deviations of the WHO Child Growth Standards median (WHO 2016).

Underweight: according to WHO underweight is defined as the weight-for-age value less than two standard deviations of the WHO Child Growth Standards median (WHO 2016).

Acute malnutrition: refers to weight less than 70% of median, weight-for-height less than -3SD, bilateral pitting oedema grade 1 or 2, or MUAC less than 110mm (MoH 2007).

Health Extension Workers (HEWs): according to the Ethiopian Ministry of Health (MoH) HEWs program strategy, HEWs are female graduates with a certificate, who are trained and deployed to work at the local health post at kebele level. Two HEWs are assigned to each kebele serving a total of about 1000 households (HSDP IV).

Agriculture Extension Workers (AEWs): are graduates (both females and males) with diploma level, who are trained and deployed to work at kebele level. Two to four extension workers, with different agricultural expertise, are assigned to each kebele serving a total population of about 1000 households (MoA 2010).

Diarrheal disease morbidity: refers to the presence of three or more loose or watery stool among children 0 to 59 months in the past two weeks (WVE 2012b)

Fever morbidity: refers to the presence of fever, based on care givers verbal report, among children 0 to 59 months in the past two weeks (WVE 2012b)

EPI status: refers to infants 6 to 12 months who received age appropriate immunization.

Deworming status: refers infants 6 to 12 months who received six monthly Mebendazole syrup or tablets twice in a year.

ABBREVIATIONS AND ACRONYMS

AEWs – Agriculture Extension Workers

ADP – Area Development Program

CF – Complementary Feeding

CSA – Central Statistics Authority

CV – Community Volunteer

DHS – Demographic and Health Survey

FAO – Food and Agriculture Organization

FGD – Focus Group Discussions

FM – Family Members

FTC – Farmers Training Centre

HEWs – Health Extension Workers

HW – Health Workers

KIIs – Key Informant Interviews

MoA – Ministry of Agriculture

MoH – Ministry of Health

SD – Standard Deviation

SMART – Standardized Methodology for Assessment and Relief and Transition

WHO – World Health Organization

WMoH – Woreda Ministry of Health Office

WMoA – Woreda Ministry of Agriculture Office

WVE – World Vision Ethiopia

WV – World Vision

ABSTRACT

Background: Complementary feeding practices are often inadequate in developing countries resulting in a significant decline in the nutritional status in children between 6 and 24 months of age. In 2011, only 4% of mothers in Ethiopia who were breast feeding gave their children 6 to 23 months of age from four or more food groups daily (CSA 2011). Despite Agriculture Extension Workers (AEWs) involvement in livestock and crops production, they were not involved in improving complementary feeding for infants and young children. This study assessed the effectiveness of using AEWs in addition to existing Health Extension Workers (HEWs), to promote complementary feeding practices and improve infants' nutritional status in Wonchi Woreda, Oromia region of southwestern Ethiopia.

Methods: A community based cluster randomized control trial in which the study kebeles were randomly assigned into intervention and control groups. One hundred ninety-two care giver-infant pairs were enrolled in each group. The intervention comprised of the introduction of messages on complementary feeding by trained AEWs. A baseline study was conducted before the intervention and a follow up study at third, sixth and ninth months, and post-intervention evaluation was conducted after 12 months. Focus group discussions (FGDs) and key informant interviews (KIIs) were held in each group, at baseline and post-intervention evaluation, with purposively sampled care givers and all AEWs respectively. Complementary feeding practices were determined using 24-hour dietary recall. Anthropometric measurement (weight and height) of infants were collected. Data was analyzed using SPSS, STATA and SMART nutrition survey softwares. Chi-square and t-test were used to determine the effect of the interventions on the outcomes and regression analysis was conducted to identify predictors.

Findings: The baseline characteristics of infants in the intervention and control groups were similar. By the end of the study, 45% of care givers had received complementary feeding messages from AEWs and the proportion of care givers who ever received complementary feeding message from AEWs was 81%. The minimum meal frequency among breastfed infants in the intervention group (3.2 ± 0.04) was significantly higher than the control group (3.0 ± 0.05) ($p=0.000$). The difference was not statistically significant for non-breastfed infants. The mean food groups intake among the intervention group (3.54 ± 0.05) was significantly higher than in the control group (3.29 ± 0.02) ($p=0.0001$) and a significantly higher proportion of infants in the intervention group were given four or more food groups ($p=0.0220$). The likelihood of providing varied foods was strongly associated with care givers exposure to AEWs messaging (Chi-square test: 19.9; $p=0.001$). Findings from the qualitative study confirmed an increase in feeding frequency and improvement in the food groups consumption in the intervention groups. The difference in the mean weight and length gain, underweight and stunting prevalence among the two groups was not statistically significant ($p>0.05$).

Conclusion: The interventions by trained AEWs had significant influence on increasing meal frequency and minimum dietary diversity but did not show effect on infants' weight and length gain and nutritional status. Care givers acceptance of AEWs involvement in infant feeding promotion influenced the increase in meal frequency. Various factors such as care givers perception or belief and inadequate feeding practice, lack of men's involvement and barriers to AEWs involvement might have affected the outcome of this study. Hence, programs that plan to use AEWs in promoting complementary feeding need to consider these factors.

CHAPTER ONE: INTRODUCTION

1.1 Study Background

Complementary feeding takes place during the transition period from exclusive breastfeeding to the period when breast milk is no longer enough to meet the nutritional needs of infants for optimal growth (WHO 2012a). Feeding with appropriate, adequate and safe complementary foods from the age of six months onwards leads to better health and growth outcomes (UNICEF 2014). Approximately six percent of deaths of children under five years could be prevented through improvements in complementary foods and feeding practices (Black et al.2008). A published report showed that there has been considerable progress in the implementation of interventions to improve breastfeeding practices in Ethiopia. However, similar progress has not been made in the area of complementary feeding (MoH 2011). The same report showed only 4% of mothers who were breastfeeding, gave their infants from four or more foods groups daily.

In Ethiopia, the HEWs program consists of two female HEWs based at a health post in each kebele (sub-district). They are primarily responsible for providing facility based, outreach and house to house preventive services including delivering messaging and counseling to care givers on appropriate practices in infant and young child feeding, as well as growth monitoring and promotion for children under the age of 3 years (MoH 2013). The best results are achieved in dealing with malnutrition when nutrition education is accompanied by agricultural education (FAO 2012). UNICEF (2016) indicated that lack of access to affordable, nutrient-rich foods, lack of education of care givers, beliefs and cultural taboos, the workload of the care givers, poor access to resources, poverty and food insecurity are barriers to meeting the nutrient needs of

children for many families in low and middle income countries. Hence, to address this gap, one of the approaches is linking agriculture with nutrition sector.

Ethiopian nutrition policy recommends that nutrition interventions at community level need to involve AEWs and HEWs in order to succeed in the production, adoption and utilization of products essential for better nutrition (MoH 2008). Evidence of the effectiveness of targeted agricultural programs on maternal and child nutrition is limited (Marie & Harold, 2013). Hence, this study investigated the effectiveness of promoting complementary feeding for care givers of infants using trained AEWs and assessed its impact on care givers' complementary feeding practices and infant nutrition status in Wonchi woreda, in the rural southwest of Ethiopia.

1.2 Agriculture Extension and Agriculture Extension Workers in Ethiopia

Agriculture dominates economic life in Ethiopia, accounting for 47% of gross domestic product, 80% of employment, and 88% of exports. During the past two decades, the government of Ethiopia has made significant efforts to increase both the quantity and quality of agriculture extension services among rural farmers (Tewodaj et al. 2009, p.2). This has been manifested through deployment of large number of agriculture extension workers, who are closely working with farmers. There are more than 64,000 agricultural extension workers (on average three AEWs per kebele) sharing their expertise with farmers according to their specialization. Among them 12% – 22% are female AEWs, depending on the region. Moreover, more than 10,000 farmers training centers were constructed for demonstration and knowledge transfer on improved technological inputs (Dereje 2012).

Agriculture extension workers train and support both male and small holder farmers on resource management and improved farming techniques that will directly and indirectly influence agricultural production and productivity. Moreover, they provide services of information and skill development, input supply, credit and saving, marketing of agricultural produce, postharvest technologies and others (Gebremedhin, Jaleta & Hoekstra 2009).

Agriculture extension workers provide their services through home visits, using model farmers, farmers training centers and by creating opportunities for farmers to work together and exchange experiences. However, individual visits by agriculture extension agents to household farms are by far the most common mode of extension delivery (Tewodaj et al. 2009). While overall extension services are relatively accessible in Ethiopia, there are differences in access between men and women, and particularly glaring differences by region. Women's groups (e.g. the women's associations at the kebele level in rural areas) may be a promising approach to reach women with extension services; in some areas they were able to successfully link extension agents with women farmers and circumvent the socially sensitive issue of male extension agents conducting one-on-one visits to women (Gebremedhin, Jaleta & Hoekstra 2009; Belay 2016).

In rural Ethiopia, women are intimately involved in most aspects of agricultural production, marketing, food procurement and household nutrition. The widely held cultural perception that "women do not farm" remains strong even though numerous agricultural tasks demand "women's work," including weeding, harvesting, preparing storage containers, managing all aspects of home gardens and poultry raising, transporting farm inputs to the field, and procuring water for household use and some on-farm uses (Tewodaj et al. 2009, p.16). However, the same

report indicated that crop marketing and control over revenues from these sales, are often gender differentiated. The gender division of agriculture activities has constrained women's access to extension services (Tewodaj et al. 2009, p.16).

Belay (2016) in his examination of the working conditions of extension workers and constraints to the adoption of modern agricultural technologies in southwestern Ethiopia revealed that, apart from the small number of extension workers in the study area, their qualification and communication skills created a barrier in promoting modern agricultural technologies in the study area. In a study conducted to assess the job satisfaction of agriculture extension workers in Kal woreda, the responses from the AEWs showed that they were unable to decide on their level of satisfaction, suggesting that they were unsatisfied. The study found a significant relationship between the recognition of best performances, promotion, level of education and level of job satisfaction (Kelemu et al. 2014, p.171).

1.3 Research Questions, Study Aim, Objectives and Hypothesis

1.3.1 Research questions

1. What is the effect of complementary feeding promotion done by AEWs (in addition to existing HEWs) on the nutritional status of infants (six to twelve months) in selected communities in Ethiopia, compared with promotion using HEWs only?
2. What is the effect of complementary feeding promotion on infant feeding practices of care givers of infants (six to twelve months) when done by AEWs (in addition to existing HEWs), compared with HEWs only?
3. What factors influence AEWs' involvement in promoting complementary feeding?

4. What factors predict care givers' infant feeding practices and infants' nutritional status?

1.3.2 Overall aim

The aim of this research was to assess the effectiveness of complementary feeding promotion using AEWs (in addition to existing HEWs) compared with HEWs alone, on care givers' complementary feeding practices and infants' nutritional status in a rural community of Ethiopia.

1.3.3 Specific objectives

The specific objectives of the study were:

- To compare the impact of complementary feeding promotion for care givers of infants using trained AEWs on care givers' complementary feeding practices (minimum meal frequency and minimum dietary diversity) in Wonchi woreda.
- To compare the impact of complementary feeding promotion for care givers of infants using trained AEWs on infants' nutritional status measured by weight and length gain, weight-for-age and length-for-age in Wonchi Woreda.
- To assess acceptability of complementary feeding promotion using trained AEWs in Wonchi woreda.
- To identify factors (facilitators and barriers) that influence AEWs' participation in complementary feeding promotion in Wonchi woreda.
- To identify predictors of care givers' infant feeding practices and infants' nutritional status in Wonchi woreda.

1.3.4 Hypotheses

H₁: Care givers of infants aged 6 to 12 months who received complementary feeding promotion by means of trained AEWs (in addition to existing HEWs) have improved complementary feeding practices (measured by minimum dietary diversity & minimum meal frequency) than those who received it from HEWs only.

H₂: Care givers of infants aged six to twelve months who received complementary feeding promotion by means of trained AEWs (in addition to existing HEWs) have better nutritional status (measured by weight gain, length gain, weight-for-age & length-for-age) compared with those who received it from HEWs only.

1.4 Motivation for Conducting This Research

Malnutrition is a major public health problem in Ethiopia. Based on the last DHS (CSA 2011) report, the prevalence of malnutrition and complementary feeding practices showed little improvement compared with the previous year's report. Improved quality of diet is one of the major contributors to improving infants' nutrition status (FAO 2012). However, recent reports showed that the quality of diet infants are eating in Ethiopia is not adequate. Only 4% mothers in Ethiopia, who were breastfeeding, fed their children 6 to 23 months of age four or more food groups daily (MoH 2011). This showed the need for the involvement of other sectors, such as agriculture, to improve complementary feeding practices among care givers in the country.

Based on my personal experience while working in community-based nutrition programs in many parts of Ethiopia, it is clear that AEWs play a critical role in crop, horticulture and livestock production. This includes staple crops, cash crops, fruit and vegetable production as

well as animal husbandry. Moreover, AEWs provide inputs, organize farmers into producer groups and networks, and link them to credit services. To deliver their roles AEWs spend the large portion of their working days in the community conducting meetings and home visits to individual farmers. The farmers (consisting of men and women) learn agricultural techniques from AEWs to implement in their farms. Among the groups and networks several of them are organized for only women where all women in the villages are expected to participate. Some of the groups are for producing vegetable, chicken and sheep, and there are women's saving groups as well.

Depending on their level of commitment, AEWs has an opportunity to meet women's groups once or twice in a month. Moreover, women also participate in irrigation groups, natural resource conservation groups and community self-help networks, together with men. Some of the mothers are pregnant while others are breastfeeding. Agriculture extension workers also meet with farmers in centers for training and on farmers' field days where they share experiences among each other. These were missed opportunities for AEWs to provide education, advice and technical support for mothers to produce diversified food and make an appropriate combination of local staple foods while preparing infants' meals. Agriculture extension workers could also establish practical cooking demonstrations to help mothers learn how to prepare nutrient dense meals. In Ethiopia, due to socio-cultural and traditional reasons, men are less involved in infant and young child feeding practices. Involving AEWs to reach men farmers will also be crucial to support women, produce diversified foods and help them in decision-making to allocate money for care givers to buy nutrient rich foods.

There are various opportunities for AEWs to engage with women and men farmers and disseminate key infant feeding messages. However, due to lack of AEWs involvement in the promotion of home and community-based solutions to improve care givers' practices in complementary infant feeding, all these opportunities could not be utilized. Currently, complementary feeding promotion is left to HEWs while AEWs focus on food and animal production. This might have contributed to the information gap among the farmers. While HEWs promote feeding practices, AEWs work with farmers and help them to link their product to the market. Because of the lack of harmonized message to the farmers, the farmers may end up selling valuable nutritional food products instead of keeping them for infants and family. They might also sell the foods they produce and buy less nutritious food. This could result in infants consuming foods that are cheaper and less nutritious, affecting their growth and development.

The government of Ethiopia is committed to strengthening community based nutrition programs using HEWs. There is little involvement by AEWs in this program despite the fact that they are continuously interacting with members of farming families. In addition, there was no evidence on the effectiveness of AEWs complementary feeding promotion on care givers' infant feeding practices and infants' nutritional status. Haddad, Cornelius & Jairo (2012 p.1) recommended the use of a rigorous study design to show the effect of agricultural interventions on nutritional status of children. Hence, the aim of this research was to assess the effectiveness of a complementary feeding promotion program using AEWs trained in complementary feeding promotion (in addition to existing HEWs) and to compare their outcomes with those using the HEWs only in a rural community in Ethiopia.

Since AEWs were involved for the first time in complementary feeding promotion, how care givers would respond to their involvement and how AEWs feel about it was not known. Hence, this study also investigated the acceptability of the AEWs involvement in complementary feeding promotion and the factors (facilitators and barriers) that affect their involvement.

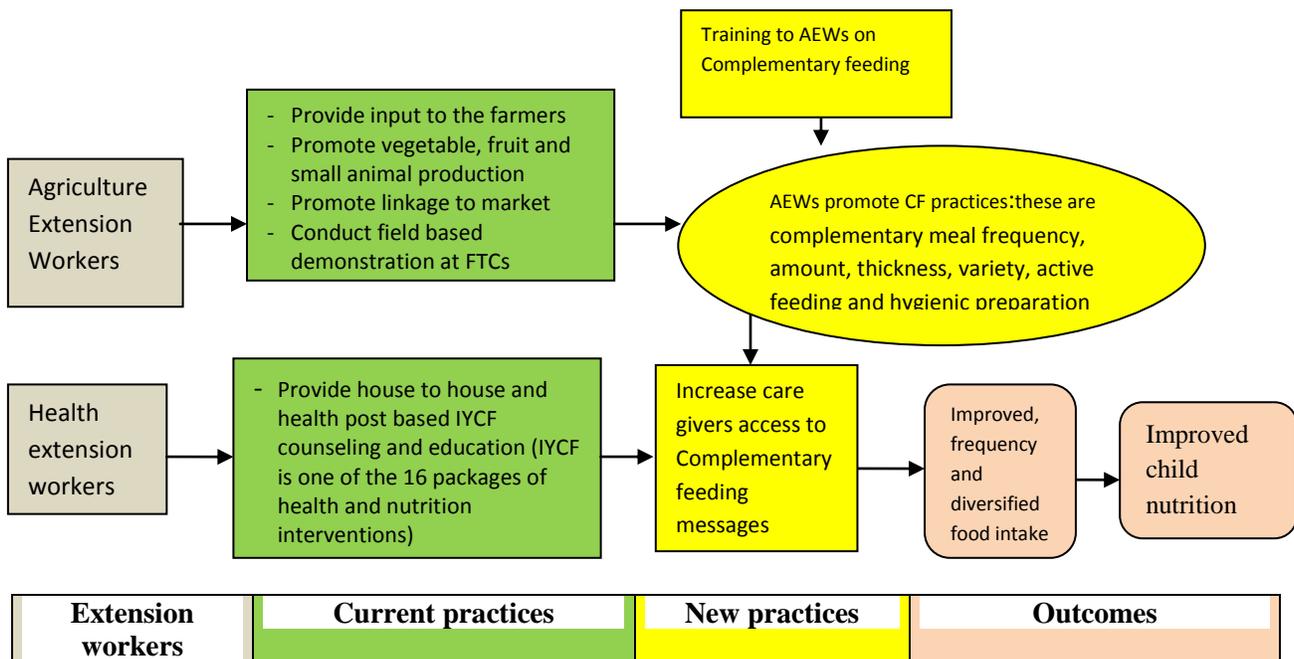
1.5 Theoretical Approach

Currently, complementary feeding promotion in Ethiopia is conducted only through HEWs and no other development workers are involved. In this study it was hypothesized that using AEWs trained in complementary feeding practices promotion may be an important option to test, compared with the current situation where AEWs were not trained to promote complementary feeding practices.

An important public health question was whether complementary feeding promotion using trained AEWs (in addition to the HEWs) can improve care givers' complementary feeding practices and the nutritional status of infants; and how it could be compared with that of current practices (HEWs only). Since ethically one cannot simply replace HEWs with AEWs, this study proposed using a model whereby the current status quo was maintained except in the experimental area, where AEWs were trained in complementary feeding practices. The national nutrition strategy indicated the important role that AEWs can play in teaching and encouraging households to adopt, produce and consume micronutrient dense foods and animal products to complement staple food crops (MoH 2013). However, there has been no strategy established on how this should happen. Hence, this research tested an approach to fill this gap.

1.5 Conceptual Framework

Figure 1.1 shows the framework for improving complementary feeding practices and infants nutrition status using AEWs trained in complementary feeding promotion (to the same extent as the HEWs). Trained AEWs are expected to improve their understanding on key complementary feeding practices including meal frequency, amount, thickness, variety, active feeding and hygienic preparation and feeding. The AEWs complementary feeding messaging, in addition to the HEWs, it is expected to increase care givers access to complementary feeding information. This will influence care givers feeding practices that will result in improved infants nutritional status.



Source: Sisay Sinamo (2012)

Figure 1.1: Conceptual framework to improve infant nutrition using trained AEWs

CHAPTER TWO - LITERATURE REVIEW

2.1 Global Burden of Malnutrition

Childhood malnutrition is prevalent in low and middle-income countries. In 2014, only 22 out of 109 countries were on course to meet the stunting reduction World Health Assembly target; 59 countries out of 123 were on course for the wasting reduction target; and five countries out of 185 were on course for anemia reduction target (IFPRI 2014). Sub-Saharan Africa is the region with the highest prevalence (percentage of population) of hunger where one person in four is undernourished. Poor nutrition causes nearly half (45%) of deaths in children under five (3.1 million children die each year). One out of six children (roughly 100 million) in low and middle income countries are underweight and one in three are stunted (WFP 2016). Among them 56% of all stunted children lived in Asia and 36% in Africa (WHO 2012b). Malnutrition increases the risk of child mortality, impairs child development and is associated with over fifty percent of child deaths (WHO 2015a). In most low-income countries, including Ethiopia, growth faltering begins in the first six months of life and age-specific malnutrition rates generally increase until about two years of age and then level off. Critically, most of this early damage is irreversible (MoH 2006).

Complementary feeding is a period when malnutrition starts in many infants, contributing significantly to the high prevalence of malnutrition in children under-five years of age worldwide (WHO 2012a). It is well recognized that the period of 6-24 months of age is one of the most critical time periods in the growth of infants and young children. The incidence of stunting is highest in this period as young children have a high demand for nutrients and there are

limitations in the quality and quantity of available foods, especially after exclusive breastfeeding (Shrimton et al. 2001; Dewey 2008; UNICEF 2013).

2.2 Prevalence of Malnutrition in Ethiopia

Malnutrition is one of the main health problems facing children and women in Ethiopia. With a population of over 80 million, Ethiopia is one of the fastest growing economies in Africa (MoA 2010). Despite these gains, 38.7% of the population still live below the poverty line resulting in a high level of malnutrition (Alive and Thrive 2012). The country has the second highest rate of malnutrition in Sub-Saharan Africa (MoH 2006). In Ethiopia, child under-nutrition is the major underlying cause for infant and under-five mortality. According to the 2016 Demographic and Health Survey (DHS) 38.4% of children under five years of age are stunted and 23.6% of children are underweight in Ethiopia. This figure does not show significant progress compared with 2014 report (CSA 2016). In 2014, among children six months to twenty-three months, stunting and underweight prevalence ranges from 21.4% to 47.1% and 9.4% to 14.2%, respectively (CSA 2014). Rates of child malnutrition increase with the age of the child. The peak age is between 6 to 24 months. Prevalence of malnutrition increases during the first two years of life reaching 52% among children aged 12 to 23 months. After the age of two years, the prevalence of stunting remains high (CSA 2005). Given the high prevalence of stunting and underweight, the severity of malnutrition in Ethiopia is categorized as “very high” according to WHO criteria, having a prevalence of underweight $\geq 20\%$ and prevalence of stunting $\geq 30\%$ (WHO 2015b).

2.3 Infant and Young Child Feeding in Ethiopia

Based on the WHO global strategy, in 2004 the Ministry of Health of Ethiopia has adopted the national guideline for infant and young child feeding (MoH 2004). This guideline provides seven essential nutrition actions: an action-oriented approach that focuses on promoting seven clusters of nutrition behaviors. These are promoting optimal breastfeeding, promoting optimal complementary feeding at 6 months, nutrition care of the sick child during and after illness, improving women's nutrition, controlling anemia, controlling vitamin A deficiency and controlling iodine deficiency. The main beneficiaries of these actions are infants and young children under the age of two years and women of reproductive age (MoH 2004).

In Ethiopia, 58 percent of infants 0 - 5 months are exclusively breastfed. Contrary to WHO recommendation according to which infants under the age of 6 months should be exclusively breastfed, 17 percent of infants 0-5 months consume plain water, 5 percent non-milk liquid, and 11 percent consume complementary foods before they reach 6 months (CSA 2016). However, the findings in 2016 are much better than what was reported in DHS 2005. Disha et al. (2012) analyzed Ethiopia's DHS 2005 to examine the associations between the WHO-recommended infant and young child feeding indicators and nutritional status among children 0-23 months of age. The findings revealed that exclusive breastfeeding among infants 0-5.9 months of age was low (43%) compared with DHS 2016 report (58%). A qualitative study conducted in the Southern Region indicated that exclusive breastfeeding is widely practiced in the study communities and mothers seemed to know the requirements for optimal breastfeeding such as on-demand feeding, frequency of breastfeeding and feeding both breasts. However, mothers commonly introduce water and linseed water as early as 2 months (Alive and Thrive 2010).

With regard to complementary feeding, little progress has been made so far in Ethiopia. In 2016, in total only 7 percent of children 6-23 months have met the criteria for a minimum acceptable diet (CSA 2016). Similar finding was reported in a cross-sectional study conducted in Northern Ethiopia where only 10.75% (95% CI: 8.07, 13.95) children aged 6-23 months received appropriate complementary feeding (Haile 2014). Another study conducted in northwest Ethiopia found comparable results: compared to the national average, the timely introduction of complementary foods, minimum meal frequency and minimum dietary diversity were 56.4%, 60.6% and 8.5%, respectively (Gessese et al. 2016). These findings were very low compared to other countries. For instance, in Indonesia Dewanti et al. (2015) reported a minimum acceptable diet among children 6 – 23 months as high as 47.7%.

At the age of 6 – 23 months, the proportion of children in Ethiopia consuming foods made from grains (70%) was the highest, compared with consumption of other types of solid or semisolid foods. Only 14 percent of children less than three years of age consumed vitamin A rich foods. Meat, fish, poultry and eggs were less consumed and introduction of these foods to the infants and young children diet was late: only one in ten children consumed them by the age of three (CSA 2016). This is contrary to the national food consumption survey findings where cereals, roots and tubers contributed only 19.1% of foods children were consuming (MoH 2013).

A qualitative study conducted in Oromia and Southern Region showed that factors relating to caregivers' knowledge, attitudes and practices affect their decisions in providing nutrient dense foods to infants and young children. The study indicated that certain foods such as green vegetables, carrot, pumpkin, banana and eggs were considered unsuitable and “too strong” for young

children to digest before 1 year of age. Meat, in particular, was considered by mothers as too hard to digest and recommend for children above 2 years old (Alive and Thrive 2010).

An assessment conducted in Southern Ethiopia by Henry, Whiting & Regassa (2015) revealed that complementary feeding practices were unacceptably poor in all the districts considered, despite the fact that a larger proportion of mothers had knowledge on the timing and importance of complementary feeding to their child. They indicated that the computed diet diversity score was less than 25% for six of nine surveys, and the most frequently consumed food groups were low protein grains, roots and tubers.

2.4 Infant and Young Child Feeding in the Study Population

There are few studies conducted on infant and young child feeding practices in Wonchi woreda. According to the formative study conducted by World Vision's Wonchi area program, though mothers started breastfeeding in less than an hour, colostrum feeding was poorly practiced; mothers express and discard colostrum because of the belief that it is not clean. Before initiating breast milk, some mothers give raw butter or cow milk, mixed with leaves of a local herb and heated for some time, believing that this could soften the lips of the newborn and facilitate the passing of stool (WVE 2009b). The same study indicated that mothers introduce complementary foods at the age of 4 to 9 months with diluted cow milk, tea, gruel made from cereals, or a thin porridge made from mixture of cereals and legumes. Meal frequency depended on the number of times the child cries, which was assumed to be the sign of hunger. When children approach 2 years of age, mothers will start providing adult foods. In Wonchi woreda, underweight prevalence was 35% among children 6 to 59 months and boys were more underweight than girls.

The reported prevalence was above the regional (28.3%) and national average (23.6%) (WVE 2014 & CSA 2016).

The table below shows the performance of infant and young child feeding practices in Wonchi woreda after three years of maternal and child nutrition intervention (Table 2.1) (WVE 2010).

Table 2.1: Infant and Young child feeding indicators in Wonchi woreda

Key indicators	Wonchi
Initiating breastfeeding after delivery within an hour	66%
Mothers fed colostrum to their infants	34%
Mothers of 0-5 months old infants who fed their infants only breast milk	68%
Mothers follow the right meal frequency for infants and young children 6 – 23 months	66%
Types of food given to infants and young children the previous day (4 types and above)	59%
Practice of feeding children more than usual during illness	45%

Source: WVE 2010

2.5 Factors Affecting Timely Introduction, Meal Frequency and Diet Diversity of Complementary Feeding Practices

Kassa et al. (2015) investigated appropriate complementary feeding practices and associated factors in Southern Ethiopia. Timely initiation of complementary feeding, minimum meal frequency and minimum dietary diversity were 72.5%, 67.3% and 18.8 % among mothers of 6–23 months aged children, respectively. A significant association was observed among care givers who were illiterate, had children 6–23 months of age and with large family size. However, Semahegn et al. (2014) reported lower rates than the previous study. In this study, the prevalence

of timely initiation of complementary feeding was 60.5% and only 19% of mothers introduced complementary foods before 6 months. The main reason reported by the mothers for early initiation of complementary feeding was lack of knowledge. Mothers who have a male child were three times more likely to initiate complementary feeding earlier than care givers with a female child (AOR 2.9, 95% CI: 1.2, 7.3).

Complementary feeding practices are often inadequate in low and middle income countries, resulting in a significant decline in nutritional status between six and eighteen months of age (Nita et al. 2004). Inappropriate feeding practices among the care givers are often a greater determinant of inadequate intakes than the availability of foods in households (WHO 2015a). In Ethiopia, poor nutrition results not only from a lack of food but also from inappropriate feeding practices, where the timing, quality and quantity of foods given to infants and young children are often inadequate (WHO 2012a). According to WHO, inappropriate practices of care givers include delayed introduction of complementary foods, low energy and nutrient density of foods offered, feeding in small amounts at meals, lack of active care and stimulation, and food restrictions due to cultural beliefs (WHO 2002a).

Many Ethiopian mothers do not realize the importance of giving specific foods to their children. The poor nutritional status of children has been a serious problem in Ethiopia for many years due to inadequate nutritional practices, poor access to health and nutrition education, lack of treatment of extremely malnourished children and inadequate intake of micronutrient rich foods (CSA 2011). Complementary foods usually based on cereal gruel and porridges are given until family food is introduced. At the age of six to eight months only one in two children were introduced to semi-solid or solid foods (CSA 2005). Much of inappropriate breastfeeding and

complementary feeding behaviors were due to lack of knowledge, rather than practical or financial constraints (CNHD 2008).

A cross sectional study conducted to determine the prevalence of appropriate complementary feeding practices and associated factors among mothers having 6 - 23 months of age children in Northern Ethiopia found that child's age (AOR:4.21), maternal education (AOR:3.84), and postnatal care follow up (AOR:2.80) were independent predictors of timely initiation of complementary feeding (Haile 2014). According to Gessese et al. (2016), care givers' occupation, knowledge of complementary feeding, maternal income, and the utilization of maternal healthcare services were associated with optimal complementary feeding practice.

Various factors affect care givers to implement the recommended infant feeding practices. Kassa et al. (2015) found that among house wife mothers and mothers who delivered at the health institution there was 64% and 74% (respectively) lower risk to initiate complementary feeding too early, than among employed mothers and those who delivered at home, with AOR 0.34 (95% CI: 0.2, 0.55) and AOR 0.26 (95% CI: 0.08, 0.89), respectively. The likelihood that mothers would practice early initiation of complementary feeding was 3.91 times higher among mothers who lacked knowledge on the duration of optimum breastfeeding than among those who correctly knew it, with AOR 3.91 (95% CI: 2.33, 6.54) (Deme et al. 2015). Similarly, Sika-Bright (2010) reported that mother's marital status, level of schooling, employment, friends' way of feeding their babies, social support and baby's age were influential in infant feeding practices.

A study conducted to assess child-related factors associated with complementary feeding practice among care givers in Uganda showed that factors such as child's age, deworming for intestinal parasites and receiving full immunization increased the likelihood of care givers providing children with a minimum acceptable diet (Mokori, Schonfeldt & Hendriks 2015). A cross-sectional study conducted in India among mother-infant pairs attending immunization services showed a significant association between the age of mother, parity and education of mothers with delayed introduction of complementary food (Holambe & Thakur 2014). This is consistent with Chapagain's (2013) findings in Nepal, where mothers who received feeding advice during immunization of children were found to be significantly associated with appropriate feeding practice. However, in an Iranian study there wasn't any significant relationship between the mothers' performance and knowledge about complementary feeding (Shams, Mostafavi & Hassanzadeh 2016). In an institutional based cross-sectional study conducted among mothers of infants aged from 6 months to 12 months selected from six public health facilities, the prevalence of timely initiation of complementary feeding at six month was 62.8% (95% C.I: 58.1, 67.31). Educational level, occupation of mother, parity, having ANC follow up, and birth preparedness were found to be independent predictors of timely initiation of complementary feeding (Shumey, Demissie & Berhane 2013).

Cultural factors appeared to have an important influence on mothers' infant feeding practices and patterns (Salarkia et al. 2011). In a cross-sectional study conducted among mothers of children 6 – 23 months of age the major reasons of the mothers who started adding complementary food before six months were the perception of mothers that breast milk is not sufficient to satisfy the child's water demand, working outside home, and lack of information on the appropriate time to

introduce complementary feeding (Getahun, Abate & Abyu 2015). According to the Iranian qualitative study, conducted to investigate the socio-economic and cultural factors affecting child feeding practices, economic factors such as care givers' literacy, income, erroneous beliefs, family restrictions and interference of elderly females, had a role in failure of breast and complementary feeding.

2.6 Gender Dynamics and Infant and Young Child Feeding

The culturally defined roles of fathers entail providing for the family (food, clothing, shelter, money for health care, security) and the moral upbringing of children as disciplinarians in the home. Despite the cultural limitations imposed on them in terms of their role in childcare, men are interested in obtaining information that can enable them to support good health and nutrition of young children (IYCN 2011). Faith et al. (2015) conducted a study using a quasi-experimental, non-equivalent comparison group design with pre- and post-test observations found that families participating in activities to engage fathers or grandmothers had better knowledge and adopt better practices related to maternal nutrition and complementary feeding than families for which nutrition messages were targeted only to mothers.

According to a formative assessment conducted in Eastern and Western Kenya, while childcare is regarded as a shared responsibility, the roles of men and women were distinctly different. Men were not involved in direct care and nurturing of children younger than 24 months since it was culturally considered as women's work (IYCN 2011). The study also found that on issues of childcare and feeding, men listen to and believe the counsel of their mothers more than their wives because they believe that grandmothers are more experienced. A study conducted in

Ethiopia showed husbands were primarily responsible to work on the farm and bringing food home for the household consumption. Food purchasing is often done by the father, but in many cases fathers provide money to the mothers to purchase food from the market (Alive and Thrive 2010). A qualitative study of primary care givers in rural Uganda to assess barriers to IYCF practices showed cultural practices resulting from the influence of respected members of the community or family was a significant barrier to the use of appropriate infant and young child-feeding practices (Nankumbi & Muliira 2015).

Another study conducted on gender perceptions on infant feeding in eastern Uganda showed that the mothers' commitment to breastfeed and the husbands' support to provide for the family strongly affected mothers breastfeeding practices. Although women had received infant feeding messages during antenatal care attendance, they expressed a need to know more. On the contrary, most men felt they were left out from health education (Engebretsen et al. 2010). This could be the result of the inadequate participation and inclusion of men in education on infant feeding while the women were pregnant. The Kenyan study also showed that men have inadequate knowledge of the recommended ways of feeding young children and their beliefs are inconsistent with recommended practices. This could result in lack of care and support from husbands and other close family members. In another Kenyan study, it was found that grandmothers and men have a negative attitude towards the recommendation for reduced workload for women during pregnancy and lactation (MoHK 2011).

Engaging male partners in breastfeeding promotion and education, as well as providing fathers with knowledge and skills for optimal breastfeeding practices, has been shown to positively

impact exclusive breastfeeding rates (Susin and Giugliane 2008; Pisacane et al. 2005). A formative study conducted in Tigray, Amhara, SNNPR and Oromia regional states in Ethiopia, to determine the fathers' infant feeding practices and their determinants, revealed that men value exclusive breastfeeding. It also reported inconsistencies in the actual duration of exclusive breastfeeding and pre-lacteal feeds (Feed the Future 2012). The same report indicated that men were generally aware of the importance of introducing complementary foods at around six months of age, but they were less knowledgeable about the quantity of foods provided to their children and what foods their children were eating on a regular basis.

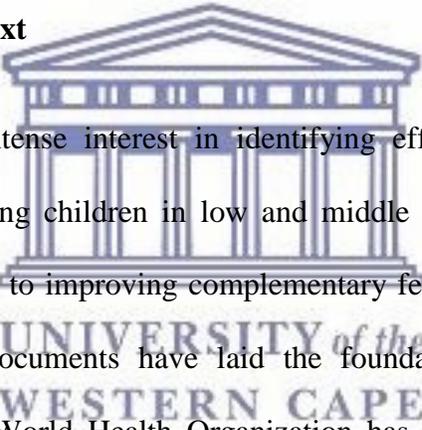
According to FAO (2016a), several programs found that women's ability to attend nutrition education sessions and put dietary and health advice into practice was limited by their workload. Especially in busy periods such as the rice transplanting season, time for food preparation and child care may be limited. The involvement of women in agriculture dates before the industrial revolution. Statistics shows that in a region like Sub-Saharan Africa, over 80% women are involved in processing food crops, providing household water and fuel wood, hoeing and weeding of farmland (FAO 2016c).

2.7 Consequences of Inadequate Complementary Feeding

The incidence of malnutrition rises sharply during the period from 6 to 18 months of age in most countries and the deficits acquired at this age are difficult to compensate for in later childhood (WHO 2002a). Undernutrition hampers both human and economic development (Feed the Future 2012). Malnutrition is responsible for nearly half (45%) of all deaths in children under five, which is equivalent to around 3.1 million deaths in children under five annually (Black 2013).

Infants and growing children are vulnerable to malnutrition due to a high physiological demand. Poor nutrition increases vulnerability to illness and infections, and vice versa. In Ethiopia high levels of malnutrition contribute to the country's high under-five morbidity and mortality rates (MoH 2004). The micronutrient composition of the diet influences disease resistance, child growth and development, and capacity to work (FAO 2012). During adult life, total losses in productivity in Ethiopia as a result of stunting for 2009 was estimated at approximately 53.6 billion Ethiopian birr, which is equivalent to 16% of Ethiopia's GDP (WFP 2013).

2.8 Success Factors for Adequate Complementary Feeding Practice in a Low and Middle Income Country Context



For decades there has been intense interest in identifying effective strategies for reducing malnutrition in infants and young children in low and middle income countries. As a result, greater attention has been given to improving complementary feeding of children from 6 to 24 months of age, and several documents have laid the foundation for developing effective programs (Dewey 2005). The World Health Organization has developed scientifically sound feeding recommendations and appropriate intervention to enhance children's dietary intake and nutritional status. Although much of the information in this global guidance may be relevant for young children in low-income settings, the recommendations have been formulated considering the economic and environmental constraints that are common in low and middle income countries (WHO 1998).

Optimal nutritional care of young children requires application of feeding guidelines based on scientific knowledge of children's nutrient requirements and the ability of breast milk and other

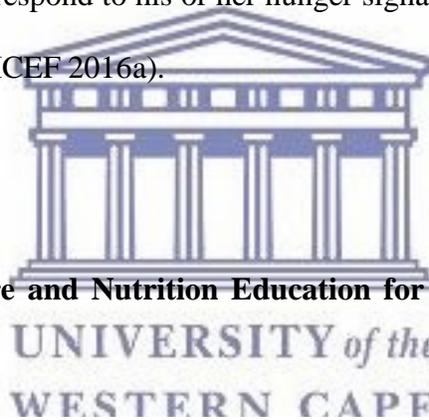
foods to satisfy the nutritional needs among infants (Brown, Creed-Kanashiro & Dewey 1995). These include appropriate duration of exclusive breastfeeding, timing of introduction of complementary foods, frequency of feeding, dietary energy density and total daily energy consumption, the importance of nutrient composition, organoleptic characteristics of complementary foods and the child's appetite in the amount of dietary intake.

Fabrizio, Liere & Pelto (2014) identified 29 studies and examined the efficacy or effectiveness of complementary feeding behavior change interventions on infant and young children age 6 -24 months in low and middle income countries. Two potential determinants emerged. Firstly, effective studies used formative research to identify cultural barriers and enablers to optimal feeding practices, to share the intervention strategy, and to formulate appropriate messages and mediums of delivery. Secondly, effective studies delineated the program impact pathway to the target behavior change and assessed intermediary behavior changes to learn what worked. Imdad, Yakoob & Bhutta (2011) in a systematic review of published randomized and quasi-randomized trials found that provision of appropriate complementary food, with or without nutritional education, and maternal nutritional counseling alone lead to significant increase in weight and height in children 6 to 24 months of age.

Breast-fed infants and young children need complementary foods with a very high nutrient density (particularly for iron and zinc), especially at ages 6–12 months. However, in low-income countries, their diet is usually dominated by cereal-based porridges with low nutrient density and poor mineral bioavailability (Dewey 2013). Effective strategies need to be implemented for obtaining the amounts of problem nutrients, as well as optimizing breast milk intake when other foods are added to the diet (Dewey & Brown 2003). To put this into practice, innovative

programs used in developed countries, such as ‘Five a Day’, campaign to increase fruits and vegetable consumption, should be explored and integrated into low and middle income countries context (FAO 2011b).

For households in most low and middle income countries, adequate quality of complementary foods and adequate frequency of complementary feeding means increasing the typical number of feeding per day. A variety of food, including micronutrient-rich foods, is also important to ensure adequate intake of all nutrients (WVI 2016a). In addition to frequent, nutrient-rich and hygienically prepared complementary foods, the role of the caregivers is important. Care givers need to interact with the child, respond to his or her hunger signals, select appropriate foods, and prepare those foods safely (UNICEF 2016a).



2.9 Integrating Agriculture and Nutrition Education for Improved Infant and Young Child Nutrition

Complementary feeding promotion requires an integrated effort of different sectors outside the health system. The Ethiopian national guidelines for infant and young children use community-based approaches to create demands for the utilization of indigenous, locally available, diversified and home-based safe foods in order to ensure access to nutrient dense, bioavailable and micronutrient rich local foods (MoH 2004). In this regard, the agricultural sector has a particularly important role to play in ensuring that suitable foods, for use in complementary feeding, are produced, readily available and affordable. To address this gap, the nutrition community began to engage in agricultural strategies to promote household and community production of micronutrient-rich foods, such as fruits, vegetables, fish, meat, and dairy (FAO

2011b). Promotion of animal products with micronutrient rich vegetables and fruits have been shown to effectively increase micronutrient intake and status, especially when combined with effective behavior change and communication interventions, as in the case of northeast Thailand (Hawke & Ruel 2006, p.1).

There is a general need for closer links between primary and community health education and agriculture extension work to ensure that nutrition advice to eat certain foods is supported by agricultural advice on producing these foods. This may include advice on appropriate horticultural techniques and methods of food preservation, storage and preparation coupled with nutrition advice to encourage cultivation and home consumption of home-garden produce (FAO 2012). In this regard, the role of AEWs, which tends to focus on crops and horticultural production, can be expanded into demonstration of food preparation techniques and promotion of diversified food utilization through basic nutrition training and training in those techniques (Patricia 2009, p.12). In practice, however, integration of nutrition education during distribution of agricultural inputs with the extension services is limited (FAO 2012; Patricia 2009, p.1).

Agriculture extension service can be a viable platform for integrating nutrition messages. However, it is important to remain modest about the possible impact of agriculture extension service on nutrition (Joshi et. al. 2013). Where extension services are underfunded and/or overstretched, additional resources and technical capacities are required to integrate nutrition into agriculture and other extension services to improve service delivery and enable scaling up (FAO 2016b). Agriculture institutions of higher learning could embed nutrition education into agriculture curriculum with support from nutrition experts to support the design and delivery of

health and nutrition messages to farmers. However, for nutrition to be accepted as part of the agriculture extension there needs to be commitment and innovation from all levels (UNA 2011).

The food and agriculture sector is essential to human nutrition, but food and agriculture interventions do not always contribute to positive nutritional outcomes. Specific attention is required to make agriculture “nutrition-sensitive” (FAO 2016d). Interventions designed to improve agriculture often focus on increasing the yield of staple crops. A much greater impact on nutrition can be achieved by shifting the main focus to increasing the variety of nutrient-rich foods produced and consumed by smallholder farmers. This requires that nutrition objectives are explicitly built into agriculture program designs, empowering women smallholder farmers and incorporating nutrition education with agriculture interventions (WVI 2016b). Agriculture extension workers are primarily concerned with ensuring food security which mainly focuses on providing access to nutritionally adequate food at household level. In most cases, achieving this may not necessarily result in improvements in energy consumption, diet quality, safety and the nutritional status of all household members, especially the most vulnerable individuals (FAO 2012; Zeitlin & Brown 1992).

The role of the agriculture extension service is to create a support system that reach a larger number of stakeholders and enable them to adopt practices. However, positive results in nutrition outcome is a product of education, access to nutritious food and sustainable behaviour change (Joshi et al. 2013). Such trial has been done in Malawi, where trained agriculture extension workers promoted production of diversified plant and animal products in the Farmers Field School, Junior farmer field life schools, schools, health facilities and homes, including

post-harvest processing and storage, home processing, preservation and preparation (Heise 2013). However, effective integration of nutrition and agriculture is often hampered by the fact that agriculture programs typically target male farmers and established female farmers, while health and nutrition programs tend to target women and children. Without careful targeting, this can lead to low overlap between the two types of interventions (FAO 2016b). Hence, harmonized targeting is essential to ensure that agricultural interventions have a greater impact on diet. However, many extension agents feel that nutrition messages fall outside of their remit and that their incorporation into routine activities detracts from core services. The non-priority status of nutrition has thrown up further obstacles to message delivery, since it has a narrow window of time available to target pregnant and lactating women in a male-dominant client base (Joshi et al, 2013).

Agriculture extension visits with nutrition extension activities could provide a joint message combining agriculture and nutrition using existing structures and messages (FAO 2011a). However, it is important to ensure that messages are simple and focus on key practices, without being overly technical. Messages should be broken into easily doable actions for individuals to incorporate, implement, translate, and share at the community level (Joshi et al. 2013).

In an intervention research project implemented in Kenya, where new varieties of sweet potatoes, rich in beta carotene, were introduced to women farmers, agricultural extension agents trained women in methods of growing and harvesting sweet potatoes, post-harvest processing, and preparation techniques. In addition, health and nutrition education sessions were conducted for care givers to heighten awareness and encourage consumption of food products using the new

sweet potato varieties (Hagenimana et al. 1999). Such kind of interventions require community involvement for its sustainability (Marsh 2002). In an extremely resource poor area in Mozambique, the effectiveness of the introduction of orange fleshed sweet potato was assessed in an integrated agriculture and nutrition intervention where community based extension workers were involved. The result showed increased vitamin A intake and serum retinol concentrations in young children (Jan et al. 2007).

The majority of Ethiopia's population, including the population in the study area, is heavily dependent on subsistence and rain-fed farming and livestock production, which accounts for almost half of the country's gross domestic product (FAO 2008). This could result in variability in food availability at household level across the year. Becker (1982), in longitudinal field studies conducted to assess the growth, dietary intake, and morbidity from infectious diseases of children between 6 and 60 months of age in two rural villages of Bangladesh, Penny et al. (2005) observed an association between seasonal fluctuation and the prevalence of malnutrition among children. They claim that improvement of nutrition education can decrease the prevalence of stunted growth in childhood in areas where access to food is not a limiting factor.

Among the various factors that account for a high prevalence of chronic malnutrition, widespread poverty and food insecurity, limited access to health services in the context of a heavy burden of diseases, and inadequate young child feeding practices hold the most important responsibility (IFPRI 2012). In Ethiopia, the deterioration of nutritional status after the age of six months can be related to inappropriate complementary feeding practices combined with the cumulative effects of recurrent illnesses and lack of access to health care (CSA 2005).

2.10 Impact of Nutrition Education on Feeding Practices and Infants' Growth

Numerous educational interventions have been shown to improve feeding practices, but few of these studies were randomized controlled trials (Caulfield, Huffman & Piwoz 1999). A meta-analysis review of published randomized and quasi-randomized trials on provision of appropriate complementary food, with nutritional education and maternal nutritional counseling alone resulted in an extra gain of 0.25kg (SD±0.18) in weight and 0.54 cm (SD±0.38) in height in children aged six to twenty-four months. Education provided to mothers about complementary feeding led to an extra weight gain of 0.30 kg (SD±0.26) and a gain of 0.49 cm (SD±0.50) in height in the intervention group compared to the control group (Imdad, Yakoob & Bhutta 2011; Aamer, Mohammad & Zulfiqar 2011). Evidence from these studies supports the view that educational interventions can effectively improve complementary feeding practices and child nutrition and growth.

Shi et al. (2010) in China found that food diversity; meal frequency and hygiene practices were improved in an education intervention group. Infants in the intervention group gained 0.22 kg more weight (95% CI: 0.003, 0.45; p=0.047) and gained 0.66 cm more length (95% CI: 0.03, 1.29; p=0.04) than did controls over a one year study period. Such interventions should be culturally sensitive, accessible and integrated with local resources (Shi & Zhang 2011). These include nutritional counseling to mothers designed to promote healthy feeding practices, provision of complementary foods and supplementation with foods either fortified with multiple micronutrients or with increased energy content (Dweny 2008; Caulfield, Huffman & Piwoz 1999). However, other educational intervention studies showed impact both on weight and length gain. Two educational interventions with the greatest impact on both weight and length gain

(effect sizes of 0.34–0.96) were the projects in Peru (Penny et al. 2005) and China (Guldan et al. 2000). Bhandari et al. (2001) reported in an interventional study where the intervention group that received nutrition education had a higher increment in length between 6 and 12 months of age ($P = 0.035$). However, these studies tended to be on a small scale, and the strategies adopted may not be sustainable in primary health care systems that work under considerable resource constraints.

Penny et al. (2013) did a cluster-randomized trial of an educational intervention in a poor peri-urban area (i.e. shanty town) of Peru. At 6 months, more babies in intervention areas were fed nutrient-dense thick foods at lunch (a recommended complementary feeding practice) ($p=0.03$), and met dietary requirements for energy ($p=0.043$), iron ($p=0.047$), and zinc ($p=0.012$) than did controls. Adjusted mean changes in weight gain, length gain, and Z scores were all significantly better in the intervention area than in the control area. The impact of complementary feeding interventions on child growth has been variable, which calls attention to the need for more comprehensive programs (Dewey & Brown 2003). A linear regression analysis conducted on Ethiopia's DHS 2005 report showed exclusive breastfeeding under 6 months of age was negatively associated with height-for-age z-score ($p<0.01$). However, higher dietary diversity score was associated with higher height-for-age z-score ($p<0.001$) and weight-for-age z-score ($p<0.001$) (Disha et al. 2012).

2.11 Effectiveness of Complementary Feeding Education on Infants' Growth

Optimal complementary feeding is an essential element in the overall strategy to prevent childhood undernutrition. Stunting is difficult to address and actions are required on many fronts

including well planned collaboration among the various sectors and strengthening of existing structures in health and agriculture extension services (FAO 2016b). The low quality of complementary foods combined with inappropriate feeding practices put under-twos in low and middle income countries at high risk for undernutrition and its associated outcomes. Reasons for this could be that either the frequency and amount of foods offered are less than required for normal child growth, or their consistency or nutrient density are inappropriate in relation to the child's needs (UNICEF 2016b). Even with optimal breastfeeding, children will become stunted if they do not receive sufficient quantities of good quality complementary foods after six months of age (Sachdev & Shekar 2008). According to Lancet, an estimated six percent or 600,000 under-five deaths could be prevented by ensuring optimal complementary feeding. Improved feeding of children under two years of age is particularly important because they experience rapid growth and development, and are vulnerable to illness. There is evidence that feeding practices are poor in most low and middle income countries. Continued breastfeeding beyond 6 months should be accompanied by consumption of nutritionally adequate, safe and appropriate complementary foods that help meet infants' nutritional requirements when breast milk is no longer sufficient (UNICEF 2016b).

Dewey, Kathryn & Seth (2008), in a systematic review of the efficacy and effectiveness of complementary feeding interventions in low and middle income countries, reported that in vulnerable populations good complementary feeding practices have been shown to reduce stunting markedly and rapidly. Contrary to these reports, Bhandari et al. (2001) in an intervention study found that the proportion of children with height-for-age Z-score less than -2 SD did not differ between the intervention and control groups. Two efficacy trials in China and

Brazil were of particular interest because nutritional counseling was given without food supplements (Guldan et al. 2000; Santo et al. 2001). In these trials, locally appropriate complementary foods, including foods rich in animal proteins and micronutrients, were promoted. In the Chinese trial, infants in the intervention group were significantly heavier and longer at 12 months of age (Guldan et al. 2000). The magnitude of the effect in the Chinese trial was greater than this study, where animal products, especially flesh foods, were not consumed at all by infants.

2.12 Summary of Literature

In Ethiopia complementary feeding practices, especially diet diversity is inadequate. Currently only 4% of infants met the recommended minimum diet diversity. This resulted in high prevalence of under stunting and underweight among infants and young children. To improve the dietary practices currently HEWs are promoting complementary feeding to the care givers. Though AEWs are involved in livestock, crops and horticulture production, there is no information on interventions that support them to promote diversified food consumption. In addition the various opportunities that AEWs have while engaging with women and men farmers for their daily activities have not been used to disseminate complementary feeding messages. Current literature review showed there is no evidence that showed the impact of AEWs complementary feeding promotion on care givers feeding practices and infants' growth. Hence, this study was conducted to assess the effectiveness of complementary feeding promotion using AEWs in addition to existing Health Extension Workers (HEWs), compared with HEWs alone, on care givers complementary feeding practices and infants' nutritional status.

CHAPTER THREE: METHODOLOGY

This chapter describes the methods used in this study, which include the study design, study area and population, inclusion and exclusion criteria, sampling techniques and sample size, description of the study intervention, training of field workers, data collection, data entry and analysis. As well, it covers the validity of the questionnaires, reliability of data collection, generalizability of the study findings, logistics and ethical considerations.

3.1 Study Design

This study was a cluster randomized control trial to assess care givers' complementary feeding practices, weight and length gain, and nutritional status (measured by weight-for-age and height-for-age) of infants six to twelve months of age. The study used quantitative and qualitative (phenomenology approach) methods of data collection. The study consisted of two groups, an intervention and a control group. After the baseline study the intervention group received complementary feeding messages that focused on frequency, amount, thickness, variety, active feeding and hygienic preparation of complementary food, promoted through trained AEWs in addition to their regular activities. In the control group the AEWs conducted their regular work. The HEWs continued their regular health and nutrition activities in both groups. The AEWs in the intervention area were using complementary feeding messages consistent with those of HEWs to promote harmonized complementary feeding recommendations. After the training, Ministry of Health Family Health Cards was given to each of the trained AEWs in the intervention group which HEWs also use to provide complementary feeding messages.

3.2 Study Variables

The study variables are described in Table 3.1.

Table 3.1: Description of dependent and independent variables

Dependent variables	Independent variables
<p>Outcome variables:</p> <ul style="list-style-type: none"> - Nutrition status of the infant (weight-for-age z- score, height-for-age z-score). - Weight gain in gm/3 months. - Length gain in cm/3 months. - Minimum dietary diversity. - Minimum meal frequency. 	<ul style="list-style-type: none"> - Care givers and infant socio-demographics: Care givers: age of care giver/mother and marital status. Infant: sex, age of infant, birth order. - Infant feeding practices: Duration of exclusive breastfeeding, continued breastfeeding, current breastfeeding status, age of introducing complementary foods, types of complementary foods, frequency of complementary foods, active feeding. -Socio-economic status: Household headship, formal education, occupation, economic status, small animal ownership, production of vegetables, fruits and dairy products. - Morbidity and feeding during illness: Diarrhea and fever in the past two weeks, infant feeding during illnesses. - Health services uptake: Immunization status and de-worming.

3.3 Study Area Description

Wonchi woreda - woreda refers to district in local language - is one of the woredas in Oromia Regional State of Ethiopia. It is located in Shawa Zone 123 kilometers southwest of the capital city Addis Ababa. The woreda consists of 24 kebeles with Chitu as its administrative center (WVE 2014). Based on projections from the 2007 national census, the woreda has a total population of 103,810, of whom 51,380 are men and 51,430 are women. Over 2.0% of the population is urban dwellers. The majority of the inhabitants practice Ethiopian Orthodox Christianity (70.1%), while 28.41% of them are Protestant and 1.3% are Muslim (CSA 2012). The same report indicated that, with an estimated area of 457.51 square kilometers, Wonchi has a

population density of 237.3 people per square kilometer, which is greater than the Zonal average (152.8). Oromo is the largest ethnic group (98.9%) and all other ethnic groups consist of less than 2% of the population. Oromiffa was spoken as a first language by 99.5% of the population.

Agriculture is the main stay of the economy. However, it neither produces enough capital to absorb the unemployed nor is sufficient for the people as livelihood. According to a study conducted in Wonchi woreda on vulnerability and livelihood strategies of households, the mean annual income of the population was 2126 Birr (96.6USD) while the food poverty line was 3183.7 birr (144.7 USD) (Demie and Okoya 2013). The same report indicated that low income, low job opportunity, low crop production and landlessness were the key vulnerabilities in the area. The major cereal crops produced in the area are teff, wheat, barley and false banana while the major legumes are lentils, beans and chickpea. Ownership of physical assets such as livestock is low and off-farm and non-farm activities are the main livelihood strategies of poor households. According to a study conducted in the area, most families in Wonchi woreda practice chicken production (84%). Among families that practice small scale irrigation for vegetable and fruit production (82%), nearly half of them reported that they ate most of what they produced (WVE 2010).

Almost all the population in Wonchi woreda has access basic primary health care services within an hour distance. There is one health post in each kebele staffed with two HEWs. In addition, five health centers and a referral hospital provide outpatient and inpatient services in the woreda (WMOH 2014). However, some health service utilization indicators are still low. A World Vision Wonchi program area study showed eight in ten (84%) children are immunized, 15% of children

under five years of age sleep under long lasting insecticide treated net, 32% of women of reproductive age use contraceptives, 80% of children were given vitamin A, 72% of sick children were taken to health institutions for treatment and only 5% of women swallowed iron tablet when they were pregnant (WVE 2010). Though mothers take their children to health facilities, withholding fluid and food intake, treatment with herbs, leaves and roots, massaging the abdomen and chest were practiced in the community when children got sick with diarrhea and vomiting (WVE 2009b).

According to a survey conducted in the study area the majority of the population access safe water supply (63%) and use latrine (85%), and over nine in ten (91%) care givers practice hand washing at critical times. Only 26% of children under five had diarrhea in the two weeks before the survey (WVE 2014; WVE 2010). Health education on immunization, nutrition, family planning, personal hygiene, safe water supply and sanitation and other health topics are being given to community members by local health workers at outpatient departments, outreach sites and public/social gatherings (WMOH 2014). Diarrhea, pneumonia, intestinal parasites, skin infections, malaria, anemia and other febrile illnesses are the major childhood illnesses in Wonchi woreda (WVE 2009a).

3.4 Study Population

The study population was all infants 6 to 12 months of age in the six study kebeles.

3.5 Inclusion and Exclusion Criteria

The sample population was households in selected kebeles with infants 6 to 12 months of age that met the inclusion criteria. Refer Table 3.2 for inclusion and exclusion criteria.

Table 3.2: Inclusion and exclusion criteria

Criteria	Description
Inclusion	All infants in the eligible age group. For twin siblings the bigger sibling, based on care givers report, was included in the study.
Exclusion	Infants with acute malnutrition currently on therapeutic feeding program. All cases to be referred for treatment. Chronically sick infants such as infants with tuberculosis, mentally retarded, and currently known HIV status and on ART One of twin siblings. The younger sibling based on care givers verbal report. One of the twin was excluded, in this case the younger sibling, to provide consistent guidance for data collectors and keep the sample size within the limit.

3.6 Sampling Technique

3.6.1 Selection of study location

Considering the number of kebeles that could meet the sample size the study included six kebeles. The kebeles were randomly selected and assigned to the intervention and control groups (Figure 3.1, Figure 3.2 & Table 3.3). First, each kebele was ranked based on its agro-ecology e.g. highland, midland and lowland, and level of food security. Ranking of the kebeles based on their different characteristics was done jointly with World Vision Wonchi area program health and agriculture project staff and the government staff working in woreda agriculture and health offices. Next, kebeles were checked for similarity in agro-ecology, level of food security and

equal number of health and agriculture extension workers. Two kebeles with only one AEW were excluded from sampling. Distance among the kebeles was considered and some kebeles were left in between to serve as a corridor and avoid contamination from the AEWs, and to minimize the likelihood of contact between care givers and thus the exchange of information among the groups.

The researcher and development workers conducted the randomization to produce comparable groups and eliminate the source of selection bias in the assignment of kebeles to the intervention and control groups. A simple randomization method was based on a single sequence of random assignments to maintain complete randomness of the assignment of the kebeles to a particular group. A random number, from a random number table, was assigned to each of the kebeles. Based on their random number a lottery method was used to categorize the 22 kebeles into two groups each consisting of 11 kebeles. Out of the 11 kebeles in each group three kebeles were again randomly selected using the random numbers assigned to them. Each of the groups consists of three kebeles of which two from lowland and one from midland were assigned randomly into intervention and control group by flipping a coin. The intervention group was assigned to receive complementary feeding message using AEWs and the control group was left to continue the current practices. Suresh (2011) reported that this randomization approach is simple and easy to implement in a clinical research. In large clinical research, simple randomization can be trusted to generate similar numbers of subjects among groups. However, randomization results could be problematic in relatively small sample size clinical research, resulting in an unequal number of participants among groups. This was the case in this study

where the highland kebeles could not be included in either of the groups due to small number of kebeles assigned to the two groups (Table 3.3).

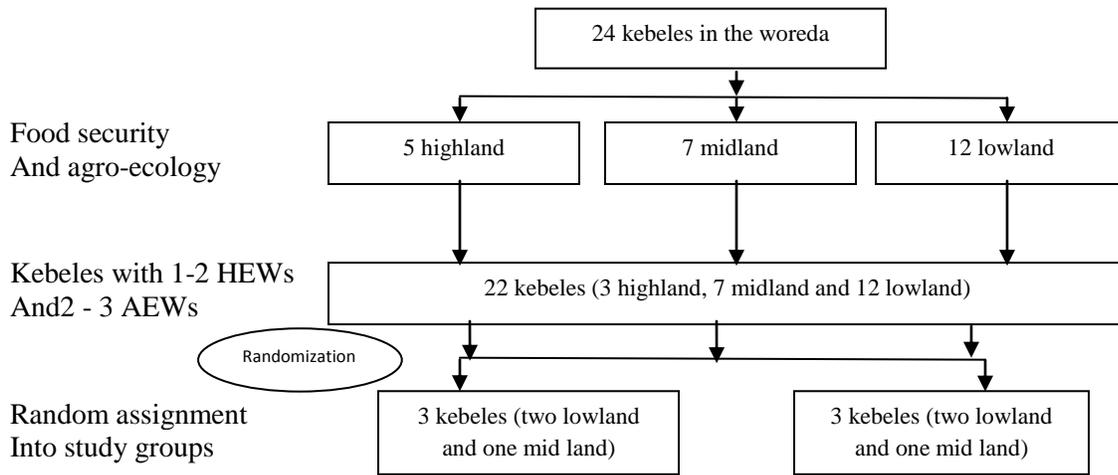


Figure 3.1: Diagrammatic representation of the randomization of study kebeles

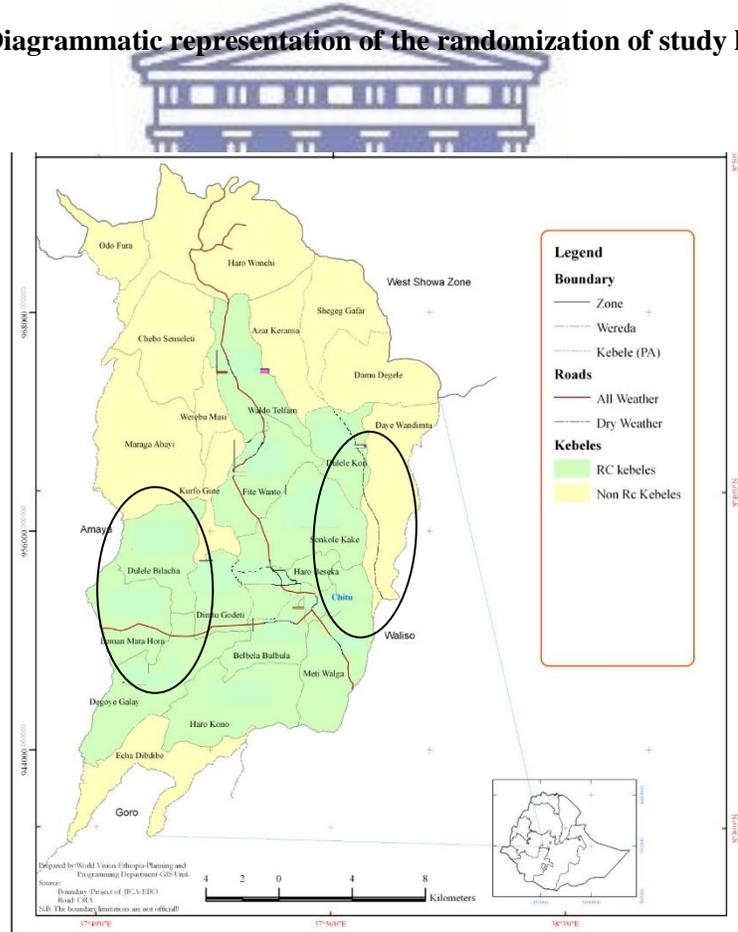


Figure 3.2: Study location showing two areas where research was undertaken

Table 3.3: Key features of the study location

Group	Kebele	Population	Estimated infants 6 - 12 months	Agro-ecology	Level of food security	No of HEWs*	No of AEWs**
Control	MatiWala	5233	105	low land	Food secure	2	2
	Duello Kori	4315	86	mid land	Food secure	2	3
	Daye Wandimtu	5330	107	low land	Food secure	1	3
Intervention	Dimtu Godeti	3385	68	low land	Food secure	2	2
	Dulele Bilacha	6216	124	mid land	Food secure	2	3
	Leman	4717	94	low land	Food secure	1	3

Source: Woreda Ministry of Agriculture Office Annual Report 2015

3.6.2 Recruitment of study participants

For the quantitative study infants aged 6 to 12 months were listed among the households in six kebeles using the form developed for this purpose (Appendix 8.3). Household lists were used to identify care givers-infants pairs that were enrolled in the study. Study participants were sampled systematically from the list proportional to the number or size of care giver-infant pairs in their respective kebeles. For the focus group discussion 10 care givers with infants 6 to 12 months were sampled purposively. The following criteria was used for selecting care givers-infants pairs: care givers with infants 6 to 12 months, a resident in the study kebeles, willing to take part in the discussion and their infants who were not sick requiring the care giver's attention. All AEWs in the study areas participated in key informant interview.

3.6.3 Blinding

Blinding was done to control for bias as follows. The researcher did not inform the study interventions and hypothesis for the development workers who participated during the randomization of the kebeles into study groups.

3.7 Sample Size Determination

The following assumptions were taken to calculate the sample size for the study. The sample size was based on the prevalence of minimum dietary diversity (feeding from four or more food groups) of the complementary feeding practices in the country.

N=size per group;

μ_1 = the proportion in the target population estimated to having characteristics being measured;
i.e. Minimum dietary diversity at least four or more food groups 4%;

μ_2 = the expected response rate of new dietary practices after the intervention =16%;

u= one sided percentage point of the normal distribution corresponding to 100% the power; e.g. if the = 90% then u= 1.28;

v= percentage of the normal distribution corresponding to the required (two sided) significance level, if the significance level 5% then v=1.96.

Cluster effect – doubling sample size as a compensatory increase to maintain power in a cluster.

Power of the test = 0.80

Calculation:
$$n = \frac{(u + v)^2 (\mu_1 + \mu_2)}{(\mu_1 - \mu_2)^2}$$

$$n = ((1.28 + 1.96)^2 \times (0.16 - 0.04) / (0.16 - 0.04)^2) = 88$$

Cluster effect = n X 2 = 176

Including 10% non-response, n= 192

Jointly with a World Vision health expert and the HEWs who were responsible to provide health services for the sampled kebeles, all care giver with infants six to twelve months were identified. One hundred and ninety-two care givers-infant pairs were randomly selected from the list of households in the kebeles, proportional to their size, and enrolled in the two study groups (Figure

3.3). The figure also showed the number of care givers-infant pairs that participated and those that did not participate during baseline, follow up and post-intervention evaluation. Absence was due to care givers' travel outside of the study kebeles and could not be traced until data collectors completed data collection in that area.

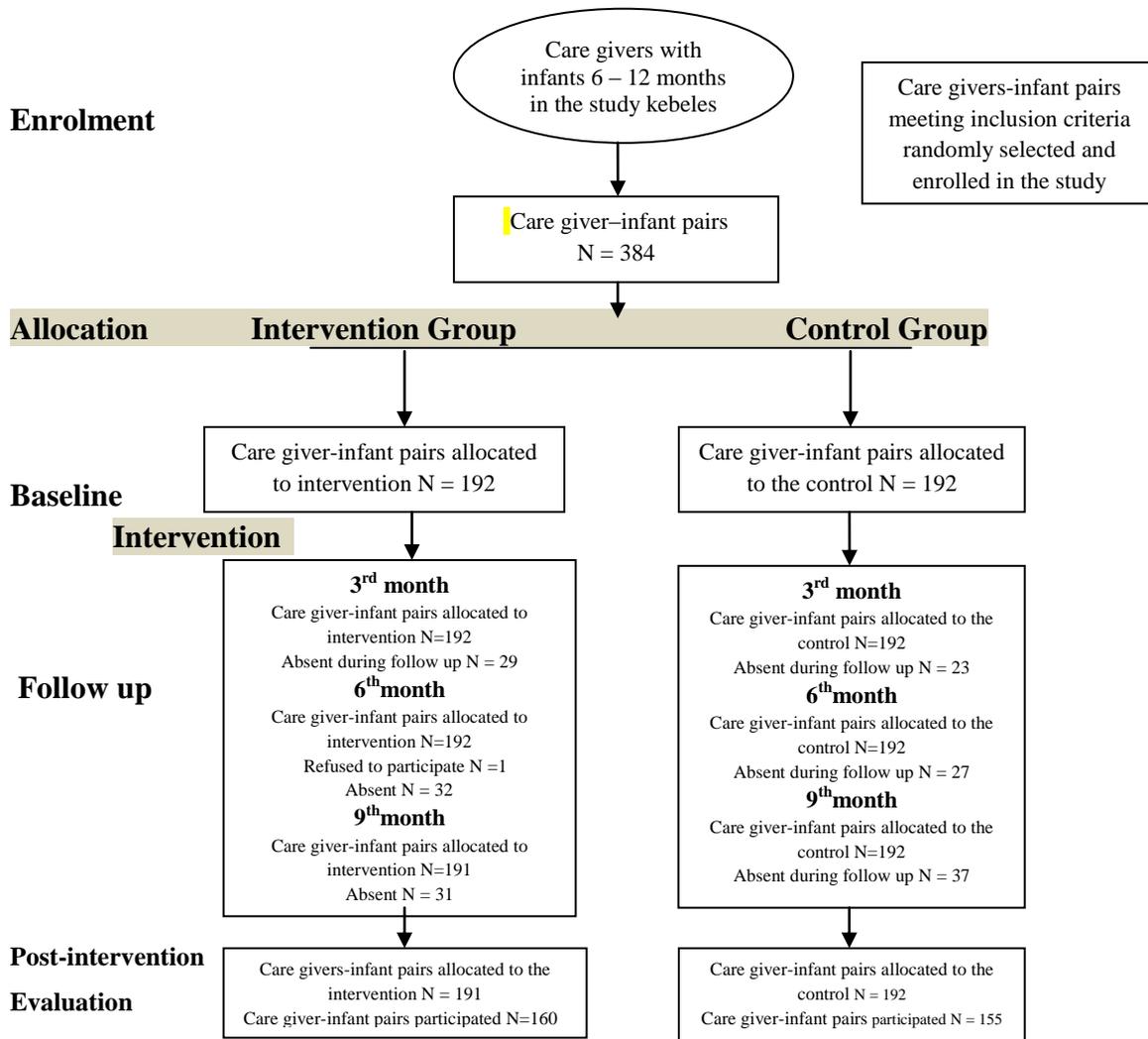


Figure 3.3: Diagrammatic representation of study participants

The names of the household heads were used to identify care givers and infants for interview and anthropometry measurement. Infants who were found to be older or younger than the age

category during the date of the visit (less than 6 months or older than 12 months) were replaced with another infant from the same village drawn randomly from the sampling list.

Table 3.4 shows the months when the study was conducted, the major agricultural activities and the status of food availability in the community (WVE 2010, p.10).

Table 3.4: Months of data collection, agricultural activities and food gap

Group Variable	Baseline	Intervention	3rd month	6th month	9th month	Post-intervention
Period for data collection	March 2014	March 2014	June 2014	September 2014	December 2014	March 2015
Major agricultural activity	Post-harvest	Post-harvest	Planting	Pre-harvest	Harvest	Post-harvest
Food Gap month	No	No	Yes	Partially	No	No

3.8 Selection & Training of Field Workers

Jointly with the World Vision Wonchi area development program a total of nine field workers were identified. All had previous experience in data collection and six participated in eight surveys previously and one participated in three previous surveys. Among them a supervisor was identified to assist the researcher during data collection. Additionally, one volunteer per study kebele was identified to assist field workers in identifying sample households and carrying the length board.

3.8.1 Field workers' training and questionnaires pilot testing

The researcher trained nine field workers on completing the household questionnaires and consent forms and how to refer to the survey manual on data collection procedures whenever

they face difficulty. After the training, the field workers practiced the questionnaires, consent forms and anthropometric measurements in non-sample kebeles that were not adjacent to the study kebeles. The field test helped to validate the household interview questionnaires as well as to standardize field workers' anthropometric measurement skills. A few of the questions were adapted to the local context to reflect the local dialect of Oromiffa or to provide the right meaning as it was indicated in the English translation.

To ensure accuracy and standardize measurements the field workers were trained on how to measure infants' length and weight. The field workers were grouped in four teams and each team measured an infant twice. A total of eight infants were measured and the data was entered into a computer program to calculate how precise and accurate each team was taking the measurements. After the practical session, feedback was given for each of the team members depending on their performances. Moreover, during data collection the researcher entered the anthropometry data into SMART nutrition survey software that automatically generates flags for abnormal values while the data were entered. Hence, each morning, before the team left for data collection, feedback was given if there were flagged results. The researcher also accompanied the team for close supervision and checking the accuracy of the measurements. This was done during the baseline, follow up and post-intervention evaluation. In addition, during the follow up periods the researcher conducted theoretical orientation before data collection.

During data collection field workers were re-calibrating the weighing scale using 500gms of bottled water before taking the weight of each infant. All field workers were given the survey manual to refer it for any questions they might encounter during data collection. Each field

worker team comprised of two field workers plus the community volunteer. The community volunteer assisted the field workers in identifying care givers' houses and carrying anthropometric equipment. Pilot testing was conducted in eight families at a non-study kebeles. Multiple measurements and interviews assisted field workers to improve the quality of measurements and internalize the questionnaires. The researcher also provided his mobile number to communicate with them and provide clarification for any questions they had during field work.

3.9 Data Collection

The research consisted of both quantitative and qualitative data collection. The data was collected at baseline, follow up study and post-intervention study. The follow up data collection was conducted to assess the changes in care givers' complementary feeding practices and the amount of weight and length gain, change in weight-for-age and length-for-age among infants in the study and the post-intervention evaluation was conducted to assess the impact of the intervention. The survey protocol was used to guide the data collection and measurements (Appendix 8.11).

3.9.1 Timeline and types of data collected in the study

The following table summarizes the types of data collected at baseline, follow up and post-intervention evaluation (Table 3.6). Follow up surveys were conducted on a quarterly basis.

Table 3.5: Types of data collected at the study period

	Baseline	Follow up	Post-intervention evaluation
Types of data collected	Care-givers interview <ul style="list-style-type: none"> - Care giver background - Care giver socio-economic status - Infant background - Infant feeding and caring - Infant health, morbidity and feeding during illness - Anthropometry Focus group discussion with care givers Key information interview with AEWs	Care-givers interview <ul style="list-style-type: none"> - Infant background - Infant feeding and caring - Anthropometry 	Care-givers interview <ul style="list-style-type: none"> - Care giver background - Care giver socio-economic status - Infant background - Infant feeding and caring - Infant health, morbidity and feeding during illness - Anthropometry Focus group discussion with care givers Key information interview with AEWs

3.9.2 Quantitative data collection

The quantitative study consisted of care givers' interviews and anthropometric measurements of infants. One questionnaire was administered for each care giver. The main outcome indicators of the study were weight gain, length gain, weight-for-age, and height-for-age and care givers' practices on recommended complementary feeding practices (minimum meal frequency and minimum dietary diversity). The estimated numbers of infants who were eligible and participated in this study are listed in Figure 3.3. Care givers were briefed on the purpose of the study and those willing to participate in the study signed the consent form before starting the interview. For illiterate care givers, they read the consent form and asked them to sign with their thumb. The field workers also explained the duration of time conducting the interview and weight and length measurement would take. Permission to participate in the study was requested during key information interviews and focus group discussions where each participant signed the consent form. The detail information provided both for care givers in the intervention and control groups is found in the appendix (Appendix 8.4-8.6).

The team supervisor, with support from the researcher, reviewed the completed questionnaires, ensured that the data is complete and the forms are filled accurately, followed households who were absent during data collection, supervised field workers, introduced the team to the kebele leaders and engaged with the leaders or other local representatives for any questions that might arise. The field workers were responsible for selecting sample households, verifying the age of the infant, administering the care givers' questionnaire, measuring the weight and length of infants, keeping the study materials safely and submitting completed questionnaires to the supervisor.

The field workers carried care givers' questionnaires, a copy of study operational manual, Saltar scale (maximum weight handling capacity of 25kg) with hanging pan and length board, which was bought from a supplier called Haimet Plc, a calendar of local events to assist in age determination if the care givers could not show a birth certificate and immunization card, pencil, sharpener and eraser. The team ensured all the materials were prepared before leaving the office.

Information on child morbidity, fever and diarrhea, was assessed using recall method for any incidence of illness in the preceding two weeks, and a 24-hour recall was used for understanding the types of foods that care givers provided to infants the previous day. Assessment of child immunization and deworming status was done using care givers verbal report.

3.9.2.1 Instrument for quantitative data collection

Based on the research objectives, for the quantitative data collection, an open-ended question was developed to capture as much information as possible.

Care givers interview questionnaire (Appendix 8.7): Care givers questionnaire was designed to obtain data on care givers' background in-terms of age, marital status, family size, having twin children and family headship. The questionnaire was designed to elicit information in-terms of the socio-demographic characteristics of the mother including education status, occupation, ownership of small livestock, vegetable and fruit production, dairy products and economic status. Infant background such as age, sex, birth order and feeding history including exclusive breastfeeding, continued breastfeeding, intention for continued breastfeeding, age of introduction of complementary foods, types of foods used to introduce, meal frequency and the types of foods given to infants in the last 24-hours were investigated. Further, care givers' access to infant feeding information was investigated. The study also measured the AEWs' participation and frequency of visits to care givers' homes in the previous three months. Finally, questions on infants' health status, especially fever and diarrheal disease in the preceding two weeks and feeding during illness, were elicited, with questions on whether the infant received more, the same or reduced amount and frequency of food during illnesses. Infants' immunization for their age and deworming in the past 6 months were also enquired about from the care givers. Finally, weight and length of the infant was measured.

Weighing and length measurement: standard Salar weighing scale and four length boards were bought from a supplier called Haimet Plc for the purpose of the study. Before weighing infants, description of the procedures of weighing and length measurement was given to the care givers. The field workers conducted weighing before length measurement. The field workers hang the weighing scales at suitable point such as tree or door frame or a stick held on the shoulders of one of the field worker and the assistant. The second field worker (measurer)

ensured the dial at eye level, hung the Salter trousers, and recalibrated the scale (reset the balance to zero) before putting the infant on the scale. The measuring field worker ensured the infant was fully undressed or dressed only in shirt, unhook the Salter trousers and put the infant in it. The measuring field worker also ensured that the infant was well centered in the trousers and that one of his/her arms was in front of the trousers and the other in back. Care was taken to watch out for falling infant. After ensuring nothing was touching the infant the measuring field worker read out loud the measurements to the nearest 0.1 kg. The other field worker repeated the measurement out loud and recorded the weight in the appropriate box of the questionnaire while the measurer calmed and returned the infants back to the care giver. The same procedure was repeated for the next infant.

To measure the length the field workers placed the length board in a flat place on the ground. Field workers ensured shoes, or any ornament or top knots on the infant's head were removed. The infant was placed gently on the board on his/her back with the head against the fixed vertical part and the soles of the feet near the cursor or moving part. The field workers kept the infants straight in the middle of the board, looking directly upward. One of the field worker held the infant's head firmly against the base of the board and the measuring field worker placed one hand on the knees (to keep legs straight), placed the infant's feet against the cursor with the other hand and pushed the cursor against the feet firmly but gently. The measuring field worker read and announced the length to the nearest 0.1 cm. The second field worker repeated the measurement out loud and recorded it on the questionnaire.

3.9.2.2 Management of appointments and follow up

After recruitment, location information was taken for each care giver in the study by the field workers. At the end of every visit, field workers reminded the care givers of the approximate date of the next visit, which was recorded by the field workers in their diary. After each visit to the care givers, the date of the completed visit was indicated both on the data collection questionnaire and the field workers' diary for recording purposes. On occasions when care givers were not available the field workers conduct a second visit to these homes before they left their kebeles. In a few occurrences an alternative day was agreed to revisit caregivers, if they could return the next day.

3.9.3 Qualitative data collection

The qualitative data collection consisted of focus group discussions with care givers and key informant interviews with all AEWs. The qualitative study was conducted to triangulate data provided by the quantitative study.. Moreover, it enabled the researcher to uncover deeper issues on the care givers infant feeding practices and AEWs involvement in promotion of complementary feeding. For the qualitative data a standardized questionnaire was designed that could help to test the study hypothesis. The key informant interview and focus group discussions were conducted at baseline and post-intervention evaluation, and were conducted using the same guide.

3.9.3.1 Key informant interview guide and interviews

Key informant interview guide: This was administered to all AEWs working in the six kebeles by the researcher. The researcher elicited information on their understanding on infant feeding practices in their community, the activities they were doing to prevent malnutrition, whether they knew if there was nutrition/behavior change education in their community, and their involvement in complementary feeding promotion. The interview also elicited information on what care givers thought about their participation in promoting complementary feeding practices, factors that influencers (barriers and facilitators) their involvement in complementary feeding promotion and suggestions to address the barriers and influencers.

Key informant interviews: the key informant interviews were conducted in Amharic language, the national language of Ethiopia, and the discussions were recorded using mobile phone while the researcher took notes. The interviews were guided by semi-structured questionnaires (Appendix 8.10). Interviews were held with all AEWs in the study area. All AEWs were selected since their number was manageable for the researcher to conduct the interview. The purpose of the interview, anonymity and duration was explained to the participants. The interviews took about an hour. The researcher probed for each question to get as much information as possible. During interviews, the researcher gave time for participants to respond and moved to the next questions when there was saturation of information. During the interview chances were also given to AEWs to ask questions before closing the interview. All the interviews were conducted in their offices.

At baseline four AEWs in the control group and eight AEWs in the intervention group, who were present in their work station, participated in the interview. All except one were males. During the post-intervention evaluation, seven AEWs, three in the control group and four in the intervention group, participated in the interview. The rest of the AEWs were not in the kebeles since some have gone to summer school and others went for the government meeting during the week where the post-intervention evaluation was conducted.

3.9.3.2 Focus group discussion guide and discussion sessions

Focus group discussion guide: The focus group discussions were guided by semi-structured questionnaires (Appendix 8.9). The researcher collected qualitative information to understand infant feeding practices, on knowledge of the presence of nutrition/behavior change education in their community and their thinking about AEWs' involvement in promoting complementary feeding. Moreover, care givers were asked to identify influencers (barriers and facilitators) for AEWs involvement and to give suggestions how to address these influencers.

Focus group discussion sessions: Focus group discussions were held with purposively selected care givers for in-depth understanding of care givers' feeding practices and to know the reasons that govern such practices. Health extension workers who were in charge of the health posts were approached to select 10 care giver-infant pairs for one focus group discussion in the intervention and control kebeles. The researcher conducted one focus group discussion per group, which consisted of 8 – 10 women, making a total of 4 focus group discussions during the study. One focus group discussion was conducted per group since only three kebeles were participating in each group and the kebeles in each of the groups were close to each other. Moreover, care givers

in those three kebeles live in a similar socio-economic and cultural setting thus, the researcher decided to conduct one focus group discussion in each group.

Care giver-infant pairs age ranged from 17 to 50 years and all of them were females. This has allowed free discussion among the participants. The location of the focus group discussion was determined jointly with the HEWs. The location accommodated the participants and provided quiet and safe place to allow care givers share their opinion. The focus group discussions were conducted in Oromiffa language using a translator and the discussions were recorded using mobile phone while the researcher took notes. At the start of the discussion, the researcher and his translator introduced themselves and explained the purpose and anonymity of the discussion. This was followed by care givers' introduction of themselves and the village they came from. The purpose of the meeting was explained and permission was asked to record the discussion.



After explaining the approximate time that it will take for the discussion, the researcher asked the first question. The researcher asked additional questions for issues that arose from the discussion to probe deeply into the topic. The researchers moved to the next questions when there was saturation of information in the previous question. In total seven questions were asked one after the other, moving from the general questions to the more specific. During the discussion the researcher gave chance for every participant to contribute and dealt tactfully with outspoken and given chance to silent participants to voice their opinion.. Before closing the discussion the researcher gave chance to care givers to ask questions and thanked them for their participation. During the discussion the researcher took notes on a note pad. At the end of the discussion the researcher sat down with the translator and reviewed the findings and clarified ideas that did not

make sense by listening to the recording. The discussions took an hour to an hour and half. Finally, the researcher wrote a summary of the focus group discussion using the transcribed notes. The focus group discussion was held at the health center for the intervention group and at the health post for the control groups.

3.10 Description of the Study Intervention and AEWs Training

Intervention materials development: The woreda health office was approached to share the material that the office is using to train HEWs on infant feeding. The office provided copies of the Ministry of Health Family Health Card. The Health Card is a hand book with pictorial illustration of key messages for mothers and fathers on breastfeeding, complementary feeding practices and other child health and nutrition practices. Key messages on complementary feeding are annexed (Appendix8.12). The Health Card has an English version as well as Oromiffa translated version. After reviewing the content, the key complementary feeding messages in the English version, the Oromiffa version was used to train AEWs. This was done to harmonize the complementary feeding messages between AEWs and HEWs. In addition, complementary feeding promotion section of the Infant and Young Child Nutrition (IYCN) Training Material, which was developed for AEWs, was used as a reference by the researcher. The IYCN training material was developed for AEWs to integrate complementary feeding into their existing work program.

Identification of AEWs: the researcher approached the woreda agriculture office and requested names and mobile phone numbers of AEWs that work in the intervention group kebeles. There were eight AEWs in three intervention kebeles and all of them were invited for the training.

Agriculture extension workers training: After the baseline data collection was completed the researcher gave one day training to AEWs on complementary feeding practices promotion. The training focused on complementary feeding messages and how they could communicate the messages during home visits and their day to day encounters with care givers. In addition, it was discussed how they would approach meeting the dietary diversity recommendations using locally available foods. Moreover, AEWs were oriented on how to communicate complementary feeding messages to care givers. Role play was also conducted among them to practice how they will communicate to the care givers. As part of the process, in the afternoon the researcher went with the AEWs to observe how they were providing the messages for selected care givers, and corrective actions were carried out for errors observed. At the end of the training each AEW was given a Family Health Card for reference. One day training was planned since the focus of the training was only the key messages and how to communicate those messages to the care givers.

Content of the intervention/complementary feeding message: the key messages comprised of meal frequency, amount, thickness, variety, active feeding and hygienic preparation of food. The messages were tailored according to the infants' age based on the IYCF recommendations (Table 3.5). In addition, active feeding and hygiene practices were part of the key messages.

Table 3.5: Complementary feeding messages promoted using trained AEWs (Source ENN 2011)

Age	Recommendation			
	Frequency (per day)	Amount of food per meal (in addition to breast milk)	Texture (thickness/consistency)	Variety
At 6 month start complementary foods	2 to 3 meals plus frequent breastfeeds	Start with 2 to 3 table spoons Start with 'tastes' and gradually increase amount	Thick porridge/pap	Breast milk (Breastfeed as often as the infant wants) +
From 6 up to 9 months	2 to 3 meals plus frequent breastfeeds 1 to 2 snacks may be offered	2 to 3 table spoonful per feed Increase gradually to half (½) 250 ml cup/bowl	Thick porridge/pap Mashed/ pureed family foods	Animal foods (local examples) + Staples (porridge, other local examples) +
From 9 up to 12 months	3 to 4 meals plus breastfeeds 1 to 2 snacks may be offered	Half (½) 250 ml cup/bowl	Finely chopped family foods Finger foods Sliced foods	Legumes (local examples) +
From 12 up to 24 months	3 to 4 meals plus breastfeeds 1 to 2 snacks may be offered	Three-quarters (¾) to 1 250 ml cup/bowl	Sliced foods Family foods	Fruits/ Vegetables (local examples)

Schedule for delivering the intervention and follow up of AEWs: After the training, the researcher requested AEWs to conduct at least a bi-weekly home visit as part of their extension activities, provide complementary feeding messages appropriate to the infants' age, and follow up care givers during their subsequent visits. The AEWs were supposed to provide these messages consistently and unchanged during the twelve months study period.

To conduct monitoring and oversight and ensure the quality and consistency of how AEWs delivered the messages the researcher organized half day quarterly follow up meetings with the

AEWs and discussed their progress, experiences and the challenges they faced in the preceding three months. During the meetings the researcher checked the AEWs' understanding of the key messages and gave feedback and refresher orientation when there was a gap. The researcher also provided advice regarding the challenges the AEWs were experiencing in the previous three-month period. During these meetings the newly assigned or transferred AEWs were oriented on the key messages and the MoH Family Health Card was given to them. In the control group AEWs continued their regular activities without interference. In both groups HEWs also continued health and nutrition promotion as per their plans at the health posts as well as community based outreach programs. The researcher documented the discussion outputs as part of his quarterly progress reports that were submitted to supervisors (Sisay, 2015) and included them in the qualitative findings.

Among AEWs who were trained to promote complementary feeding messages at the start of the study, only five were in the intervention area by the end of the study (Table 3.7). Three AEWs left the intervention area. One of them moved away from the woreda and the other two were transferred to the control kebeles. The woreda agriculture office assigned replacement for those AEWs who left the intervention kebeles. The researcher trained the newly assigned AEWs to promote complementary feeding messages with other AEWs. Three of the eight AEWs were at summer school during the nine-month follow up study and post-intervention evaluation.

Table 3.7: Availability of trained AEWs during the study period

Group Variable	Baseline	3rd month	6th month	9th month	12th month
AEW1	X	X	X	X	X
AEW2	X	X	X	X	X
AEW3	X	X	X	X	X
AEW4	X	Transferred	-	-	-
AEW5	X	X	X	At school	At school
AEW6	X	X	Transferred	-	-
AEW7	X	X	X	X	X
AEW8	X	Transferred	-	-	-
AEW9		X	X	-	-
AEW10		X	Transferred	-	-
AEW11			X	At school	At school
AEW12			X	At school	At school
AEW13				X	X



3.11 Data Entry and Analysis

Data completeness was verified at the field level and feedback was given to the field workers. Moreover, anthropometry data was entered into SMART nutrition survey software and feedback was given to field workers on the quality of the data collected the previous day. After reviewing for completeness of the care givers' responses, data was entered into an excel based data entry template, which was later exported to SPSS for cleaning and analysis. The data was first tested for normality using the Shapiro-Wilke test before conducting analysis.

3.11.1 Quantitative data analysis

Analysis of quantitative data was done using SPSS version 20 and Stata version 11 softwares. The anthropometry data was analyzed using SMART nutrition survey 2011 software. The main analysis compared the difference between the intervention and control groups for each measurement at baseline, third, sixth and ninth month follow up and post-intervention

evaluation. Relationships between variables were tested for correlations and for significant differences between mean values among the intervention and control groups. Difference between mean was compared using two sample test comparison for numeric variables and categorical variables were compared with chi-square and Fisher's exact tests.

World Health Organization definition (2007) was used to measure diet diversity score using a 24-hour recall method. Accordingly, infants that consumed from four or more food groups were considered meeting the dietary diversity score. The minimum meal frequency was analyzed based on the infants' age and breastfeeding status.

Descriptive statistics such as frequencies, percentages, means and standard deviations were used to assess the difference between the intervention and control groups in terms of care givers' and infants' socio-demographic characteristics, infant feeding practices, infant morbidity, feeding during illness, care seeking practices, minimum meal frequency, diet diversity, and weight and length gain. Variables that were significant were used in a regression model. Chi-square and Fisher's exact tests were utilized to test for association between categorical variables such as age, marital status and early infant feeding practices. Regression analysis was also conducted to test for the impact of the intervention on the meal frequency, dietary diversity, weight and length gain, underweight and stunting. Statistical significance was set at $p < 0.05$.

To control the effect of confounding factors the kebeles were assigned to the intervention and control group using a random method. Moreover, the number of HEWs, AEWs and agro-ecology of the study location were taken into consideration to reduce the difference between the two

groups. There was similarity between the two groups while comparing the baseline characteristics. In addition, the overall association between dependent and independent variables, the effect modification was examined for each level of third variable.

During the course of the study the Woreda Agriculture Office transferred three AEWs from the intervention kebeles. Two of them were transferred to two control group kebeles. As a result, responses of caregivers who were exposed to AEWs were excluded from analysis to reduce the effect of care givers exposure to AEWs transferred to the control kebeles as indicated in modified intention-to-treat approach. On the other hand, the intention-to-treat (ITT) principle requires all participants that are randomized must be included in the final analysis and analyzed according to the treatment group to which they were originally assigned, regardless of the treatment received, protocol violation, withdrawals, lost to follow up, non-compliance, refusal of the allocated treatment or cross-over, regardless of deviations that may happen after randomization (Iosief & Montedori 2010). Intention-to-treat ignores noncompliance, protocol deviations, withdrawal, and anything that happens after randomization. Intention-to-treat analysis maintains prognostic balance generated from the original random treatment allocation and estimate of treatment effect is generally conservative (Gupta 2011). As a result, randomized controlled trials that use the modified intention-to-treat (mITT) approach are increasingly being published. Such trials have a preponderance of post-randomization exclusions (Montedori et al. 2011).

There are various advantages and disadvantages of intention-to-treat. According to Nickson (2014), the pros of intention to treat analysis include that it is supported by the CONSORT

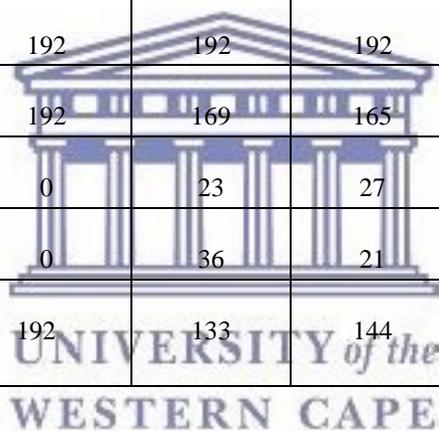
statement, is a more reliable estimate of true treatment effectiveness by replicating what happens in the ‘real world’, simplifies the task of dealing with suspicious outcomes, prevents bias when incomplete data is related to outcome, preserves baseline balance between groups, minimizes Type 1 errors (‘false positives’), preserves sample size and when the ITT and per-protocol analyses come to the same conclusions, confidence in the study results is increased.

However, intention-to-treat estimates conservative treatment effect because of dilution due to noncompliance and it will be more prone to Type 2 errors (false negatives). Moreover, heterogeneity is introduced when non-compliant, dropout and compliant subjects are mixed together and it does not assess treatment efficacy accurately unless there are negligible protocol violations. In addition, protocol violations and poorly conducted trials may cause the results obtained from two different treatment groups to appear similar. In this regard, ‘modified ITT’ analysis allows the exclusion of some randomized subjects (Nickson 2014). Iosief, Abraha & Montedori (2010) recommend the intention-to-treat approach as the method of choice for analysis in trials investigating the superiority of an intervention, and recommend for authors to provide complete information on post-randomization exclusions if there are appropriate reasons to exclude participants.

Hence, this study used modified intention-to-treat approach to prevent the effect of responses of care givers of infants in the control group who were exposed to trained AEWs complementary feeding messaging. As a result, care givers who were exposed to AEWs were excluded from the final analysis. The following table summarizes the total number of infants tracked and the final number of infants’ data used during analysis (Table 3.8).

Table 3.8: Number of care giver-infant pairs enrolled in the study and final sample size during analysis

Group		Baseline	3 rd month	6 th month	9 th month	Post-intervention evaluation
Intervention	Tracked	192	192	192	191	191
	Participated	188	169	159	160	160
	Absent	4	2	32	31	31
	Refused	0	0	1	0	0
	Analyzed	188	169	159	160	160
Control	Tracked	192	192	192	192	192
	Participated	192	169	165	165	155
	Absent	0	23	27	27	37
	Excluded from analysis	0	36	21	31	17
	Analyzed	192	133	144	134	138



3.11.2 Qualitative data analysis

For the qualitative part of the study the researcher translated the transcribed interview and focus group discussion notes into English and read it multiple times to understand the findings and broader ideas that could be derived from the data. Next the researcher developed anchor codes from the focus group and key informant interview guides to help categorization and theming of the codes (Adu 2015). The anchor codes were infant feeding practices, nutrition education, and role of AEWs, influencers (barriers and facilitators) for AEWs involvement, and actions to

address the influencers. Initial coding was conducted with anchor codes, followed by a further level of coding, using comment boxes and highlighting functions of a word processing program, as the researcher read the focus group and key informant interview study notes. Coding of baseline and post-intervention evaluation notes was done separately. A word, phrase or section of a phrase or a sentence was used to assign several codes (Nigatu 2009 & Adu 2015).

After the coding was completed, the results were grouped using anchor codes. Repeated ideas within the anchor code that represented the same information expressed by different respondents were combined or eliminated. Codes within each anchor code that reflected the same idea and shared patterns of relationships or interactions were organized into different categories, which were then combined to form the different themes. Finally, synthesis of the summary of the findings was written based on key themes that emerged, addressing the research questions. Quotations were also included to illustrate the themes. This was done for each study group. Analysis and inference of information from each theme was then done.

During the baseline qualitative information analysis, a total of 121 codes were identified. The codes were grouped into 12 categories and finally into 4 themes. The themes, categories and subcategories (codes) that resulted from the data collection through the focus group discussions and key informant interviews are annexed (annex 8.14).

During post-intervention evaluation, 87 codes were identified from qualitative information review. The codes were grouped into 12 categories and finally into 4 themes. The themes,

categories, and subcategories (codes), which resulted from the data collection through focus group discussions and key informant interviews, are summarized in appendix 8.15.

3.12 Validity, Reliability, Trustworthiness and Generalizability

3.12.1 Validity of questionnaires

The researcher conducted a literature review before developing the questionnaires to ensure their validity. Literature review was conducted to understand issues related to the research topics, what kind of evidence was available and what were the information gaps. The review included published articles, strategy and policy papers and documents available online. This has enabled the researcher to be aware of what work has been done in the same or similar topics in the past, what factors have not yet been examined, what the present survey questionnaire can build on, what has already been discovered and how additional information could be gathered to fill the information gap. Based on this a research question was articulated.

The questionnaires were also evaluated by the study supervisors who are experts in the subject area. The questionnaires were translated into the local language, Oromiffa, and pre-tested. Based on the feedback from the pre-test, adjustments were made to the final questionnaire (Appendix 8.7-8.8). The purpose of pilot testing was to know the length of time it will take, to understand care givers' understanding, to correctly organize and word questionnaires in an easy way so that care givers can provide accurate, unbiased, and complete information. After the pilot testing of the questionnaires among care givers of infants 6 to 12 months in non-sampled kebele, the questionnaire evolved into its final form. This consisted of grouping and sequencing questions into an appropriate order, numbering questions, and inserting interviewer instructions.

3.12.2 Reliability of data collection

The researcher trained field workers to understand the data collection tool, internalize the sampling procedure, practice how to conduct the interviews and measurements among infants and care givers in non-sample kebele. To improve the accuracy, several measurements were taken until the field workers were comfortable to conduct the measurements easily. Field workers conducted multiple measurements among non-sample households during the pilot testing to familiarize themselves with the tools. To improve the quality of measurements they practiced the use of the data collection tools and anthropometric measurements. The data collection tools included household questionnaires, consent forms, and a data collection manual. The pilot study also helped to validate the household interview questionnaire. The data collection questionnaire was clearly formatted and easy to use. In the intervention area, all the field level AEWs were trained before taking part in the study. The field workers spent an hour to an hour and half with the families during the baseline and post-intervention evaluation and about thirty minutes during the follow up period.

Field workers were trained for one day on anthropometric measurement techniques and how to re-calibrate weighing scales before each measurement. Internationally accepted weighing scales and length boards were used to conduct weighing and length measurements. Anthropometric data were entered into SMART nutrition survey software on the same day and feedback was given to field workers to improve the quality of measurements. Data completeness was verified at the field and feedback was given to field workers. For the qualitative study the researcher took about two hours with each focus group discussion and all the participants were encouraged to

take part in the discussion. The researcher probed participants to share all the information and took time to explain the questions while noting down their responses.

The researcher informed field workers on follow up plans and the plan for post-intervention evaluation. Agriculture extension workers were informed about the key age-appropriate complementary feeding messages that they used during bi-weekly home visits as part of their extension activities. A few of the questions in the questionnaire were adapted to the local context to reflect the local dialect of Oromiffa and to provide the right meaning as it was indicated in the English translation. Time was taken to explain the questionnaire to the interviewees and also to note down their responses. The researcher and the field supervisor supervised the field workers to provide onsite support.

3.12.3 Trustworthiness of qualitative data

At baseline and post-intervention evaluation, a qualitative study was conducted using focus group discussion and key informant interview methods. Eight to ten care givers who were selected by HEWs to participated in the focus group discussion and they were given equal chance to contribute information. The same number of care givers participated during the baseline and post-intervention evaluation. All AEWs, who were present at their work station during the baseline and post-intervention evaluation, participated in key informant interviews. Data collection questionnaires that were developed based on literature review were validated with field workers before starting the baseline study. Similar data collection questionnaire was used during baseline and post-intervention evaluation.

Before starting the discussions and interviews the researcher established a good rapport with study participants so that they could ask questions for clarity and share their experiences and ideas freely. Moreover, participants were probed to share more if their responses needed detailed information. The researcher took adequate time during interviews and focus group discussions and ensured saturation of information before moving to the next question. The information collected from key informant interviews and focus group discussions was triangulated to ensure consistency. Finally, the data was transcribed and analyzed using qualitative data analysis method. The references cited in the study to explain how these different aspects mentioned in this section ensured trustworthiness.



3.12.4 Generalizability of the study findings

The findings can be generalized to the study population where there is a similar agriculture extension program. The study limitations need to be considered when generalizing to other woredas, regions or nationally.

3.13 Logistics

The researcher prepared a budget and 12 months work plan for the study and provided all required funds from his own resources (Appendix 8.11). The researcher procured four Saltar weighing scales and four length boards from local supplier and provided the field workers with pencils, erasers and sharpeners. During the study, one vehicle was hired from a private company to transport field workers and conduct supervision. The budget also covered printing and photocopy costs of data collection, survey manual and consent forms, which were printed after piloting.

3.14 Ethical Considerations

After getting the approval from the UWC senate in November 2013, the research proposal was submitted to the Ethics and Research Review committee at the Oromia Regional Health Bureau which is the government's research ethics review committee for the region. The Research Review Committee gave written approval in January 2014 (Appendix 8.13). World Vision Ethiopia management has also reviewed the proposal and provided written permission to conduct the study in World Vision's Wonchi program area. Based on the Ethical Approval from the Oromia Regional Health Bureau, an additional support letter was received from Zonal Health office, which Wonchi woreda health office reports to. Finally, the district health officials and health workers were given the background of the study and its purpose, and they provided a written letter of support to conduct the study in the selected kebeles. After identifying the study kebeles, Wonchi woreda health office also sent an official letter to HEWs that provide services in the six sample kebeles, instructing them to collaborate during data collection.

The field workers read the information sheet to all care givers and all study participants signed the consent form at baseline and agreed to participate voluntarily during the 12 months period with the right to choose to stop participating at any time. Participants were assured that their refusal to participate or withdrawal would not affect the relationship they had with AEWs. All information was kept confidential and care givers and each participant were given a code. Those who participated in focus group discussions and key informant interviews were also assured of confidentiality and anonymity regarding the information and experiences they shared. They were also asked not to discuss this information with anyone else.

CHAPTER FOUR: RESULTS– QUANTITATIVE STUDY FINDINGS

The purpose of the study was to compare the effectiveness of a complementary feeding promotion program for care givers of infants using trained agriculture extension workers in a rural area of Ethiopia. The quantitative study findings are presented in this chapter.

4.1 Findings at Baseline

4.1.1 Care givers' demographic and socio-economic characteristics

The mean age of care givers was 28.6 ± 5.84 years and 28.5 ± 5.79 years in the intervention and control groups (Table 4.1). There was no statistical difference between the intervention and control groups in-terms of care givers' age, marital status, having a twin infant, being head of the family, family size, level of education, occupation, and economic status ($p > 0.05$).

Table 4.1: Care givers' demographic and socio-economic characteristics

Characteristics	Study groups		P value (Chi-Square/t-test*)
	Intervention (N=188)	Control (N=192)	
Age (mean± SD)	28.6±5.84	28.5±5.79	0.992*
Care givers age (in years)			0.544
17-20	7.1%	8.6%	
21-25	28.4%	22.7%	
26-30	35.5%	41.6%	
31-35	16.4%	17.8%	
36-50	12.6%	9.3%	
Marital status			0.289
Married	95.6%	95.3%	
Widowed	1.6%	1.6%	
Divorced	2.1%	1.6%	
Other	0.5%	1.1%	
Twin Infant	7.1%	4.1%	0.680
Head of family	2.1%	1.2%	0.998
Family size (mean±SD)	5.9±2.2	5.7±1.9	0.206*
Education			0.960
Illiterate	56.4%	46.9%	
Primary school	36.2%	46.4%	
Secondary School	6.9%	6.9%	
First degree/diploma	0.5%	0%	
Occupation			0.997
Farmer,	89.9%	96.3%	
Government employee	2.7%	0.5%	
Merchant	6.4%	2.1%	
Other	1.1%	1.1%	
Economy			0.593
Poor	46.4%	45.7%	
Middle class/rich	53.6%	52.7%	

4.1.2 Care givers' small animal ownership and production of vegetables, fruits and dairy products

At baseline 57.8% of care givers in the intervention group and 46.6% care givers in the control group had small animals (Chi-square test: $p=0.837$). Nearly four in ten (38.9%) care givers in the intervention group and 49.0% in the control group were producing vegetables and fruits (Chi-square test: $p=0.443$). Thirty seven percent of care givers in the control group and 31.4% percent in the intervention group were producing dairy products. There was no statistical difference between the two groups in terms dairy products production (Chi-square test: $p=0.219$).

4.1.3 Infants socio-demographic characteristics

In both groups, the majority of infants were twelve months old followed by nine months (Table 4.2). Over half of the study participants were females. There was no variation between the two groups based on their age, sex and birth order ($p>0.05$).

Table 4.2: Infants' demographic characteristics

Characteristics	Study groups		p-value (Chi-square/t-test*)
	Intervention (N=188)	Control (N=192)	
Age (mean \pm SD)	9.2 \pm 2.1	8.9 \pm 2.1	0.1687*
Age (in months)			0.1438
6	16.0%	16.8%	
7	10.1%	14.1%	
8	8.5%	14.1%	
9	19.7%	16.2%	
10	13.8%	11.0%	
11	10.6%	8.9%	
12	21.2%	18.8%	
Sex			0.2590
Male	43.6%	42.7%	
Female	56.4%	57.3%	
Birth order (mean \pm SD)	3.9 \pm 2.1	3.6 \pm 2.0	0.2875*

4.1.4 Breastfeeding and complementary feeding practices

Almost all infants were breastfed at the start of the study and nearly one in six infants in the intervention (58.8%) and control (63.9%) groups were on exclusive breastfeeding (Table 4.3). About half of the infants in both groups were introduced to complementary foods at six months of age. Cereals were the main food groups used to introduce infants to complementary foods. There was no statistical significant difference between the two groups in terms of care givers exclusive breastfeeding practice, current breastfeeding, mean intended duration of breastfeeding, age of introduction of complementary foods and the types of foods used during complementary foods introduction ($P>0.05$).



Table 4.3: Breastfeeding and complementary feeding practices

Characteristics	Study Group		Test statistics	P value (chi-square/ t test*)
	Intervention (N=188)	Control (N=192)		
Exclusive breastfeeding				
Yes	58.8%	63.9%	0.948	0.7580
No	41.2%	36.1%		
Current breastfeeding				
Yes	98.4%	98.4%	0.500	0.8230
No	1.6%	1.6%		
Intended duration of breast feeding in months (mean±SD)	28.1±6.5	28.9±7.1		0.2123*
Age of complementary foods introduction in months (mean±SD)	5.4±1.9	5.5±2.2		0.4686*
Month of complementary foods introduction				
Less than 6 months	30.6%	31.6%	2.83	0.5870
At 6 months	49.0%	46.7%		
7 to 12 months	20.4%	21.7%		
Foods used to introduce complementary foods				
Cereals	63.9%	53.1%		0.0670
Protein	8.3%	10.1%		
Fruits	3.4%	7.1%		
A mixture of them	24.4%	29.7%		

4.1.5 Infant morbidity, health services and feeding during illness

Significantly higher proportion of infants in the intervention group had fever in the two weeks prior to the study day than the control group (Chi-square test: 4.2; $p=0.0400$) (Table 4.4). However, there was no statistical difference between the two groups in terms of the presence of diarrhea in the two weeks prior to the study day, and deworming and immunization status ($p>0.05$). Among infants that were ill, there was no significant difference between the two groups in terms meal frequency and amount of food given to infants ($p>0.05$).

Table 4.4: Infants morbidity, health services and feeding during illness

Characteristics	Study groups		Test statistics	Chi-square p-value
	Intervention (N=188)	Control (N=192)		
Presence of illnesses				
Fever	38.3%	27.1%	4.2	0.040
Diarrhea	34.6%	28.4%	5.2	0.076
Child health service uptake				
De-wormed	50.8%	49.7%	2.3	0.688
Immunized	90.0%	94.7%	1.3	0.256
Meal frequency during illness				
Increased	28.2%	27.3%	6.78	0.173
Decreased	62.8%	59.5%		
No change	9.0%	13.2%		
Amount of food given during illness				
Increased	62.9%	47.5%	1.27	0.866
Decreased	11.3%	29.7%		
No change	25.8%	22.8%		

4.2 Findings at Post-intervention Evaluation

4.2.1 Care givers' access to complementary feeding messages from AEWs

Care givers access to complementary feeding message promoted through AEWs increased during the course of the study (Figure 4.1). During post-intervention evaluation, the proportion of care givers who reported receiving complementary feeding message from AEWs in the past three months was 45%. However, care givers who ever received complementary feeding message from AEWs has increased from 35% on the third month follow up to 81% during post-intervention evaluation.

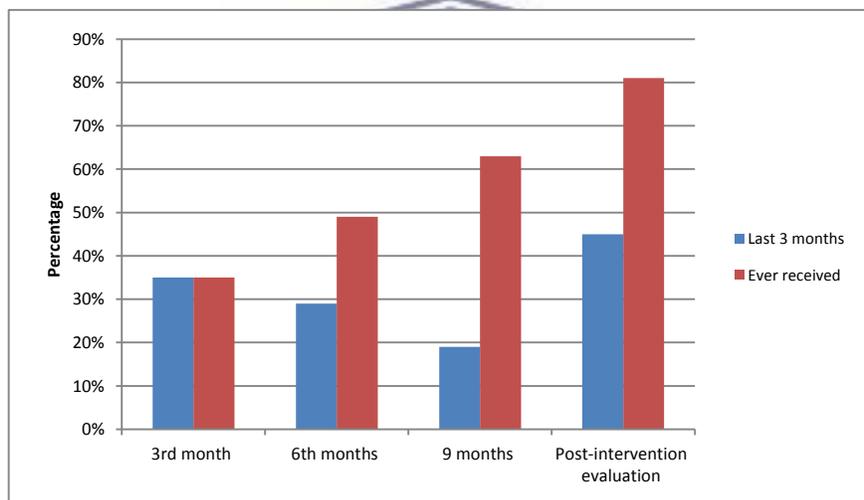


Figure 4.1: Proportion of care givers who received complementary feeding message from agriculture extension workers

4.2.2 Frequency of AEWs' home visits to provide complementary feeding message

The mean frequency of home visits conducted by AEWs to provide complementary feeding messages to care givers has showed progressive increase. The mean frequency of home visits that AEWs made were 1.6 ± 0.7 , 1.8 ± 0.8 , 1.8 ± 0.5 and 1.9 ± 0.8 times in three months during the

third, sixth and ninth month follow up and post-intervention evaluation respectively. The visits were most frequent in the last three months period before post-intervention evaluation, where 65.3% of care givers were visited three times (Figure 4.2).

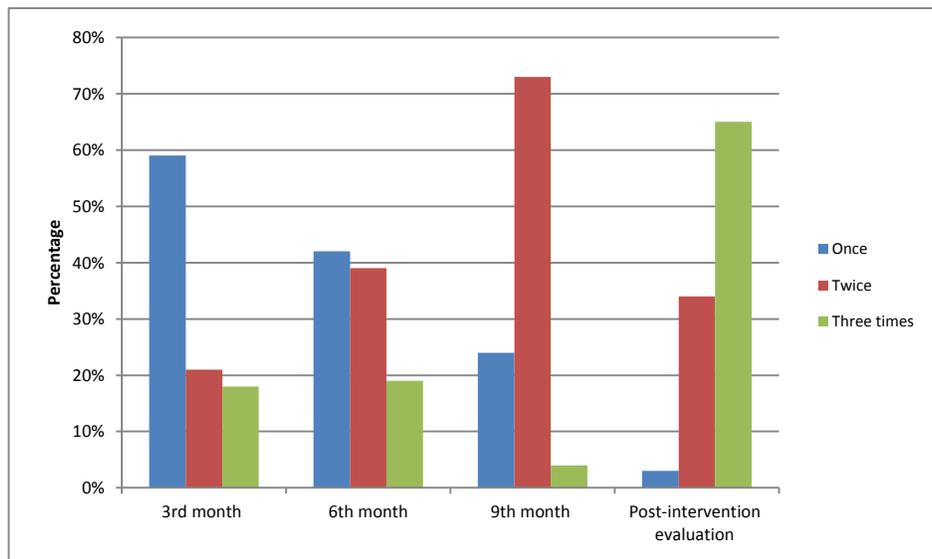


Figure 4.2: Agriculture extension workers home visit frequency in the study period

4.2.3 AEWs' complementary feeding messaging and minimum meal frequency

The mean minimum meal frequency of the infants in the intervention group was significantly higher than that of the infants in the control group during the sixth and ninth month follow up and post-intervention evaluation ($p < 0.05$) (Table 4.5). By the end of the study significantly higher proportion of infants in the intervention group were fed four or more times than in the control group ($p = 0.0000$).

Table 4.5: Minimum meal frequency of infants' in the study

Characteristic	Study groups		P value (two sample t-test)
	Intervention	Control	
Meal frequency (mean±SD)			
Baseline	2.9±0.08	3.1±0.08	0.0374
3 rd month follow up	2.9±0.05	2.9±0.04	0.8685
6 th month follow up	3.1±0.06	2.8±0.06	0.0008
9 th month follow up	3.1±0.04	2.8±0.06	0.0012
Post-intervention	3.2±0.05	2.8±0.06	0.0000
Baseline (meals/day)	N=188	N=192	
Once	5.9%	3.1%	0.0734
Twice	17.6%	13.8%	
Three time	58.8%	59.2%	
Four times	14.4%	17.7%	
More than four	2.2%	5.0%	
3 rd month follow up (meals/day)	N=169	N=133	
Twice	10.1%	15.8%	0.8685
Three time	76.3%	76.1%	
Four times	13.0%	7.9%	
6 th month follow up (meals/day)	N=159	N=144	
Twice	11.8%	21.0%	0.0008
Three time	63.2%	68.9%	
Four times	24.3%	9.2%	
9 th month follow up (meals/day)	N=160	N=134	
Twice	1.2%	1.6%	0.0012
Three time	67.3%	62.3%	
Four times	26.2%	7.9%	
Post-intervention evaluation (meals/day)	N=160	N=138	
Twice	6.9%	29.5%	0.0000
Three time	66.7%	62.3%	
Four times	25.8%	8.2%	
More than four times	1.3%	0.0%	

Comparison of post-intervention evaluation findings for breastfed and non-breastfed infants in the two groups showed that the mean meal frequency of breastfed infants in the intervention group was significantly higher than of breastfed infants in the control group (p=0.0290) (Table

4.6). However, the mean meal frequency was not significantly different between non-breastfed infants in the two groups ($p=0.3621$).

Table 4.6: Post-intervention comparison of minimum meal frequency among breastfed and non-breastfed infants

Characteristic	Study groups		P value (Chi-square/t-test*)
	Intervention	Control	
Meal frequency (mean±SD)			
Breastfed	3.2±0.04	3.0±0.05	0.0290* 0.3621*
Non-breastfed	3.3±0.54	3.1±0.59	
Meal frequency for breastfed (meals/day)	N=136	N=112	0.0374
Once	0.0%	1.7%	
Twice	6.6%	20.4%	
Three time	66.2%	67.8%	
Four times	26.5%	9.1%	
More than four	0.7%	0.8%	
Meal frequency for non-breastfed (meals/day)	N=24	N=16	0.082
Twice	4.4%	31.2%	
Three times	69.6%	56.3%	
Four times	21.6%	31.2%	
More than four	4.4%	0.0%	

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4.2.4 AEWs' complementary feeding messaging and minimum dietary diversity

Infants in the intervention group consumed significantly more food groups than in the control group during the sixth and ninth month follow up and post-intervention evaluation ($p<0.05$) (Table 4.7). Though it is a very small difference the post-intervention evaluation showed that the minimum dietary diversity score among breastfed infants in the intervention group was significantly higher than of breastfed infants in the control group ($p=0.0025$). However, there was no significant difference for non-breastfed infants ($p=0.2041$).

Table 4.7: Mean minimum dietary diversity score among infants in the study

Characteristics	Study groups		P value (two-sample t test)
	Intervention	Control	
Baseline (mean±SD)	2.27±0.07	2.43±0.08	0.1241
3 rd month follow up (mean±SD)	3.1±1.19	2.92±1.17	0.0823
6 th month follow up (mean±SD)	3.27±0.96	3.04±0.82	0.0428
9 th month follow up (mean±SD)	3.56±0.07	3.11±0.03	0.0000
Post-intervention evaluation (mean±SD)	3.54±0.05	3.29±0.02	0.0008
Post-intervention evaluation – breastfed (mean±SD)	3.50±0.07	3.27±0.06	0.0025
Post-intervention evaluation – non- breastfed (mean±SD)	3.60±0.58	3.33±0.72	0.2041

Among the seven food groups recommended by World Health Organization, during the post-intervention evaluation a significantly higher proportion of infants were fed from four or more food groups in the intervention group than in the control group (p=0.0220) (Figure 4.3).

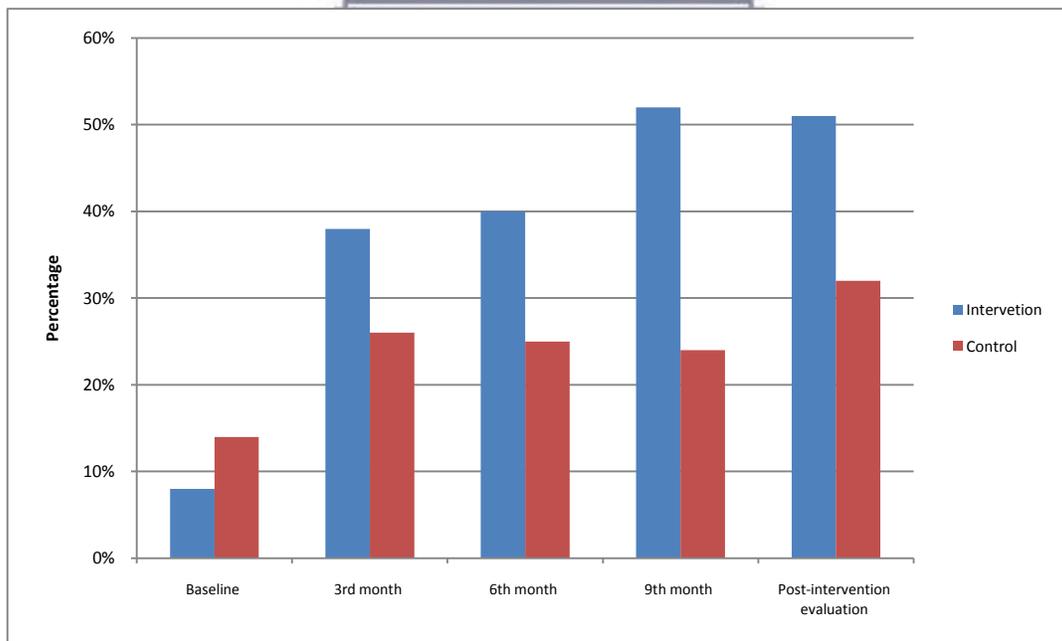


Figure 4.3: Proportion of infants who consumed from four or more food groups

Among the seven foods groups, almost all infants in both groups consumed grains, roots and tubers (Table 4.8). Infants in the intervention group were six times more likely to consume legumes and nuts than in the control group ($p=0.018$). There was no statistical difference between the two groups in terms of consumption of flesh foods, dairy products, eggs, vitamin A rich fruits and vegetables, and other fruits and vegetables ($P>0.05$).

Table 4.8: Food groups consumed among infants in the study in 24-hours recall period

Characteristics	Study groups		Test statistics, Chi-square p-value	Fisher's exact
	Intervention (N=160)	Control (N=155)		
Grains, roots and tubers				
Yes	98.7%	99.9%		
No	0.3%	0.1%		
Legumes and nuts			(5.9, 0.014)	0.018
Yes	75.0%	42.1%		
No	25.0%	57.8%		
Dairy product (milk, yoghurt and cheese)			(0.5026, 0.478)	0.444
Yes	10.4%	10.5%		
No	89.6%	89.5%		
Flesh foods (meat, fish, poultry, liver/organ meats)				
Yes	0.0%	0.0%		
No	100%	100%		
Eggs			(1.07, 0.301)	0.458
Yes	20.3%	15.6%		
No	79.7%	84.4%		
Vitamin A rich fruits and vegetables			(0.22, 0.636)	0.686
Yes	36.9%	15.6%		
No	63.1%	84.4%		
Other fruits and vegetables			(1.37, 0.503)	0.564
Yes	14.6%	8.9%		
No	85.4%	91.1%		

4.2.5 AEWs' complementary feeding messaging and infants' mean weight and length gain and nutritional status

The mean weight and length gain of infants in intervention group did not show significant difference compared with the mean weight and mean length of infants in the control group ($p>0.05$) (Table 4.9).

Table 4.9: Comparison of mean weight and length of infants in the study

Variable	Study groups		P value (two-sample t test)
	Intervention	Control	
Baseline	N=188	N=192	
Mean weight in kg (\pm SD)	7.8 \pm 1.4	7.7 \pm 1.1	0.2247
Mean length in cm (\pm SD)	70.1 \pm 8.1	69.6 \pm 6.5	0.4050
3 rd month follow up	N=169	N=169	
Mean weight in kg (\pm SD)	8.5 \pm 1.3	8.2 \pm 1.1	0.0350
Mean length in cm (\pm SD)	73.4 \pm 4.7	72.2 \pm 4.3	0.0317
Weight gain (3 rd month – baseline)	0.66 \pm 0.58	0.57 \pm 0.59	0.1792
Length gain (3 rd month – baseline)	3.0 \pm 1.70	3.0 \pm 1.54	0.5575
6 th month follow up	N=159	N=165	
Mean weight in kg (\pm SD)	9.4 \pm 1.4	9.1 \pm 1.19	0.1036
Mean length in cm (\pm SD)	78.0 \pm 4.7	76.7 \pm 4.8	0.0323
Weight gain (6 th month – 3 rd month)	0.74 \pm 0.52	0.64 \pm 1.01	0.2540
Length gain (6 th month – 3 rd month)	4.0 \pm 2.04	3.1 \pm 2.55	0.0020
9 th month follow up	N=160	N=165	
Mean weight in kg (\pm SD)	9.5 \pm 1.4	9.3 \pm 1.2	0.1346
Mean length in cm (\pm SD)	79.4 \pm 4.8	78.3 \pm 4.5	0.0461
Weight gain (9 th month – 6 th month)	0.22 \pm 0.48	0.10 \pm 1.16	0.1924
Length gain (9 th month – 6 th month)	1.59 \pm 1.40	1.40 \pm 1.02	0.6122
Post-intervention	N=160	N=155	
Mean weight in kg (\pm SD)	9.90 \pm 1.60	9.78 \pm 1.41	0.4949
Mean length in cm (\pm SD)	80.9 \pm 5.5	80.59 \pm 4.8	0.5778
Weight gain (12 th month – baseline)	2.05 \pm 1.29	2.03 \pm 0.94	0.3463
Length gain (12 th month – baseline)	11.3 \pm 10.2	10.7 \pm 6.40	0.5063

At post-intervention study, there was no statistical difference in weight-for-age and height-for-age prevalence among infants in the intervention group compared with infants in the control group ($p>0.05$) (Table 4.10). Overall there was deterioration of the prevalence of stunting and underweight among the groups but the difference between the post-intervention and baseline was significant for the underweight prevalence and did not show statistically significant for stunting prevalence.

Table 4.10: Prevalence of underweight and stunting based on z-scores and sex

Period	Prevalence of under nutrition	Intervention			Control			P value (Chi-square)
		Overall	Boys	Girls	Overall	Boys	Girls	
Baseline	Underweight	17.7%	17.7%	17.8%	14.1%	18.5%	10.9%	0.0777
	Stunting	12.2%	12.5%	12.2%	12.6%	12.5%	12.7%	0.3820
3rd month	Underweight	25.9%	25.7%	26.0%	27.9%	26.4	27.9%	0.0033
	Stunting	16.1%	14.9%	17.0%	19.4%	17.0%	21.1%	0.0000
6 th month	Underweight	18.8%	19.5%	18.1%	19.4%	25%	14.9%	0.1819
	Stunting	11.4%	10.4%	12.5%	13.8 %	16.1 %	11.6 %	0.5019
9 th month	Underweight	22.8%	21.4%	24.0%	24.8%	27.3%	22.7%	0.4483
	Stunting	16.6%	13.0 %	20.0%	19.8%	18.2%	21.2%	0.1433
Post-intervention	Underweight	20.5%	22.2%	18.3%	22.9 %	23.9 %	22.1%	0.2817
	Stunting	18.3%	19.7%	18.7%	19.6 %	13.4 %	24.4 %	0.6235

Post-hoc power analysis was conducted to assess whether the study had adequate power to see the effect of the intervention on infants' nutritional status (underweight and stunting prevalence), where the study did not reveal a statistical difference from the null hypothesis. The following formula and assumption was taken to calculate the power;

$$Power = \Phi \left\{ \frac{\Delta}{\sqrt{p_1q_1/n_1 + p_2q_2/n_2}} - z_{1-\alpha/2} * \frac{\sqrt{\bar{p}\bar{q}(1/n_1 + 1/n_2)}}{\sqrt{p_1q_1/n_1 + p_2q_2/n_2}} \right\}$$

Where,

p_1, p_2 = proportion of underweight and stunting in the intervention and control groups

$\Delta = |p_2 - p_1|$ = absolute difference between two proportions

n_1 = sample size for intervention group

n_2 = sample size for the control group

α = probability of type I error (usually 0.05)

z = critical Z value for a given α or β which is 1.96

K = ratio of sample size for the control versus intervention

$\Phi()$ = function converting a critical Z value to power

The power for stunting was calculated considering 18.3% and 19.6% prevalence of stunting among infants in the intervention and control groups respectively.

$$Power = \Phi \left\{ \frac{0.013}{\sqrt{0.183 \cdot 0.817/160 + 0.196 \cdot 0.804/138}} - 1.96 * \frac{\sqrt{0.189 \cdot 0.811(1/160 + 1/138)}}{\sqrt{0.183 \cdot 0.817/160 + 0.196 \cdot 0.804/138}} \right\}$$

$$Power = \Phi(-1.671) = 0.047 = 4.7\% \text{ power}$$

Hence, the study had only a 4.7% probability of detecting the observed difference ($\Delta = |p_2 - p_1|$) of 1.3% stunting prevalence among the two groups if an effect of this magnitude exists.

For underweight prevalence, the power was calculated considering 20.5% and 22.9% prevalence of underweight among infants in the intervention and control groups.

$$\text{Power} = \Phi \left\{ \frac{0.024}{\sqrt{0.205 \cdot 0.795 / 160 + 0.229 \cdot 0.771 / 138}} - 1.96 \cdot \sqrt{0.2161 \cdot 0.7839 \left(\frac{1}{160} + \frac{1}{138} \right)} \right\}$$
$$\text{Power} = \Phi(-1.454) = 0.073 = 7.3\% \text{ power}$$

Hence, the study had only a 7.3% probability of detecting the observed difference ($\Delta = |p_2 - p_1|$) of 2.4% underweight prevalence among the two groups if an effect of this magnitude exists.

Thus, in this study the intervention may not have enough effect to achieve the outcome or the sample size may have been too small to detect the effect of the intervention.

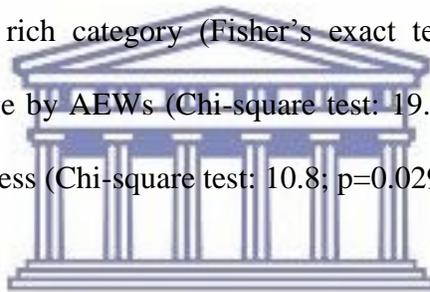


4.2.6 Predictors of infants' feeding and nutritional status

The following variables were tested in a multi-variant regression analysis to establish whether they predict the dependent variables of meal frequency, diet diversity, weight and length gain and nutritional status measured by underweight and stunting: maternal characteristics such as maternal age, marital status, family size, twin infants, household headship, education status, ownership of small animals, vegetable and fruit production, and dairy products ownership. Moreover, infant age, sex, birth order, breastfeeding status, care givers' access to complementary feeding information, infants' immunization for age and deworming were tested.

The predictors of complementary feeding frequency, different food groups consumed, weight gain, length gain, infant nutritional status measured by weight for age and length for age, were summarized below (Table 4.11).

The likelihood of providing frequent meals among care givers in the intervention group was strongly associated with the amount of food the infants consume during illness (Chi-square test; 14.1 and $p=0.029$). The likelihood of providing varied foods was strongly associated with care givers being married (Chi-square test; 28.1; $p=0.005$), owning small animals (Chi-square test; 10.4; $p=0.034$), producing dairy products (Likelihood-ratio chi-square test; 9.8; $p=0.044$), being economically from middle or rich category (Fisher's exact test: $p=0.018$), having received complementary feeding message by AEWs (Chi-square test: 19.9; $p=0.001$) and the amount of food given to infants during illness (Chi-square test: 10.8; $p=0.029$).



The predictors of meal frequency were care givers' economic status, access to infant feeding information and diarrheal disease. In addition, care givers' education, small animal ownership, dairy product production, access to infant feeding information and complementary feeding messages given by AEWs, predicted diet diversity. Infants' weight gain was associated with care givers' marital status, dairy product production, care giver economic status, infants' age, while length gain was determined by production of vegetables and fruits, infants' age and time for introduction of complementary foods. Weight-for-age was associated with care givers' occupation and fever among infants, whereas the length-for-age was associated with dairy products ownership, messages given by AEWs and having twin infants. In summary, multiple

factors predicted infant feeding and growth. However, messages given by AEWs were a strong predictor of diet diversity and stunting among infants.

Table 4.11: Predictors of meal frequency, dietary diversity and infants' nutritional status

Independent variables	Dependent variables					
	Meal frequency	Dietary diversity	Weight	Length	Underweight	Stunting
Mother age	0.4427	0.6362	0.9516	0.9401	0.8657	0.9595
Marital status	0.2029	0.3468	0.0336	0.1778	0.9548	0.4285
Family size	0.4728	0.4785	0.1507	0.8063	0.5368	0.7505
Twin	0.4336	0.6800	0.7363	0.3544	0.2810	0.0337
Household head	0.7174	0.7463	0.8052	0.4256	0.3700	0.4708
Education	0.8970	0.0473	0.1373	0.6895	0.6107	0.9116
Occupation	0.9624	0.4208	0.1851	0.1089	0.0490	0.7044
Small animal	0.5315	0.0316	0.5917	0.3041	0.5950	0.8146
Vegetable fruits	0.9133	0.4934	0.1706	0.0165	0.1075	0.3241
Dairy products	0.3018	0.0142	0.0317	0.9439	0.2744	0.0351
Economy	0.0101	0.9590	0.0431	0.6317	0.7223	0.3685
age	0.7188	0.4622	0.0048	0.0000	0.3086	0.4472
Sex	0.9625	0.3380	0.5487	0.8006	0.8618	0.8314
Birth order	0.6620	0.2530	0.6454	0.1349	0.8054	0.8580
Exclusive breastfeeding	0.0284	0.7482	0.7018	0.3579	0.8043	0.5490
Current breastfeeding	0.4463	0.4246	0.1969	0.4708	0.5855	0.7880
Intended duration of breastfeeding	0.1484	0.6258	0.5841	0.9824	0.2970	0.8086
Age of complement foods introduction	0.9624	0.7901	0.1713	0.0258	0.5129	0.5533
Info child feeding	0.0060	0.0065	0.7808	0.8170	0.4750	0.1209
Message AEWs	0.3800	0.0000	0.7515	0.9613	0.8158	0.0368
Message frequency	0.4619	0.3184	0.8913	0.2314	0.1038	0.6986
Fever	0.0609	0.9135	0.2873	0.3980	0.0416	0.6430
Diarrhea	0.0038	0.3508	0.4872	0.0813	0.1397	0.6083
Meal frequency during illness	0.0007	0.5729	0.2282	0.1348	0.1825	0.4985
Amount of food given during illness	0.0004	0.2803	0.3525	0.0603	0.2106	0.2771
EPI	0.0948	0.1132	0.5586	0.0929	0.2700	0.2193
Deworming	0.9363	0.6448	0.3920	0.4304	0.3645	0.7188

CHAPTER FIVE – QUALITATIVE STUDY FINDINGS

The following themes emerged from the qualitative study findings: perceptions or beliefs of care givers about what and how to feed infants, lack of knowledge and practices among care givers regarding the importance of feeding eggs, dairy products and flesh foods, especially meat, to infants, lack of husbands' and family members' support to care givers, community level sources for infant feeding information, and barriers for AEWs' involvement in complementary feeding promotion. These will be discussed in the following paragraphs and will be separated into baseline and post-interventions evaluation findings.

5.1 Baseline Qualitative Study Findings

5.1.1 Perception or beliefs of care givers about what and how to feed infants

Care givers preferred to give infants watery *Atmit* since they believed that it is easy for them to swallow. Most care givers in both groups did not give thickened porridge or softened adult diet until the infants reached one year of age. Vegetables and fruits were not added to infants' meal at this age. Care givers did not prepare separate meal for infants. One of the care givers at Daye Wondimtu kebele reported that:

'The types of food I gave to my infant were determined by the types of crops available at home. I did not make any arrangements to make special meal preparation for my infant. In most cases I share what I prepared for adults'.

Care givers considered infants too small to take more frequent meals. Care givers in the intervention group reported that the younger the infants' age the lesser the frequency of meal the infants will receive. This was due to the care givers' perception that infants did not need much at this age. Care givers in the control group had similar opinion. Though care givers in both groups

motivate infants with singing while feeding, they neither used separate meals to encourage self-feeding nor estimated how much food to give infants.

5.1.2 Lack of knowledge and practices on eggs, dairy products and flesh foods feeding

In both groups, eggs and dairy products (such as milk, butter and yoghurt) were added to infants' meals occasionally. None of the care givers in either group added meat to infants' meals. A care giver in Dimtu Godeti kebele stated that:

'If an egg or milk is available at home, my daughter will be given. If it is not available, I do not think to buy from the market. I do not give eggs since I prioritize selling to get cash for other households' expenses such as food products or household goods such as salt, coffee, soap, gas and oil'.

In both groups AEWs reported that care givers' infant feeding practices vary from family to family depending on the types of crops they produce, livestock availability and families' understanding about what to feed infants. According an AEW in control kebele called Dulele Kori:

'Farmers in this community mainly produce cereals. The crops are primarily produced for market consumption and the types of foods consumed at home depend on the families' awareness. If care givers have good understanding of infant feeding they feed infants meals that consist of cereals and legumes and sometimes milk if available. If they do not have good understanding they can give only one type of food which is prepared from cereals'.

Another AEW in the intervention kebele, Dimtu Godeti, reported that:

'In my kebele families who have irrigation scheme for vegetables production can easily be able to feed infants with vegetables from their produce. Others families who own cattle can provide milk to their infants. However, if they do not produce infants might not get them'.

Care givers raised various reasons for not providing flesh foods, especially meat, to infants. Care givers thought that infants are too young to swallow meat. The situation is worsened by lack of care givers' allocation of money to buy meat for infants, unavailability of meat except at major holidays, inadequate ownership of small animals (cows and chicken) and little consumption of meat in the community during most months of the year due to prolonged fasting. During fasting months animal products are not consumed in the community due to religious obligation. One of the care givers in the control group shared her experience as follows:

'I did not give my son meat in the past since it could be hard for him to take it. Moreover, meat is only available during holidays where we slaughter animals'.

According to AEWs, animal products such as milk and egg are produced in the area. However, AEWs in both groups reported that care givers sell animal products, especially eggs, for economic reasons such as buying kerosene or paying children's school fees. An AEW in Dulele Kori kebele reported that:

'Parents think infants are not ready to take diet from animal sources. Because of this care givers only selected foods that are mainly made of cereals such as injera or beso'.

5.1.3 Lack of husbands' and other family members' support to care givers

Care givers in both groups mentioned that they were primarily responsible for feeding infants and they were occasionally assisted by older children. However, husbands never participated in infant feeding in either group. One common opinion on this issue among AEWs was described by one of the AEW in Lemen kebele as follows:

'In a community where I live, lack of family support with regards to feeding children could influence care givers' decisions to utilize nutrient dense foods available at home or bought from the market since husbands mainly decide how to spend the family income. Moreover, family planning needs to be part of the intervention since the size of the family

could also affect what families feed to infants. Families that have large family size will not take care of their children adequately’.

While indicating lack of control of small animals by care givers, one of the AEWs in the control kebele, called Meti Walga, reported that:

‘In a kebele where I work many of the chickens were owned by youth and children to create income to cover their school expenses. Because of this there is little chance for care givers to access egg to feed infants’.

5.1.4 Community level sources of infant feeding information

Most care givers in the focus group discussion reported that HEWs were the main sources of infant feeding information in their kebele. Volunteer women also provide infant feeding information when they meet women networks meetings. The main locations for information dissemination were health facility, homes, community meetings and women groups meetings.

One of the care givers in the intervention group shared her experience as follows:

‘I learned about complementary feeding mainly from HEWs and they also taught me how to prepare Atmit by mixing different cereals and legumes. HEWs conduct home visits to educate us on complementary feeding. They also call us to the health facility to teach us in a group’.

However, care givers in both groups reported that AEWs have never participated in teaching them on infant feeding. Agriculture extension workers in both groups also reported that HEWs are the primary source of infant feeding information in their kebeles and they themselves were not involved in infant feeding promotion. During an interview in control kebeles, called Dulele Kori, an AEW indicated that:

‘In a Kebele where I work HEWs are the main source of nutrition information for care givers and they exchange infant feeding information with them during home visits and community meetings. However, I did not participate in infant feeding education of care givers since I was not trained’.

5.1.5 Barriers for AEWs' involvement in complementary feeding promotion

The major barrier for AEWs involvement in complementary feeding promotion was lack of training. Other challenges for AEWs' involvement in complementary feeding promotion were recognition of AEWs only as agents for agricultural issues, lack of experience to communicate about infant feeding with care givers, lack of regular visits to households and lack of prioritization of complementary feeding promotion in AEWs activities. If these challenges were attended, care givers could be willing to learn from AEWs. One of the care givers in Dimtu Godeti kebele reported that:

'If AEWs were trained to participate in complementary feeding promotion I would accept their advice and practice it'.

Similarly, AEWs in both groups reported that they were not involved in complementary feeding promotion due to lack of training and motivation that could help them promote complementary feeding in their community. While sharing the situation in the intervention kebele, Lemen, an AEW reported that:

'So far I did not participate in providing message on complementary feeding since I was not trained. However, if I got training I am willing to share the message to care givers'.

5.2 Post intervention evaluation findings

5.2.1 Perceptions or beliefs of care givers about what and how to feed infants

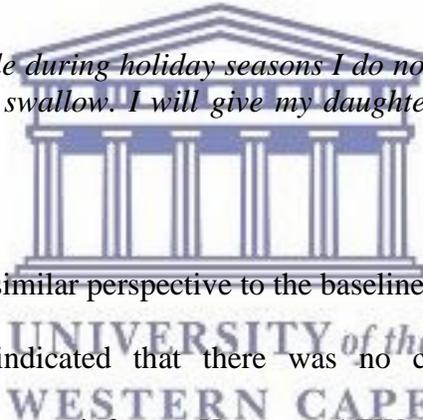
Contrary to the baseline findings, during post-intervention evaluation, care givers in the intervention group reported that infants were given more frequent meals than in the control group. Most care givers in the intervention group provided three to four meals in a day, while in the control group most of them reported that they gave three meals in a day. However, most care givers in both groups did not add fruits and vegetables to infants' meals since they still felt that it

could be difficult for them to swallow. Interview with AEWs shows the majority care givers produce vegetables or fruits or both.

5.2.2 Lack of knowledge and practice on eggs, dairy products and flesh foods feeding

Similar to the baseline findings, during post-intervention evaluation, care givers in both groups reported that they fed infants mainly with cereal based diet. However, more care givers in the intervention groups reported giving eggs to infants. In both groups eggs were sold to buy salt, coffee, soap, gas and oil. Similar to the baseline finding none of the care givers in either group gave meat to infants. One of the care givers in Dimtu Godeti kebele shared her practice as follows:

‘Even if meat is available during holiday seasons I do not give her meat. This is because meat is hard for her to swallow. I will give my daughter meat when she reaches three years’.



AEWs in both groups shared a similar perspective to the baseline regarding consumption of flesh foods among infants. They indicated that there was no change in terms of flesh food consumption, especially meat, among infants. However, AEWs in the intervention group expect that the message they gave to the care givers could help care givers, especially those who owned chicken and cattle, to provide egg and dairy products to infants. Agriculture extension workers in both groups related the absence of meat in infants’ diet with the unavailability of meat during most months of the year, lack of skills regarding flesh food preparation that meets the needs of infants, lack of experience in buying animal products from the market, poverty and large family size.

5.2.3 Lack of husbands' and family members' support to care givers

During post intervention evaluation, focus group discussion and key informant interview findings showed that there was no difference among the two groups in terms of the support provided to care givers by their husbands on infant feeding.

5.2.4 Community level sources of infant feeding information

Similar to the baseline findings, HEWs and women volunteers were the primary sources of infant feeding information to care givers. However, care givers in the intervention group reported that they received infant feeding messages from AEWs when they conducted home visits and during various community meetings. One of the care givers in the intervention kebele reported that:

'I learned about how to feed my child from HEWs, women volunteers and AEWs. However, AEWs made more visits during major agricultural activities than any other time'.

Based on key informant interviews, AEWs in the control group did not participate in infant feeding promotion. However, AEWs in the intervention group reported that the training they received has enabled them to educate care givers on infant feeding with confidence. In addition to home visits, AEWs in the intervention group reported that they used community networks, particularly Doradoma (where one women's leader mentors twenty to thirty women), Gari Missoma (farmers' groups composed of men and women farmers), vegetable, chicken and sheep producing women groups, women saving groups, irrigation groups (men and women), social and self-help group, natural resource conservation groups (men and women) and other opportunities where they met with the community to communicate complementary feeding messages. While sharing their involvement one of the AEWs in intervention group kebele, called Dulele Bilacha, reported that:

'The knowledge I got from the training and mentorship during the follow up study period enabled me to communicate about complementary feeding to care givers during home visits, community meetings and women group meetings. I used any of the contact points with care givers and farmers to communicate on infant feeding'.

Agriculture extension workers confirmed that the training they received enabled them to know complementary feeding messages and develop confidence to communicate complementary feeding messages among care givers. One of the AEWs reported that:

'I am much more confident to communicate with care givers now than I was before and I even started using the message I learned at my own house'.

5.2.5 Barriers for AEWs' involvement in complementary feeding promotion

Care givers in the control group reported that lack of training was the major barrier for AEWs involvement in complementary feeding promotion. However, care givers in the intervention group recognized the AEWs' involvement in teaching them on infant feeding. However, care givers indicated that the infrequent visits were the major barrier for their full involvement. On the other hand, AEWs in the intervention group reported that they made efforts to visit care givers in their homes every other week. However, the frequency of household visits to care givers was affected by the large number of households per AEW, distance among the households and lack of transportation to conduct visits every other week, competing priorities such as farming season, assignment from their supervisors, work related travels and their school commitments. In addition, lack of incentives and transport to reach all households have also influenced their motivation to conduct home visits as scheduled. In the control group, similar to the baseline observation, AEWs reported that they lack the required knowledge to be involved in complementary feeding promotion.

5.3 AEWs' Experiences and Challenges During the Follow up Period

Follow up meetings held with agriculture extension workers enabled the researcher to get feedback on their progress, experiences and the challenges that AEWs were facing in the previous three months. Table 5.1 summarized AEWs and the challenges they faced during the follow up period.

Table 5.1: Agriculture extension workers experiences and challenges during follow up periods

Kebele	AEWs experiences	challenges faced
Lemen	<ul style="list-style-type: none"> The three AEWs were responsible for 902 households in the kebele & 250 of them are irrigation users. They reached care givers during farmers' training, home visits, meetings with women vegetable producer groups and women fuel saving stove groups. 	<ul style="list-style-type: none"> During the rainy season not all care givers come for group meetings Difficulty to visit all households during the rainy season Unreasonable expectations from care givers such as provision of tools and animals due to poverty
Dulele Bilacha	<ul style="list-style-type: none"> There are 878 households and 200 of them are irrigation users. They communicated complementary feeding messages during home visits, bi-monthly women's groups meetings, seed multipliers women's group meetings, farmers' training, women's network meetings, farmers' network meetings and agricultural activities. 	<ul style="list-style-type: none"> Expectation of something from outside by the end of messaging Inability to cover the entire kebele due to its big size Competing assignments from supervisors School commitment
Dimtu Godeti	<ul style="list-style-type: none"> There are 445 households in the kebele and 107 are irrigation users. AEWs used the following opportunities to communicate the message: home visits, meeting with model farmers (105 were females) and their networks, women's groups for sheep and vegetable production, fuel saving stove women's groups, women's networks and demonstration plots, irrigation users' meetings. 	<ul style="list-style-type: none"> Lack fruits and vegetables in their farm Expectation of getting something from outside to implement the messages Competing priority during agricultural seasons School commitment

In summary, the qualitative findings revealed that care givers in the intervention group increased frequency of meals following the interventions while more care givers in the intervention group reported giving eggs to infants than the control group. AEWs in the intervention group were actively involved in complementary feeding promotion using home visits and various contact points. This includes home visits, women's group meetings and various community meetings where women and men farmers were participating. However, AEWs did not make home visits as frequently as scheduled due to various barriers. This was due to competing priorities that AEWs faced for work related assignments and travels, or personal commitments. Care givers were positive on trained AEWs' involvement in promoting complementary feeding. The training given to AEWs on simple complementary feeding messages and mentorship provided by the researcher enabled them to build confidence when they communicated with care givers.



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CHAPTER SIX: DISCUSSION

This study assessed the effectiveness of complementary feeding promotion using AEWs in addition to existing Health Extension Workers (HEWs), compared with HEWs alone, on care givers' complementary feeding practices and infants' nutritional status in Wonchi Woreda, Oromia region of southwestern Ethiopia. Our study showed that complementary feeding promotion through trained AEWs had significantly increased the minimum meal frequency and dietary diversity among infants in the intervention group while no significant difference was observed among infants in the two groups in terms of their nutritional status.

6.1 AEWs' Complementary Feeding Promotion and Minimum Meal Frequency

Infants' meal frequency needs to be gradually adjusted with their age so that they could be accustomed to the new taste and texture of the foods and meet the nutritional demand for their growth and development since breast milk alone cannot meet their nutritional needs (WHO 2006, p. 176). Though the difference was very small, this study demonstrated that complementary feeding messages, which comprised of meal frequency, amount, thickness, variety, active feeding and hygienic preparation of food, delivered by trained AEWs, were able to improve the minimum meal frequency among breast-fed infants in the intervention group but not the case for non-breast infants in the same group. The observed improvements in the quantitative findings of this study confirm the reports from focus group discussions where care givers in the intervention group reported that they increased meal frequency to three to four times a day after receiving the complementary feeding messages from AEWs. During home visits and community meetings with care givers, they reported the experience they had with AEWs in terms of follow up and the support they received to address their concerns. In a cluster randomized control trial study

conducted to assess the effectiveness of nutrition education packages in improving feeding practices, dietary adequacy and growth of infants and young children in rural Tanzania it was found that offering age-specific, practical problem-solving education and counseling on feeding and health care practices, and ensuring continuous support, will result in a larger impact on dietary adequacy than could be achieved through routine health education alone (Kulwa et al. 2014).

Though literatures on the involvement of AEWs in complementary feeding promotion in low and middle income countries is scanty, similar findings were reported in a study conducted in Nepal where care givers who had adequate exposure to complementary feeding education were significantly more likely to meet minimum meal frequency and diet diversity requirements (Joshi et al. 2012). Compared with the national average, in this study higher proportion of breastfed infants, aged 9 to 23 months, met the recommended three meals per day. In the current study, about 90% of infants had met the minimum meal frequency recommendation while a secondary analysis of the Ethiopian Demographic and Health Survey (DHS) 2011 showed only 50% of the children met the recommended minimum meal frequency with a message given only through HEWs alone (Melkam et al. 2013). The observed difference in this study might have resulted from a sustained exposure of care givers to complementary feeding messages from AEWs in addition to the routine messages given by HEWs. However, this study was focusing on a small sample size study compared to the DHS study, which was conducted among a large number of infants in communities where there is a health system that provides community nutrition services through HEW program.

Essential nutrition action behavior change communication is a key approach to bring changes in infant and young child feeding practices. A prospective randomized control trial carried out to test the efficacy of a specific intervention for reducing the extent of child malnutrition and behavior change of mothers relating to child-feeding practices, care-giving, and health-seeking practices under the Bangladesh integrated nutrition project (Roy 2005, p.320), found that home based complementary feeding promotion focusing on providing adequate meal frequency and energy density of food improved significantly in the intervention group after three months. The findings of Roy (2005) are consistent with my study finding where the changes observed in infants' meal frequency could be attributed to the AEWs' involvement in complementary feeding promotion which could have an influence on care givers infant feeding behavior.



In this study, about 81% care givers had ever interacted with AEWs at least once and two in three care givers were exposed to AEWs messaging three times. This could be the result of AEWs willingness to integrate the message delivered as part of the day to day activities. In addition, the findings showed that AEWs have been able to reach the majority of the care givers included in their daily activities. This observation was higher than the findings of the Alive and Thrive operational study in Ethiopia, where only about one in three mothers were exposed three times to peer promoters involved in infant and young child counseling (WVE 2012a). The same study has indicated that meal frequency among children 6 to 24 months was directly related to the frequency of peer promoters' visit to the family to provide complementary feeding counseling. Similar to the current study, Kang et al. (2013) demonstrated increased meal frequency among care givers who were exposed to complementary feeding education given by community volunteers. Increased meal frequency will provide infants opportunity to get

adequate diet that could meet their growth and developmental needs. However, the diet needs to be nutritionally dense to meet their daily nutrient requirements (WHO 2012a).

6.2 AEWs' Complementary Feeding Education and Consumption of Diversified Foods

The World Health Organization recommends at least four of the seven food groups to provide better quality diet for breastfed and non-breastfed children (WHO 2007). Dietary diversity is a qualitative measure of food consumption that reflects household access to a variety of foods, and is also a proxy for nutrient adequacy of the diet of individuals. Dietary diversity scores have been validated for several age/sex groups as proxy measures for macro and/or micronutrient adequacy of the diet (FAO 2013, p.7). In this study, half of the infants in the intervention group have met the WHO recommendation. This figure is much higher than the DHS report where only 6% of children 18-23 months of age received the four plus food groups in Ethiopia (CSA 2011). A similar finding was reported in a study conducted by Gebremedhin et al. (2017), to assess predictors of dietary diversity in predominantly food-insecure area of South Wollo, Ethiopia among children ages 6 to 23 months. The study revealed that only 7% of the children met the recommended minimum dietary diversity. However, in the current study a significantly higher proportion of infants of care givers, who were exposed to AEWs' complementary feeding messages, consumed more diversified food groups than the control group, concurring with the findings of other studies. Higher exposure of the care givers to AEWs' messaging might have contributed to this difference. In a randomized control trial study conducted in Ethiopia, higher exposure to peer mothers' complementary feeding messages had resulted in higher dietary diversity among infants in the intervention group (WVE 2012a). Another study conducted in India showed an improvement in the variety, quantity and consistency of complementary foods

and hygiene practices after nutrition education on infant feeding was provided to care givers (Vani, Sushma & Veenu 2003, pp.1; Shi & Zhang 2011). However, in the current study the mean number of food groups consumed by the intervention group was less than the medium dietary diversity score of four that provide the best sensitive and specific indicators of MAR less than 50% (Steyn et al. 2006; FAO 2013). This might have been because the majority of infants' meals in both groups of this study was based on grains, roots and tubers followed by legumes and nuts. A quarter or less of infants consumed dairy products, eggs, vitamin A rich fruits and vegetables and almost none of them consumed flesh foods. In addition, change in diversified diet consumption might not only come from complementary feeding messages provided by AEWs.



In the current study, significantly higher proportion of infants in the intervention group consumed legumes and nuts than the control group. This could be the result of care givers' response to AEWs messages to diversify infants' meals with locally available food. The qualitative study has also showed that care givers increase the diversity of infants' meals by adding legumes and nuts to the cereals. Though there was no difference among the two groups, grains, roots and tubers were the most frequently consumed food groups consumed among infants. This finding is consistent with other study reports in Ethiopia where complementary foods are usually based on cereal gruel and porridges until family food is introduced. Moreover, the most frequently consumed food groups were low in protein grains, roots and tubers (CHND, 2006; Henry, Whiting & Regassa 2015; CSA 2016). This could be the result of various factors. Based on the key informants' interviews, cereals, roots and tubers are the major crop products produced in the community. Hence, care givers might have provided them since they are locally accessible and affordable foods for them to prepare infants meal. Secondly, care givers might

wait for infants to reach three years of age to add flesh foods and vegetables and fruits into the infants' meals as it was reported in the focus group discussions. Similarly care givers maintained the same practice across various agricultural seasons, as shown during the subsequent follow up period, which might have resulted from deep rootedness of this practice in the community because of the beliefs and cultural norms that did not allow them to provide infants these food groups, irrespective of variation in food availability.

Throughout the course of the current study, infants did not consume any flesh foods such as meat, fish, poultry and liver/organ meat. The focus group discussions revealed that care givers add legumes to infants' diet, while preparing infants food, as a recipe to increase the nutrient density of the staple cereals. This might be a compensation strategy in the study area where animal source protein foods were lacking in infants' diet. The findings in the current study were similar to a cross sectional study conducted in Nigeria to assess diet diversification in complementary feeding children age 0 to 24 months, where children's diet was based on cereals, roots and tubers, with little consumption of protein-rich foods, both of plant and animal origin (Beatrice 2010). However, it is well documented that cereal based diet is low nutrient density and has poor minerals bioavailability (Dewey 2013).

Poor dietary diversity has a negative effect on infants' growth. Logistic regression analysis conducted in the review of Demographic and Health Survey 2008/09 to determine the level of dietary diversity in nutritional status of children aged 6 to 59 months in Kenya showed that intake of highly diversified diet reduced the probability of the child being malnourished by nine percent. Similar results were found in a study conducted to assess the association of dietary

diversity and stunting among under-fives who participated in the national surveillance project in 2003-2005. The results showed that, compared with low diet diversity score, high dietary diversity was associated with a 15, 26 and 31% reduced odds of being stunted among children aged 6-11, 12-23 and 24-59 months, respectively, after adjusting for all potential confounders. Low dietary diversity in this study might have contributed to the lack of significant difference in stunting and underweight status between infants in the intervention and control groups.

A year-long Chinese community-based pilot nutrition education study, with 250 infants each in intervention and control groups where the intervention included training and mobilizing of village nutrition educators who made monthly growth monitoring and complementary feeding counseling visits to all pregnant women and families with infants born during the study in the sample villages, showed a more frequent consumption of foods of animal origin such as eggs, fish, chicken or meat, and of vegetables and fruits among infants whose care givers received complementary feeding counseling (Gulden et al. 2000). Compared with care givers in this study, care givers in the Chinese study might be living in settings where there is lower prevalence of cultural and traditional beliefs that influence the implementation of the recommended complementary feeding messages, or they might be economically able to buy these foods whenever they need them. The findings in this study revealed the gap in the uptake of the Ethiopian infant and young child feeding guidelines where the use of diversified home-based, locally available and safe foods is recommended to ensure infants and young children's access to indigenous, nutrient dense, bio-available and nutrient rich locally available foods (MoH 2004). The finding in this study, where infants consumed low diet diversity, is inconsistent with the national guideline recommendations that state that breast-fed infants and young children need

complementary foods with a very high nutrient density (particularly for iron and zinc), especially at ages 6–12 months.

6.3 Socio-cultural, Economic and Behavioral Factors Affecting Infant Feeding Practices

Various factors might have contributed to lack of flesh foods consumption among infants in both groups. The infant feeding messaging provided by trained AEWs could not demonstrate a significant change in this practice by the end of the intervention. In this study, focus group discussion revealed that families consumed meat only when animals were slaughtered during holidays. The rest of the year meat could not be available. Availability was not the only barrier for care givers to add meat to infants' meals. Other factors like care givers thinking that infants cannot swallow meat until they reach three years of age, and lack of tradition to buy foods such as egg, milk or flesh foods from the market to enrich infants' diet, might have contributed to lack of flesh foods in the diet of infants. The religious obligations of fasting, which did not allow families not only to consume but also to prepare animal products at home for most part of the year, might also have contributed to inadequate access to meat and other animal products by care givers. This study finding is consistent with an exploratory qualitative study which was carried out to determine the views, beliefs and experience of mothers, caregivers and health professionals in Iran about the role of socio-economic and cultural factors in child feeding practices. The study revealed that cultural factors appeared to have an important influence on mothers' infant feeding practices and feeding patterns of their children (Solaria et al. 2011). In addition, AEWs reported that lack of appropriate flesh food preparation techniques for infants' consumption of meals prepared with meat, might have contributed to care givers' continued practice of providing predominantly cereal based adult foods until infants reach three years of

age. This could be one of the major barriers affecting the diversified food uptake of infants, since care givers are not introduced to appropriate preparation techniques as well as how to preserve flesh food when there is plenty of it, such as during holiday season.

This study showed no differences among the two groups in vegetable and fruits consumption. This could be associated more with the caregivers' beliefs rather than unavailability. According to the qualitative study, inadequate inclusion of vitamin A rich fruits and vegetables and other fruits and vegetables might have been related to care givers beliefs that it might be difficult for infants to swallow. The finding in this study is consistent with MoH Ethiopia report (2015) on maternal, newborn, infant, young child and adolescent nutrition where certain foods such as banana, egg, pumpkin, carrot, kale and other green vegetables and meat are considered unsuitable and "too strong" for infants and young children, and are not given until they reach two to three years. Contrary to flesh foods, care givers in this study had better access to vegetables and fruits. The interviews with AEWs indicated that these foods were available in the families who own vegetable and fruit gardens.

A formative assessment conducted in eastern and western Kenya by the Ministry of Health to assess factors that affect the engagement of grandmothers and men in infant and young child feeding and maternal nutrition showed that culturally prescribed gender role was cited as a factor influencing the level of men's involvement in infant feeding (Monk 2011). This was the case in this study where both the focus group discussions and care givers interview reports indicated that infant feeding was considered women's responsibility and fathers were not involved at all. Similar report was found in Kenya where men are not involved in direct care and nurturing of

children younger than two years since the culture considered it as only women's work (IYCN 2011). In addition, in this study the support in infant feeding from other family members, including grand mothers' was very limited. This could influence care givers' decision to utilize nutrient dense food available at home, or buy them from the market. Moreover, it will allow care givers to maintain the cultural status quo and practices that will be shared from the grandmothers. If AEWs in this study had intentionally targeted complementary feeding messaging with fathers and grandmothers, better results might have been achieved. Faith et al. (2015) in a community based study conducted to assess engagement of fathers and grandmothers to improve maternal and child dietary practices in Western Kenya showed that nutrition messages that allow the fathers' and grandmothers' engagement had better practices related to maternal nutrition and complementary feeding than nutrition messages that were targeted only to mothers.

The lack of men's involvement could constrain women to access nutrient dense foods from the market due to financial constraints. This was a reality in many nutrition education programs where husbands were not targeted. This could be the case in the current study. Similar to the current study, Engebretsen et al. (2010) reported that most men in Uganda were not primarily targeted to health education sessions where infant feeding information was provided. In Ethiopia, in addition to knowledge on IYCF practices among men, economic constraints, limited agricultural resources, cultural values and gender roles, and women's expectations in their family life affects men's involvement and support for improved infant and young child feeding practices (Feed the Future 2012). Moreover, husbands' inadequate involvement could also limit care givers decisions to buy nutrient rich foods or use them as part of the infants' meal if at all it is

available at home. This is because husbands play a critical role in making decision on household resources especially on allocation and spending household finances.

This study used complementary feeding messages taken from the national IYCF manual which was not adapted to consider the local socio-cultural, economic and behavioural factors that might have influenced care givers' infant feeding practices. As Fabrizio, Liere and Pelto (2014) indicated, complementary feeding messaging conducted by trained AEWs in this study would have been more effectively designed if formative research was conducted at the start of the study to identify care givers perception and belief, knowledge and practices, socio-cultural barriers and economic enablers for optimal complementary feeding practices among infants.

6.4 Acceptability of AEWs' Involvement in Complementary Feeding Promotion

Literature on the acceptability of AEWs in promoting complementary feeding practices was lacking. Hence, the discussion on this section was primarily based on the focus group discussions and interviews held with care givers and AEWs respectively. This study showed AEWs' complementary feeding messages to the care givers had a small but significant influence on meal frequency and dietary diversity. This is similar to UNICEF recommendations that good counseling and negotiation with the mother is crucial to ensure optimal complementary feeding practices (UNICEF 2015).

The acceptance and participation of AEWs in complementary feeding promotion has increased after they were adequately trained to provide complementary feeding promotion. Based on the focus group discussions and interview conducted with AEWs, this might be the result of the

AEWs' increased knowledge on recommended complementary feeding messages and the skills they gained on how to communicate complementary feeding messages. Though AEWs has been able to reach less than half of the care givers in the last three months, they have been able to use various contact points to communicate messages regarding complementary feeding to care givers. This might have also helped them to interact with care givers more frequently and reach those who were absent during home visits. This was done as part of their day to day activities when they visited communities or organized meetings with women groups for other agricultural extension services such as kitchen gardening, animal producing groups, cooking stove groups and women's saving groups. As FAO (FAO 2016d) indicated, nutrition sensitive messaging could be combined with other agricultural activities where AEWs engage with care givers.

6.5 Facilitators and Barriers for AEWs' Involvement in Complementary Feeding Promotion

This study found that training given to AEWs and the researcher's ongoing mentorship could have increased AEWs confidence to communicate complementary feeding messaging as part of their activities. This is contrary to the report by Joshi et al. (2013), where many extension agents felt that nutrition messages fell outside of their responsibility and their incorporation into routine activities detracted them from core services. In the current study, irrespective of their busy schedule, AEWs willingly participated in complementary feeding messaging through home visits and as part of their daily activities. This is consistent with Patricia's (2009, p.12) report where the role of AEWs, which tends to focus on crops and horticultural production, can be expanded into food preservation, cooking demonstration and promotion of diversified food utilization through providing training on basic nutrition and communication techniques.

However, it is critical to develop an open dialogue with AEWs to explore how they will sustain such input and actively use all available opportunities to interact with caregivers.

As expected, in the current study the proportion of care givers visited during the main agricultural season was less than care givers visited during other agricultural seasons (Sisay 2015). This could be due to increasing demand for the AEWs' extension support from the farming community during this period. As it was reported during AEW interviews, the ongoing follow up and mentorship support might have been an opportunity for AEWs to resolve such challenges and served as an incentive for them to continue promoting the messages effectively to care givers even if they had a crowded work schedule. Moreover, the simplicity of the messages and their focus on key practices might have enabled AEWs to understand, easily remember and communicate the messages effectively (Joshi et al. 2013). In addition to agricultural activities other competing priorities, such as school commitment and travel out of the kebeles for number of meetings, could not allow AEWs to conduct the scheduled bi-weekly home visits to care givers to communicate the recommended messages.

In this study care givers recognize HEWs and community volunteers as a main provider of complementary feeding information. This was expected as HEWs and community volunteers were tasked and trained to provide such services in the community. However, the complementarity and harmonized message provided by AEWs might have resulted in acceptance and positive uptake of feeding recommendations among care givers. This could be due to the reinforcement of similar messages that might have provided by HEWs and community volunteers. Joshi et al. (2013) also encourages message repetition when it comes to nutrition and

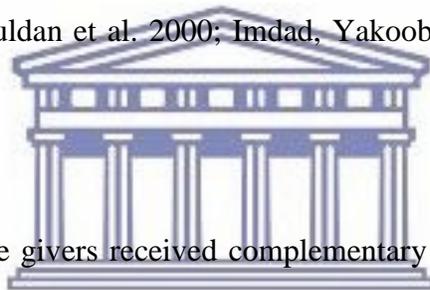
hygiene. This is because similar messages across various platforms could be re-enforced to facilitate understanding, practice and community buy-in.

The FAO report (2016b) indicated that the agriculture extension program is typically a male dominated sector that target male farmers and established female farmers, and for it to reach women with nutrition messages is not feasible. Contrary to this report, in this study, in addition to providing agriculture extension services trained AEWs conducted home visits to talk with female care gives on complementary feeding messages. Moreover, they also used various contact points to interact with male and female farmers. It is the opinion of the researcher of this study that such reports, like the FAO report, might be the result of lack of intentional targeting of care givers through agriculture extension program rather than the inability of AEWs to provide basic complementary feeding messages to care givers. In addition, lack of intentional targeting of AEWs to reach female care givers, the lack of mentorship and training about how to reach women care givers could also affect AEWs' involvement in complementary feeding messaging. This observation is supported by a 2006 Demographic and Health Survey report in Nepal where the extension service platforms could not provide opportunities to reach care givers of infants' and children during the first 1000 days of life since the agriculture extension program mainly targets males (Joshi et al. 2013).

6.6 The Influence of AEWs' Complementary Feeding Promotion on Infants' Weight and Length Gain and Nutritional Status

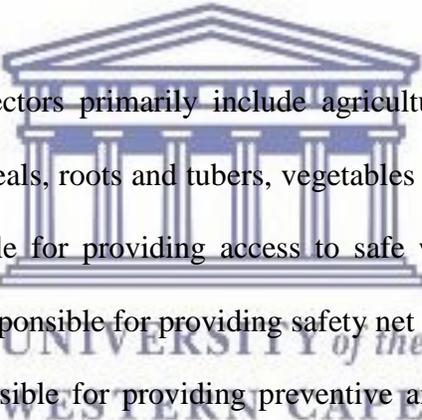
In this study, although there was not statistically significant difference between pre-intervention and post-intervention measurements between the two groups, complementary feeding messaging

led to better mean weight gain and length increase among infants in the intervention group. These findings are similar to a randomized control trial study conducted in India to determine the difference in the results of intervention providing generous amounts of a micronutrient-fortified food supplement supported by counseling and nutritional counseling alone. In the Indian study nutrition counseling alone did not affect weight and length increments among infants between four and twelve months of age (Bhandari et al. 2001). Contrary to this, other educational intervention studies showed positive impact both on weight and length gain. Among the many factors that could potentially affect positive nutritional outcome, poor dietary diversity could be one of the contributing factors for lack of significant change in weight gain and length increase among infants in this study (Guldan et al. 2000; Imdad, Yakoob and Bhutta 2011; Penny et al. 2005).



In this study infants whose care givers received complementary feeding messages from AEWs were less stunted than those in the control group but the difference was not statistically significant. This was contrary to the quasi-experimental design study by Tomedi et al. (2008), where an intervention group of children 6 to 20 months of age received group education on appropriate complementary feeding and hygiene. During the seven months intervention period, there were significant group differences in pre-post Z-score changes between the intervention and non-intervention group for weight-for-age and weight-for-height, but not for height-for-age. In the current study, the observed lack of difference in infants' nutritional status could be explained by not only as a result of inadequate effect of the intervention to achieve better nutrition outcomes but also due to the influence of other factors, such as food insecurity, inadequate hygiene practices, and poor health seeking and caring practices, on underweight and

stunting. The results of this study could serve as evidence to show that unless complementary feeding messages are linked to other nutrition sensitive sector interventions that could directly or indirectly contribute to reducing malnutrition in children, complementary feeding messaging alone could have little effect on stunting or underweight. This finding is also supported by another randomized control trial study conducted to assess the impact of timed and targeted counseling using trained peer mothers on infant and young child feeding practices in four rural woredas in Southern Nations Nationalities and People Region, Ethiopia (WVE 2012a). The results showed that there was no statistically significant difference in children's nutritional status among mothers who received infant feeding counseling.



The main nutrition sensitive sectors primarily include agriculture that is responsible for the production of nutrient dense cereals, roots and tubers, vegetables and fruits and animal products; water and sanitation, responsible for providing access to safe water, hygiene and latrine use promotion; social protection, responsible for providing safety net food and cash for poor families and health sector that is responsible for providing preventive and curative health services for infants and promote care giving and optimal infant feeding practices. In addition, the involvement of the women's and children's affairs sector is also critical to address gender and socio-cultural and community beliefs and empower care givers to be actively involved in household decision making about resources for better nutritional outcome in infants. Education sector could also contribute through providing care givers employment opportunities as well as empowering women to make better decisions on the types of infants' diet and allocation of household resources.

This study showed a seasonal fluctuation in the prevalence of under-weight and stunting among the study participants. Prevalence of malnutrition, especially underweight, was highest during the food gap months of the year. Stunting and underweight prevalence has reduced during pre-harvest and harvest seasons, at sixth and ninth month follow up periods respectively, when families have better access to food. Brown, Black and Becker (1982) also observed an association between seasonal fluctuations, and growth and the prevalence of malnutrition among children.

6.7 Predictors of Meal Frequency, Diet Diversity and Infants' Growth

In this study a strong association was found between the economic status of care givers and minimum meal frequency, minimum dietary diversity and infants' weight gain. Middle class or rich families were significantly more likely to meet the minimum meal frequency and minimum dietary diversity than poor families. This could be due to middle class or rich families' ability to buy diversified foods from the market when they are not producing it or when they exhaust the food they produced at home. This study finding is consistent with the report by Molla et al. (2013), where children born in the wealthiest households had a better meal frequency and dietary diversity score. Similar finding was found in the study conducted in Southern Ethiopia where both low wealth index and high household food insecurity corresponded with low diet diversity score (Henry, Whiting & Regassa 2015). This might indicate that poor families might not be able to produce or purchase diversified foods needed for themselves, resulting in infants' inadequate weight gain. According to WHO (2007), infants of economically poor care givers were significantly less likely to gain weight than of infants from non-poor care givers.

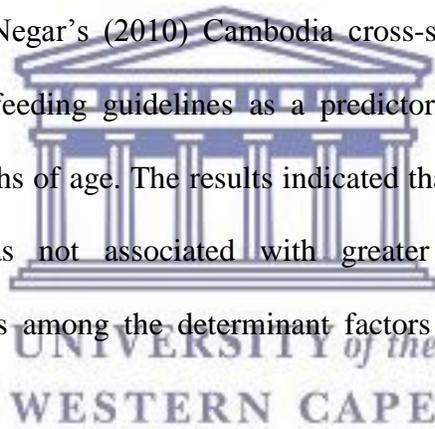
In the current study, infants of care givers who did not have occupation were more likely to be underweight. Based on the researcher's opinion this could be due to care givers with no occupation rely on a small waged income which could cover only cheap cereal based staple foods. Moreover, it could limit their ability in deciding the types of foods they wanted to buy and feed infants. In this study, the majority of care givers were farmers by occupation and very few of them were involved in other types of occupation. This could narrow care givers' alternative income generating opportunities which further restricts care givers' ability to avail diversified foods needed for infants as well as the entire family. As a result, care givers with no occupation could not be able to access diversified food which is one of the essentials for the growth of infants. Care givers who were economically poor were not only unable to feed their infants well but also might not have been able to access childhood health services such as immunization, seek health services in a timely fashion when children get sick and adopt better health practices at home. According to UNICEF (2015), poverty resulting from poor households' economy and lack of employment is the basic cause of undernutrition as a result of household food insecurity, inadequate care, living in unhealthy household environment and lack of access and utilization of health services.

Among various factors that account for a high prevalence of chronic malnutrition, limited access to health services in the context of a heavy burden of disease hold the most important responsibility (IFPRI 2012). This is especially so when infants get sick. In Ethiopia fever and diarrhea are among the most common childhood illnesses (MoH, 2005). Childhood illnesses and care givers' inadequate feeding practices are the major contributors to child malnutrition (Luchuo et al., 2015). In the current study, infants with diarrhea had significantly lower

minimum meal frequency than infants without diarrhea. This could be as a result of poor appetite, trouble in swallowing, care givers' fear of the worsening of the diarrhea or finding it difficult to breastfeed (Shrimpton et al. 2001& Ogbo et al. 2017). According to UNICEF (2015), undernutrition impacts infants with diarrhea since diarrhea could increase the duration and severity of illnesses and infants with diarrhea are at higher risk of malnutrition due to malabsorption, loss of appetite, loss of nutrients from the body or increased nutrient requirements.

In the current study infants who had fever were more likely to be underweight than infants who did not have fever. Fever due to acute respiratory infection could impact infants' nutritional status due to appetite loss and metabolic effects such as muscle breakdown and iron deficiency as a result of anemia which manifest as fever (UNICEF 2015). Once infants got malnourished its effect could trigger further weight loss and reduced resistance to infection. Wamani et al. (2006) in a two-stage cluster sampling study to assess predictors of poor anthropometric status among children under two years of age in rural Uganda found that underweight was associated with a history of fever and cough, while stunting was associated with a wider range of factors including history of a fever episode. Another prospective cohort study conducted to assess the prevalence and predictors of malnutrition among Guatemalan children at two years of age revealed that childhood illnesses such as vomiting and fever in the preceding week were significant predictors of underweight status at two years of age. Significant predictors of stunting at two years of age included household size, number of children under five years old, diarrhea in the previous week, underweight and stunting at one year (Nagata et al. 2016).

Access to child feeding information and messages on complementary feeding delivered by AEWs were important determinants for increased meal frequency, diversified foods given to infants and for infants less likely to be stunted. Since there was no other similar study, the finding of this study could not be compared. However, Penny et al. (2005) reported that nutrition education delivered through health services and care givers' practice based on the knowledge gained has decreased the prevalence of stunted growth in childhood in areas where access to food is not a limiting factor. In a randomized control trial study conducted in Ethiopia it was shown that infant feeding promotion through trained peer counselors has resulted in increased meal frequency and dietary diversity among infants 6 to 24 months (WVE 2012a). However, this is contrary to Negar's (2010) Cambodia cross-sectional study which assessed adherence to complementary feeding guidelines as a predictor of better health outcomes in infants six to twenty-four months of age. The results indicated that adherence to complementary feeding recommendations was not associated with greater dietary diversity. However, availability of these foods was among the determinant factors to provide diversified diet to infants.



According to UNICEF (2015), household food security is the underlying determinant of child nutritional status. To increase dietary diversity scores the current Ethiopian national nutrition program underlines the promotion of nutrient dense foods at household level through kitchen gardening, fruit production and small animal production (GoE 2016, p.31). In this study, care givers who own small animals and produce dairy products were more likely to feed infants with diversified diet and to have infants less likely to be stunted. This is consistent with the qualitative study findings showing that infants' diet was enriched with eggs and milk whenever available at

home. This could be related to the households' food security and ability to provide diversified foods to infants not only from their produce but also through the purchase of foods that were not available at home.

Gebremedhin et al. (2017) reported that food secure households, households with backyard gardening and number of chickens owned were significant predictors in providing diversified foods to children age 6 to 23 months and had a direct contribution to rapid weight and height gain. As it was found in this study, infants of care givers that had dairy products and were producing vegetables and fruits were more likely to gain weight and height respectively than those infants of care givers that were not. Similar to this study, Disha et al. (2012) linear regression analysis of the Ethiopia Demographic and Health Survey (EDHS) 2005 data showed higher dietary diversity score was associated with higher height-for-age z-score and weight-for-age z-score. However, according to WHO (2012a), infants of care givers that did not have the right knowledge and understanding of appropriate feeding practices often had a greater chance of inadequate dietary intakes even if the foods are available in households.

In this study infants who were younger during enrolment were more likely to increase in length and gain more weight than older infants. This is expected since infants enrolled at 6 months of age had a better chance of length and weight gain than infants enrolled at the 12 months. According to Graber (2017), infants grow dramatically and show observable change more in the first year of life than at any other time. This is not only in a physical growth but also cognitive, emotional, social, language, sensory and motor developments. Xu, Wang, Guo and Karlberg (2002) in a longitudinal study to assess the growth of infants during infancy and childhood in

children from Shanghai, China, reported that the age of onset of childhood phase of growth, normally occurring between 6 and 12 months, is recognized to be an important time during postnatal human development. This is a period where infants will be introduced to complementary feeding and to achieve rapid physical and developmental growth infants need to be fed with nutrient dense foods and with the recommended minimum meal frequency. As found in this study care givers might not adhere to these recommendations not only due to lack of knowledge but other socio-cultural, economic and gender related factors. Hence, they need to be followed up and supported to successfully utilize this window of opportunity for infants' growth.

Timely introduction of complementary feeding could benefit infants to meet their nutritional needs when breast milk is no longer enough. In this study infants of care givers who introduced complementary foods in a timely manner had a higher length gain than those infants who were introduced late. This indicates that care givers were filling the nutrient gaps that breast milk can no longer provide. In addition, since infants grow faster during this period, timely introduction of complementary feeding could enable infants to receive the nutrient needs they have for rapid growth. A cross sectional study conducted among mothers, fathers and grandfathers in India to assess influence of timely introduction of complementary foods on improved nutritional status concluded that while the timing of complementary feeding in and of itself may not lead to improved nutritional status, timely introduction of foods of appropriate quantity and quality in a hygienic environment, along with increased maternal interaction time would likely have the desired positive effects on the growth of young children (Philips et al. 1996).

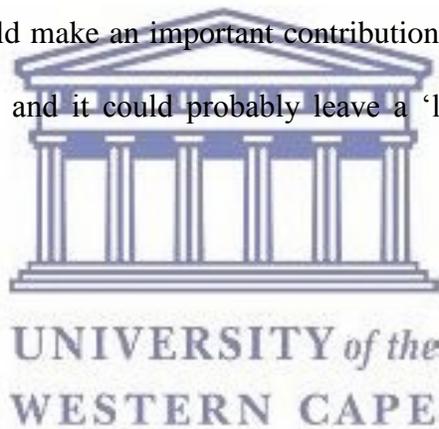
6.8 Limitations & Strengths of the Study

Success in practicing complementary feeding recommendations is dependent on the cultural norms and traditions, women's role in resource decision making, cost and food availability, seasonality, and men's involvement. Understanding this requires conducting a formative study to develop the key complementary feeding which was not conducted in this study. Therefore, in this study the implemented key messages were generic and not informed by the actual socio-cultural, economic and gender related formative study findings that informs the community needs and practices.

The researcher could not conduct regular on-site visits for the support and mentorship of AEWs and to ensure the quality of the data collection, due to financial constraint and work overload. The scope of the study was Wonchi District, Woliso zone, Oromia regional state, and therefore the study findings can only be generalized to areas of similar circumstances. The practices of complementary feeding were determined based on maternal self-reports and might have a recall bias. In addition, no attempt was made to check the messages care givers received from AEWs. Voluntary participation of AEWs and competing priorities in their daily activities might have affected them to meet the home visit recommendation of the study. In this study, no direct observation of care givers complementary feeding practice was conducted at household level. Moreover, pre-intervention and post-intervention knowledge of AEWs on complementary feeding was not measured. The weight-for-length analysis was not included as part of the study variable. Moreover, the instrument was not designed to capture the source of data by kebele hence the variation among the kebeles could not be analyzed. Finally selection of one of the twin

siblings and the transfer of two AEWs to the control group for a reason beyond the influence of the researcher has reduced number of care giver-infant pairs used for post-intervention analysis.

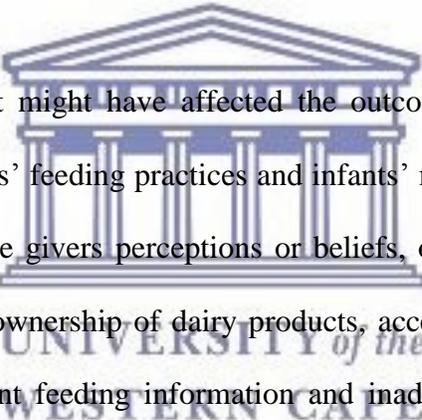
The strengths of this study were the use of a randomized control trial to assess the effectiveness of complementary feeding promotion using trained AEWs among a longitudinal cohort of care givers of infants 6 to 12 months for over one year period. This could also provide viable route for providing support to care givers of infants in rural communities. Moreover, the study could provide opportunities to link nutrition and agriculture to improve nutritional outcomes. Testing whether such an inter-sectoral approach could work to improve complementary feeding practices and infants nutrition status could make an important contribution to the field. The research was conducted in ‘real life’ setting and it could probably leave a ‘legacy’ that benefits the study community.



CHAPTER SEVEN: CONCLUSION AND RECOMMENDATIONS

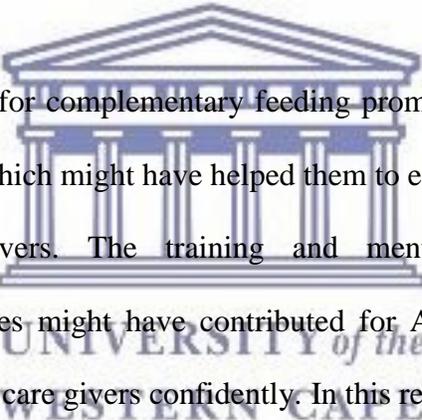
7.1 Conclusion

In this study, irrespective of the limitations, care givers who received complementary feeding messages from trained AEWs had significantly higher minimum meal frequency and minimum dietary diversity scores than care givers who did not receive the messages. The message provided to care givers through AEWs home visits and various contact points might have contributed for the change observed. Unlike other educational intervention studies, the observed difference was not statistically significant in terms of weight gain, length increase, improvement in weight-for-age z-score and height-for-age z-score.



There were various factors that might have affected the outcome of AEWs' complementary feeding promotion on care givers' feeding practices and infants' nutritional status. On one hand, these factors could relate to care givers perceptions or beliefs, or knowledge and practices on infant feeding, production and ownership of dairy products, access to flesh foods, care givers' economic status, access to infant feeding information and inadequate feeding practices when infants get sick. On the other hand, there were also socio-cultural, economic and behavioral factors such as perception or beliefs that infants cannot take meat, vegetables and fruits until two to three years and lack of men's involvement in infant feeding, that were deep rooted in care givers' culture and religion. As a result, nutrient-dense foods such as flesh foods and vegetables and fruits were excluded from infants' meal and could not be available at the period when infants need them most. Such factors could not be addressed with AEWs messaging alone unless complementary feeding programs consider working with other sectors.

In this study, AEWs were voluntarily involved in complementary feeding promotion through home visits. Though, AEWs could not meet the home visit recommendation of the study, the bi-weekly home visits, they visited care givers as frequently as they could. Competing priorities in their daily activities, such as high demand during farming seasons, travel for work related meetings and school commitment might have contributed to this. Despite these barriers, AEWs' involvement was well recognized among care givers, which was not the case at the beginning. In addition to home visits, AEWs created additional contact points with care givers to communicate complementary feeding information. These are additional opportunities to be considered in linking complementary feeding promotion with agriculture extension program.



The messages that AEWs used for complementary feeding promotion were consistent with the Ministry of Health curriculum which might have helped them to establish a positive and effective communication with care givers. The training and mentorship provided on simple complementary feeding messages might have contributed for AEWs to easily internalize the messages and communicate it to care givers confidently. In this regard, in order to make nutrition messaging as part of AEWs' work, there needs to be a clear understanding of what type of messages AEWs could communicate, how much time they will allocate for such kind of activities and how best they could overcome the barriers. However, messages need to be informed by formative study and address the socio-cultural, economic and behavioral barriers.

In this study there was no husbands' involvement in infant feeding. Agriculture extension workers tried to utilize their day to day interaction to reach male farmers and share messages in complementary feeding practices. However, this did not make a difference at the end of the study.

Finally, based on the current study findings, the hypothesis of *care givers of infants 6 to 12 months, who received complementary feeding promotion by means of trained AEWs (in addition to existing HEWs), will have better complementary feeding practices (measured by minimum dietary diversity & minimum meal frequency) than those who received from HEWs only* was accepted. Due to lack of evidence in this study, the hypothesis that *care givers of infants 6 to 12 months who received complementary feeding promotion by means of trained AEWs (in addition to existing HEWs) will have better-nourished infants (measured by weight-for-age & height-for-age) compared with those who received from HEWs only* was rejected.

This study has demonstrated that involvement of AEWs positively contributed to infants feeding practices. Hence, training the AEWs on infant and young child feeding practices, involving them in the promotion of complementary feeding, facilitating the working environment and communication with HEWs on what each of them are doing to promote infant feeding will have paramount public health significance. Moreover, it could also contribute towards the achievement of the national nutrition program accelerated stunting reduction program where it planned to promote diversified foods production and consumption using AEWs as one of the multi-sectoral nutrition sensitive interventions.

7.2 Recommendations

Our study findings showed that complementary feeding promotion using trained AEWs has resulted in improved minimum meal frequency and minimum dietary diversity. Efforts to promote complementary feeding using trained AEWs should not be underestimated in resource limited settings, such as the rural Ethiopia, despite lack of evidence on infants' nutritional status. To effectively engage AEWs into complementary feeding promotion, the messages need to be simple and easy to understand and remember. However, these messages need to be supplemented by other activities like cooking demonstration, support in the production of small animals and kitchen garden, addressing the perceptions and beliefs among care givers on infant feeding such as adding flesh foods to infants' diet, care givers economic empowerment and husbands' involvement in infants feeding. In addition, men's involvement, women's empowerment over resource ownership and decision making, and addressing the socio-cultural and economic factors that could affect care givers' access to diversified food sources needs to be considered. In this regard, a formative study could be done to investigate perception or belief, socio-cultural, behavioral, and economic and gender related barriers and design locally appropriate complementary feeding messages.

To consider nutrition education as part of AEWs' daily activity, the agriculture extension program at Ministry of Agriculture must consider incorporating a simple infant feeding promotion tool as part of AEWs' pre-service and in-service training curriculum and job description. Moreover, on-site mentoring and problem solving supportive supervision to AEWs should be provided for effective delivery of these messages in a consistent manner. Though home visit was the most frequent mode of agriculture extension service delivery in Ethiopia, in

this study home visits conducted by AEWs were not as frequent as it was scheduled. Hence, AEWs must be encouraged to make frequent visits as well as use various contact points, such as women's groups and community meetings, to increase the chance of providing care givers with consistent and repeated complementary feeding messages and reach those care givers who were absent during home visits. However, this could depend on the number of additional contact points that AEWs could have. Support could be provided for AEWs to identify and use potential opportunities in geographic locations where these contact points were non-functional or did not exist.

It is well recognized that achieving change in child growth and nutritional status requires an integrated and multi-sectoral intervention. Hence, in addition to complementary feeding promotion, actions are required from various sectors (agriculture, education, health, sanitation, social protection, women's empowerment etc). In this regard, for agriculture sector AEWs messages could focus on nutrition sensitive actions such as nutrient dense crops production, animal husbandry and fruits and vegetables production. Agriculture extension program could also play a crucial role in the introduction of food preparation and preservation technologies, such as powdered meat and dried fruits and vegetables that could address care givers' concern that infants could have difficulty to swallow meat, vegetables and fruits. Additional behavior change communication interventions are needed to address the perceptions or beliefs and behavioral factors, based on formative study findings.

Special consideration should be made to reach influencers such as husbands to support care givers in infant feeding, caring and in the allocation of resources to buy nutrient rich foods. This

is one area where AEWs could prioritize communicating with men farmers. However, any gender empowerment effort which involves men in infant feeding must be taken cautiously. This is because in the study area, like other contexts in Ethiopia, besides infant feeding knowledge other socio-cultural and economic barriers could prevent men involvement in infant feeding. On the other hand, AEWs should strengthen their efforts to empower women through income generating activities, access to extension services, and information and activities that could increase their ability to care for infants. This could include introduction of labor and time saving technologies, education and employment opportunities that could provide them financial capacity to avail nutrient rich foods.

Further research might be needed on many of the issues that this study did not cover. These are the effectiveness of fathers' complementary feeding education using trained AEWs on infant feeding practices and growth; testing various strategies to improve consumption of flesh foods among infants such as powdered meat; effectiveness of integration of complementary feeding messaging with other sectoral interventions on infants nutritional status; effective strategies to increase AEWs home visit frequency; and investigating whether use of male AEWs affects the interaction with care givers. Application of the findings of this study to other programs and settings must consider the study limitations.

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CHAPTER EIGHT: APPENDICES



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