THE IMPACT OF THE FIVE YEAR NUTRITION PROJECT IN SELENGE PROVINCE OF MONGOLIA

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Mongolia

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The impact of the five year nutrition project in Selenge province of Mongolia

A thesis submitted in partial fulfilment of the requirement for the degree of Master of Public Health

By

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Where other people's work has been used (either from a printed source, internet or any other source) this has been carefully acknowledged and referenced in accordance with departmental requirements.
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LIST OF ABBREVIATIONS

ADB	Asian Development Bank
ANC	Antenatal care
C-IMCI	Community Based Integrated Management of Childhood Illnesses
CI	Confidence Interval
CNWs	Community Nutrition Workers
EPI-INFO	Statistical Software
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
GOM	Government of Mongolia
HB	Haemoglobin
HF	Health Facilitator
ICHD	International Course Health Development
LBW	Low birth weight
LW	Lactating Women
MDGs	Millennium Development Goals
MMR	Maternal Mortality Ratio
MOH	Ministry of Health,
MOF	Ministry of Finance
MUAC	Mid-upper arm circumference
NHF	Nutrition Health Facilitator
NNS	National Nutritional Survey
NO	National Office
NFSP	The National Food Security Plan
NRC	The Nutrition Research Centre of Mongolia
NSO	National Statistical Office of Mongolia
OR	Odds Ratio
PD	Positive Deviant
PEM	Protein Energy Malnutrition
PHI	Public Health Institute
PLW	Pregnant and Lactating Women
PW	Pregnant Women
RR	Relative Risk
SD	Standard Deviation
SPSS	Statistical Package for the Social Sciences
UNIFEM	UN Development Fund for Women
UNICEF	United Nations Children's Fund
UNDP	United Nations Development Project
WB	World Bank
WHO	World Health Organization
WVM	World Vision Mongolia
WVC	World Vision Canada
VDD	Vitamin D deficiency
VM	Volunteer Mother

ABSTRACT

Background
My thesis is based on the result of a study of the impact of World Vision Mongolia's five year Nutrition Project which was implemented in the poor nomadic areas of the Selenge province of Mongolia.

Thesis objective
The general objective of this thesis is to analyse the child nutritional status in Selenge province since the project implementation and assess whether the changes in child nutritional outcomes were associated with the nutrition project interventions.

Study method
In collaboration with Nutrition Research Centre the nutrition project assessment was done pre and post intervention design with the comparison of indicators from the baseline and the evaluation. Within the scope of this thesis all data collected during the surveys will be analysed. A literature review of studies on main interventions will be done in order to look at impacts of those interventions in developing countries.

Findings
The implementation of the Nutrition Project contributed to the improvement of the child nutritional impact and nutritional status of children under five and mothers despite their poor socio-economic condition. The Nutrition Project reached its goal of elimination of severe PEM and 50% of reduction of moderate PEM among children under five. The mean prevalence of stunting decreased from 16.4% to 6.4%. Underweight and wasting declined from 5.1% to 1.8% and from 2.2% to 0.6% respectively. Project was unable to achieve its target to reduce anaemia by 30% but did achieve its target to reduce 30% of the prevalence of rickets.

Conclusion
The implementation of the WVM Nutrition project was associated with improved child macronutrient nutritional status but not with micronutrient nutritional status in the nomadic soums of Selenge province. In terms of the supplementation, the project almost achieved its target coverage 80%.

Recommendation
Define the project specific target group as children under two years.

Keywords: *Mongolia, malnutrition, maternal-child health, nutrition, micronutrients deficiency*

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INTRODUCTION

I have been working in WVM since 2005 as a Mother and Child Health Nutrition Project Officer. My main reason for joining the ICHD (International Course Health Development) course was to enhance my knowledge of public health related issues.

Appropriate and sufficient nutrition is a basic of maternal and child health. In South East Asia 3.8 million children die before their fifth birthday (Onis *et al*., 1997). The most common form of the under nutrition in children is PEM and Micronutrient Deficiency which is accountable for 0.4 million deaths in children under five (Rice *et al*., 2000).
The millennium development goal has a target to halve the people who are below the poverty line, to halve the proportion of people suffering from hunger and to reduce by two-thirds the under-five mortality rate.

The East Asia and Western Pacific Regional Strategy "To reduce maternal and child malnutrition'' aims to achieve the Millennium Development Goal includes the following main objectives:

1. Reduce by one third the malnutrition level among the children under five between 1990-2015, with more focus on under two;
2. To reduce iron deficiency anaemia by one third;
3. To provide macronutrient supplements for 50% of all women of reproductive age;
4. To promote breastfeeding for children under six months and continued breastfeeding with an age-specific, appropriate, safe and nutritional supplementary food supply;
5. To improve the nutritional status of mother and children.

Although the Government of Mongolia (GOM) is making efforts to achieve the above objectives, not much has been done due to lack of funding. Nutrition related activities are mainly dependant on donor organizations (MOH, 2009B).
According to the WHO Global Database on Child Growth and Malnutrition, Mongolia is classified as "deteriorating status'' country (WB, 2006). In addition to the serious consequences on individual health, micronutrient deficiencies negatively impact broader development goals for Mongolian society and child malnutrition is the one of the public health issues which need to be taken into account.

According to the National Nutritional Fourth survey (NNS) conducted in 2010, nutrition and health issues are national concern, and the prevalence of underweight children, nutrition, anaemia and rickets in Selenge province far exceed the national averages indicating the severity of these problems in this region. Selenge is the fifth worst province in terms of poor nutrition among the 21 provinces of Mongolia (NSO, 2009).

World Vision Mongolia had been implementing its five year (2005-2010) Nutrition Project in Selenge, one of the poor nomadic provinces of Mongolia. To define the project objectives and to determine the situation analysis on malnutrition prevalence among mothers and pregnant women and children under five, the knowledge, attitude, and caring practice of mothers on nutrition baseline was conducted in 2005. The project ended in 2010 with a final evaluation.

Thus, my thesis is based on the result of a study on the impact of this project in order to define future perspectives and develop recommendations to project managers based on the project baseline and evaluation. I have taken the opportunity to learn from in-depth research for this thesis. My work experience of the project implementation helped to analyse the research findings.

Thesis findings will be used for further improvement of Nutrition Projects in Mongolia.

1. CHAPTER: COUNTRY BACKGROUND

The economic, social and cultural characteristics of Mongolia are described in this chapter in order to assist analysis of the possible factors influencing to children's nutritional status. According to the UNICEF framework, those characteristics influence child nutritional status in the country.

1.1 Geography and population

Mongolia is a landlocked country which occupies the Northern part of Asia and borders with Russia and China. Mongolia has population of 2,832,224 people and covers 1,564,116 square kilometres with density of 1.5 people per sq. km that is higher only than the Falkland Islands and Greenland (NSO, 2010). The climate is both desert and continental, with large daily and seasonal temperature ranges. Temperatures during the winter reach as far as minus 45 degrees and to plus 35 degree in summer (FAO, 2010). Extreme weather conditions cause poverty and food shortage (FAO, 2007). Specially, during the winter nomadic families face dzud[1], results in loss of livestock which affect food security, health and nutritional status (Tachiiri *et al*., 2008; FAO, 2007).

The capital city is Ulaanbaatar. Mongolia has 21 rural provinces[2]. Each province is divided into 16-17 soums[3], and each soum is composed of baghs[4] which have average populations of 50 persons (GOM, 2010). People reside in rural areas is around 49% and around 32% of the population are nomadic[5] (NSO, 2010).

1.2 Socioeconomic situation

1.2.1 Population

The collapse of the USSR in 1990 marked the end of Soviet subsidies to Mongolia and caused much demographic change. Since then annual population growth[6] declined from 3% in 1990 to 1.17% in 2004 (NSO,

[1]A dzud is a condition of a snow storm, prolonged extreme cold down to -50 degrees and snow cover of more than 30cm.
[2]Country is divided into 21 major provinces including capital city , two bigger cities and 18 provinces
[3] A Soum is administrative unit of the province and comprised of up to 26 baghs.
[4] A Bagh is administrative unit of the soum which consisted of 500-600 people..
[5] The nomadic lifestyle refers to households who have no fixed home and move according to the seasons from place to place with livestock.
[6] Population growth increased by 16.1% between 2000-2010. Annual population growth rate is 1.54%.

2009). The mean household size is 4.7[7] persons and is higher in rural areas (NSO, 2010).

1.2.2 Nomadic lifestyle

Around 36% of the population are nomads who engage in traditional rural livestock herding. The Nomadic lifestyle required travel to long distances to reach to health services and also involves very limited social support (Smith *et al*., 2005). Some herder families travel up to 400 km from soum and provincial centres. Herders are most vulnerable to dzuds because of their nomadic lifestyle (Foggin *et al*.,1997; FAO, 2007). Also, herder's diets consist of dairy products during the summer and only mainly meat during the winter (FAO, 2007). Because of the lack of electricity herder's families do not have refrigerators so it is not possible to use vegetable in all season (Smith *et al*., 2005; FAO, 2007).

1.2.3 Education

The literacy rate[8] is high (97.4%) and the education level of women is higher than that of men in Mongolia (UNDP, 2006). Three out of five adults are women who had completed tertiary education (NSO, 2009). In rural areas, herders do not allow the boys to go to the school but prefer to send girls. This is because herders keep the boys to help them and also this is a kind of tradition that if the family has a boy he must become a herder to keep the income (Smith *et al*., 2005). People in urban areas are educated three times than in rural areas (GOM, 2010). Furthermore, poor people are 1.5 times more likely to lack primary education than the non-poor [9] (NSO, 2010).

1.2.4 Water and sanitation

Clean water and sanitation facilities are rare for rural families. Only 30% of poor and rural population use water from wells, rivers and snow. One in eight people have no access to sanitation facilities (NSO, 2009).

1.2.5 Gender

One of the main indicators of the status of woman in society is domestic violence against woman and it is common in Mongolia. Although it is normally not reported a study showed that one in nine women had experienced violence (UNIFEM, 2002). Sixty per cent of the poor, unemployed population are women and 12% of the households are female-headed (NSO, 2010). Among the employed, women work longer hours than men (Graig and Ouyntsetseg, 2004). Furthermore women

[7]Average household size is 4.2 persons in urban , 5.3 persons in rural areas.
[8]Adult literacy rate is 98.4 where 98% man, 97.5% women
[9]Non-poor population defined monthly income is above poverty line

are overloaded with household work by 15-18 hours a day in rural area due to the nomadic lifestyle. This may limit the and effort women can to spend caring their children (Smith *et al*.,2005).

1.2.6 Macro-economy

With the collapse of the USSR in 1990 marking the end of Soviet subsidies to Mongolia, the country underwent a rapid political and economic transition resulting in increased poverty levels and declining agricultural and domestic production (Foggin *et al*., 1997; Graig and Ouyntsetseg, 2004). While national income[10] has increased in recent years, unemployment rates remain high at 11.5% of the eligible population (NSO, 2010). GDP (Growth Domestic Product) growth decreased from 10.6% to 6.37% between 2004 and 2010. Per capita GDP increased from US$ 370 to US$ 1580 between 1990 and 2011 (MOF, 2011).

The mining and agricultural sectors are the main dynamic sectors for economic growth. Mining contributes 20% and agriculture 25% of the GDP (GOM, 2009). One of the main economic activities is livestock production which accounts for 13% of the total exports (MOF, 2009).
Regardless of positive economic growth, poverty[11] is high in Mongolia (GOM, 2010). Although the overall poverty rate dropped since 2000, it increased in rural areas from 42% to 47% while decreasing from 30% to 26% in urban areas (NSO, 2010).

The economic condition of herders depends totally on livestock herding due to the lack of other sources (NSO, 2009). Declining livestock numbers causes rural populations to be vulnerable (Batima *et al*., 2006; Graig and Ouyntsetseg, 2004). Herders who have less than 20 bods[12] are counted as poor (NSO, 2010).
Extreme weather condition such as dzuds caused a loss of almost 35% of the animal population and deterioration of nutritional status of children and women in 2010 (MOH, 2009B).

1.3 Country Health system

1.3.1 Health care services

Health care service delivery is based on the primary health care system based on treatment rather than preventative care. Health units are

[10] National income was 3,203,031,000 US$ in 2010 in Mongolia
[11] As UNIFEM report one third population are considered as poor and live under poverty line. Poverty level estimated as 31.2% in the country where 23.5% in urban, 38.9% in rural areas.
[12] The Bod scale is an estimate the size of herd counting all livestock as equivalent to one cattle

available in all soum. The average doctor ratio is 1:420 and health posts provide health care services to communities with populations above 650-1500 people (MOH, 2011). The doctor ratio is 1:700 in rural areas and 1:320 in cities (MOH, 2009B).
Furthermore the rural population has a limited geographical accessibility to health services as remote households are as far as 400 km from provincial hospitals [13] (GOM, 2010). The immunization rate is a relatively high 82% in the country and is 7% less in rural area (MOH, 2011). Although child growth monitoring charts were provided to all homes with children under five only 50% of the rural families completed them (MOH, 2009A).

1.3.2 Health status of children and mother

Although deliveries increased by 41.5% from 2000 to 2010 the maternal mortality ratio (MMR) dropped from 158.5 to 45 deaths per 100,000 live births in this period (MOH, 2011). Meantime, MMR has increased to 89 deaths per 100,000 live births in 2007 due to dramatic increase[14] in births (MOH, 2008).
Although more than 83.4 % of women visit primary health care facilities for antenatal care (ANC) and 99.5% of deliveries take place at health facilities with health workers assistance maternal mortality remains a critical issue in nationwide (MOH, 2009A).
The under-five mortality rates demonstrated a downward trend from 42.4 to 24.6 deaths per 1,000 live births between 2000 and 2010 (MOH, 2011). However, mortality rates differ widely by to geographic area and tend to be as much as two tims higher in rural areas (MOH, 2009A).
Despite the slow decline of under-five mortality rates, rural children are still in great danger of dying from avoidable diseases. For example, they are three times more likely to die from respiratory diseases than children in urban areas (MOH, 2011).

Despite a significant overall national reduction of MMR and the fact that more than 99.5% of births take place at health facilities, rural women are twice as likely to die due to pregnancy and birth complications in soum hospital[15] settings (MOH, 2009A). For instance, in soum hospitals maternal mortality increased almost twice, from 66.6 to 158.6 per 100,000 during 2004-2008 (MOH, 2009A). The main determinants for the constant maternal mortality and child mortality in severe rural climate conditions are poorly developed infrastructure and the lack of skilled medical professionals resulting in the low quality of medical service. This is specially the case in soums and baghs (Janes and Chuluundorj, 2004).

[13]Provincial hospital is referral hospital that provides CEmOC
[14] Birth rate increased from 18.1% in 2006 to 20.8% in 2007.
[15]Soum hospital is a primary level of hospital that provides BEmOC

1.3.3 Nutritional situation in Mongolia

Nutrition activities in Mongolia are run under the "The National Plan of Action for Mongolia for Food Security Plan'' (NFSP) with two four-year phases for the period of 2009-2016. The plan has a special focus on children and pregnant and lactating women (PLW), to achieve the national Millennium Development Goals (MDGs) nutrition target to *"Halve, between 1990 and 2015, the proportion of people who suffer from malnutrition"* (GOM, 2010).

The plan is aiming to prevent micronutrient deficiency in children under five, PLWs and stakeholders by providing Vitamin D and Iron supplements to target beneficiaries (GOM, 2010). The NFSP is an important project for improving nutrition related policies in the country by collaborating with stakeholders. However, the GOM has no funding obligation and nutrition related activities are mainly dependent on namely donor organizations: UNICEF, WHO, ADB and WVM (MOH, 2009A).

Iron supplements, Sprinkles and Vitamin D supplements were provided by UNICEF and WVM during 2001-2003 and 2005-2010 respectively. With the initiation of WVM, the Ministry of Health (MOH) has implemented a national "Sprinkles'' project[16] for the last three years. Besides the National "Sprinkles'' project, WVM has been implementing its Nutrition Project in 18 out of 21 provinces in the country. The nutritional status of the Mongolian children is considered as a public health problem in the country.

According to fourth NNS the prevalence of anaemia in children under five decreased two-fold from 21% in 2004 to 10.6 in 2010 (Table one).
The prevalence of anaemia was higher among the children aged six to 11 months. On the other hand every two-third child among this age was anaemic. Fifty six percentage of children who have anaemia live in rural area (MOH, 2011).

Rickets, resulting from inadequate vitamin D levels, is the most significant nutrition issue in Mongolia. Rickets is found in one in every three under five children (MOH, 2006A). Rickets prevalence increased from 32% in 2004 third NNS to 43% in 2010 (fourth NNS) (MOH, 2011).

A 2009 survey "Assessing the consequences of Dzud" reported that 53 % of the children 6-23 months had one or two symptoms of rickets while 21% of children had more than two symptoms in the western part of Mongolia (GOM, 2010). The 4th NNS reported that only 16% of those children received Vitamin D (MOH, 2011).

[16] With the collaboration of MOH, WVM has been implementing its Sprinkles Project since 2009 with the provision of Sprinkles for children under -5 in 18 provinces in Mongolia

Table 1: Malnutrition prevalence in 3rd and 4th NNS

Forms of malnutrition	% 3rd NNS (2004)	% 4th NNS (2010)
Anaemia	21	10.6
Rickets	32	43
Underweight	7	4.7
Stunting	20	15.6
Wasting	3.2	1.7

Source: MOH 2011.

The fourth NNS reported that the prevalence of underweight decreased by six times since 2000 (MOH, 2011). The highest prevalence of underweight was observed in children 13-24 months in the western rural region (MOH, 2011). The fourth NNS showed that prevalence of underweight and stunting in children under five in rural areas was two folds higher than children in urban areas. Children in poor families are more likely to be underweight. For instance nine out of 10 children in poor families in rural area were underweight (MOH, 2011).

Stunting is the most widespread form of malnutrition in Mongolia and one third children had a severe stunting. The latest survey reported that wasting decreased slightly and 1.7% of the children under five were wasted (MOH, 2011).

The prevalence of over nutrition was higher, with 6.6% of children overweight and 0.9% obese. The prevalence of underweight and stunting was higher amongst children with low birth weight (LBW) (MOH, 2011). It is among the most vulnerable groups, children 0-5 years and PLWs where these nutritional deficiencies are detected at alarmingly high levels.

While milk and meat are mainly available, 31% of children among 6-11 months were reported never to have consumed meat and dairy products (MOH, 2011).
The fourth NNS revealed that only 45% of children were exclusively breastfed till 6 months and one in three children among children 6-11 months were consumed a meat.

The Latest (fourth) NNS strongly reported that maternal knowledge on appropriate child caring feeding practices and hygiene behaviours are the main determinants for inadequate dietary intake of children under five rather than the household food security (MOH, 2011).

2. CHAPTER: WORLD VISION MONGOLIA NUTRITION PROJECT

The summary of the World Vision Mongolia's Nutrition Project's main activity will be discussed in this chapter.

2.1 Nutrition Project background

The WVIM Nutrition Project implemented its five-year Nutrition Project in all eleven soums of Selenge province from 2005-2010 in order to improve the nutritional status of approximately 8,875 children under five years and about 1,804 PLWs.

The baseline conducted in 2005 before the project implementation known the following nutritional problems in the province:

- Anaemia: 25.5% among children under five, 6.5% among the mothers who have children under two, and 22.9% of the pregnant women
- Rickets: 58.5% among children under two
- Underweight: 5.1% among children under five
- Wasting: 2.2% among children under five
- Stunting: 16.4% among children under five

The survey found poor nutritional knowledge, hygiene practices and inadequate caring practices among caregivers and poor health knowledge and nutritional education amongst the mothers. The survey also revealed that the supplementation coverage and duration were inadequate. In general the survey strongly recommended that Integrated Management of Childhood Illnesses (IMCI) rely on a clinical approach without community involvement.

Based on the survey findings, the WV Nutrition Project applied several approaches which were already known to be a successful in improving child nutritional status. The project recognizes the need to balance short-term and long-term sustainable approaches. In order to improve the health and nutritional status of young children and PLWs, the "Hearth'' model and home based complementary foods with Sprinkles strategies were used.

The project targets were to reduce anaemia and rickets by 20% and wasting underweight and stunting by 50% among the children under five compared to the baseline. The project target coverage was 80% for supplementation and 40% for community based nutrition training.

2.2 Nutrition Project activities

WVM has been implementing following main activities in order to improve children under five and mothers' health status in Selenge province:

1. To increase the nutritional intake of mother and child under five through behavioural change and supplementation
- Community based rehabilitation of malnourished children through "Hearth" approach
- Provision of home based fortification "Sprinkles'' for children aged 6-59 months to prevent and treat anaemia
- Provision of Vitamin D for children under two years old to prevent and treat Vitamin D deficiency (VDD)
- Provision of Iron tablets for PLWs

2. Enhance the capacity building and nutritional knowledge of community and nutrition workers (CNW) through the community based education project
- Training of the local medical professionals and community members on the IMCI, including prevention and treatment of malnutrition and micronutrient deficiency in children and PLWs
- Improve the knowledge of community on the nutrition through Volunteer Mothers (VMs) participation

The Nutrition Project's main interventions will be discussed in the following.

2.2.1 Hearth model

The Hearth model is an approach to promote long-term community-based solutions to nutrition and health issues. Hearth is basically depends on that each community, well-nourished and malnourished children exist, despite living in similar socio-economic conditions. The main strategy of the Hearth model is to identify best selected practices that allow poor mothers to succeed in nourishing their children with limited resources.
Positive deviant (PD) behaviour of the poor mothers with well-nourished children was assessed through the VMs and CNWs. With support with local family clinic all children under five were screened for PEM and anaemia. Children who were identified as anaemic and malnourished are able to participate to Hearth session.
Sessions were delivered through the 12 days home based rehabilitation training to mothers with children on how to care for and improve the health of their child. Mothers were expected to contribute food products from whatever they had at home. Community VMs trained on Hearth sessions and their responsibility was to conduct Hearth session according to IMCI key practices such as feeding, caring, health seeking and hygiene. During the session mothers prepared healthy complementary foods based on the VM guidance.
After the 12 days were completed mothers were supported by follow-up visit by VMs for a month. Also, the participating children were weighed by CNWs weekly for six months. During the home follow-up visits CNWs give

feedback on caring and feeding practices. Children who didn't gain weight during the session were supposed to re-enrol.
Based on local knowledge and experience this approach empowers the poor mothers and communities to find sustainable solutions to their problems. Regrettably it was found that children in herding families were not involved due to their distance from the other families. One of other problems was that children who attended kindergarten were unable to attend to session.
Hearth sessions were conducted in kindergartens in order to solve above problem. However this approach focused on mothers, and if the mothers are employed the other caretakers were encouraged to involve in session.

2.2.2 Home based fortification using Sprinkles

A sprinkle is an innovation in "home-fortification" to address vitamin and mineral deficiencies in child. Sprinkles are powdery sachets with micronutrients in, which are easily disseminated into foods prepared at (Ip *et al*., 2009; Zlotkin *et al*., 2005). It can help to fortify homemade food without changing the taste and colour (Lander *et al*., 2008). The sprinkles content and dose were selected by the international recommendations (FAO, 2002) and based on the result of the trial (Stoltzfus and Dreyfuss, 1997). Composition of the Sprinkles is attached in Annex three.

Sprinkles were distributed to all children under five for daily meals for at least four consecutive months in order to decrease their prevalence of micronutrient deficiency. Sprinkles were distributed through family clinics during the UNICEF project implementation in 2003 and then from the second year of the WV Nutrition project implementation Sprinkles were distributed through CNWs based on the monthly distribution plan to beneficiaries. CNWs recorded the number of packets remaining from the previous visit during each visit to a household. The distribution records were collected from the households during the visit and all CNWs compiled into monthly reports, which were submitted to nutrition project management. Herding families received Sprinkles for three months in advance due to difficulties of long distance.

2.2.3 Iron tablets and Vitamin D supplementation

In order to prevent and cure infants and young children from rickets recommendations were given on the use of high doses of Vitamin D and the target was to set up to provide Vitamin D supplements to 80% of infants and young children in the target areas.
Children were given a one month supply of Vitamin D and Iron syrup and followed by CNW monitoring. Vitamin D supplementation was distributed through family clinics. Doctors were responsible to decide to give a supplement based on diagnose of rickets. However, Vitamin D was

recommended for children of 6-23 months age for five months from October to May during the winter. Children of 6-59 months received seven tablets of Vitamin D as a treatment dose. Children were recommended not to take Sprinkles during the treatment in order to avoid overlapping.
PLWs received iron tablets on monthly basis and the recommendation was to take them from the first month of pregnancy for six months. Iron tablets for pregnant women were delivered by health facilities whilst lactating women (LWs) received them from CNWs.

2.2.4 Capacity building training of health workers and advocacy

Local staff including 160 CNWs and 333 VMs was recruited from the community. The number of local staffs was carefully chosen for the Mongolian situation which involves long distances, and wide-spread locations. One CNW was available for 19 VMs, one VM for 20 children and one project nutrition health facilitator (NHF) for 16 CNWs. CNWs received monthly training provided by the WV National Office (NO). CNWs and VMs were trained monthly by NHF on child nutrition and health related issues. Technical support was provided by the NO and quarterly monitoring was held. UNICEF weighing scales, and wooden height measurement were provided and child growth monitoring charts were provided to all households to monitor the weight process of child.
The VMs' task was supported by CNWs to organize community education sessions. The main responsibility of the CNW and VM were monthly weighing of children who were identified as malnourished and record keeping. Additionally CNWs and VMs were responsible for nutrition counselling to mothers and distribution of iron and Sprinkles supplementations. Collaboration with provincial health department all local training was organized.
The Nutrition Project health facilitator together with focal person (head paediatrician who is responsible for IMCI) was responsible for organizing training on topics which included prevention and diagnosis of micronutrient deficiencies.
Additionally, health staffs were trained on facilitating community based education and counselling. Evaluators concluded that although skill and knowledge of the staff improved, discrepancies exist in terms of quality of community based trainings and caretakers counselling (MOH, 2006A).
Training and monitoring costs to distant households were shared with the provincial health department in order to enhance the government participation.

2.2.5 Community participation, education and awareness

The project seeks to increase community participation to address national priorities and to implement creative local health improvement plans. Community participation was at level of "passive participation".

The working group consisted of health professionals, WVM staff, and community members, and met regularly to discuss the progress of the project and to identify further directions.
Non-health actors such as parents, schools, kindergarten, government, and private companies participated in the project implementation. At the soum sectors were supported and monitored by different organizations and companies and soum governor offices played the important role of coordinating and encouraging the participation.

2.2.6 Nutrition Project Funding

The project was funded by 700,000 USD for the five year project implementation. The study report has not been published due to lack of funding. Budget was allocated as 45% for the supplementation, 40% for education components and 15% for the project administration.

3. CHAPTER : PROBLEM STATEMENT

3.1 Problem statement

According to the study review in 2005 over 53% of child deaths were related to malnutrition (Caulfield, 2004). In South East Asia 3.8 million children die before their fifth birthday (WB, 2006). Most of the common form of the under-nutrition in children is PEM and Micronutrient Deficiency which accounts for 0.4 million deaths in children under five (UNDP, 2006). Significant impacts of under-nutrition are related to psychological and physical development as well as behavioural problems (WB, 2006).

In addition to the serious consequences on individual health, micronutrient deficiencies negatively impact broader development goals for Mongolian society. In a recent report on the progress toward achieving the MDGs it is noted that Mongolia is making steady progress towards reaching their education goals by providing universal access to education for all children (GOM, 2010). This is encouraging news; however, the report also states there is a low probability of reaching their nutrition goal of halving hunger by 2015.
Households with low socio-economic status consume only 58% of the minimum energy requirements, falling into the WHO category of "semi-hunger and starvation" thus, greatly increasing their risk of diet-related disease (WB, 2006). With 70% of the poor being children and adolescents and 24% single mothers, it is evident that women and children are the most vulnerable (FAO, 2007).

According to third NNS, nutrition and health issues are of national concern, the prevalence rates of underweight children, nutrition, anaemia and rickets in Selenge province far exceed the national averages, indicating the severity of these problems in this region. Selenge the fifth worst province in terms of poor nutrition among the 21 provinces of Mongolia (NSO, 2007).
PEM, anaemia and rickets are nutritional deficiencies that are commonly found among children in Selenge province and identified as a severe public health problem. They are related to medical science and are named "background" diseases.

The baseline recorded 19.7% of children under age five having PEM with 5.4% being underweight, 16.4% being stunted, and 2.2% being wasted in Selenge province. One in two children (58.5%) in Selenge province suffered from rickets. Rickets was especially prevalent children aged two to five years. The prevalence of rickets was higher in children under two than the national level (41%).
The prevalence of anaemia was moderate among children under five (25.5%) and severe among children under two years.

However, these indicators were demonstrated to have no statistical difference, meaning the underweight condition and stunting were similar but wasting was higher than the national level.
The prevalence of being underweight tended to increase from age one and reached 10.0% at the 42-47 month age group and the prevalence of stunting increased with age beginning from birth up to 48-53 months (30.4%) in Selenge province.
According to the baseline it is well known that children in Selenge province need better nutrition including micronutrients in order to learn and develop.
To address the high prevalence of under nutrition found in the baseline assessment in 2005 in Selenge province, the WVM Nutrition Project applied several approaches such as Hearth and Sprinkles. For the first time in Mongolia, this project services were delivered through a community approaches rather than using a formal health facility based approach.
Thesis aimed to determine the benefits of the WV nutrition project comparing the baseline data with final evaluation data after five years of project implementation. Moreover, the thesis is intended for project managers who wish to improve their nutrition projects in order to know how to strengthen similar projects. One of the aims is for support offices to make a decision to fund such projects in developing countries.

3.2 Thesis Objectives

The general objectives of the study is to analyse children's nutritional status in Selenge province since the implementation of the nutrition project interventions and to determine whether the changes in nutritional outcomes among children under five were associated with the project interventions.

The specific objectives are:
1. To conclude whether the Nutrition Project interventions met planned targets and coverage;
2. To analyse the available baseline and evaluation data, and determine the project contributions to the observed child nutritional outcomes;
3. To provide recommendations to the project management team and local health organizations for further improvement of the project implementation.

3.3 Study Method

Collaboration with NRC the nutrition project assessment was done pre and post intervention design with the comparison of indicators from the baseline and evaluation. These surveys included a questionnaire, physical examinations, anthropometric measurement, and clinical observation. The

survey questionnaire was adapted from WVC Health Survey. Within the scope of this thesis all data collected during the surveys will be used. A literature review of studies on the community based Hearth model and home fortification Sprinkles intervention will be done in order to look at impacts those interventions in developing countries.

Pub Med and Medline, e-journals, organisation links such as WHO, UNICEF, FAO, UNDP and Mongolian Government websites were utilized. Books from KIT were used based on library search.

The key words for searching were: *Mongolia, health system, mother and child health, nutrition, malnutrition, rickets, anaemia, stunting, growth, micronutrients, care practices, complementary feeding, health seeking nutrition project, nutrition interventions, nutrition project evaluation, effectiveness and efficacy nutrition indicators, outcome and process of indicators, project impact, statistical analyses, Hearth, positive deviant, community based approach, Sprinkles, and Vitamin D.*

3.4 Conceptual framework

The main concern in implementing the Nutrition Project was to improve the child nutritional status among the children under five. A conceptual framework which was adapted from UNICEF for child malnutrition (1998) was used in order to analyse the main cause of the child nutritional status. Furthermore this adapted framework was used for the analysis of the evaluation findings in this thesis.

The adapted framework identifies three levels of corresponding underlying, basic and immediate determinants of child nutritional status (figure three). On the other hand this framework shows that malnutrition is an outcome of causes at different levels.

The immediate causes of a child's nutritional status directly depend on individual dietary intake and the child's health status. Those causes are interdependent on each other and on household food security, adequate care for children and proper health services.

Underlying determinants relate to families and are categorized into two factors which are proximal and distal. Distal factors are mostly related to availability of resources such as economic, caregivers and health resources to take care of children. Directly experienced factors depending on caretaker care practices are proximal. Resources for caring children are the mother's education level, religion, knowledge, decision making capacity, health status and social status. Additionally, household income, food resources, household size, and health facilities are identified as distal factors.

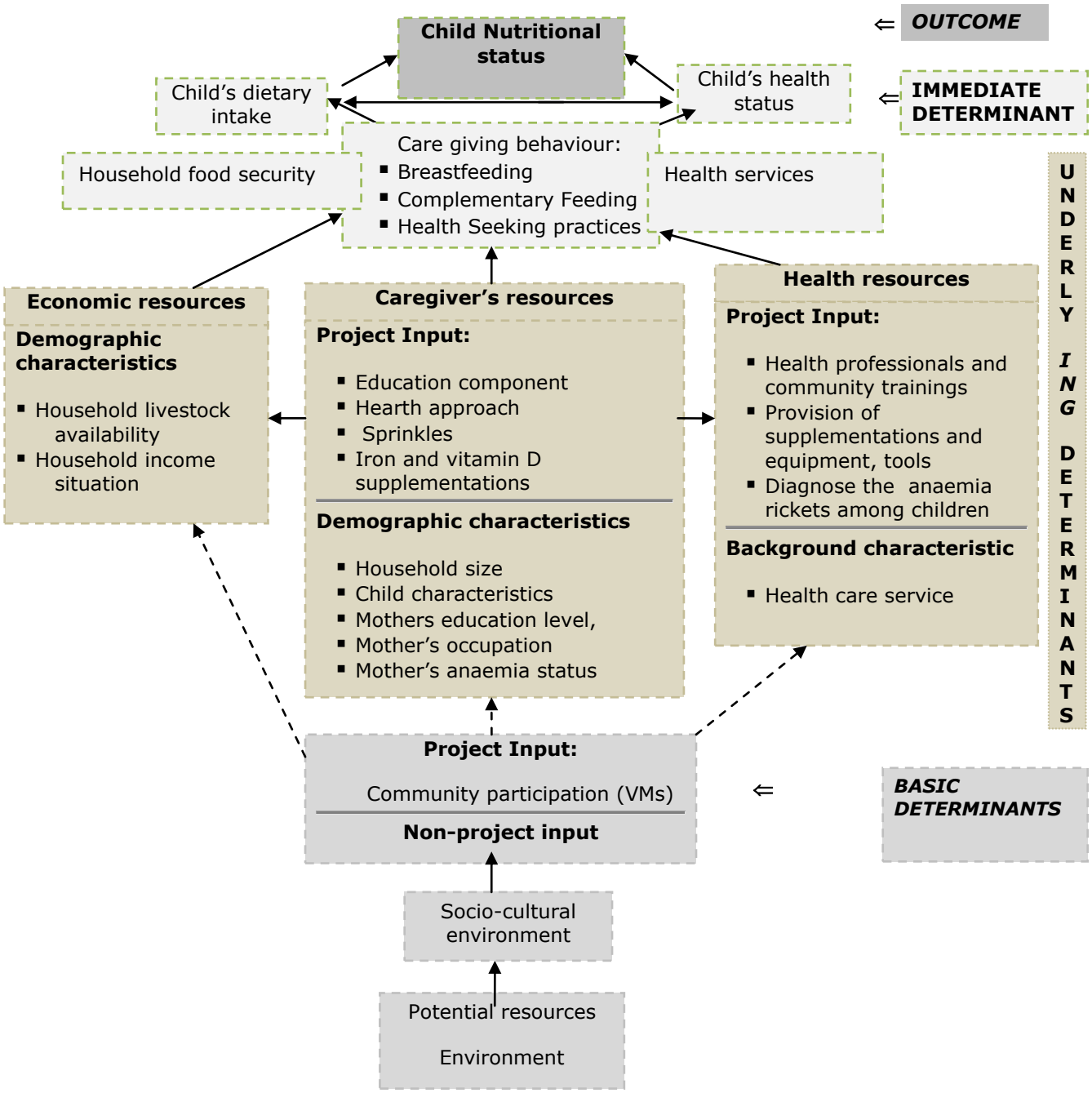


Figure 1: Conceptual framework (adapted from UNICEF 1998) on the causes of child under nutrition (Engle, 1999A).

The basic determinants related to community are resources for food security, care and health services. Thus basic determinants include potential resources such as economic, political, cultural, and social factors. According to the framework each step is interrelated the others which means that an action affecting one area might have an important affect to other areas (UNICEF, 1998). For instance, inadequate dietary intake is seen as a direct cause of malnutrition on one side while at the other side, food intake is itself an impact of the child's nutritional status.

In this thesis, children's nutritional outcomes are analysed in relation to provision of adequate care, health services and household food availability which are dependent on the background characteristics as household, mothers and community resources. Child care and health resources are analysed as a part of nutrition project input and non-project input. All the variables for the background characteristics project inputs were identified within the framework for the analyses.

3.5 Literature review on the main interventions

The main interventions, the Hearth, community based approach and Sprinkles have been shown to be effective and efficacious to prevent and reduce child under nutrition in several developing countries (Marsh *et al*., 2002; Lapping *et al*., 2002).

3.5.1 Sprinkles

A survey conducted by Save the Children on the effectiveness of Sprinkles on child nutrition and growth showed that it is effective in preventing and treating anaemia with a few side effects (Liyanage *et al*., 2002; Menon *et al*., 2007; Ip *et al*., 2009). A study conducted in Bangladesh found that iron (12.5 g) in Sprinkles is as effective for preventing iron deficiency anaemia as a 30 mg iron supplement (Ip *et al*., 2012; Mason *et al*., 2004 ; Marsh *et al*., 2002). A different study in Ghana showed that Sprinkles in complementary food does not reduce the absorption of iron (Zlotkin *et al*., 2005; Christofides *et al*., 2006).
World Vision Haiti's project implementation showed that the prevalence of anaemia decreased from 57% to 37% among children 6-24 months (Menon *et al*., 2007). However, Sprinkles have been proven to be an effective approach to control of anaemia, but more studies are needed to evaluate the effectiveness of Sprinkles in a general population and in a different context (Davidson and Nestel, 2004).

3.5.2 Hearth approach

Studies in Vietnam, Haiti, Cambodia, and Bangladesh reported that the improvement of nutritional status among Hearth enrolled children at the community level were not well studied. Hearth studies were unable to identify the potential effects of other factors such as household income or parents' education level.
Positive deviant "Hearth" approach implemented in Vietnam showed that severe malnutrition among children under age three decreased by 74% (Sternin *et al*., 1998; Mackintosh *et al*., 2002; Lapping *et al*., 2002). According to the Hearth project implementation in Haiti, 75% of children achieved adequate growth and 66% of children continued gaining weight (Menon *et al*., 2007). Evidence strongly supports the advantages of the

Hearth approach because it is community resource based and more likely to be sustainable (Lapping *et al*., 2002). The main important factors for the success Hearth approach and its sustainability were identified as the distance of the households, trained and motivated health workers and community mobilization (Sternin *et al*., 1998; Mackintosh *et al*., 2002; Lapping *et al*., 2002).
While densely populated areas showed improvement in weight, no impact was shown in sparsely populated areas in Nepal (Sternin *et al*., 1998).
Therefore more comprehensive studies need to look at the impact in different community settings based on community needs.

3.5.3 Community based nutrition project

Community based nutrition projects are crucial for poor, rural populations that are less accessible to health facilities (UN, 2004). Community based project is to improve the accessibility based on existing community resources to address child under nutrition (Mason *et al*., 2004; Menon *et al*., 2007).
Projects with community involvement are more likely to provide incentives for community participation and better accountability and sustainability and more efficient use of existing resources (Mansuri and Rao , 2004; UN, 2004).
A project implemented in Vietnam reported a significant decline in the prevalence of severely underweight conditions and iron deficiency anaemia in children by 17.2%, and 23.7 respectively (Daelmans and Martines, 2004). Another study showed that prevalence of anaemia among children under five decreased by 42% compared to non-project areas in Vietnam (Mason *et al*., 2004). An evaluation of a community based approach in Vietnam showed improvement of mothers' knowledge according to the complementary feeding of 9% to 20% compared to non-project areas (FAO, 2003).

Successful implementation of community based approaches in Vietnam, Bangladesh, and Cambodia were explained by strong public awareness raising campaigns to establish a supportive environment at the community level. According to the experience of a Thailand community based approach, an adequate ratio of CNWs and VMs is very crucial for achieving the target coverage, support and follow-up (Mason *et al*., 2006).

An essential part of the community based nutrition project identified in Bangladesh was adequate training, support, incentives for CNWs and functioning of the referral system (Marsh *et al*., 2002).

Although, several studies of community based nutrition approach were conducted, most were unable to rule out the influence of contextual factors.

4. CHAPTER: SURVEY METHOD

4.1 Survey area

The baseline and final evaluation surveys both were conducted in 11 soums in Selenge province. Nutrition Project was implemented for five years from 2005 to 2010 in this province.

4.2 Study type

The surveys were conducted in all (11) soums in Selenge province. Nutrition Project was implemented for five years from 2005 to 2010 in this province. The baseline survey was conducted in 2005 and no follow-up study was done until the evaluation survey which was conducted in 2010. The survey lacks a control group. The multi-staged random sampling and cluster grouping methods were used in both the baseline and evaluation surveys. The method first selected of a soum and determined the required number of clusters from each soum and estimated a total number of children under five. In the second stage of the method children aged 0-59 months were selected through random sampling within the selected cluster.
The pre and post intervention designs were applied in order to measure changes that occurred in child nutritional status before and after the project implementation. Both surveys included a questionnaire which was adapted from WVC' Health Survey and child anthropometric measurement, finger prick test for anaemia and clinical observation for rickets.
Variables and indicators for surveys explained and the types of data which were collected according to the conceptual framework are described in annex one.

4.3 Sampling procedure

4.3.1 Study population

Children under five, their mothers[17] and PLWs were sampled in the target soums.

4.3.2 Sample size

Appropriately sized samples of children under five and PLWs were calculated using the "Population survey" sample size function of the EPI-

[17]If the mother of child is absence, caretakers were interviewed instead

INFO 6 computer programme with a 95% of confidence interval and the power to detect a prevalence of anaemia difference between the baseline and evaluation surveys. The sample size of the baseline survey was calculated based on the prevalence of anaemia (24.1% among the children under five) of the third NNS which was conducted in 2004. The calculated sample size for the baseline survey was 276 children under five. The sample size for the evaluation survey was calculated according to the possible changes of the prevalence of anaemia among children under five by ±5% from the baseline data. The calculated sample size was 360 children based on the anaemia the 95% confidence level. The sample size of the evaluation was calculated to be chosen 398 children under five. The Sample size of PLWs was calculated as above with consideration of the fertility rate in province.

4.3.3 Sample selection

Both baseline and evaluation surveys used the multi-staged random sampling and cluster (25) grouping methods. The evaluation sample size was selected from the same population but not same target group as had been selected for the baseline survey. All soums of Selenge province were selected as survey areas as the nutrition project was implemented in all soums. In the first stage of sampling, the number of children who were supposed to be involved in the survey was calculated in comparison to the total number of children.

Table 2: Sample selection

Soums	Baseline 2005		Evaluation 2010	
	number of clusters	number of children under five	number of clusters	number of children under five
Altanbulag	1	14	1	16
Eruu	1	29	2	32
Tushig	1	16	1	16
Tsagaannuur	1	8	1	16
Bayangol	1	16	2	31
Mandal	2	28	6	97
Khuder	1	16	1	16
Saikhan	2	32	1	15
Orkhontuul	1	16	1	14
Sukhbaatar	3	50	3	81
Tushig	1	16	1	16
Sant	1	8	1	16
Baruunburen	1	14	1	16
Shaamar	1	13	1	6
Total	**18**	**276**	**25**	**398**

The next step was performed locally with the support of soums governors and doctors and doctors units based upon the registrations. Baghs were

chosen in line with the planned cluster numbers from every soum; at the third stages the study children aged 0-59 months were chosen in every selected bagh using a "Random selection table". Different numbers of children were selected from each bagh according to the large distances between rural families and the population size of the soum.
The study included 125 pregnant women who were living in the centre of soums and near soums, and at the households of selected children aged 0-59 months and their neighbourhood. The purpose of the study was to include all pregnant women, so it registered all pregnant women who were living in selected soums located in provincial centre.

4.4 Data collection procedure

4.4.1 Study approvals

The survey methodology was discussed at a meeting of the Medical Ethics Committee of the MOH which gave permission to conduct the survey. Survey approval was obtained from the Research Ethics Committee of the MOH. Approval was also given by PHI to the analysis and use of data by this thesis.

4.4.2 Ethical consideration

Survey permission was obtained by oral and written consent from every sampled family head and individual.

4.4.3 Survey team

Five teams of four interviewers and three medical doctors collected data for three weeks. Data collection was completed by five groups of three to five people. The survey team included a researcher from NRC and physicians, and interviewers were recruited from Ulaanbaatar. The mother of each selected child was interviewed by the surveyor. Medical doctors were responsible for the clinical examination and laboratory assessment. Each interview including the clinical examination and laboratory assessment took 45-50 minutes. Although the survey teams worked long hours due to poor road conditions in rural areas, the field work finished on time. NRC conducted the data entry.

4.5 Quality assurance

4.5.1 Pilot test

Physicians and interviewers were trained on the questionnaire and taking anthropometric measurements. In addition the survey team attended a field practice to identify problems that might occur during data collection. As a result of the pilot test of the questionnaire necessary adjustments

were made. All equipment - weighing scales, height measurement, and hemocue apparatus were pre-tested.

4.6 Data collection and techniques

Data collection was conducted jointly by NRC and PHI with the provincial health department. The survey used interviews, anthropometric measurements, clinical examinations and laboratory testing methods.

4.6.1 Interview

Interviews of caregivers, mothers and pregnant women were used to assess the feeding patterns, consumption of micronutrient supplements, and knowledge of various nutrition topics and household fortified food consumption. The interview questionnaire was adapted from WVC's Health Survey. The questionnaire included open and closed questions which were administrated to the mother of the sampled child.

4.6.2 Anthropometric Measurement

The prevalence of PEM, overweight conditions and obesity were assessed based on the anthropometric measurements of the weight and height of children under five and of lactating mothers and mid-upper arm circumference (MUAC) was taken of pregnant women.
Physicians measured the height of children with UNICEF electronic weighing scales with a precision of 100 g and measured the heights with and a wooden height measurement device. Children wore light clothes during the weighing as recommended by the UNICEF weighing guide.
Child growth was assessed based on z-scores calculated using the "WHO Child Growth Standard'' on the international growth curves. According to WHO recommendations, the weight, height and age of each child were assessed by standard percentile Weight/Age, Height/Age and Weight/Height indices (Annex one).

Figure 2: Child growth assessment

Z score (SD)	Growth indicators		
	Length/height-for-age	**Weight-for-age**	**Weight-for-length/height**
> 3.0			Obese
2.1-3.0			Overweight
Median			
-2.1 to -3.0	Stunting	Underweight	Wasting
<–3	Severe stunting (see below note)	Severe underweight	Severe wasting

Source:WHO, 2006

4.6.3 Laboratory Assessment

To diagnose anaemia and assess the prevalence of anaemia, haemoglobin levels were measured in peripheral blood obtained from children 0-59 months old, lactating mothers of children under two years, and from pregnant women using a hemocue system within high sensitive and specific, which is a common internationally accepted method in epidemiological surveys. Children and pregnant women having HB less than 11.0 g/dl and women having less than 12.0 g/dl were considered anaemic.

4.6.4 Physical examination

Clinical examinations consisting of observation and palpation was performed in young children to detect 18 classic signs of rickets. (Annex one)

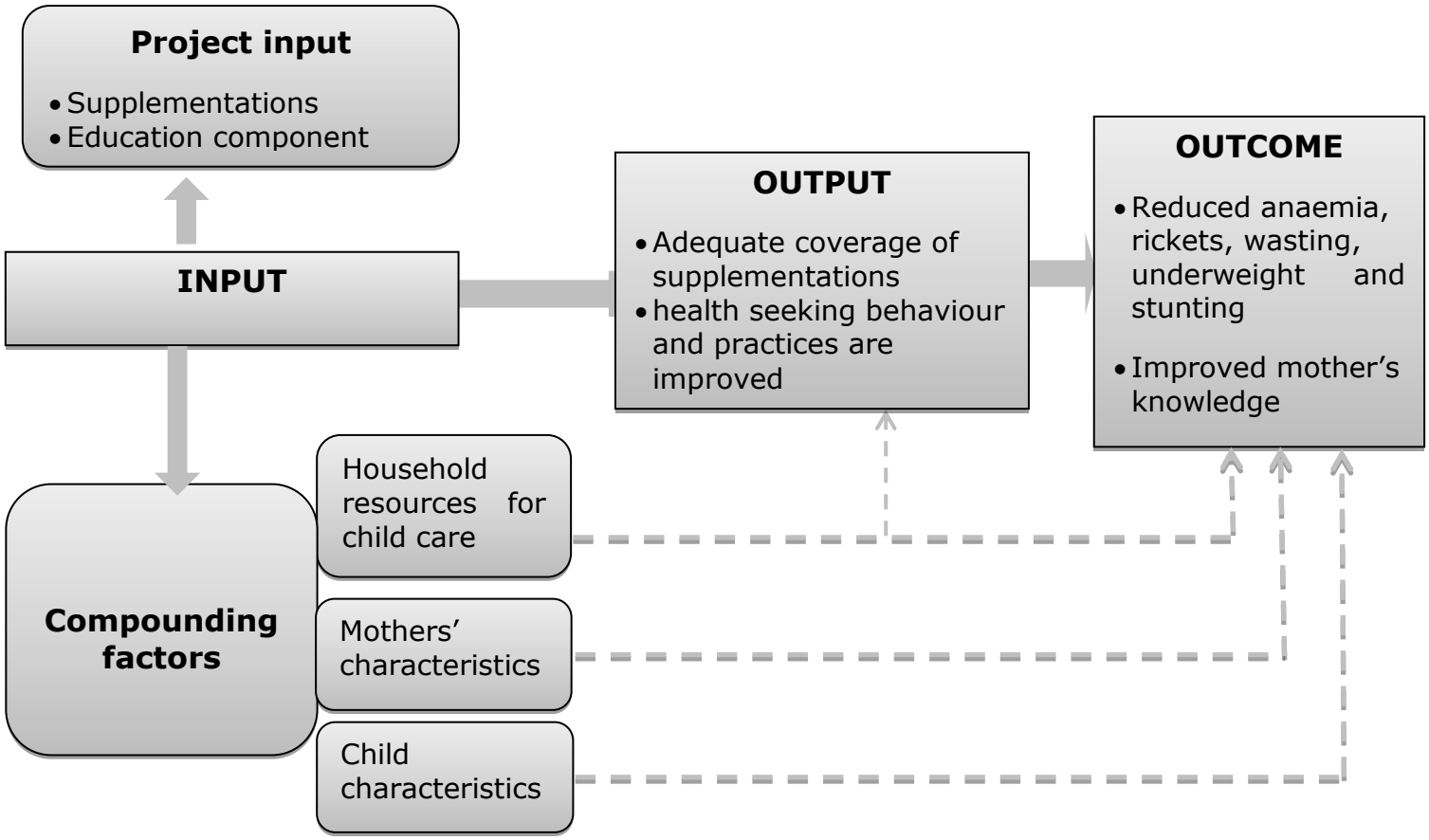
4.7 Data analysis

SPSS and EPI-INFO 6 computer software were used for the data analysis. The statistical significance of differences in prevalence and measures of central tendency between subgroups was calculated using Chi-square p value. P values were considered as follow: $p>0.005$ were non-significant, $p<0.005$ were significant, and $p<0.001$ were highly significant. A logistic regression method was applied to analyse the association between project input, demographic characteristic and child nutritional outcomes.

5. CHAPTER: SURVEY FINDINGS

As explained earlier in the adapted conceptual framework, a child's nutritional outcome depends on provision of health service, adequate care and household food resources. These require availability of resources which were explained as project and non-project inputs in this thesis. Survey findings will be analysed through the following logical framework in this chapter.

Figure 3: Framework for analysis



5.1 Demographic characteristics of the samples

Demographic characteristics were analysed in order to find out the possible compounding factors which could influence to child nutritional status.

5.1.1 Child characteristics

Table three below summarizes the distribution of children who participated in the survey by age and sex.

While the proportion of children who participated in the surveys compared by sex was similar, the proportion of children aged 0-23 months increased significantly from 42% to 49% (x^2=19.2, p<0.01).

Table 3: Child characteristic

Indicators		Baseline 276		Evaluation 360		X^2	P
		n	%	n	%		
Age	0-23	118	42	217	49	**19.2***	**0.000**
	24-59	158	57	143	50		
Sex	Boys	150	54	177	49	1.68	0.195
	Girls	126	45	183	50		

5.1.2 Mothers' characteristics

Table four shows that there were relatively many mothers who had a secondary education level but there was no significant difference among mother's education level before and after the project intervention (x^2=7.58, p>0.05).
Also there was no significant difference in employment status of mothers.

Table 4: Mothers' characteristics

Indicators		Baseline (276)		Evaluation (360)		X^2	P
		n	%	n	%		
Education level	Higher	63	22	100	27	**7.58***	**0.055**
	Secondary	195	70	226	62		
	Elementary	5	1.8	3	0.8		
	No education	13	4.7	31	8.6		
Occupation	Herders	17	6.1	31	8.6	1.34	0.246
	Non-herders	259	38	329	38		

Furthermore, table five below shows that herding mothers had a lower education compared to non-herding mothers (x^2=24.5, p<0.01).

Table 5: Association between mother's education level and occupation in the evaluation.

Occupation/education	Below secondary education		Above secondary education		X^2	P
	n	%	n	%		
Herders (31)	15	51	16	48	**24.5***	**0.000**
Non-herders (329)	51	15	278	84		

5.1.3 Household characteristics

The income of single member surveyed households was estimated and compared with regional averages[18]. Poverty is high in the study area. Table six shows the household income and livestock holding and there was no significant difference in baseline and evaluation (x^2=3.29, p>0.05).

Table 6: Household characteristics

Resources for child care		Baseline (276)		Evaluation (360)		X^2	P
		n	%	n	%		
Income level	Poor	201	73.8	238	66.2	3.29	0.070
	Non-poor	75	26.2	122	33.8		
Livestock	Available	68	24	156	43	**23.9***	**0.000**
	Not available	208	75	204	56		

The proportion of families with livestock availability increased from 24% in the baseline survey to 43% in the evaluation survey (x^2=23.9 p<0.01).

5.2 Nutrition Project interventions

It is crucial to evaluate whether the nutrition project inputs were sufficient to achieve the target outcomes in order to analyse children's nutritional outcome where observed in the evaluation. Coverage of the vitamins and minerals were analysed in a relation household resources and mother's characteristics.

5.2.1 Efficacy of Sprinkles

As shown below in table seven the surveys found a statistically significant increase (x^2=31.3, p<0.001) in use of Sprinkles from 2.2% in the baseline to 58.3% in the evaluation.

Table 7: Consumption of Sprinkles

Use of Sprinkles	Baseline (276)		Evaluation (398)		X^2	p
	n	%	n	%		
yes	6	2.2	142	58.3	**31.3***	**0.000**
no	269	97.8	203	51.0		

Although Sprinkles consumption increased since the baseline, there was no significant (x^2=2.03, p>0.001) progress made in percentage of duration of usage compared to the baseline. In total 51.0% of the surveyed children under five used Sprinkles. Out of those children,

[18] According to the National statistical Office, regional average income were 14.3US$ in 2006, 62.3 US$ in 2011.

59.1% had consumed Sprinkles for more than two months, while 39% had consumed them for less than two months.

Table eight demonstrates that Sprinkles consumption was significantly different in different age groups. For instance, it was high among children 6-35 months old. Furthermore, children of 6-35 months almost reached the 80% target only nearly one third of the children 36-59 months received Sprinkles.

Table 8: Sprinkles consumption by age group

Children under five		Consumption	
Age/ months	total	n	%
0-5	50	0	0
6-11	59	36	61.0
12-17	66	45	68.0
18-23	48	37	77.1
24-29	40	26	65.0
30-35	32	22	68.8
36-41	36	14	38.9
42-47	21	7	33.3
48-53	28	9	32.1
54-59	18	7	38.9

However, 59% of children 6-23 months old and 62.4% of children 24-59 months old used more than 60 sachets, and 18% of children were not taking Sprinkles on a daily basis.

According to the evaluation there was no difference in use of Sprinkles in relation to the mother's occupation, household livestock availability or household income (Table nine).

Table 9: Sprinkles usage regarding mother's occupation in evaluation

Mother's occupation	Used		Not used		X^2	p
	n	%	n	%		
Herder (31)	18	58.0	13	41.9	0.038	0.843
Non-Herders (329)	185	56.2	144	43.7		

5.2.2 Consumption of Vitamin D

As table ten shows, there was a statistically significant increase from 35.1% to 78.3% (x^2=100, p<0.01) in the proportion of children using Vitamin D. Also a significant increase in use of Vitamin D in both children 0-23 months (x^2=8.34, p>0.001) and 24-59 months (x^2=46.4, p<0.001). Additionally, a significant number (x^2=11.5, p<0.01) of children were using Vitamin D supplements with the preventative purpose.

Table 10: Vitamin D consumption in different age groups

Age groups/months	Baseline		Evaluation		X^2	P
	n	%	n	%		
0-23 n1=83 n2=223	66	79.5	204	91.5	**8.34***	**0.004**
24-59 n1=223 n2=175	31	14	78	77.6	**46.4***	**0.000**
0-59 n1=276 n2=360	97	35.1	282	78.3	**100***	**0.000**

However while consumption of Vitamin D increased compared to the baseline, the proportion of children who used a sufficient dose to give an effect (5-9 tablets) was insufficient (44.0%) and was significantly higher (x^2=38.3, p<0.001).

As presented below in table 11, the proportion of children who used the Vitamin D as tablets significantly increased (x^2=126, p<0.000) compared to baseline.

Table 11: Dosage and forms of Vitamin D

Vitamin D		Baseline 56		Evaluation 282		X^2	P
		n	%	n	%		
Tablets in piece	1-4	14	26.1	122	44.0	**38.3***	**0.000**
	5-9	12	21.7	112	40.4		
	10-13	29	52.2	42	15.5		
Forms	tablet	23	41.1	275	98.2	**126***	**0.000**
	drop	51	73.2	7	2.5		

Furthermore, the study demonstrates that the mothers' education was not associated with the usage of Vitamin D (Table 12).

Table 12: Consumption of vitamin D regarding to mother's education in evaluation

Mother's education level	Not used		Used		X^2	P
	n	%	n	%		
Non-educated (1)	0	0	1	100	0.325	0.850
Secondary (229)	52	22	191	83		
Higher (100)	26	26	90	39		

5.2.3 Consumption of iron supplement among lactating women

Table 13 reveals that there was statistically significant increase in the consumption of iron tablets among LMs (x^2=28.3, p<0.001) between the baseline and the evaluation surveys.
LMs with young children were more likely to use iron supplement than those with older children. Relatively low levels of anaemia were observed among LMs with children aged 0-5 and 6-11 month old children.

Table 13: Consumption of Iron tablet among lactating mothers

Iron tablet	Baseline (118)		Evaluation (157)		X^2	P
	n	%	n	%		
Lactating mothers	25	21	83	52	**28.3***	**0.000**

The haemoglobin level was determined for 158 LWs with children under two years old and 39.6% of their children were identified with anaemia, whereas 34.2% of children for those LWs observed with no anaemia were recorded with anaemia.

The prevalence of anaemia among children from those mother who had anaemia (62.1%) is 1.8 times higher than above (OR=3.1, CI [1.27-7.9]). Interestingly, mothers aged 13-19 (16.7%) years old were more exposed to anaemia than mothers aged 20-29 (8.0%) and 30-39 (6.8%).

5.3 Maternal knowledge on nutrition and child caring practices

5.3.1 Breastfeeding

Table 14 below shows that there was a statistically significant increase in knowledge of the recommended duration of exclusive breastfeeding and continuation of breastfeeding (x^2=26.0, p>0.001 and x^2=8.03, p>0.001).

Table 14: Mothers' knowledge on exclusive breastfeeding

Indicators	Baseline (276)		Evaluation (360)		X^2	P
	n	%	n	%		
Knowledge on the duration of exclusive breastfeeding (six months)	153	55	269	74	**26.0***	**0.000**
Knowledge on continuation of breastfeeding (two years)	140	50	223	61	**8.03***	**0.005**

5.3.2 Complementary feeding

Mothers' knowledge on the main principle of feeding a child aged 6-24 months is summarized in below table 15.
As presented below, there was a statistically significant decrease in the knowledge of breastfeeding when a child wants (x^2=82.7, p<0.001). Mothers who had a knowledge of the sufficient portion of servings and separate food preparation was significantly decreased (x^2=38.8, p<0.001 and x^2=38.3, p<0.001).

Table 15: Mother's knowledge on feeding principles of children 6-24 months

Knowledge on principles feeding of children aged 6-24 months	Baseline 276		Evaluation 360		X^2	P
	n	%	n	%		
Breastfeeding when a child wants	200	72	130	36	**82.7***	**0.000**
Several food choices	159	44	203	56	3.090	0.079
Sufficient portion of serving	75	27	31	8.6	**38.8***	**0.000**
To prepare separate food for child	171	61	134	37	**38.3***	**0.000**
Support to eat	124	44	27	7.5	0.05	0.010

Table below 16 shows that mothers' knowledge of feeding frequency as recommended by WHO for children was significantly increased (x^2=9.50, p>0.002).

Table 16: Mother's knowledge on child feeding frequencies

Indicators	Baseline		Evaluation		X^2	P
	n	%	n	%		
Mothers of children aged 0-23 months who answered correctly n1=118 n2=223	54	45	94	42	0.40	0.522
Mothers of children aged 24-59 months who answered correctly n1=158 n2=137	132	83	130	94	**9.50***	**0.002**

Thirty per cent of children 0-5 months of age had been given complementary food, meaning that approximately one third of children started complementary feeding before the appropriate age. In fact use of complementary food among children under six months significantly decreased from 61% to 28% (x^2=8.73, p<0.001).

Although the survey findings revealed that for about 80% of children under two years old and who were on complementary food is prepared separately and they were given support during the feeding (Table 17).

Table 17: Practice of supporting child during the feeding

Indicators		Baseline (92)		Evaluation (188)		X^2	P
		n	%	n	%		
Food is prepared separately	Yes	66	71.7	140	74.5	3.61	0.057
	no	26	28.3	31	16.5		
Provision of support for feeding	Yes	68	73.9	150	79.8	**6.73***	**0.009**
	no	24	26.1	23	12.2		

In the contrary one in every five children received food that was not prepared separately.

The study showed that there was positive significant improvement in provision of support during their feeding (x^2=6.73, p>0.001).
Consumption of dairy products and meat increased from 76.5% to 83.8% and 66.5% to 92.5% respectively among children of 6-23 months.

5.3.3 Health seeking practices

Mother's knowledge on health seeking behaviour is summarized in table 18 below. The data shows that significantly few mothers identified the cause of rickets (x^2=5.40, p<0.020) but it improved from 22% to 31%.

Table 18: Mother's knowledge of health seeking behaviour

Indicators	Baseline 276		Evaluation 360		X^2	P
	n	%	n	%		
Knowledge of causes of rickets (insufficient food, not taken vitamin D, lack of sun exposure) n1=275 n2=360	62	22	111	31	**5.40***	**0.020**
Knowledge of causes of anaemia (insufficient nutrients, bleeding (menstrual), multiple births) n1= 275 n2=348	56	20	139	38	**27***	**0.000**
Knowledge of prevention of rickets (sun exposure , vitamin D, dairy products) n1= 275 n2=360	65	23	113	31	4.64	0.031
Knowledge on anaemia prevention and treatment (iron supplement, livestock liver, meat) n1= 275 n2=348	80	29	160	44	**15.6***	**0.000**

Furthermore, the comparison revealed that there was a statistically significant increase in mothers' knowledge of the cause of anaemia (x^2=27, p<0.001). Mothers' knowledge on anaemia prevention statistically increased (x^2=15.6, p<0.001).

However there was no statistically significant increase observed in mother's knowledge of the prevention of rickets which increased by 8%.

Table 19 below shows that mothers' knowledge of the importance of iron tablets significantly improved (x^2=57.1, p<0.001) while the proportion of mothers who knew that pregnant women should attend to ANC within 3 months slightly decreased from 79% to 71% in the evaluation survey.

Table 19: Mothers' knowledge on iron during the pregnancy and ANC visit

Mother knowledge of	Baseline 276		Evaluation 360		X^2	P
	n	%	n	%		
Importance of iron tablet	66	44	193	57.1	**57.1***	**0.000**
ANC visit within three month	218	79	305	71.6	3.52	0.061

5.4 Behavior outcomes

5.4.1 Breastfeeding

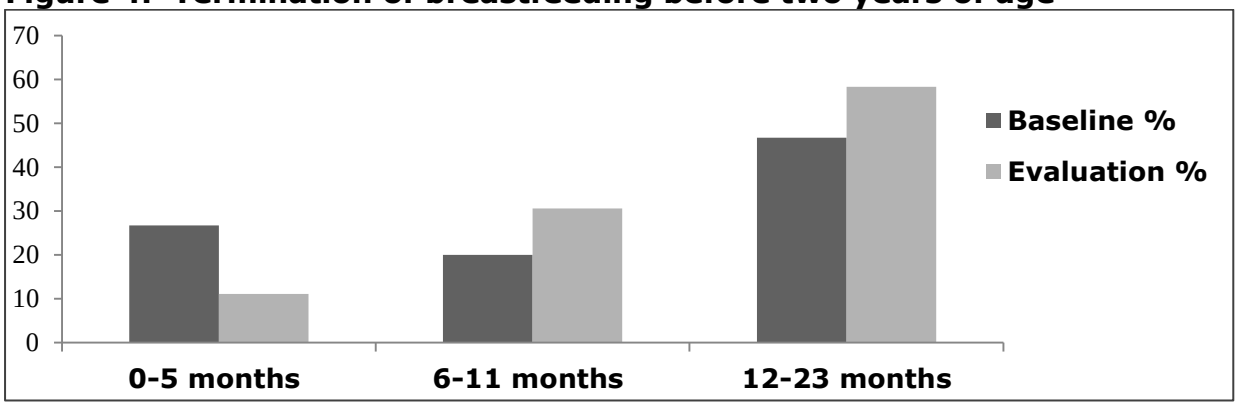
As presented in table below 20, exclusive breastfeeding among children 0-5 months old significantly decreased (x^2=5.2, p>0.001) while continuation of breastfeeding children aged 6-23 months (x^2=18.1, p<0.001) increased.

Table 20: Prevalence of breastfeeding among children under two

Indicators	Baseline		Evaluation		X^2	P
	n	%	n	%		
Children 0-5 months who were exclusively breastfed n1=33 n2= 50	23	69	22	44	**5.2***	**0.021**
Children aged 6-23 months who continued breastfeeding n1=171 n2=173	99	35	137	79	**18.1***	**0.000**

So, although the duration of exclusive breastfeeding decreased (p=0.021), the percentage of children breastfed between 6-23 months increased (p<0.001).

Figure 4: Termination of breastfeeding before two years of age



According to the evaluation survey 79% of children 6-23 months continued breastfeeding into their second year (figure four). Although exclusive breastfeeding decreased among the children of 0-5 months,

figure five shows that fewer women stopped breastfeeding during that period.
The study showed that giving a breast milk substitutes, milk and feeding child with meals prior to six months decreased significantly (x^2=61.2, p<0.001) and (x^2=2.923, p<0.087) respectively.

5.4.2 Complementary feeding

No significant difference observed in children's age at initiation of complementary feeding was observed. However table 21 below shows that the frequency of feeding was not adequate for their age and there was a statistical increase at the evaluation survey (x^2=6.5, p>0.001).

Table 21: Age of introduction of complementary foods

Complementary feeding	Baseline		Evaluation		X^2	P
	n	%	n	%		
Timely introduction n1=92 n2=188	41	44	105	55.9	3.15	0.075
Feeding frequency>3-4 times n1=250 n2= 129	153	61	96	74.6	**6.5***	**0.010**

5.5 Nutritional outcomes

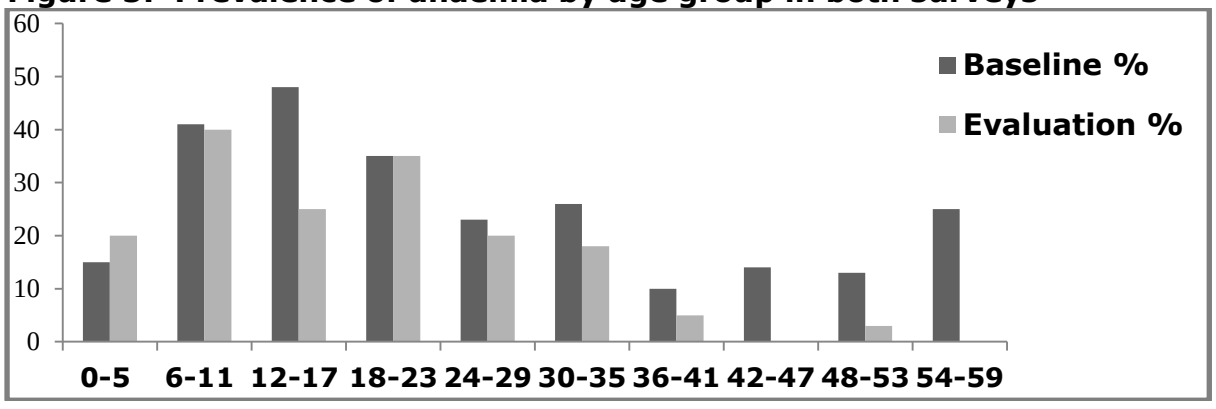
5.5.1 Anaemia in children under five

As shown in table 22 the prevalence of anaemia among children 0-59 months decreased from 25% to 21% which was not statistically significant.

Table 22: Prevalence of anaemia

Age in months	Baseline		Evaluation		X^2	P
	n	%	n	%		
0-23 months (n1= 118 n2= 217)	40	34.2	66	30.6	0.429	0.512
24-59 months (n1=276 n2= 360)	70	25.5	85	21.5	0.625	0.610

Figure 5: Prevalence of anaemia by age group in both surveys



Looking at age groups (figure five) on the below figure the prevalence of anaemia among children aged 0-23 months was "moderate" while among children 24-59 months was it was "mild". The prevalence of anaemia among these two age groups was significantly different (x^2=25.1, p<0.001).
The prevalence of anaemia among 6-11, 12-17 and 18-23 month old children were significantly high (X^2= 40.0, p<0.001) although while the prevalence of anaemia tended to decreased among the children of all age groups, a significant decrease showed only among children of 12-17 months (X^2=4.6, p<0.05).
Furthermore, boys are more likely than girls to have "moderate" anaemia (x^2=7.3, p<0.05).

5.5.2 Rickets in children under two

As presented in table 23 below, the prevalence of rickets decreased significantly (x^2=10.3, p=0.001). The prevalence of rickets was significantly different among children of different age groups.

The lowest prevalence of rickets was observed among 18-23 month old children (x^2=25.9, p<0.001) and tended to decrease with age. This fact is related to significant decrease in prevalence of rickets among children 12-17 months old (x^2=8.96, p>0.001) and 18-23 months old (x^2=25.9, p<0.001), respectively.

Table 23: Prevalence of rickets by age group

Age group/ months	Baseline		Evaluation		X^2	P
	n	%	n	%		
0-5 n1=33 n2=48	12	36.4	24	50	1.47	0.225
6-11 n1=24 n2=58	12	50	31	53.4	2.46	0.117
12-17 n1=30 n2=65	20	66	22	33.8	**8.96***	**0.003**
18-23 n1=31 n2=46	25	80.6	10	21.7	**25.9***	**0.000**
0-23 n1=118 n2=217	69	58.5	87	40.1	**10.3**	**0.001**

Furthermore, there was a significant decrease in the percentage of children with residual signs of rickets compared to the baseline (x^2=79.2, p<0.001).

5.5.3 Protein energy malnutrition in children under five

The findings in the table 24 below for the prevalence of PEM shows a statistically significant decrease in prevalence of stunting from 16% to 6.3% (x^2=14.0, p<0.001) and of being underweight from 5.1% to 1.8% (x^2=23.8, p=0.001).

Table 24: Prevalence of PEM

Forms of PEM %	Baseline 276		Evaluation 360		X^2	P
	n	%	n	%		
Wasting	6	2.2	2	0.6	3.29	0.069
Underweight	14	5.1	14	1.8	**23.8***	**0.000**
Stunting	45	1.4	25	6.3	**14.0***	**0.000**

In the comparison of two age groups, the prevalence of stunting was relatively different among children aged 0-23 months than among 24-59 months old children (x^2=3.2, p=0.07).

5.6 Association between inputs and outcomes

A logistic regression statistical analysis used to explore the associations intended based on the logistic framework (figure three).

To explore the significant association between inputs and child nutritional outcomes binary logistic regression method was used.

5.6.1 Association between inputs and child micronutrient deficiencies

Table 25 presents the association between background characteristics and anaemia.

Table 25: Association between inputs and anaemia

Anaemia		**OR**	**95%**	**CI**	**P**
Background characteristics	Family size (4+/1-3)	**1.17**	1.053	1.307	0.003
	Livestock availability (No/Yes)	1.23	0.855	1.786	0.259
	Household income poor/non-poor	0.81	0.565	1.186	0.291
	Education (No/Yes)	0.94	0.814	1.097	0.461
	Mothers occupation Herders/Non-Herders	1.05	0.971	1.140	0.213
	Age/months (0-23/24-59)	**0.31**	0.200	0.485	0.000
	Sex (girl/boy)	1.11	0.717	1.730	0.630
Project Interventions	Sprinkles consumption (No/Yes)	**1.92**	1.245	2.979	0.003
	Vitamin D consumption(No/Yes)	**1.67**	1.049	2.675	0.030
	Mothers training attendance (No/Yes)	1.06	0.734	1.542	0.734
	Knowledge on cause of anaemia (No/Yes)	0.86	0.532	1.397	0.547
	Knowledge on prevention of anaemia (No/Yes)	1.05	0.665	1.660	0.829
	Knowledge on the duration of Exclusive breastfeeding(No/Yes)	1.14	0.940	1.392	0.177

Among the background characteristics, child age and family size were significantly associated with child anaemia status.

The odds of anaemia increased significantly with increasing family size. Children who live in households with four or more members were most probably to be anaemic than those who lived in families with less than four members (OR=1.17, 95% CI [1.053-1.307], P>0.001).

Furthermore, as presented above in table 25, the odds of being anaemic is less likely among children under two years of age than children of two years or more (OR=0.311, 95% CI[0.200-1.485], P<0.005).Children who consumed Sprinkles were half as exposed to anaemia than who did not (OR=1.926, 95% CI [1.245-2.979], P<0.05). Also, the likelihood of anaemia was 1.5 times higher among the children who didn't consume Vitamin D (OR=1.675, CI [1.049-2.675], P<0.05).

Associations between background characteristics and child rickets status are shown below in table 26.

None of the background characteristics were associated with rickets but among the education component mothers' knowledge on the prevention of rickets was significantly associated with child rickets (OR=1.936, CI [1.234-3.036], p<0.05).

Table 26: Association between inputs and rickets

Rickets		**OR**	**95%**	**CI**	**P**
Background characteristics	Family size (4+/1-3)	1.04	0.948	1.155	0.361
	Livestock availability (No/Yes)	0.92	0.667	1.281	0.640
	Household income poor/non-poor	0.79	0.579	1.091	0.152
	Education (No/Yes)	0.94	0.814	1.097	0.461
	Herders/Non-Herders	1.05	0.971	1.140	0.213
	Age/months (0-23/24-59)	1.20	0.831	1.750	0.322
	Sex (boy/girl)	0.72	0.502	1.055	0.093
Project Interventions	Sprinkles consumption (No/Yes)	0.91	0.609	1.385	0.686
	Vitamin D consumption (No/Yes)	0.86	0.554	1.341	0.512
	Mothers training attendance (No/Yes)	0.84	0.606	1.164	0.296
	Knowledge on the cause of rickets (No/Yes)	1.00	0.728	1.398	0.956
	Knowledge on the prevention of rickets (No/Yes)	**1.93**	1.234	3.036	0.004

5.6.2 Association between inputs and child macronutrient deficiencies

Table 27 below presents the association between background characteristics, project interventions and stunting.

The odds to be stunted are twice as high for a child under two than for a child two years or more (OR=1.92, 95% CI [1.037-3.574], p<0.05).

Furthermore, child meat consumption was strongly associated with child stunting. The odds of being stunted are three times as high for child who does not consume meat than for a child who does (OR=3.54, CI [2.078-6.042], p<0.01).

Mother's knowledge of child feeding and caring practices was significantly associated with child stunting with the odds of being stunted being 0.8 less among the children whose mothers has a good knowledge of feeding frequency than those whose mother has no knowledge (OR=0.77, CI[0.603-0.996], P<0.05).

Table 27: Association between inputs and stunting

Stunting		**OR**	**95%**	**CI**	**P**
Background characteristics	Family size (1-3/4+)	1.06	0.914	1.235	0.427
	Livestock availability (No/Yes)	0.88	0.514	1.509	0.645
	Household income poor/non-poor	0.69	0.402	1.193	0.185
	Education (No/Yes)	0.98	0.879	1.101	0.782
	Occupation Herders/Non-Herders	0.83	0.463	1.517	0.561
	Age/months (0-23/24-59)	1.92	1.037	3.574	0.037
	Sex (boy/girl)	0.83	0.463	1.517	0.561
	Meat consumption (No/Yes)	3.54	2.078	6.042	0.000
Project Interventions	Sprinkles consumption (No/Yes)	0.35	0.144	1.858	0.121
	Vitamin D consumption (No/Yes)	1.16	0.557	2.439	0.684
	Mothers training attendance (No/Yes)	1.06	0.627	1.790	0.827
	Main principles of food (No/Yes)	1.20	0.714	2.035	0.483
	Frequency of food (No/Yes)	0.77	0.603	0.996	0.270

The associations between background characteristics, project interventions and children being underweight shown are below in table 28.

As shown above in table 28 , the odds of being underweight were four times (OR=4.55, 95% CI [1.17-17.72], p<0.05) higher among children under two than among children two years or older.

Table 28: Association between inputs and being underweight

Underweight		OR	95%	CI	P
Background characteristics	Family size (1-3/4+)	1.07	0.831	1.377	0.599
	Livestock availability (No/Yes)	1.12	0.459	2.763	0.793
	Meat consumption (No/Yes)	3.67	1.452	9.318	0.004
	Household income	1.18	0.493	2.865	0.699
	Education (No/Yes)	1.04	0.722	1.522	0.804
	Occupation Herders/Non-Herders	1.06	0.869	1.304	0.540
	Age/months (0-23/24-59)	**4.55**	1.170	17.72	0.026
	Sex (boy/girl)	1.38	0.477	4.000	0.556
Project Interventions	Sprinkles consumption (No/Yes)	0.16	0.020	1.273	0.083
	Vitamin D consumption (No/Yes)	1.78	0.568	5.583	0.322
	Mothers training attendance (No/Yes)	0.54	0.196	1.502	0.239
	Main principles of food Yes/No	1.31	0.541	3.210	0.548
	Frequency of food (No/Yes)	1.03	0.392	2.743	0.942

The association between background characteristics, project interventions and wasting are explained below in table 29.
The study observed that amongst the project interventions, only Vitamin D was associated with wasting. The odds of wasting were significantly higher among the children who were not using Vitamin D (OR=7.22, 95% CI [1.689-30.92], p<0.05) than those who were.

Table 29: Association between inputs and wasting

Wasting		OR	95%	CI	P
Background characteristics	Family size (1-3/4+)	1.102	0.751	1.617	0.616
	Livestock availability (No/Yes)	0.602	0.120	3.011	0.536
	Meat consumption (No/Yes)	5.18	1.029	26.13	0.047
	Household income	0.945	0.223	3.989	0.938
	Education (No/Yes)	0.717	0.415	1.238	0.232
	Occupation Herders/Non-Herders	0.833	0.623	1.113	0.217
	Age/months (0-23/24-59)	0.730	0.139	3.816	0.709
	Sex (boy/girl)	3,815	0,604	24,09	0,154
Project Interventions	Sprinkles consumption (No/Yes)	0.273	0.030	2.422	0.244
	Vitamin D consumption (No/Yes)	**7.22**	1.689	30.92	0.007
	Mothers training attendance (No/Yes)	0.249	0.030	2.036	0.195
	Main principles of food Yes/No	0.99	0.243	4.066	0.991
	Frequency of food (No/Yes)	1.23	0.244	6.255	0.792

Furthermore, child meat consumption was significantly associated with child wasting as the odds of being wasted were five times as high for children who did not consume meat than those for who did (OR=5.18, CI[1.029-26.13], p<0.01).

5.6.3 Association between significant inputs and child nutritional outcomes

A multinomial logistic regression model was applied to test if child nutritional outcomes were associated with project inputs after adjusting for possible compounders and to assess the impact of the inputs.
All variables that were significantly associated ($p<0.05$) with any child nutritional outcomes were included as covariates from the above univariate logistic regression.
Covariates included family size, child meat consumption, child age, mothers' knowledge and Vitamin D consumption.

As presented below in table 30, the odds of a child being anaemic for the children who live in families with more than four members after adjusting for the other interventions was still significant (OR=1.164, CI[1.047-1.306], $p<0.05$).
Children of 0-23 months who were living in households with more than four members were more susceptible to anaemia.

Table 30: Impact of the inputs on anaemia

Input /Anaemia	OR	95%	C.I.	P
Family size 4+/1-3	**1.569**	1.0471	1.3061	0.0055
Child age/ months (0-23/24-59)	**0.393**	0.2573	0.6002	0.0000
Sprinkles consumption (No/Yes)	1.1975	0.7390	1.9403	0.4643
Vitamin D consumption (No/Yes)	1.4822	0.9178	2.3937	0.1075

Furthermore, the results show that the effectiveness of a project intervention of supplementation for anaemia was no longer significant after adjusting with possible compounding factors.

As presented below in table 31, there was no significant association between mothers' knowledge and rickets after adjusting with possible compounding factors.

Table 31: Impact of the inputs on rickets

Input/rickets	OR	95%	C.I.	P
Family size 1-3/4+	1.0489	0.9499	1.1582	0.3452
OccupationHerders/Non-Herders	0.9832	0.9204	1.0503	0.6147
Knowledge on rickets (No/Yes)	1.0000	1.0000	1.0000	0.5502

As shown in table 32 below, child meat consumption was associated with child stunting after adjusting with possible compounding factors. The odds of being stunted was three times higher for children who do not consume meat than for those who do (OR=3.34, CI [1.95-5.73], $p<0.05$).

Table 32: Impact of the inputs on stunting

Input/stunting	OR	95%	C.I.	P
Family size 1-3/4+	1.0820	0.9248	1.2658	0.325
Child age/ months (0-23/24-59)	1.4176	0.8186	2.4546	0.212
Meat consumption (No/Yes)	**3.3484**	**1.9536**	**5.739**	**0.000**

Similarly, as presented in table 33, children 0-23 months and who were not consuming meat were more susceptible to being underweight. Thus meat consumption was a significant characteristic after adjusting with compounding factors.
The odds of being underweight were four times higher for children under two years, and two times higher for children who did not consume meat than those who consume meat and children two years or older.

Table 33: Impact of the inputs on underweight

Input/underweight	OR	95%	C.I.	P
Family size 1-3/4+	1.1073	0.8514	1.4402	0.4471
Child age/ months (0-23/24-59)	**4.5388**	**1.3023**	**15.819**	**0.0176**
Meat consumption (No/Yes)	**2.8656**	**1.1237**	**7.3081**	**0.0275**

As shown below in table 34, the impact of the Vitamin D was greatest among the children who were wasted.
Furthermore the odds of being wasted were four times higher for children who were not consuming meat than for those who were (OR=4.5, CI [0.90-23.28, $p<0.05$).

Table 34: Impact of the inputs on wasting

Input/wasting	OR	95%	C.I.	P
Family size 1-3/4+	1.1670	0.7573	1.7982	0.4840
Vitamin D consumption (No/Yes)	**4.5108**	**1.0810**	**18.822**	**0.0387**
Meat consumption (No/Yes)	**4.5842**	**0.9026**	**23.283**	**0.0463**

Vitamin D supply was significantly associated with child wasting after adjusting for possible compounding factors. The odds of being wasted were four times higher for children who were not taking Vitamin D than for those who were (OR=4.5, CI [1.08-18.82, $p<0.05$).

However, family size was no longer associated with child macronutrient outcomes after adjusting for possible compounding factors.

6. CHAPTER: DISCUSSION, CONCLUSION AND RECOMMENDATION

6.1 Discussion

This study is aiming to analyse the nutritional status of children in Selenge province in relation to the nutrition project implementation. Moreover, it is to find the association between the nutrition project interventions and observed changed in child nutritional outcomes.

Although 64% of families were reported as a poor in the evaluation, there was an increase in income due to mining sector development in Selenge province since 2006 (GOM, 2008). According to the government report the proportion of families with livestock availability increased, but it was still not sufficient to meet herder household's needs (GOM, 2009).

In summary, the study findings showed that changes observed before and after the project implementation were likely to contribute to the significant impact of the child growth.
The findings of this study are that family size; child age, meat consumption, and mothers' education were significantly associated with child nutritional outcomes and influenced child nutritional status, independently from the project. However, family size has a potentially negative effect on child nutritional outcomes. Among the project interventions the education component and Vitamin D consumption were most effective for the improvement of child nutritional outcomes.

6.1.1 Nutrition project interventions

Efficacy of Supplementation

Unfortunately the nutrition project was not able to reach the planned 80% target due to the weak project achievement. Sprinkles consumption increased from 2% in the baseline survey to 58.3 % in the evaluation survey. Failure to enrol the children at 36-59 months affected the low coverage of supplementation. Apart from the increase in consumption there was no progress made in the percentage of duration of usage compared to the baseline. However, the Sprinkles effectiveness study in Cambodia showed that two months of consumption is effective in reducing anaemia among 9-24 month old children (Ip *et al*., 2009; Michelson *et al*., 2009).
According to the evaluation survey, 40% of children 6-23 months old consumed Sprinkles for a short period (less than two months) which would be anticipated to have an impact on their anaemia status. However, children who consumed Sprinkles for more than two months were two times less likely to suffer anaemia. Sprinkles were more effective for the children who were anaemic regardless of age. However, a

study conducted in Haiti revealed a greater impact of Sprinkles among younger child (Menon *et al*., 2007).

A satisfactory seventy eight per cent of children under five consumed Vitamin D in the evaluation survey although adequate duration and intake were not achieved. Furthermore, the odds of being wasted were four times higher for children who were not taking Vitamin D. Although, consumption of Iron among breastfeeding mothers significantly increased to 52%, the project was not able to achieve target coverage of 80%.

The consumption of Sprinkles among the children 18 times, iron supplements consumption increased by two times compared with the baseline (Table 7, 13). An increase in the distribution of supplementation could be related to the community based distribution through VMs who were played an important role in encouraging the mothers in relation to child care (Deitchler *et al*., 2004). However, effective coverage of the target population was not included in the monitoring and reporting system.

Although, the robustness of the association between Sprinkles and anaemia supported the study findings, the limited success of anaemia reduction could be explained by supplementation intakes being insufficient among some age groups to have a positive effect.

Although a clinical study showed that the side effects of Sprinkles are minimal (Liyanage *et al*., 2002) mothers observation of side effects such as dark and watery faeces might have caused the incomplete use of supplementation. Thus, Sprinkles are better than traditional iron supplementation projects that face challenges of compliance (Menon *et al*., 2007).

Knowledge and behaviour

Although, exclusive breastfeeding among children of 0-5 months decreased by 25%, the percentage of children breastfed between 6-23 months increased by 44%. Inadequate knowledge of mothers led to inadequate feeding practices such as giving any fluid or solid food for the children or stopping breastfeeding before age of six months. In addition, the fact that insufficient food portions, insufficient choice of food, and non-separate food preparation were observed suggests inadequate knowledge of the main principle on child feeding practices (Table 15).

Mothers' knowledge of rickets was significantly associated with child rickets. The study findings revealed that the education component of the nutrition project was the key to improving the children's' nutritional outcome. Generally, the mother's knowledge on the child feeding and

caring, and health seeking behaviour improved significantly compared to the baseline. Thus, the study demonstrated that community based education components were the successful part of the project.
However, inadequate knowledge and beliefs of mothers such as feeding meat too early could be the main reason for the poor practices. However, the isolation of herder families is critically related to education *(*Mason *et al.,* 2006; FAO, 2003) and the VM's role was crucial to convey the messages. On the other hand, the training messages could be more practical and suitable in the local context.

6.1.2 Child nutritional outcomes

Anaemia

The project was unable to meet the anaemia prevalence target which was only reduced from 25.5% to 21% which is not significant. Apart from the increase among the children of 0-5 months, the anaemia prevalence decreased among the children of all other age groups and a significant decrease showed among children 12-27 months old. Furthermore, the observed increase in anaemia among the children of 0-5 months can be explained by the low rate of exclusive breastfeeding (Allen *et al*., 2005; Krebs and Hambidge, 2007).
An "Efficacy and effectiveness of Sprinkles" study conducted in the Western provinces of Mongolia demonstrated that Sprinkles were the main contributing factor for anaemia reduction apart from the quality of complementary food (Lander *et al*., 2008).

A recent study conducted in Haiti showed that Sprinkles intervention is more effective for anaemic children regardless of age than for non-anaemic children (Menon *et al*., 2007). The study revealed that there was a significant association between Sprinkles and child anaemia status. Children who consumed Sprinkles were half more exposed to anaemia than those who did not. Also, the prevalence of anaemia was higher among the children under two years old.
However, a recent study in Sri Lanka showed that anaemia is strongly associated with socio-economic factors and mothers' education level (Menon *et al*., 2007).

There was a statistically significant difference in anaemia prevalence among different size families. Children 0-23 months old who were living in a household with more than four members were estimated to be 1.5 times more likely to be anaemic. However, a survey in Vietnam reported that anaemia prevalence is not associated with household size.
The study conducted in Vietnam showed that anaemia is strongly associated with socio-economic factors and mothers' education level (Marsh *et al*., 2002).

Rickets

The project reduced the rickets prevalence from 59% to 40% but was unable to reach the target of 30%. The increased proportion of children of 0-11 months with rickets might be explained by the inadequate duration intake of Vitamin D distributed.

Protein Energy malnutrition

Although the project was unable to reduce wasting by its target of 50%, the project did meet its target to reduce being underweight and stunted by 50%. However, the insignificant observed decrease in wasting could be explained by the small sample size.

The study found that children over two years were significantly more susceptible to stunting and being underweight. Furthermore, children under two years who did not consume meat were more susceptible to stunting and being underweight, and children who consumed a meat and used Vitamin D were less exposed to wasting. Furthermore, children were estimated to be three times more likely stunted and underweight if they did not consume a meat. However, not consuming a meat effects to nutritional status of children 6-11 months (Gibson, 2007; Dewey and Brown, 2003). It is crucial to mention that almost 87% of the poor nutritional growth children were found in non-herding families. However, although herding families were excluded from the Hearth sessions due to their isolation.

However, Engle and Mason mentioned that families have a less contact with CNWs and VMs due to the remoteness (Engle *et al*., 1999; Mason *et al*., 2006). CNW and VMs successfully were involved them in community educational training which could bring positive impacts on child nutritional outcome. However better educated mothers are always better in obtaining and practicing the new knowledge (Peltro *et al*., 2003).
It is critical that better access to education training through CNWs and VMs could lead non-herding mothers to benefit from the community based education and bring positive implication on child growth.

6.2 Conclusion

The implementation of the WVM Nutrition project was associated with improved child macronutrient nutritional status but not with micronutrient nutritional status in the nomadic soums of Selenge province.

The Nutrition Project achieved its goal of elimination of severe PEM and 50% of reduction of the moderate form among children under five. The mean prevalence of stunting decreased from 16.4% to 6.4%. Being

underweight and wasted declined from 5.1% to 1.8% and 2.2% to 0.6% respectively.

However, the project was unable to achieve its target to reduce anaemia by 30% as it only declined from 25.5% to 21.5% which is not significant. The prevalence of anaemia was higher among the children with anaemic mothers than children with non-anaemic mothers. Thus, it means poor iron status of the mother due to poor iron intake coincides with poor iron intake of children and hence anaemia in children.

Sprinkles distribution was expected to be the main intervention for improving children's anaemia status but the expected result was not achieved because of the inadequate coverage and insufficient consumption of Sprinkles. Although the project did not achieve its target of reducing the prevalence of rickets to 30% it did was decreased significantly from 59% to 40%.

In terms of the supplementation, the project almost achieved its target Vitamin D coverage 80%. Although the 80% planned target for Sprinkles was not achieved coverage was achieved among the children of 18-23 months. Although supplementation coverage was achieved, project was unable to meet its target for adequate duration. Only 40% of children who consumed Vitamin D used it for an adequate duration. A goal for Sprinkles consumption was duration of more than two consecutive months, and project achieved 59% of this target.

Although Sprinkles were well accepted by mothers, some perceived side effects were the main reason that children did not consume the full dosage. Moreover, it can be concluded community based supplementation distribution though local VMs is more effective than distribution at health facilities.

The education component achieved improvement in nutrition and health seeking knowledge and attitude among the caregivers. Education component messages were delivered through VMs and there was a significant association between mothers' education and child nutritional outcome. Despite their remoteness and isolation, inclusion of herding households in the education component was the most successful part element to improve child nutritional outcome among the herding families. The herding lifestyle was not the obstacle to successful project implementation.

"Hearth" was the major intervention project in Selenge province but only 8.5% of children from the sample who were malnourished and at risk were enrolled to in it. Ninety four percentage of the children who enrolled in the Hearth project gained weight and all mothers gained knowledge on nutrition and health seeking behaviours. The prevalence of anaemia was lower among the Hearth enrolled children.

Although due to a limitation of study community participation was not evaluated, the local community role brought a positive effect to the project implementation. The limitation of the study was the lack of control groups for both the baseline and evaluation surveys. The decision was made to compare the findings with the third NNS. However, it was not comparable because the nutrition project was implementing its nutrition project in most survey selected provinces. Therefore thesis findings are not featured in the project interventions.

One of the strength of this thesis is there was a lack of seasonal change of diet in herding families. Data for the both the baseline and evaluation survey were collected during the spring. Due to the missing data from baseline on pregnant women and community participation study was unable to estimate precisely.

The WV Nutrition Project would bring the same impact in other project implementation areas because most interventions are community based and nutrition project education messages are practical and suitable for the local community situation especially in herding families.
However, mothers' behaviour on nutrition related activities also depends on the socio-cultural context. For example, due to their lifestyle, herding families are unable to consume fresh vegetables, fruits and use refrigerators to keep such products. However the study revealed that these are not obstacles to improving children's growth.

The Implementation of the Nutrition project following lesson learnt:

- Sprinkles can be an effective intervention to reduce the prevalence of anaemia
- Sprinkles are better than other iron supplements and well accepted by mothers
- The community based distribution method through VMs was more effective than the health facility system for achieving sufficient coverage
- Exclusion of children in herding families from the Hearth approach could negatively affect child growth
- However education component was suitable in local context, inadequate knowledge of mothers was the main reason for the poor child caring and nutrition practices

Finally, it can be concluded that the WV Nutrition Project's community based education project was the key to improving children's nutritional status in Selenge province. From the study findings, contextual factors were likely to contribute to the children's nutritional outcomes and observed child nutritional improvements cannot be attributed to project holistically.

Although the provision of supplementation was the main contributing factors to the children's better growth, the project was unable to improve the status of anaemia in children under five due to the poor project implementation.

In general, apart from the anaemia, significantly improved child nutritional growth was observed in PEM. The study found that among all the project interventions counselling was the most successful for improving the child nutritional impact and it was significantly associated with child PEM. The effect on the reduction of stunting, being underweight and wasting was the counselling was conveyed through the community based approach.
However, further study is needed on supplementation strategies in order improve the efficiency of the supplementation.

6.3 Recommendations

Based on the study findings the following recommendations were given to the WVM Nutrition Project team and Local Health Organization in order improve further implementation of the project.

WVM project Team

- Enhance the supplementation distribution and monitoring system. Define the specific target group as children under two who are living in bigger households with more than four members.
- Focus on the duration of supplementation and encourage them to consume for longer period.
- Monitor the distribution of Sprinkles and Vitamin D supplementation among the children with anaemia and rickets.
- Enhance the monitoring and evaluation system. Apart from efficacy effective coverage of supplementation should be included in the reporting system
- Enhance the promotion of exclusive breastfeeding until six months and continuation of breastfeeding until two years and beyond
- Enhance the mothers' knowledge of child feeding and caring practices and the importance of supplementation through awareness
- Encourage the community to develop community based education intervention

Local Health Organization

- Strengthen the collaboration with the project and contribute to the implementation
- Conduct regular training to health workers and health professionals
- Improve the monitoring and evaluation system

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Annex 1: Variables description

Child nutritional outcome variables		
Micronutrient status	Anaemia	Children under-5-Hb level less than 11.5g/dl Pregnant women-Hb level less than 11.5g/dl Lactating women-Hb level less than 12.5g/dl
	Rickets	Occipital maleate Bold occipital Soft edge of fontanel Convex forehead Asymmetrical or odd shaped skull Rib-breastbone joint enlargement Chest deformation (pigeon chest) Knobby enlargements on the ends of wrist and knucklebones Abnormal knee Diaphragm Bowed legs X-shaped legs Decreased muscle tones Spine deformities
Anthropometry	Wasting Underweight Stunting	weight for height Z score <2 weight for age Z score <-2 height for age Z score <-2
Behaviour	Caring practices	Exclusive breastfeeding-% of children 0-5 months who exclusively breastfed Timely introduction of complementary food-% of children who started complementary food at six months of age Feeding frequency- % of children fed at least three times a day
	Health seeking	Knowledge on breastfeeding % of mothers who answered correctly that exclusive breastfeeding continues to six months % of mothers who answered correctly about continuation of breastfeeding to two years Knowledge of rickets % of mothers who understanding that rickets are caused by insufficient nutrients, lack of sun exposure and Vitamin D % of mothers who identified methods of prevention and treatment of rickets as dairy products, sun exposure and

		Vitamin D Knowledge of anaemia % of mothers who were able to identify the main cause of anaemia as insufficient nutrients, bleeding and multiple births Knowledge on maternal health % of mothers who had knowledge of prevention of anaemia by meat, livestock liver and iron supplements % of mothers who identified the times required to attend to ANC within the last three months of pregnancy % of mothers who knew that pregnant women should take iron tablets
Demographic variables		
Household resources	Livestock availability Household size	% of families with livestock number of family members living together
Child characteristic	Sex age	Selected child's sex Selected child's age
Mothers characteristic	Education Occupation	Non-educated, elementary, junior, high school, college Herders, non-herders
Project input variables		
Sprinkles Vitamin D Iron tablet	Coverage Duration	% of children aged 6-59 months who received Sprinkles for a minimum of one month time during the year prior to study Number of months that child received Sprinkles % of children aged 6-59 months receiving Vitamin D during the year prior to the study % of women who used iron tablets during their pregnancy and lactation period

Annex 2: Summary of survey findings (baseline and evaluation)

Indicators		Baseline	Evaluation
Children under 5 years			
1	Underweight:among children aged 0-59 months	5.1	1.0*/1.8**
2	Stunting: among children aged 0-59 months	16.4	8.1*/6.3**
3	Wasting: among children aged 0-59 months	2.2	0.3*/0.3**
4	Low birth weight:in children 0-59 months	-	3.6
5	Anaemia: in children 2-59 months of age	25.5	21.5
6	Rickets:in children 0-23 months of age	58.5	40.1
7	Residual signs of rickets: among children aged 24-59 months	57.6	11.2
8	Early initiation of breastfeeding: in children 0-23 months of age		87.4
9	Age-appropriate breastfeeding: in children 0-23 months of age	83.9	83
10	Exclusive breastfeeding: in children 0-5months of age	69.7	44
11	Continued breastfeeding at one year:	-	86.4
12	Continued breastfeeding at two years:	-	48.6
13	Timely introduction of complementary foods or proportion of children 6-8.9 months of age who receive complementary foods	-	100.0
14	Proportion of children aged 6-23 months who are fed at appropriate frequency for their age	-	74.6
15	Proportion of children aged 6-23 months, who received foods from ≥ 4 groups	-	90.2
16	Use of multiple micronutrient powder: in children 6-23 months of age	-	68.2
17	Use of multiple micronutrient powder: in children 6-59 months of age	2.2	58.3
18	Vitamin A supplementation coverage:in children 6-59 months of age	-	82.8
18	Vitamin D supplementation coverage: in children 6-59 months of age	20.3	70.9
Pregnant women			
1.	Under nutrition	-	0.8
2.	Anaemia	22.9	21.7
3	Use of multiple micronutrient tablets	-	13.2
4	Proportion of women who received 60 or more sachets of multiple micronutrient tablets	11.6	18.8
Lactating mothers (of children under 2 years)			
1.	Wasting	-	3.2
3.	Anaemia	6.5	8.2

Annex 3: Content of the Sprinkles

	Micronutrients	**Amount in micronutrient powder**
1	A (µg)	400
2	Д (µg)	10.0
3	E (mg)	5.0
4	C (mg)	30
5	B1 (mg)	0.5
6	B2 (mg)	0.5
7	B3 (mg)	6.0
8	B6 (mg)	0.5
9	B12 (µg)	0.9
10	Folic acid (µg)	150.0
11	Iron (mg)	10.0
12	Zinc (mg)	4.1
13	Copper (mg)	0.56
14	Selenium (µg)	17.0
15	Iodine (mg)	90.0