The causes of malnutrition in children under 3 in the Somali Region of Ethiopia related to household caring practices

Preliminary Report

Report on research findings from Somali Caring Practices research project in Shinile and Dambal districts of Shinile zone, Somali region, Ethiopia[1]

Save the Children (UK), Ethiopia February 2007
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[1] Fieldwork conducted between Sept 2005 and July 2006 in Shinile zone
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EXECUTIVE SUMMARY

The aim of the research was to establish associations between prevalence of acute and chronic malnutrition and its causes at the household level, with particular emphasis on caring practices. The recommendations are designed to guide future programming for Save the Children (UK) and a wider group of organizations concerned with improvements in child malnutrition.

The research was designed using the UNICEF Conceptual Framework on the causes of malnutrition. Household surveys and FGDs were used to collect information on health, caring practices and food security. Fieldwork was undertaken in 2 Livelihood Zones (LZ): pastoral and agro-pastoral in Shinile and Dambal districts of Shinile zone between September 2005 and July 2006; two rounds in each LZ. These are current, secure operational areas for Save the Children (SCUK). The quantitative survey of 3738 households included 4293 children under 36 months. The practices of child feeding were compared to international standards on breastfeeding duration, exclusive breast feeding, feeding frequency and dietary diversity. Wealth was assessed by animal ownership (for pastoralists) and by a combination of animal ownership and land cultivation (for agro-pastoralists). The data were analysed, wherever possible for their associations with malnutrition of children. In addition, information to support the research was gathered from key informants at each kebele and FGDs with mothers, men and children. Background information was collected from district officials.

The research results indicate rates of wasting (low weight for height in children under 3 yrs) changed seasonally and were highest in the second pastoral survey following the bad *jilaal* dry season (21.3 % overall and 2.7% severe). Average for 3 rounds was 15.9% overall and 1.8% severe. Stunting (low height for age) was more consistent across the seasons with 19.6 % overall stunted and 4.1% severely stunted in the 3 rounds. Underweight (low weight for age) was on average 30.1% overall and 6.8% severely underweight in the 3 rounds [2]. Wasting was higher on average than national Demographic Health Survey (DHS) data for 2005 and stunting was less.

Wasting, stunting and underweight all increased with age, particularly from 6-12 months. At this age illness is at its highest rate, weaning foods have either not started or are of inadequate quality and mothers start to leave the children for extended periods with other carers. Catch up growth is inadequate thereafter although levels of wasting improve after about 24 months. Boys tend to be more malnourished than girls at most ages, although this is not understood to be related to any differences in practices or conditions but rather to biological differences.

Prevalence of wasting was higher on average in poorer groups (17.5%) compared to the better-off (12.5%) ($p = 0.024$) although there was no discernable difference for stunting. Milk consumption was greater in the better- off group but feeding frequency of solid food was only related to wealth in one survey round when average feeding frequency was high (first agro-pastoral survey). During the harsher seasons, we hypothesise that more sharing of resources between better-off and poor minimized the differences. There is strong community support and sharing of resources that offer some protection against the vulnerable food security situation. Dietary diversity, on the other hand, was more related to wealth in each survey, the better-off

[2] The first survey round was not included in the analyses due to initial problems with age and weight assessments

having greater capacity to provide a diverse diet to young children. Poorer children were also at greater risk of common childhood illness (shown by differences in diarrhoea and fever).

Breastfeeding practice did not follow international recommendations for exclusive breast feeding for the first 6 months (only 6.6% of infants were exclusively breast fed), mostly due to the common practice of giving animal milk early. Breastfeeding also stops early; more than half the children are no longer breastfeeding at 20 months. Animal milk forms an important part of the diet of the children and for those over 6 months is an important protective factor for wasting. For the younger children under 6 months it is a risk factor for underweight. Solid and semi-solid foods are started later than the recommended 6 months. This is due to a lack of special weaning foods, as well as methods to prepare suitable foods, time constraints and a belief in the benefits of milk. Frequency of feeding and diversity of weaning foods do not meet international recommendations for most children. For each age group less than 20% met these recommendations and less than 10% of children consumed vegetables, legumes, fruit or meat on the survey day. Although not assessed biochemically, the type of diet consumed by these children is likely to result in micronutrient deficiencies and anaemia. Low consumption of these foods was related to lack of money, market availability and lack of priority given to these foods.

One hypothesis resulting from the research is that the consumption of animal products could be contributing to lower rates of stunting compared to other regions of Ethiopia where animal products are not as available. The availability of animal products, especially milk is the positive aspect of diets that needs emphasizing, and the communities are well aware of this and prize milk above most other foods.

Another key association was identified between child morbidity and both stunting and wasting. There were high rates of diarrhoea (23%) fever (28%) and cough (32%) in children. The odds ratios (OR) for wasting and diarrhoea was 1.6 and for wasting and fever 1.7 in a multiple logistical regression model. The direction of causality is not clear for these associations: illness causes malnutrition and malnutrition also causes illness.

Vaccination coverage was poor, particularly for BCG (5%) and health services in general are lacking in the communities surveyed. Consequently, long distances have to be covered to reach functioning facilities and children are not taken for medical attention until all local remedies have failed, and then only if funds are available. Hygiene and sanitation conditions are poor and clean water is rarely available. Poor hygienic conditions were particularly relevant for younger children who are most vulnerable to infections.

Most women carers were uneducated and illiterate, and their knowledge of good caring practices and causes of diarrhoea limited. The statistical association between knowledge and malnutrition was weak, however, suggesting that other resources were needed to apply good knowledge.

The workload of mothers is considerable and includes on average 2 hours collecting water per day (more during the dry season) and 2 hours collecting wood as well as income generation and other domestic activities. Mother's time constraints affect feeding and care in several ways: the women tend to keep breastfed children with them as much as possible during daily tasks, but the older children may be left with an older sibling or female relative for part of the day. Collecting

water for long hours is associated with the number of meals the mother can consume, her nutritional status and her ability to practice exclusive breast-feeding. Mother's chronic illness and nutritional status are associated with child malnutrition. Mother's illness was particularly related to young child malnutrition (OR of 2.4 for underweight when the mother was chronically ill). Maternal care is therefore related to child care and hence nutrition of the child.

Poor food security is a basic cause of malnutrition that is a major constraint to sufficient household food security and hence adequate feeding practice; this was particularly apparent in the harsh conditions of the dry season in the pastoral areas in early 2006 when the whole Somali Region was experiencing severe drought. At this time, in addition to poor food security, more children and mothers were ill. This shows that emergency consideration should always be given to health issues when there is a food crisis.

There were some differences between pastoralists and agro-pastoralists that either improve or worsen the risk of malnutrition. Pastoralists had, less fever & cough and spent less time away from children; factors that would benefit nutrition. On the other hand, they had smaller households, less vaccination coverage, were further from markets and health facilities and started weaning foods late; factors that would worsen malnutrition.

There were some differences between the causes of stunting and wasting. This is important because, although all these potential causes of malnutrition need to be addresses, some issues relate to wasting and hence more transient problems (e.g. fever, mothers illness) and some to stunting and hence more constant problems (e.g. diarrhoea, vaccination, mothers nutrition).

The constraints of food availability, economic resources, time, knowledge, health services, hygienic environment, health and nutrition of the mother all have an impact on the nutritional status of children. There are clearly many factors that limit good nutrition from the 3 main underlying causes: insufficient household food security, inadequate mother and child care, insufficient health services and an unhealthy environment. In order to tackle malnutrition the issues from all the underlying causes identified above will need to be addressed. It is difficult to give priority to any issue when all need to be satisfied to improve malnutrition.

SCUK's recommendations for programmes

1. Due to the high rates of acute malnutrition and seasonal differences, assessment and treatment of acute malnutrition and continuation of nutrition and early warning information systems will be necessary, followed by response.
2. Poverty is linked to the main causes of malnutrition, hence, livelihood initiatives, delivered through livestock and rangeland management, but possibly including alternative income sources, e.g. cash transfers and support to micro-enterprise. Livelihood initiatives should take into consideration women's work load, so any initiative aimed at women should not reduce time for care of children.
3. Child and maternal morbidity were important determinants of malnutrition, therefore support to health services, particularly Maternal and Child Health and health extension, immunization and vitamin A supplementation.

4. Shortage of clean and sufficient water is necessary to achieve improved hygiene as well as for animals, therefore safe water and sanitation programme to improve hygiene, prevent infections and also reduce the time required by women to fetch water
5. Dietary diversity was very poor, therefore, an initiative to improve dietary diversity is necessary. This may be approached through support to markets, small scale home gardening and education linked to improved income generated through livelihoods initiatives.
6. Informal education to improve knowledge on nutrition and health. This should emphasize breast feeding information, how to prepare weaning foods and increase dietary diversity using local foods, nutrition during pregnancy and lactation, hygiene education, HIV prevention. If possible all household members including men, women and older children should be included.
7. The workload of women, women's health and their decision-making in the household are key issues related to malnutrition, therefore, gender initiatives to empower women as decision makers within the communities is necessary through support to women's groups.

There are strong links between these recommendations, for example, a livelihood component would also support women if their workload was reduced, similarly water provision would not only improve hygiene but could be used for livestock, small irrigation and reduce women's time. Health services could improve both child and maternal health, enabling women to provide better care. With nutrition education, the demand for a more diverse diet could increase.

The immediate, underlying and basic causes need to be addressed to prevent chronic malnutrition and to guard against shocks. This will require action at all levels: national, regional, district, kebele and household. This report has focused on the types of programmes that could be implemented by SCUK with partners at the local level, but coordinated and integrated policies that focus on the issues that are particular to pastoralists and agro-pastoralists will be necessary to have lasting benefit.

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ABBREVIATIONS

ABE	Alternative Basic Education
AP1; AP2	First and second agro-pastoral surveys
BESO	Basic Education Strategic Objective
BCG	Bacille Calmette-Guérin
CSB	Corn Soya Blend
DHS	Demographic and Health Survey
DPPC	Disaster Prevention and Preparedness Commission
EOS	Enhanced Outreach Strategy
ESHE	Essential Service for Health in Ethiopia
FGD	Focus Group Discussion
GAM	Global Acute Malnutrition
HAZ	Height for age z score (measure of stunting)
HCS	Hararghe Catholic Secretariat
HEA	Household Economy Approach
LZ	Livelihood Zone
MCH	Mother and Child Health
MDG	Millennium Development Goals
MUAC	Mid Upper Arm Circumference
NGO	Non Government Organization
OR	Odds Ratio
PCDP	Pastoral Community Development Project
P1; P2	First and second pastoral surveys
SAM	Severe Acute Malnutrition
SCUK	Save the Children (United Kingdom)
SCUS	Save the Children (United States of America)
SPSS	Statistical Package for Social Sciences
STATA	Statistics data Analysis
TBA	Traditional Birth Attendant
WAZ	Weight for age z score (measure of underweight)
WHZ	Weight for height z score (measure of wasting)
WFP	World Food Program
UNDP	United Nations Development Program
UNICEF	United Nations Childrens Fund

GLOSSARY

Kebele	The smallest administrative unit; equivalent to a village.
District	Also called woreda; a larger administrative unit
Zone	A group of districts.

1. INTRODUCTION

Aims

The aims of the research were to establish associations between prevalence of acute and chronic malnutrition and its causes at the household level in the Somali Region of Ethiopia and to make recommendations for future programmes to address these causes.

Background

Rates of malnutrition in Ethiopia are amongst the highest in the world, and there has been little reduction in recent years: 47.6% to 47.2% from 2000 to 2006[3]. In Sub Saharan Africa, the average is 30% underweight and this level of malnutrition has remained fairly constant since 1990. Whereas other regions of the world have experienced reductions in malnutrition since 1990, Sub Saharan Africa has moved slowly on meeting the MDG to reduce hunger by half by 2015.

In Ethiopia, the emphasis has been on emergency nutrition interventions that respond to acute malnutrition rather than the ubiquitous chronic malnutrition that is so persistent. SCUK's Young Lives Project[4] describes three main approaches that have been considered in Ethiopia for tackling chronic malnutrition: the food-based approach, in which food security is considered the main problem; the public health approach, in which insufficient health service and an unhealthy environment is considered the main problem; the gender approach which is based on the constraints to caring practices, but in practice is usually focused on nutrition education.

In Amhara SCUK has identified three main constraints to adequate nutrition in children under 2 years: poor health, lack of knowledge and poverty[5]. Other empirical research reveals the multi-faceted nature of hunger in Ethiopia. Clear relationships between malnutrition and socio-economic differentials, female education, exclusive breast-feeding, quality, frequency, diversity and timing of weaning foods, demographic factors (birth interval and household size), health of the mother and state of the physical environment and distance to health centre have been observed.[6] [7] [8] [9] [10].

[3] http://unstats.un.org/unsd/mdg/Data.aspx

[4] Child Nutritional status in poor Ethiopian households: the role of gender, assets and location. Young Lives working paper No 26 (no date). This is a longitudinal childhood poverty research project.

[5] Health Wealth and Knowledge: Determinants of malnutrition in North Wollo, Ethiopia, September 2002

[6] Factors associated with Stunting in Infants aged 5-11 months in the Dodota-Sire district, rural Ethiopia. M. Umeta et al J. Nutr 133: 1064-1069, 2003

[7] Malnutrition among children in Southern Ethiopia levels and risk factors. G. Yimer, Ethiop J. Health Dev. 2000;14 (3):283-292

[8] Dietary diversity is associated with child nutritional status: evidence from 11 demographic and health surveys. M.Arimond & M. Ruel J. Nutr. 134:2579-2585, 2004

[9] Household and environmental factors influencing anthropometric outcomes in preschool children in a rural Ethiopian community. I. Okike & M. Jabbar. Ecology of Food and Nutrition 44: 167-187 2005

[10] Tackling child malnutrition in Ethiopia. Do sustainable development poverty reduction programme's underlying policy assumptions reflect local realities? Young Lives working paper 19

A wide-ranging analysis of the causes of malnutrition in Ethiopia was carried out in preparation for the formulation of a National Nutrition Strategy for Ethiopia[11]. In this analysis, causes that fall under basic, food security, care and health were reviewed along with presentation of an institutional framework. This analysis did not identify specific causes for the Somali region or for pastoralists or agro-pastoralists. SCUK has produced a Children's Rights Situation Analysis for the Somali Region which provides details on violations of child's rights relating to livelihoods and poverty, health and survival, education and HIV/AIDS in detail[12] but not a specific analysis on the causes of malnutrition.

There is therefore little specific research on the causes of malnutrition in the Somali Region or amongst pastoralists in general. There are likely to be similarities and differences between the issues identified for sedentary farming groups and for the pastoralists, for example concerning access to services, patterns of food consumption, the situation of women and climate. The present research aims to fill that gap in knowledge.

1.1 Previous Nutrition Surveys in the Somali region carried out by SCUK

Data on acute malnutrition in different areas of the Somali region from recent surveys have been collected by SC UK (Table 1). All the surveys conducted in the dry season showed high rates of GAM and SAM; but even in the wet seasons many of the GAM results were still critical. The surveys conducted by SCUK, it should be remembered, are in response to an alert or particular need, so should not be considered as representative of the usual levels.

Table 1:
Emergency nutrition levels in Somali Region – 2005/6

Date	Season	Area	Prevalence of global acute malnutrition [13]	Prevalence of severe acute malnutrition
Jan, 2005	Dry	Gashamo (pastoral)	**19.7%** CI (16.3-23.1%)	**3.1%** CI (1.7-4.5%)
March, 2005	Wet	Fafan IDP Camp (ex-pastoral)	**16.4 %** CI (13.0 – 19.7%)	**1.1 %** CI (0.1 - 2.0 %)
May, 2005	Wet	Fik and Hamaro (pastoral)	**16.1**% CI (13.6-18.7 %)	**1.2 %** CI (0.5-1.9 %)
May, 2005	Wet	Segeg, Duhun and Garbo (pastoral)	**20.7%** CI (17.2-24.2%)	**1.8%** CI (0.9 – 2.6 %)
January, 2006	Dry	Dollo-ado & Dollo-bay (agro-pastoral)	**19.0%** CI (15.4-23.3)	**1.6%** CI (0.6-2.5)
January, 2006	Dry	Dollo-ado, Dollo-bay and Barrey (pastoral)	**18.8 %** CI (15.8 -21.6%)	**1.4 %** CI (0.33-2.47 %)
January, 2006	Dry	Moyale & Hudet (pastoral)	**19.7 %**	**1.8 %**

[11] An assessment of the causes of malnutrition in Ethiopia. Todd Benson. IFPRI and World Bank, Washington DC 2005 http://www.ifpri.org/PUBS/wpapers/ethionutrition.asp#dl
[12] Children's rights situation analysis in the Somali Region, Ethiopia. M. Lagu, SCUK. 2004
[13] Global Acute Malnutrition is defined as <-2 z-scores weight for height or oedema and Severe Acute Malnutrition as <-3 z-scores weight for height or oedema. 95% confidence intervals shown in brackets.

Date	Season	Area	Prevalence of global acute malnutrition [13]	Prevalence of severe acute malnutrition
			CI (16.0-23.4 %)	CI (0.8-2.7 %)
August, 2006	End wet/early dry	Elkare and Hargelle (pastoral)	**10.5%** CI (8.1-12.8%)	**0.5%** CI (0.1-1.0%)
Aug/Sep, 2006	End wet/ early dry	Dollo-ado, Dollo-bay and Barrey (pastoral)	**14.5%** CI (11.8-17.2%	**0.7%** CI (0.1-1.3%
Aug/Sep, 2006	End wet/early	Moyale & Hudet (pastoral)	**7.6%** CI (5.3-9.8%)	**0.1%** CI (0.0-0.3%)
October, 2006	Wet	Fik, Hamaro, Duhun & Segeg (pastoral)	**12.6%** CI (9.9-15.3%)	**0.5%** CI (0.1-1.0)

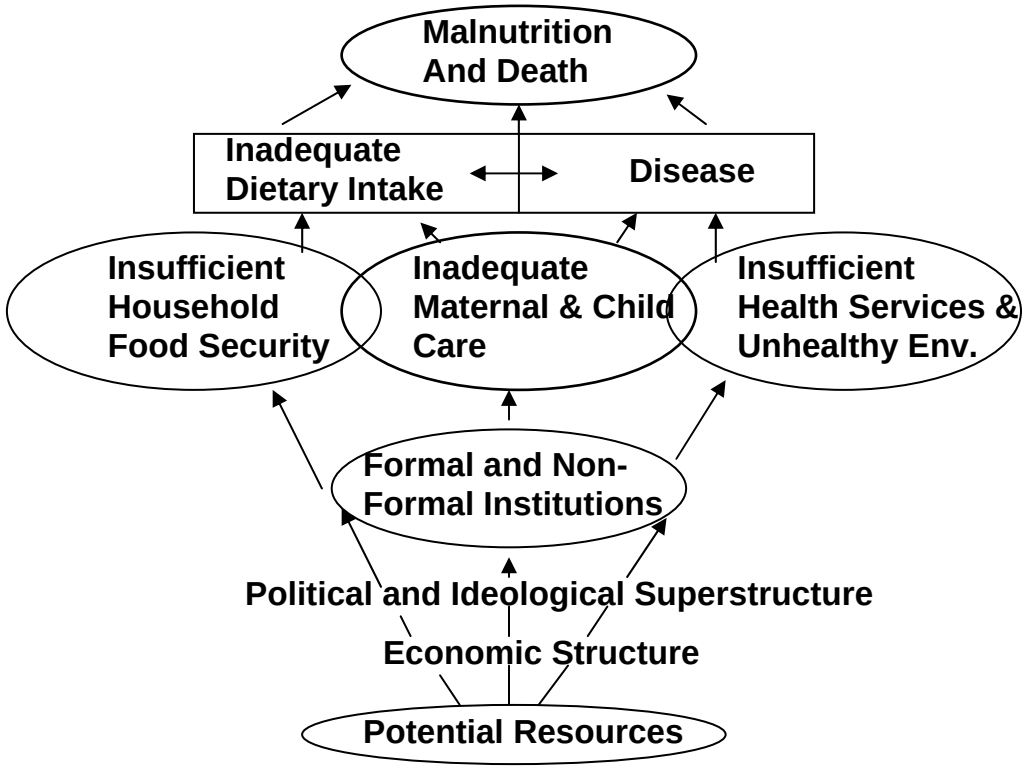
1.2 Effect of child malnutrition and its definition

Acute malnutrition (wasting) is defined according to weight-for-height or cut-offs of Mid Upper Arm Circumference (MUAC) and by presence of nutritional oedema. It is associated with an immediate increase in morbidity and mortality. Chronic malnutrition (stunting) is defined as low height-for-age and is associated with impaired cognitive performance in children and decreased physical capacity, productivity and reproductive performance in later life. Underweight measured as weight-for-age may be explained by stunting or wasting and is a combined measure. Stunting is a long-term measure of malnutrition that can result from a series of exposures to acute malnutrition. In cross-sectional surveys (such as this one) it is more difficult to isolate causes of stunting than wasting due to the long-term nature of the malnutrition.

1.3 Causes of child malnutrition

Figure 1 provides an overview of a general framework that follows a model developed by UNICEF for analysing both chronic and acute malnutrition. The immediate causes of malnutrition are insufficient food intake and disease. These also potentiate the effect of each other; children who suffer from malnutrition are more prone to disease and disease is one of the causes of malnutrition. Below these, there is a wide range of 'underlying causes' that operate at the household and community level. These underlying causes are grouped into insufficient household food security, inadequate maternal and child care and insufficient health services and unhealthy environment. Finally, a third level of ‘basic causes’ are potential resources, the environment, economic structures, and the political and ideological superstructure.

Figure 1 UNICEF Conceptual framework on causes of malnutrition [14]



1.4 Pastoral and Agro-pastoral livelihood zones in Shinile and Dambal districts

SCUK carried out Household Economy Assessments (HEAs)[15] in 2001[16] and 2002 [17] and therefore has gathered information on the livelihoods, sources of food and income and usual coping strategies. Shinile Zone is one of the nine administrative zones of Somali National Regional State. Lying in the northernmost tip of the Region, it borders with Djibouti in the North, Somalia (Somaliland) on the Northeast, Jijiga Zone on the southeast, Diredawa and Oromia Regions on the south and Afar Region on the west. The Zonal population mainly depends on livestock production. There is also a significant amount of trade activity and a small amount of crop production in the southern part (the agro-pastoralists). The population figures are estimated at 110,545 for Shinile district and 88,426 for Dambal [18]. There are also ex-pastoralists, mostly petty traders who live in more settled small urban settlements; these, however were not the subject of this assessment.

[14] Strategy for improved nutrition of children and women in developing countries UNICEF 1990

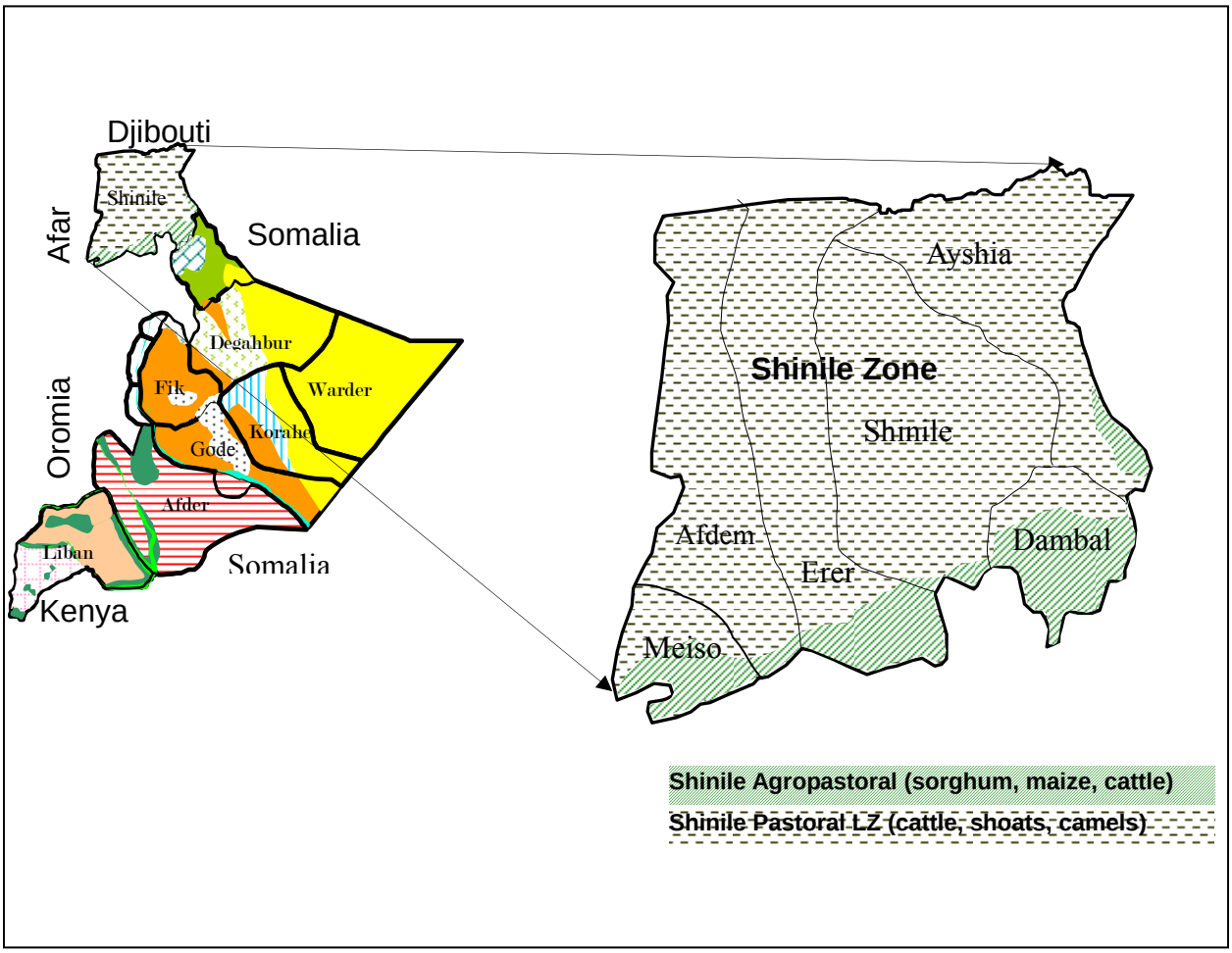
[15] The HEA is a means of gathering information from Focus groups representing different wealth groups and different livelihood zones on incomes, sources of food and expenditures.

[16] Shinile Agro-pastoral Food Economy Zone Household Food Economy Baseline Study by SC-UK, DPPB and Partners October 2001

[17] Shinile Pastoral Food Economy Zone Household Food Economy Baseline Study by SCUK, DPPB and Partners Feb 2002

[18] Ethiopian Central Statistical Authority 2003 projected to 2005

Figure 2 Map of surveyed areas of Dambal and Shinile



The main rainy seasons of this area are *gu/ dira* and *karan*. *Gu/ dira* normally starts about late March and ends mid-May. *Karan* starts in July and continues up to early September. The *dira (gu*) rains are followed by the *hagaa* season, which is a dry spell that can cause crop failure if the *dira* rains were not sufficient, (see Appendix for seasonal calendar). The performance of the dira' and karan rains determines if the year is considered normal, good or bad. The pastoralists and agro-pastoralist livelihoods are characterised by vulnerability to shocks and are highly dependent on rainfall. They are also dependent on livestock markets and changes in government control over trade. Livestock disease can devastate livelihoods and environmental degradation adversely affects pasture, browse and bush product availability. Conflicts over land and resources are also a threat. There has been a series of droughts over the past 10 years resulting in loss of livestock and hence livelihoods that are already vulnerable have been stretched further. From self assessment of vulnerability, there has been a decline in the proportion of households reporting that they were "doing well" compared to "struggling". In 1994 almost all households reported that they were doing well and by 2004 this was down to about 20%; the rest were "struggling"[19]

[19] Vulnerable livelihoods in Somali Region, Ethiopia, Institute for Development Studies, 2006 Stephen Devereux.

1.4.1 Shinile Pastoral Livelihood Zone

The Pastoral Livelihood Zone covers the largest area in Shinile Zone, where pastoralists make up about 75-85% of the population. In Dambal district pastoralists make up about 40% of the population; in Shinile about 90%. The rest of the population are mainly involved in agro-pastoralism. The pastoralists keep the full range of livestock – sheep, cattle, goats and camels, but cattle and sheep predominate. In the dry season, the herd is divided into smaller groups, with sheep and milking animals staying with the core family near villages, while hardier animals (camels, cattle, goats) are driven to further areas for water and pasture. In the rainy season all livestock remain around homes. When milk is abundant in the wet seasons, more is left for the calves and kids to suckle and the rest is consumed. There are also more milk gifts in such seasons. This is mainly because there is little market demand for milk due to poor physical access to the few urban and market centres. Most cattle milk is used for making ghee, but the proportion depends on the wealth group. Milk and milk products are a very important source of food most of the other foods are purchased and comprise sugar and sorghum. Pastoralists are faced with a variety of risk factors mainly related to rainfall and market failures and conflict. Coping strategies include migration, controlling animal mating, increased livestock sales and increased unskilled labour seeking. In the pastoral LZ the main determinant of wealth is animal ownership.

1.4.2 Shinile Agro-pastoral Livelihood Zone

People in this LZ grow mainly sorghum and keep cattle. The main crop grown is sorghum followed by maize. The main planting season is the *dira* (late March/early April), while the main harvest season is in November-December. The main constraints to crop production include: limited knowledge and skills for farming, lack of agricultural inputs and difficulty in clearing new land or land that has gone fallow. All three species of livestock are kept although camels are least important. In normal years they keep the livestock within their localities or adjacent places. In bad years livestock may go as far as Afar and Oromia Regions. The main food sources for the LZ are, own cereal production (mainly sorghum), own livestock production (milk and ghee), and purchases (cereals, sugar, oil). Among the agro-pastoral groups, wealth is determined mainly by livestock holdings, especially cattle. This is followed by land holdings.

The major vulnerability/risk factor is the failure of seasonal rains, which adversely affect the crop and pasture availability. This also means poor livestock production, body condition and low prices. Other risk factors include restriction in the collection of bush products like charcoal, firewood and construction materials that are affected by a bad season and are important sources of income for the poor groups.
Coping strategies include: increased sale of livestock, sending children to stay with wealthier relatives, increased employment seeking, reducing number of meals, substituting for less expensive foods, migration in search of pastures and water and self employment seeking. The wealthier groups would also reduce gifts.

1.5 Food Security situation in 2005/6

From the Food Security Reports[20] at the time when the research programme started in September 2005 the food security situation in most parts of Shinile was considered normal, although poor

[20] Quarterly Food Security Updates, Disaster Prevention, Preparedness and Food Security Bureau, Somali Regional State, Ethiopia; Food Security Monitoring and Early Warning Programme.

karan rains were reported in parts of Dambal district. By the beginning of 2006 the food security situation in Shinile (as in the wider Somali region) deteriorated and emergency nutrition surveys showed a sharp increase in acute malnutrition; GAM rates rose to 19 %, (Table 1). By April-June the food security situation had returned to near normal except in pocket areas and parts that received inadequate *gu* rains. More details are given below from our key informant interviews.

1.6 Services and programmes in Shinile and Dambal districts

The Somali region is very poorly served by services and programmes, even compared to the rest of Ethiopia. Many programmes did not reach the Somali Region in 2005/6, for example, the Productive Safety Net Programme, Micronutrient deficiency control, Child Growth Promotion, Food Security Project, Essential Service for Health in Ethiopia (ESHE) are not implemented in Somali Region[21].

The infrastructure of Shinile Zone is very poor, with only one main road connecting Dire Dawa and Djibouti, which passes through the eastern part of Shinile district. There are only dirt roads connecting all the kebeles within the zone, many of which become impassable during rainy seasons. There is no public transport within the surveyed districts. Pack animals are the major means of transportation. There is a railway connecting Addis-Ababa – Djibouti that passes through Shinile districts.

Health service coverage is the worst in the country, with highest population to health worker ratios in Ethiopia[22]. The existing Health facilities within the two districts are very limited and of poor quality. These are described in more detail in the results section. The Education department is operating somewhat better than other departments. Formal schools are located in the majority of the kebeles within the two districts. Non-formal schools (Alternative Basic Education) exist in some rural kebeles. The number of teachers is limited in Dambal district. School feeding programmes exist in five kebeles in Shinile only. The school enrolment rate is only 12% in the Shinile.

Water is one of the major problems in Shinile and Dambal districts. Clean water for human consumption is almost lacking. Water for livestock is also seriously short during dry seasons People have to travel long distance during these times for livestock watering and to collect drinking water.

1.7 Non Government Organizations (NGOs)

Several NGOs operate in the districts of Shinile and Dambal and their work covers many intervention areas that relate to the causes of malnutrition:
Save the Children (UK) implements the drought cycle management aspects of the SCUK/ SCUS collaborative Pastoral Livelihoods Initiative. Early Warning systems operate in the districts in conjunction with DPPC. The Alternative Basic Education project (ABE) is also operational with several schools in the districts. Emergency food distributions and food / cash piloting project have also been implemented in the districts over the past 2 years. *UNDP (United Nations Development Programme)* has supplied agricultural inputs and solar energy system in the districts. *PCDP (Pastoral Community Development Project)* is involved in school construction, expansion and rehabilitation; construction of clinics; animal health services; income generation

[21] An assessment of the causes of malnutrition in Ethiopia, IFPRI November 2005
[22] Health Sector Strategic Plan 2005-2010, Federal Ministry of Health, Ethiopia

activity; expansion of water supply system in Shinile town and excavation of boreholes. *HCS (Hararghe Catholic Secretariat)* is also involved in water provision, animal health, human health (training TBAs and medicine supply) and supports fuel for the routine vaccination. *Handicap International* works on the *e*xpansion of drinking water supply and training to District Administration. *UNICEF* offers teacher training; education materials supply and supports EOS program. *WFP (World Food Program)* provides general food distribution and food for the school feeding program. *BESO (Basic Education Strategic Objective)* offers teacher training; has established district pedagogical centre; provides new software for personal information management to the education bureau.

2 DESIGN AND METHODS OF THIS ASSESSMENT

The nutrition surveys for this research were carried out in 2 seasons for the pastoral and 2 seasons for the agro-pastoral LZ. The pastoral surveys were timed to fall one at the end of the *karan* rainy season (P1; September 2005) and at the end of the *jilaal* dry season (P2; March 2006). The agro-pastoral surveys were timed to fall one in the mid *jilaal* (AP1; November 2005) and one at the end of the *dira* dry season (AP2; May 2006). Shinile and Dambal districts of Shinile zone were selected for the study because they are already operational areas for SCUK in the Somali region and the security situation is stable. For much of the Somali Region the security situation would make this kind of assessment extremely difficult.

The design was cross-sectional, the same children were not purposely followed at each round, but because we revisited the same sites, some of the same children were found in the repeated survey rounds. These children were identified by matching the names of household head, carer and child for each repeat round to find out how many households were revisited. A future longitudinal analysis is therefore possible with those children, but not undertaken for this report.

2.1 Conceptual framework

The emphasis is on measuring anthropometry (stunting and wasting and underweight) as indicators of chronic and acute malnutrition; we have not attempted to measure signs of micronutrient malnutrition. The research followed the UNICEF model above; the areas covered specifically by this research are detailed in figure 3.

2.1.1 Definitions of caring practices

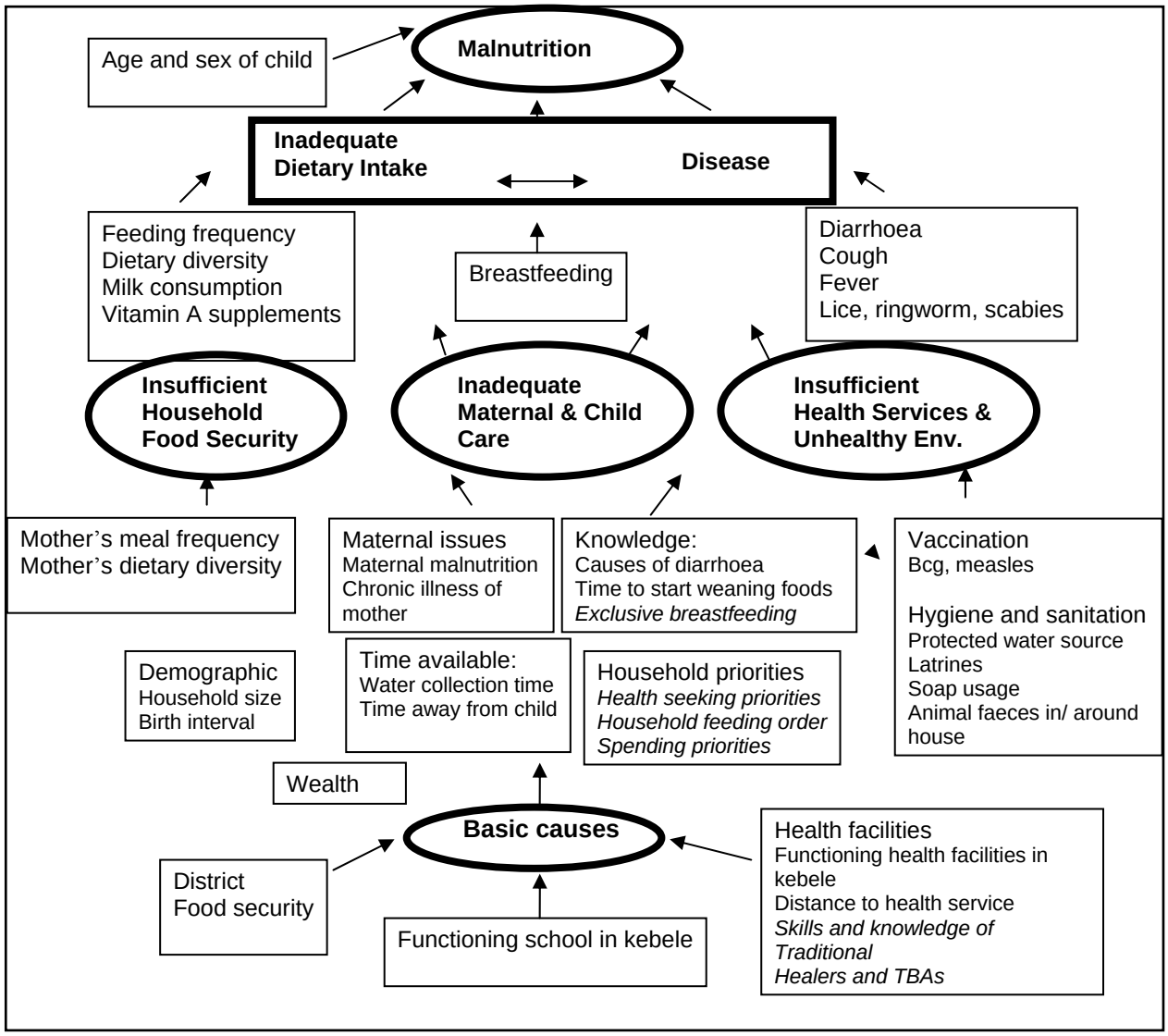
Care-giving behaviour includes breastfeeding and complementary feeding practices, hygiene practices, health seeking behaviour and providing stimulation and emotional support. It also includes care of mother. Constraints to providing adequate care are many including lack of food of sufficient quality and quantity, economic resources, time, knowledge, health services and a hygienic environment, the competing household's priorities for resources, social support and stress of the mother (fig 3).

2.1.2 Immediate causes

These included feeding frequency, dietary diversity and milk consumption (all assessed by recall of previous day's consumption); vitamin A supplements in the previous 6 months; breast feeding (whether the child was breast fed the previous day and if so whether it was exclusive or predominantly exclusive). The disease group included diarrhoea, fever or cough in the previous 2

weeks and the presence of lice, ringworm or scabies by visual inspection. The symptom of fever is non-specific but will include malaria that is known to be prevalent in the area.

Figure 3
Conceptual Framework of potential causes of malnutrition used in the research
The factors in italics were assessed qualitatively, for the rest, the assessments were quantitative.



2.1.3 Underlying causes

Insufficient household food security was assessed by mothers daily meal frequency and monthly diversity of foods consumed. The constraints to providing adequate maternal and child care were considered under five groups: maternal issues, time available, knowledge, household priorities and demographics. The wealth of the household is also included here as a constraint to caring practices. Insufficient health services and unhealthy environment were assessed by two groups of variables: vaccination and hygiene and sanitation.

2.1.4 Basic causes

Basic causes considered were district food insecurity, lack of school facilities and lack of health faculties. These factors were assessed at the level of the kebele. The analysis did not attempt to identify some of the root causes, such as political issues, cross-border issues, global climate change, globalization and other international political determinants of malnutrition.

The research required a quantitative survey of households, key informant interviews and FGDs.

2.2 Quantitative assessments:

Households with children aged less than 3 years were selected because children of this age are vulnerable to the development of stunting or wasting. The sample size for each survey round was approximated by the inclusion of 12 variables in a multiple regression model for anthropometric indices and a design effect of 2. This calculation suggests a sample size of 960. We aimed for 1000 households with children under 3 years and to reach this exhaustive sampling was necessary. In each household two questionnaires formats were completed. The questionnaires were pre-coded but allowed for extra codes to be added in the field. The household information was collected from the mother or other carer of the child and included demographics of the household, household illness, water and sanitation, knowledge of the mother/carer, maternal anthropometry, food security, animal ownership. A second format was used for each child under 3 years covering anthropometry, vaccinations, morbidity, feeding practices and time the mother or carer spent away from the child. Completion of questionnaires and anthropometric assessments were carried out by a team of trained enumerators and local, trained auxiliary helpers who also acted as local guides. The formats were based on SC-UK's previous experience and were field tested prior to use (see Appendix for formats).

2.2.1 Anthropometric assessments:

Age to the nearest month was recorded for all children using a detailed local calendar.
Weight for all ages was recorded to the nearest 10g using Soenhle electric beam balance scales.
Length was measured for all children aged 6 months or more. A standard wooden length board with 0.1cm demarcations was used. Children under 85cm were measured standing and less than this lying down. The presence of bilateral oedema was assessed in children over 6 months.
Mid-upper arm circumference (MUAC) was measured in children over 6 months and mothers to the nearest 0.1cm using a standard MUAC measuring tape. There were problems in P1 with weights and age assessments, hence most data are presented for just 3 survey rounds.

2.2.2 Data analysis and statistical methods

A feeding score, maternal knowledge score, hygiene score and HIV/ AIDS proxy indicator score were constructed from the data (Appendix). Quantitative data were entered and cleaned in Epi nfo 6.04, which was used to calculate anthropometric indices. Where the measurements of weight, height and age produced indices outside the usual range of expected data the Epi info programme produces a special marker and these data are excluded from the analysis. Five children were excluded in the height for age analysis and 13 in the weight for height analysis due to this. Further clarification is available in the Epi info guidance[23]. Further analysis was conducted in the STATA (version 8) and graphs in SPSS (version 13). Statistical tests were applied: t tests for the difference of means, chi squared tests for the difference in proportions and,

[23] Using Epi-Info 6.04 Data processing and analysis of nutrition surveys: a training manual ; SCUK 2003

multiple logistic regression analysis for the relationship between malnutrition indicators and several parameters simultaneously. Multi-level analysis was used with household as the primary sampling unit to allow for multiple children from the same household. The multiple logistic regression methods and results are shown in the Appendix, tables A5-8. Briefly, the purpose of was to determine the importance of many possibly important factors simultaneously; this is necessary to determine if various factors are associated independently with malnutrition. ORs were used[24]. Unless otherwise stated, the malnutrition analyses are presented for three rounds (AP1, P2, AP2) data together.

2.2.3 Limitations of the quantitative assessments:
Because the surveys were cross sectional at the household level, they have several limitations:

1. Implications of causality from associations in the data need to be cautiously interpreted; when two factors are associated it does not necessarily mean that one causes the other.
2. Analysis is dependent on household variability; where there is no variability the statistical methods cannot be used, for example if most women are uneducated it is not possible to assess the association of education and malnutrition.
3. We do not know the reasons for the reported behaviour

To address these limitations, additional sources of information were used: background information collected from key informants and district officials and FGDs to explore findings in more depth.

2.3 Qualitative assessments
2.3.1 Key informants: In each kebele (village) additional information was collected from key informants, a group of senior male community leaders. This information focused on kebele-level information, such as the nearest health facility, education and market, rainfall performance, livestock condition and food relief. The key informants also outlined the main problems they perceived in their communities and some offered solutions.

2.3.2 District officials: were interviewed in Shinile and Dambal about education, health, food distributions and other organizations working in the area.

2.3.3 Focus group discussions: these were carried out with women, men, children and TBAs. The information gathered was focused on gaining an understanding of the reasons behind particular practices identified by the quantitative assessments. At the start of the assessment FGD with community elders was used to describe the typical profiles of the wealth groups. Further details were also gathered on the time schedules of women, priorities for purchases and health seeking behaviour. Children were asked about their experiences of taking care of their younger siblings. TBAs were asked about the health care they offered communities. FGDs were not carried out in each kebele, but in rotation in different kebeles and lead by a dedicated facilitator.

[24] In this analysis, the lower the p value, the more significant the variable in the model. A low odds ratio means that the risk associated with the factor is less, for example if for diarrhoea the odds ratio is 1.2 it means for those with diarrhoea the odds of being malnourished is 20% more likely compared to a child without diarrhoea

3. RESULTS

3.1.1 Quantitative data

The numbers of households and children under 3 within the households for each survey round are shown in table 2. Refusals were minimal but some kebeles could not be reached during the rainy season due to inaccessibility. During the dry season whole families had migrated, some households were absent due to religious ceremonies or funerals.

Table 2
Numbers of households and children surveyed in four rounds of surveys in Shinile and Dambal

Round	Season	House-holds	Children
Pastoral Sept/Oct 2005 **(P1)**	End of *karan* rain	684	813
Agro-pastoral Nov/Dec 2005 **(AP1)**	Mid *jilaal* dry season	1026	1211
Pastoral Mar/Apr 2006 **(P2)**	End of *jilaal* dry season	988	1095
Agro-pastoral May/June 2006 **(AP2)**	End of *dira* rainy season	1040	1206
Total		3738	4325

In P2 there were 9.6% of the children in the sample who had been included in P1. In AP2 there were 31.6% of the children who had been included in AP1. The low percentage of repeated children in P2 could be explained by the migrations of people, the exclusion of petty traders and the improved accessibility for P2 compared to P1. Also some of the older children would not be surveyed again in the second round in each LZ because they were over 3 years in the second round and new children under six months would be added. In these pastoral communities it is therefore not possible to carry out a truly exhaustive survey. The statistical validity of the sampling could be compromised if the excluded households were atypical, but we cannot test this, so have to assume that the study sample is valid for its purpose.

3.1.2 Key informant interviews

Seventy seven key informant interviews were carried out in total; 17 in P1, 17 in AP1, 23 in P2 and 20 in AP2.

3.1.3 District officer interviews

Interviews were carried out in Dambal and Shinile district offices with the relevant chairman, education and health officers.

3.1.4 FGDs

Table 3 lists the different focus groups that were carried out in 4 rounds. Total number was 136

Table 3
FGDs, numbers of different groups in four rounds of surveys in Shinile and Dambal

	P1	AP 1	P2	AP 2
Women, general	13 groups	14 groups	-	-
Women with 0-12 mo children	-	-	10 groups	14 groups
Women with 1-3 yr children	-	-	11 groups	18 groups
Men	5 groups	11 groups	8 groups	11 groups

TBAs	-	-	7 individuals	4 individuals
Children	-	6 groups	1 group	3 groups

3.2 Comparisons of key variables for pastoral and agro-pastoral LZs and for the different seasons from household interviews.

Tables A1 and A2 show the comparisons of pastoral and agro-pastoral and the different seasons for key variables. Key data are described below.

3.2.1 Household characteristics

Household size was larger in agro-pastoral compared with pastoral LZ (6.2 compared to 6.0 persons). There were equal numbers of boys and girls sampled in the different LZs but the children were slightly younger in the pastoral sample (17.0 vs. 17.7 months).

3.2.2 Migrations

Levels of in-migration were particularly high in the second pastoral survey when 8.6% of households had in-migrated to the district, most from another location within the zone (in the other 3 rounds in-migration was only 1%). Ten percent of households on average had at least once household member who was away from the household at the time of the survey, but in the second pastoral survey there was more out-migration (16.2%). This greater movement of people was related to the poor pasture condition, as described below.

3.2.3 Wealth

The percentages of 'poor' households increased in the second pastoral and second agro-pastoral surveys (Table 4). The same wealth breakdowns were used for each round within LZs, so the increased proportion of poor households could be explained by actual loss or sale of animals in response to the drought. Underreporting of animal numbers is also possible as households anticipate a restocking programme in response to the drought.

Table 4
Wealth characteristics of households in 4 rounds; percentages in each group

WEALTH	P1	AP1	P2	AP2	Total
better off	11.1	12.1	9.3	9.1	10.4
medium	28.4	32.9	24.0	29.1	28.8
poor	49.2	54.9	63.9	60.9	57.8
petty trader	11.3	0	2.7	0.9	3
Total	100	100	100	100	100

3.2.4 Maternal / carer characteristics

Most carers of the child were the mother in both LZs and there were only 0.2% female headed households. The mean maternal MUAC for pastoral LZ was lower than for the agro-pastoralists (240.7 and 243.4 mm respectively), but this was likely to be related to the P2 survey when the food security situation was very poor rather than due to long term differences in LZs. The average birth interval was 27.0 months in the pastoral and 25.6 in the agro-pastoral LZ.

3.2.5 Education

Levels of education were very low in both LZs: 98% of mothers/carers and 76% of fathers were uneducated. Knowledge about caring practices was poor; less than 25% of carers in both LZs knew at least one correct cause of diarrhoea and less than 30% knew the recommended age to start weaning foods. The pastoral women thought weaning foods should start on average at 10.1 months and agro-pastoralists at 9.8 months. These are both very late compared to recommendations for 6 months. The overall knowledge score was higher for agro-pastoralists (1.1 and 1.4 in pastoral and agro-pastoral surveys).

3.2.6 Health

There were high reported prevalences of diarrhoea (22.6%), fever (27.6%) and cough (32.5%). Fever and cough were higher in the agro-pastoral surveys. Ringworm and lice were also more prevalent in the agro-pastoralist children. Chronic sickness of the mother or father (>3months in the past year) was slightly higher in the pastoral LZ and higher in women than in men.

Vaccination coverage was poor. Only 5% of children age 0-36 months had a BCG scar. The national coverage for BCG vaccination for children 12-23 months is 60.4% (by card or mother's information) and for measles 34.9%[25]. Compared to the DHS data, therefore the BCG coverage was particularly poor; however the method for assessment may be different between visual inspection for a scar and reported vaccination. In children over 9 months measles vaccination was 3% with card 27% without card. Vaccination coverage for measles and vitamin A supplementation were higher in the agro-pastoralists due to a recent campaign by the Enhanced Outreach Strategy (EOS).

3.2.7 Hygiene and Sanitation

Hygiene conditions were poor and hygienic practices inadequate in both pastoral and agro-pastoral areas. Only 19% of households were using a protected water source. Only 22% of households used soap at all on the previous day and this was rarely (9%) used specifically for children; more was used in the rainy seasons, probably related to water availability. Nearly all households have no latrine and had animal faeces in or around the house. In addition women and children reported consumption of soil in FGDs. Although there were little differences between pastoralists and agro-pastoralists in terms of hygiene and sanitation, using the hygiene score, (with scores from 0-4), pastoralists scored higher (1.36) than agro-pastoralists (1.21) and this was related to the differences in safe disposal of children's faeces.

3.2.8 Staple foods and food security

The staple food for both pastoralists and agro-pastoralists is sorghum with wheat consumed more in the pastoral and maize more in agro-pastoral LZ. Cereal is predominantly purchased although in agro-pastoral areas own production supplied 36% of households as the main source. More pastoralists than agro-pastoralists used relief food as the main source of cereals (18% vs. 2%). In most kebeles there had been free food distribution in the past 6 months but supplementary food had only reached about half of the agro-pastoralist kebeles in Dambal as part of the EOS programme that was operational only in Dambal district.

[25] Demographic and Health Survey, Ethiopia 2005; Central Statistical Agency, Addis Ababa & ORC Macro, Calverton, Maryland USA

3.2.9 HIV/ AIDS

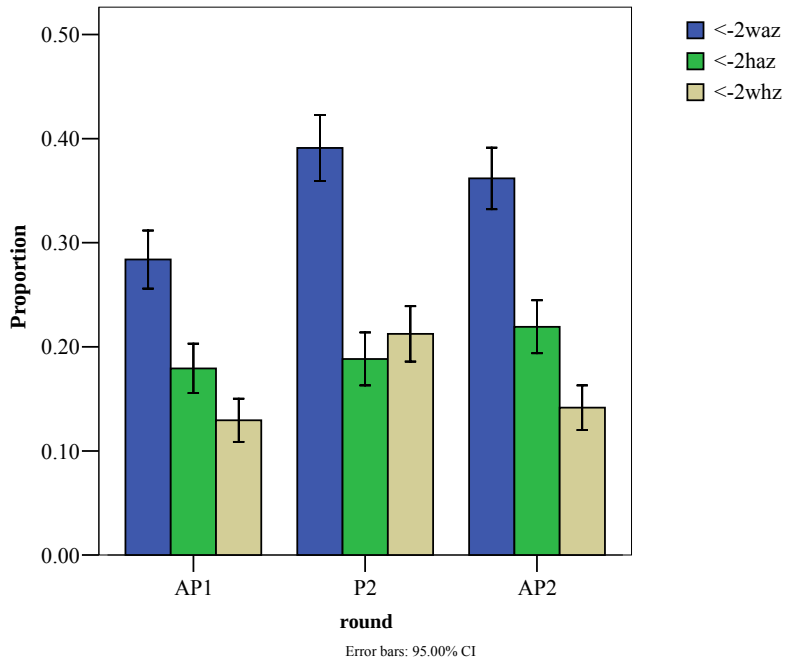
The HIV proxy indicator we used for the study included orphans, parental morbidity and mortality. Because there were few orphans (less than 3%) and low parental mortality (less than 1%) and due to the many possible causes of morbidity, the indicator for HIV was not sensitive enough to assess HIV. It has not therefore been possible to carry out statistical analysis for the relationship between HIV/AIDS and malnutrition.

From FGD most women and men had heard of HIV, but when asked whether it was possible to prevent infection, more of the men's groups gave plausible answers, such as avoiding extra marital intercourse. Amongst the women, from 17 groups only two knew how to avoid infection. HIV/ AIDS education is therefore necessary, particularly for the women.

3.3 Child malnutrition and its relationship to possible causal factors

Tables A3 and A4 show the age and sex adjusted odds ratios for wasting and stunting with immediate and underlying potential causes of malnutrition. The appendix includes multiple logistic regression analysis for wasting, stunting and special analyses for young children.

Figure 4
Underweight, stunting, and wasting in 3 survey rounds (children over 6 months)

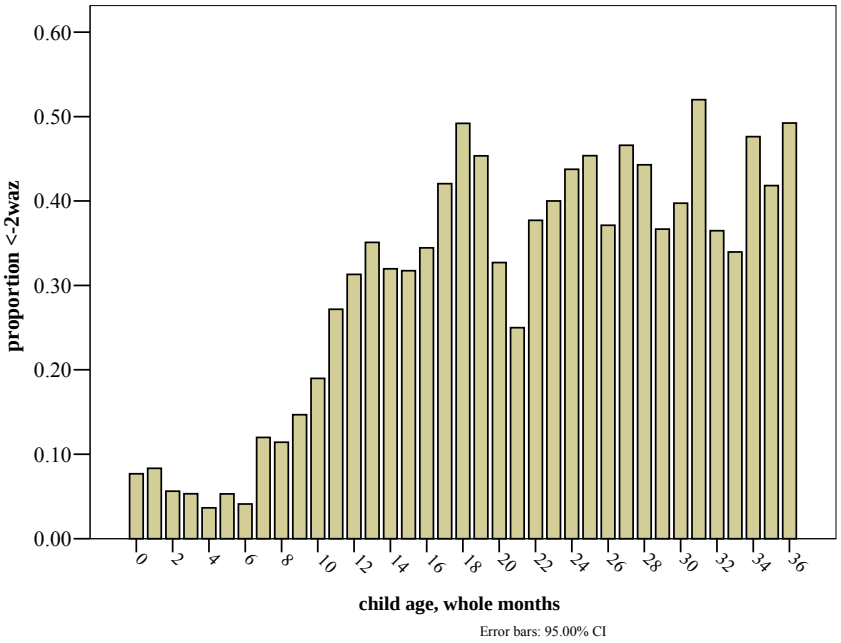


3.3.1 Prevalence of stunting wasting and underweight in different survey rounds

The first round data are excluded due to problems with the anthropometric assessments. The proportion of underweight children was highest in P2 (34.3%). The proportion of stunted children was highest in the AP2 (21.9%). The proportion of wasted children was highest in P2 (21.3%). (Figure 4) There were only 2 cases of oedema, also during P2. The prevalence of wasting measured by MUAC was much less than the rates recorded by WAZ; the highest rate was in AP2, only 7.6%. (Appendix) These types of differences between wasting measured by the

two different measures have been observed previously in Somalia[26] and are the subject of a special research project conducted by the Ethiopian Emergency Nutrition Unit with SCUK.

Figure 5
Underweight by age at 1 monthly intervals

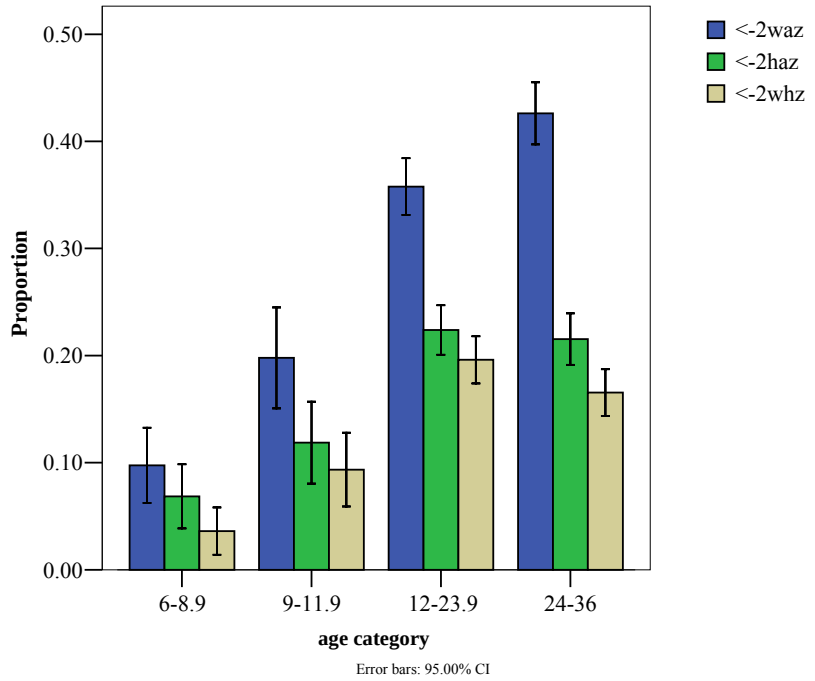


3.3.2 Malnutrition and age

Figure 5 shows the age distribution of weight for age (underweight) in children from 3 rounds. There was a sharp rise in the prevalence of underweight from the age of 6 to12 months then the rate remains high until 36 months. All measures of anthropometry deteriorated with increasing age but by 24 months the proportion of children wasted decreased slightly (figure 6). In the multiple logistic regression models, increasing age was related to wasting and stunting even after including other important variables which means that there is some unexplained deterioration in nutritional status related to age that was not explained by the measured variables (tables A5-A9).

[26] Baseline assessment for SCUK's "Result Three" interventions in rural areas of Belete Weyne district of Somalia. Mark Myatt 2005

Figure 6 Prevalence of underweight (low weight for age), stunting (low height for age) and wasting (low weight for height) by age (3 rounds pooled data)



Compared to the national data for malnutrition; rates of stunting (HAZ) were lower at each age in the Shinile data compared to national data. Wasting (WHZ) was less in the younger age groups but more in the older children compared to the national data. Rates of underweight (WAZ) were lower in Shinile than in the national data although by 24-36 months the Shinile children show similar rates of underweight to the national sample (Table 7). The pastoral and agro-pastoral children therefore are less stunted than the average Ethiopian child at this age but wasting starts earlier in these children.

Table 5
Comparison of Shinile zone data (3 survey rounds) with DHS data (national) from 2005

	% children with moderate plus severe malnutrition (<-2 z scores)					
	Stunted (HAZ)		Wasted (WHZ)		Underweight (WAZ)	
Age (mo)	**Shinile**	**DHS**	**Shinile**	**DHS**	**Shinile**	**DHS**
<6	n/a	8.1	n/a	6.4	5.9	4.4
6-8	6.9	26.6	3.6	10.3	9.7	19.1
9-11	11.9	32.7	9.3	14.2	20.0	38.2
12-17	20.0	46.3	16.1	18.8	34.3	47.5
18-23	25.4	61.7	24.1	16.6	38.7	48.2
24-36	20.7	51.3	16.0	9.0	42.0	42.2

3.3.3 Malnutrition by sex

Stunting is less prevalent in girls than boys (OR 0.76 p=0.004) although for wasting there is little difference. In the multiple logistic regression models, boys are twice as likely to be underweight as girls in the restricted analysis of children under 9 months (table A8). This suggests a long term difference between the growth of boys and girls and the differences start very early in life. No obvious differences in feeding pattern or illness account for these differences. The sex differences have been observed in other studies in Ethiopia, for example in the Young Lives cohort of children[27] more boys than girls aged 1 year were stunted, wasted and underweight. This phenomenon might be explained as a biologically rather than a socially determined difference, or is explained by factors not assessed in this study.

3.4 Causes of malnutrition from the conceptual model

3.4.1 Immediate causes

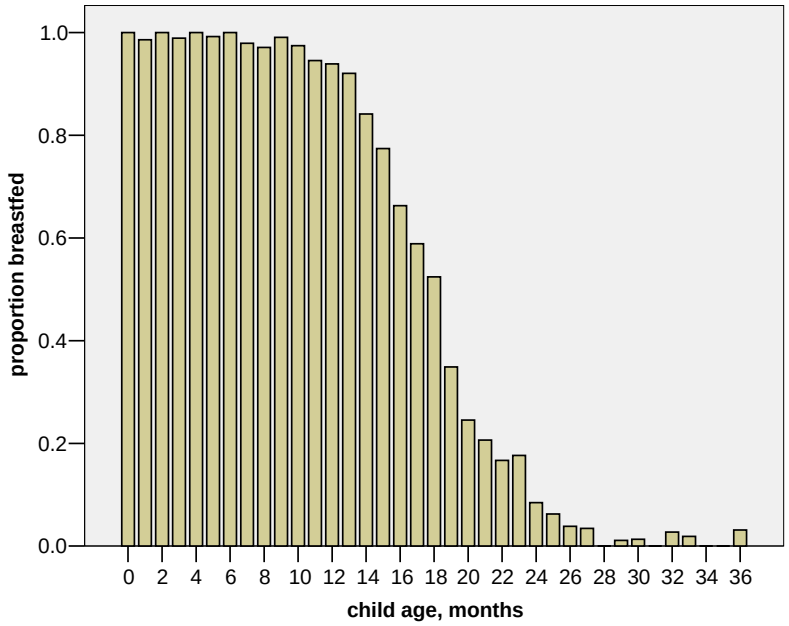
3.4.1.1 Inadequate nutrient intake

3.4.1.1.1 Breast feeding

Timing of breastfeeding

Figure 7 shows the pattern of breastfeeding at different ages. For the first 12 months most children are breastfed; after this the proportion decreases rapidly until at 19-20 months less than half the children are breastfed. The recommendation is for breastfeeding to continue until 24 months of age, therefore most children did not satisfy this recommendation.

Figure 7
Proportion of children breastfed at different ages.



[27] Tackling child malnutrition in Ethiopia. Do sustainable development poverty reduction programmes's underlying policy assumptions reflect local realities? Young lives working paper No 19 (no date)

During FGD with pastoral women, they agreed with the recommendation to breastfeed until 2 years, but in practice they stop sooner. The agro-pastoral women thought breast feeding should cease earlier and the main reason was because they wanted to get pregnant. This practice is related to the prohibition on breast feeding and sexual intercourse that is widely believed to prevent childhood diarrhoea. In addition, there were relationships between early cessation and other practical constraints, such as the need to leave the child whilst fetching water or carrying out other tasks (see below).

Exclusive and predominant breastfeeding

The type of breastfeeding was defined as exclusive (nothing in addition to breast milk) or predominant (breast milk plus water, or water with sugar only). In the first six months, the recommendation is for exclusive breastfeeding. Only 6.6% of the children of this age were exclusively breastfed and 36.0% predominantly breastfed. The majority of children were receiving animal milk during the first six months (56.4%) and therefore not meeting the recommendation for exclusive or even predominant breastfeeding. This practice would be likely to result in mal-absorption of nutrients and diarrhoea. Infants under 6 months who are exclusively breastfed were less underweight, but the numbers were small to test statistically.

Unexpectedly there was a higher risk of stunting and underweight associated with breastfeeding for children over 12 months, but this risk appears to be related to children receiving breast milk when there is shortage of other foods, thus the relationship between breastfeeding and malnutrition of the older children is confounded by the (lack of) consumption of other foods. This unexpected relationship is, however, also apparent in the multiple logistic regression models (tables A6, A7), showing that this explanation does not account for the effect totally, and it is not clear why breastfed children should be more stunted in the older age group. This relationship was also found in Ethiopia as one of the countries studied for the associations between dietary diversity and stunting[28]

In FGD women were asked what foods they gave to an infant in the first 40 days. Water with sugar was almost universally provided and animal milk and *'badhi*' (fatty tissue from sheep). When asked why they thought that breast milk is not sufficient for a new baby most replied that more vitamins were available from the other foods (including water with sugar). Sheep's milk was favoured by the pastoralists and goats and camel milk by the agro-pastoralists. Education on the best practice for breastfeeding and its nutritional benefits is required.

3.4.1.1.2 Milk consumption

Milk is a very important part of the pastoralist and agro-pastoralist diet, and from a young age children are given milk. Milk consumption was lower during the second pastoral survey; the proportion of children over 6 months receiving milk was 68% during that survey, much higher in the second agro-pastoral survey (94%) and intermediate in the first pastoral and first agro-pastoral (75% and 80% respectively). This consumption pattern is related to livestock condition and migration of animals causing poor food security at that time. The most common milk is goat's followed by cow's. Cow's milk is more common in agro-pastoral compared to pastoral

[28] Dietary diversity is associated with child nutritional status: evidence from 11 demographic and health surveys. Arimond, M and Ruel, M J. Nutr. 134: 2579-2585, 2004

LZs. Milk consumption is protective against wasting for most children (OR 0.60 for those consuming milk the previous day p <0.001), but for the younger group (<9 months) it is a risk factor (see multiple logistic regression table A8). This is because for the young group (at least up to 6 months) exclusive breast feeding is recommended.

3.4.1.1.3 Feeding practices: solid or semi-solid foods

Time to start foods

The recommended age to start weaning foods is from 6 months, and the frequency and diversity should increase up to the age of 12 months (Table 6). Most respondents believe that weaning foods should be started much later than recommendations (only 19% of pastoral and 28% of agro-pastoral women believed weaning should start as early as 4-6 months). Fig 8 shows the distribution of weaning food consumption by age, showing that at 6 months very few children have started weaning foods and even by 12 months only approximately half the children have started. This would suggest that practice is broadly following the beliefs that women have about times to start weaning but not meeting recommendations. However this practice is also explained by other constraints.

In FGD, when asked why they do not start earlier, the pastoral and agro-pastoral women gave the following reasons: there is food shortage so they give just milk; the child cannot eat sorghum which is the main food available; the child lacks teeth for chewing; complementary foods are not needed; because the child will develop diarrhoea; breast milk is sufficient. To enable earlier introduction of weaning foods, these constraints will need to be addressed, i.e. both knowledge and practical constraints of food availability.

For the age group 6-18 months, those who have started weaning foods (semi-solid foods) are not significantly more or less stunted or wasted than children who have not started; this is a cause for concern as the implication is that weaning foods are of very poor quality and are not benefiting children nutritionally as much as they should at this age. The quality of the foods is a great concern and is discussed below.

Frequency and diversity of foods

Frequency of feeding and dietary diversity recommendations are not met by the majority of children (Table 6) Figure 9 shows the relationship between feeding frequency and underweight. With the exception of the youngest age group, increases in feeding frequency are associated broadly with improvement in prevalence of underweight. Similarly, increases in dietary diversity are also associated with improvements in underweight, with the exception of the youngest group (figure 10). The relationship between frequency and diversity when data from all ages and survey rounds are amalgamated is shown in tables A3 and A4. For wasting, dietary diversity and overall feeding score were both protective and the P2 survey was the greatest contributor to this effect. It was during this harsh season that children's nutritional status was most affected by their dietary intake. For stunting feeding frequency, dietary diversity and overall feeding score were protective, but just in round AP1. We would expect dietary diversity to be more important for stunting, but with the narrow range of foods available it is not easy to find associations for all rounds.

Figure 8
Proportion of children who had started weaning foods at the time of the survey by age

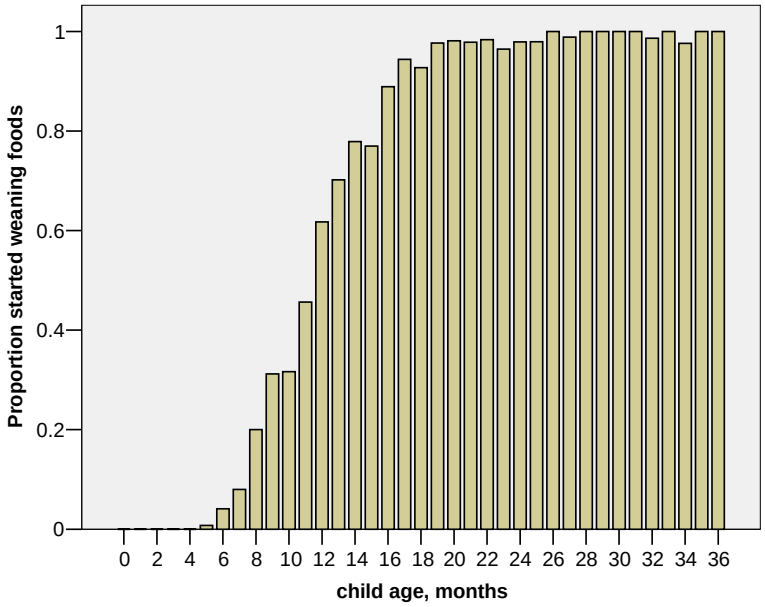


Figure 9
Frequency of feeding and proportion of underweight children

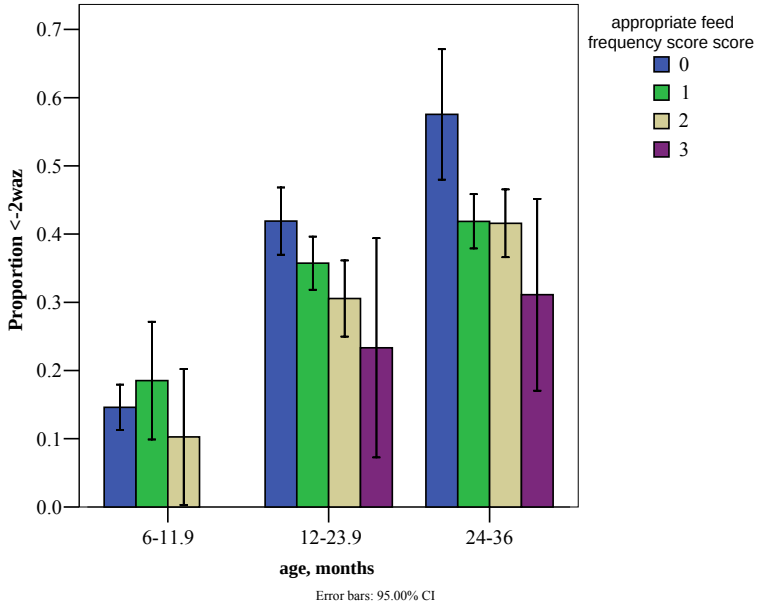


Figure 10
Dietary diversity and proportion of underweight children

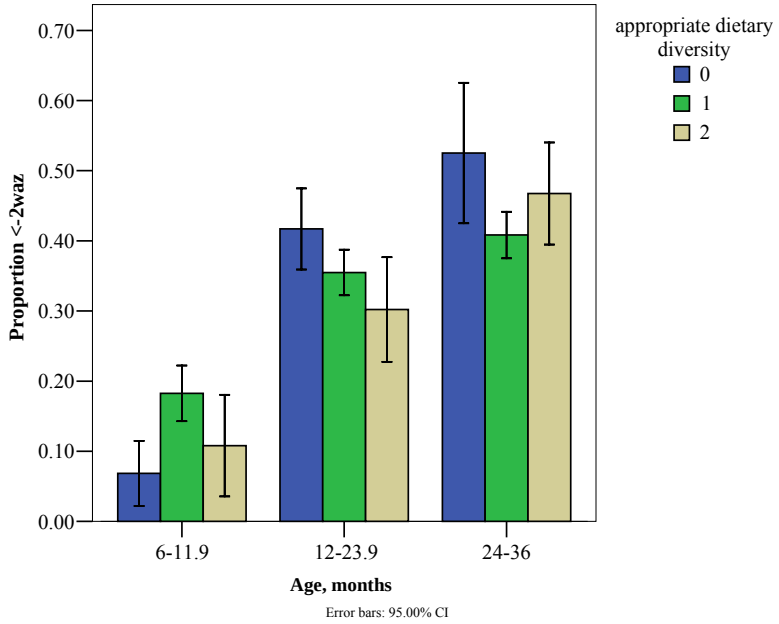


Figure 11 shows the proportions of children who consumed different foods. In addition to breast milk children less than 6 months consumed animal milk. Up to 12 months the children still consumed predominantly animal milk with approximately 20 % consuming cereal and 14% oil. After 12 months consumption of cereals and milk increases to at least 80% of children and oil to 50%. Consumption of carotene containing foods, tubers, legumes, fruit and meat are all below 10% in children of all ages. These foods were seasonal: meat and oil were consumed more in the very dry pastoral season (P2), vegetables and fruit more in the wet seasons (P1 and AP2). The low consumption of different types of foods is the reason that dietary diversity recommendations can rarely be met.

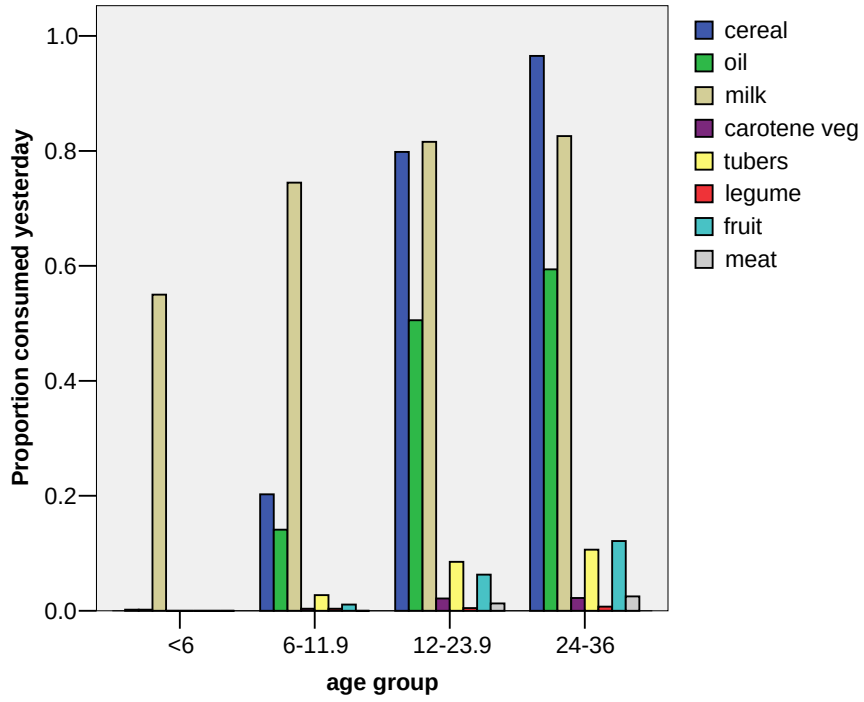
3.4.1.1.5 Vitamin A supplementation.
Only 31% of children >6 months had received a vitamin A capsule in the last 6 months. The national coverage for vitamin A supplementation for children 6-59 months was 46%. [29]
In AP1 vitamin A supplementation was related to reduced risk of stunting and in P2 to reduced risk of wasting (tables A3 and A4). Vitamin A supplementation is clearly important and coverage needs improvement.

3.4.1.1.6 Consumption of wild foods
During the rainy season, wild foods are consumed; in the pastoral area these consist of various different fruits, gums from small thorny trees, bark from small shrubs. The agro-pastoralists consume a wider variety of wild fruits of different colours. These wild foods, however are usually collected and eaten by older children who mind the animals rather than the small

[29] Demographic and Health Survey, Ethiopia 2005; Central Statistical Agency, Addis Ababa & ORC Macro, Calverton, Maryland USA

children. It might be possible to make use of these foods to develop special weaning foods for children 6-12 months of age, but seasonality means they would not be available year round.

Figure 11
Proportion of children who consumed food groups on the previous day (not including breast milk)



3.4.1.1.7 Overall feeding scores

Overall feeding scores are shown in table 6. They are calculated with a maximum score of 6 for each age group except <6 months as shown in the Appendix. The feeding scores were well below recommendations for each age group. Comparison of different survey rounds shows that the agro-pastoralists score higher than pastoralists and that there was little difference between the seasons (table A1 and A2). Age and sex adjusted ORs for wasting show a protective association of overall feeding score for all rounds combined OR = 0.87 p=0.006, but for stunting this was only apparent in the AP2 data (tables A3 and A4). In the multiple logistic regression models, overall feeding score was not a significant predictor of wasting or stunting, but for underweight it was protective (tables A5, A6, A7). The children clearly need to increase dietary diversity and frequency to meet their requirements and the lack of significance for overall feeding in the some of the multiple regression models does not change this recommendation. The lack of a strong association in the statistical models for malnutrition is probably because of the widespread poor feeding practices and almost universal lack of sufficient frequency and diversity. The constraints to better feeding practice are explored below.

Table 6
Recommendations for feeding practices for children up to 36 months and percentage of children satisfying the requirements.

Age (months)	Breast-feeding	%	Diversity of foods	%	Frequency of feeding	%	Feeding score
0-5.9	Yes	98%	Breast milk only	7%*	On demand	n/a	--
6-8.9	Yes	98%	≥ 2 food groups	8%	≥ 2 times/d	6%	2.94 ± 0.96
9-11.9	Yes	96%	≥ 3 food groups	18%	≥ 3 times/d	12%	3.37 ± 1.12
12-23.9	Yes	55%	≥ 4 food groups	12%	≥ 4 times/d	6%	2.42 ± 1.15
24-36	n/a	n/a	≥ 4 food groups	16%	≥ 4 times/d	9%	2.43 ± 0.94

*this percentage represents exclusive breastfeeding

3.4.1.1.8 Constraints to adequate feeding
From the FGDs with women the following reasons were given for feeding practices:
What are the reasons for not giving special weaning foods?
"No money ; milk is more important ; do not know what is weaning food; a child should eat what the family eats; cannot always go to the market; no special weaning food; shortage of weaning food; shortage of time to cook; cannot give sorghum because the children cannot chew it."
Women were not aware of what would constitute a good weaning food, and mentioned foods such as biscuits, spaghetti and rice (all refined carbohydrates with low nutrient density).

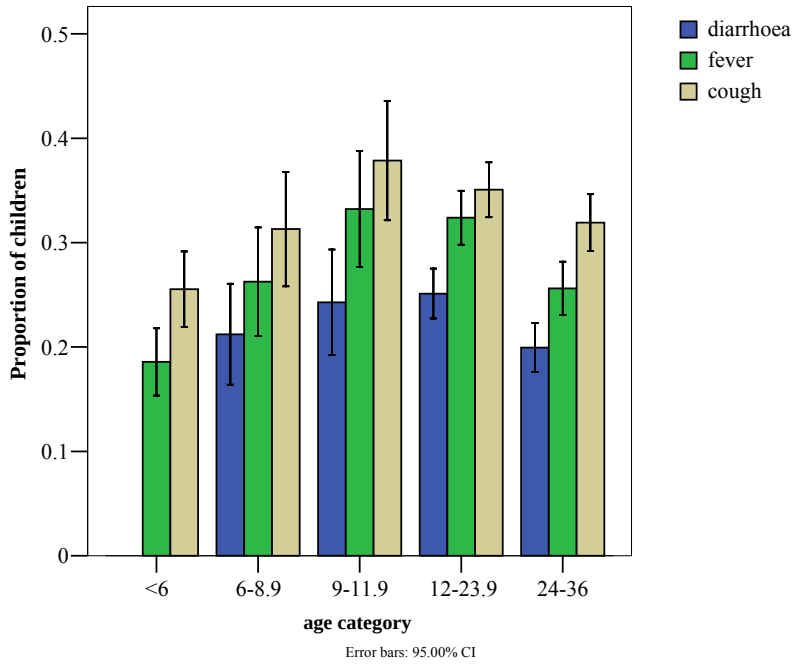
Why not more frequent feeding?
Shortage of weaning food; breast feeding children cannot eat more than this; children do not like the food available; the food available is not good so milk is better; shortage of time to prepare; less time to feed because of the workload.

These responses reveal an array of different constraints to adequate feeding practices including financial, knowledge/ belief systems, lack of time, lack of food availability and lack of traditional processing for the preparation of weaning foods. There is also a traditional practice of removing the child's milk teeth if they suffer from diarrhoea, vomiting or fever which would make the consumption of the family foods even more difficult. These constraints are explored further section 3.4.2 (underlying causes).

3.4.1.2 Immediate cause: Disease

Morbidity in children was assessed by prevalence of cough, fever or diarrhoea in the past 2 weeks. These symptoms increased from birth until age 12-24 months then decreased (figure 12). Cough and fever were strongly related in the children; children with fever tend to also have cough. Diarrhoea is also associated with prevalence of fever and cough. Fever was present more in agro-pastoral than pastoral children.

Figure 12
Proportion of children with diarrhoea, cough and fever reported in the past 2 weeks by child age (diarrhoea assessed in children over 6 months)



Being wasted was associated with both diarrhoea (OR = 2.01 p<0.001) and fever (OR = 1.86 p<0.001) controlling for age and sex. Being stunted was associated with diarrhoea (OR = 1.52 p<0.001) and fever (OR=1.28 p=0.016). Underweight was associated with both fever (OR =1.58, <0.001) and diarrhoea (OR = 1.82 p<0.001) (tables A3, A4). In multiple logistic regression models, diarrhoea and fever are both important risk factors for malnutrition (tables A5-7) after accounting for other factors.
These common childhood symptoms are risk factors for malnutrition, but malnutrition is both a cause and effect of these conditions, so the children are likely to be suffering from a vicious cycle of infection and malnutrition.

3.4.1.3 Interaction between disease and dietary intake

To be expected, children suffering from current illness were more malnourished than those without illness. It was also apparent that those who were ill at the time of the survey had reduced dietary intake. This was true for cough and fever for children 12-24 months and for diarrhoea with children at age 24-36 months. Disease can exert its detrimental effect on malnutrition both directly (for example by increasing the metabolic rate) and indirectly by reducing dietary intake. To break the cycle, it is necessary to reduce disease and increase dietary intake and quality if possible for maximum impact on malnutrition.
.

What are the possible causes of diarrhoea and fever?

The fact that children with diarrhoea, cough and fever consumed less food than those without the symptoms is likely to be a response to the illness rather than a cause, so it is difficult to identify dietary causes of these symptoms from cross-sectional data.

Diarrhoea was associated with the use of unprotected water source just in AP2 ($p=0.03$) and with hygiene score just in AP1 ($p <0.001$). It is not clear why this relationship was not stronger. The carers reported that soil consumption was common in children; this combined with poor hygiene practices and lack of latrines could negate any benefits from clean water, use of soap etc.

3.4.2 Underlying causes

3.4.2.1 Insufficient household food security

Mother's meals and child's meals

Household food security was assessed by mother's meal frequency and mother's dietary diversity. The number of meals per day that the mother consumed correlates closely with the number of meals consumed by the child ($r = 0.36$ $p<0.001$) and the diversity of foods consumed by the mother in a month is closely correlated with the child's daily dietary diversity ($r = 0.43$ $p<0.001$). This implies that when food is available, it is given to the child, when there is scarcity both mothers' and the child's feeding suffers.

There was not a strong relationship between mothers meal frequency or diversity and malnutrition, with the exception of the P2 survey where both were found to be protective against wasting (table A3), even after controlling for child feeding (data not shown). In this harsh season, household food security was clearly a limitation for adequate child nutrition.

In FGD, mothers were asked their reasons for low consumption of fruit and vegetables. Their answered reveal some of the constraints:

- *Vegetables*: They need more money; they are only available in season or for a special celebration; they are only possible when someone goes to the market to sell an animal
- *Meat:* Only available during the dry season when animals die; only consumed for a special celebration or when someone dies
- *Fruit:* When money is available; if they had an irrigation scheme; only when they go to the market in big town; seasonally, in the summer; during Ramadan

The men were then asked what they thought were particularly nutritious foods.

Agro-pastoralists: Out of 11 FGDs meat, milk and sorghum were mentioned by most respondents. In only 3 discussions fruit was mentioned, in 3 vegetables and 3 any kind of pulse. CSB was mentioned in four groups.

Pastoralists: Out of 6 FGDs, milk was mentioned by 4 groups, meat by 2 groups and vegetables and fruit by just one group. Pulses and CSB were not mentioned.

From this we can conclude that vegetables, fruit and pulses are not generally considered as nutritious foods.

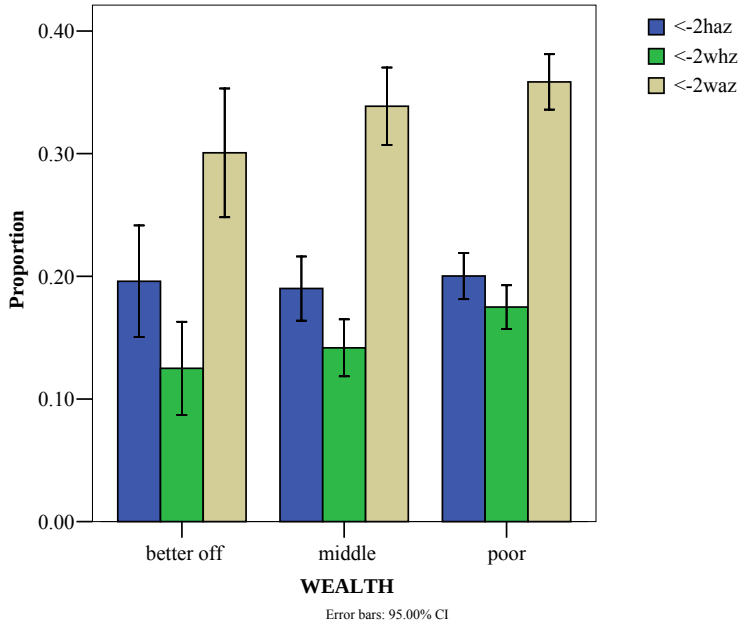
These discussions suggest that to improve vegetable and fruit consumption several constraints need to be removed: lack of money, lack of markets or home production, reluctance to slaughter animals for meat, low priority given to these foods and lack of knowledge on nutrition.

3.4.2.2 Inadequate maternal and child care

In this section the constraints to adequate care are considered: wealth, maternal issues, time constraints, knowledge constraints, household priorities, demographic factors and children as carers.

3.4.2.2.1 Wealth

Figure 13
Prevalence of stunting (haz), wasting (whz) and underweight (waz) by wealth group (excluding petty traders)



1. Wealth and malnutrition
Prevalence of wasting increased with increasing poverty; on average the poorest group were 17.5% wasted, and of this 2.3% severely wasted. The better off group, by contrast were 12.5% wasted and of this only 0.3% severely wasted (p=0.024) (figure 13). In the multiple logistic regression, however wealth is not an important predictor for wasting, implying that the wealth differentials are explained by variability in the other factors included in the model (tables A5-A9). These differences are described below, for example, better off children had better health, dietary diversity and greater milk consumption, all of which could contribute to better nutrition. Stunting on the other hand is not so associated with wealth.

2. Wealth and breastfeeding
The poorer group practice exclusive or predominant breastfeeding more than the medium and better off groups in the under 6 month group (49.4, 36.2, 31.1 % respectively p=0.005). The same pattern also holds for the 6-9 month group. These differences are likely to be caused by economic constraints to milk availability more than belief systems.

3. Wealth and milk consumption
Milk consumption was higher in better-off children than poorer: 86 vs. 72% of children consumed milk the previous day ($p< 0.001$). This trend applied to each round and age group.

4. Wealth and feeding frequency
Differences in feeding frequency were only apparent for wealth in AP1. In P2 and AP2 there were smaller differences by wealth. These were seasons following harsh long dry season when communities were stretched to provide food. The lack of differentials may be explained by the practice of sharing scarce food supplies between better-off and poor at times of hardship.

5. Wealth and dietary diversity
In each round the better-off group had higher dietary diversity score than the other 2 groups; in all rounds combined, 20% of better-off children met the diversity score vs. 13 % of poor children ($p<0.001$). The difference between the wealth groups is again less apparent in P2 when dietary diversity was generally less during this harsh season.

6. Wealth and timing of initiation of weaning foods
There was no particular relationship between the timing of initiation of weaning foods and wealth group.

7. Wealth and health
The prevalence of diarrhoea and fever were higher in the poor compared to the better off households. 18.7% of the better off children had diarrhoea compared to 23.0% of the poor ($p= 0.075$). For fever 21.7% of the better off and 29.1% of the poor had fever in the past 2 weeks ($p= 0.013$). Ringworm and lice were not different in the wealth groups. There are many ways in which these differences could have occurred, for example through better nutritional status or through better environmental conditions in the better-off group.

3.4.2.2.2 Maternal issues
Mother or carers nutritional status
Maternal nutritional status was assessed by maternal MUAC. Although few women (7.3%) were below the cut off of 210mm, maternal MUAC was associated with measures of child wasting; both child MUAC and low weight for height. The OR for a child being wasted with a mother with low MUAC was 1.92 ($p<0.001$); a malnourished mother was almost twice as likely to have a malnourished child as a well-nourished mother.

This relationship could be direct; i.e. poorly nourished mothers are unable to provide the care required for children or the explanation could be that both maternal and child wasting have a common cause, such as poor food security. This can be tested by regression analysis. Maternal MUAC was a significant predictor of stunting, wasting and underweight in all the multiple regression models (tables A5-A9). This implies that maternal malnutrition has a detrimental effect on child malnutrition that is independent of food availability in the household and the number of meals given to the child. The implication is that poorly nourished mothers are unable to provide good care for their children.

Maternal malnutrition was not directly related to child morbidity (diarrhoea, fever or cough).

Maternal and paternal illness

Maternal and paternal illness lasting at least 3 months in the past year was reported by the mother /carer. On average 7.2% of mothers/ carers and 3.5% of fathers were ill over the past year. Malnourished mothers / carers were more likely to be ill (OR = 2.2 $p<0.001$). As with children, there is a vicious cycle between maternal malnourishment and illness. The main causes of illness of the mother were cough/ cold/ TB (29%) abdominal pain (23%) joint/ back pain (22%) fever/malaria (14%) anaemia (4%) diarrhoea (2.6%). The main illnesses of the fathers were cough/cold/TB (40%) joint/back pain (19%) abdominal pain (15%) fever/malaria (10%) psychosis (5%) paralysis of limbs (4%) and diarrhoea (2%).

Mothers who are ill are more likely to have a wasted child (OR = 1.52 $p = 0.013$, a child with diarrhoea (OR = 1.57 $p =0.001$), a child with fever (OR = 2.00 $p<0.001$) or a child with cough (OR = 1.53 $p=0.001$) after controlling statistically for malnourished mother. There are therefore nutritional implications for the child if the mother is ill. There was no statistical relationship between sickness of the father and child wasting, diarrhoea, fever or cough.

Mother's illness could contribute to child's illness and malnutrition because they are exposed to the same deprivations or because mothers are unable to provide adequate care when they themselves are ill. The multiple logistic regression models suggest that the health of the mother *per se* is important. Including other variables such as feeding, child illness into the statistical model still shows an association between mother's illness and malnutrition; particularly for the youngest children and for wasting (Tables A5-A9).

Malnourished and sick mothers are more likely to deliver low birth weight babies and breast feeding could be affected by diet and illness. This means that the nutrition problems could be starting before birth or during the neonatal period for these mothers. In FGD some women reported that during late pregnancy they restrict their dietary intake to prevent a difficult birth During the first 40 days after birth some women restrict intake of water and other 'cold foods' including wheat and rice because there is a belief that the these foods can harm the uterus. Maternal diet should be a topic for nutrition education so mothers become aware of the risks to themselves and their children of these practices.

Other gender issues from FGDs

- From the Men's FGD it was clear that the men were the ones to decide on choices of food purchases
- When the woman is pregnant it is usually a female relative or neighbour who takes care of the children and the man continues his usual tasks, although several pastoral men also mentioned providing meals for children during his wife's pregnancy. The agro-pastoral men also reported that their role was to fetch a female relative or to give cooked food.
- The women's time schedules reveal that the bulk of the work is carried out by them and that they do not rest during the day (with the exception of the better off group during the rainy season). The FGD with men on time schedules showed that several hours per day were spent in discussion or chewing chat.
- Chronic illness (of 3 months or more duration in the past year) was more prevalent in women than men (7.3 vs. 3.4%).

- Education and literacy are worse in women than in men (see section 3.4.2.2.3) Information on nutrition and caring practices is available from relatives and TBAs; unfortunately faulty beliefs may be passed through generations.
- Women do have traditional support structures and during late pregnancy and after a child is born neighbours and relatives will assist the mother with tasks.

3.4.2.2.3 Time constraints

Time schedules of mothers/ carers

The proportion of mothers/ carers who were away from their children on the previous day is shown in figure 14. Most mothers /carers avoid leaving their youngest children behind while they carry out daily activities. As the child gets older more mothers are away from their children. By the age of 24 months, approximately half the children are spending time away from their mothers/ carers. They do this because the child has become too heavy to carry and because breastfeeding has ceased.

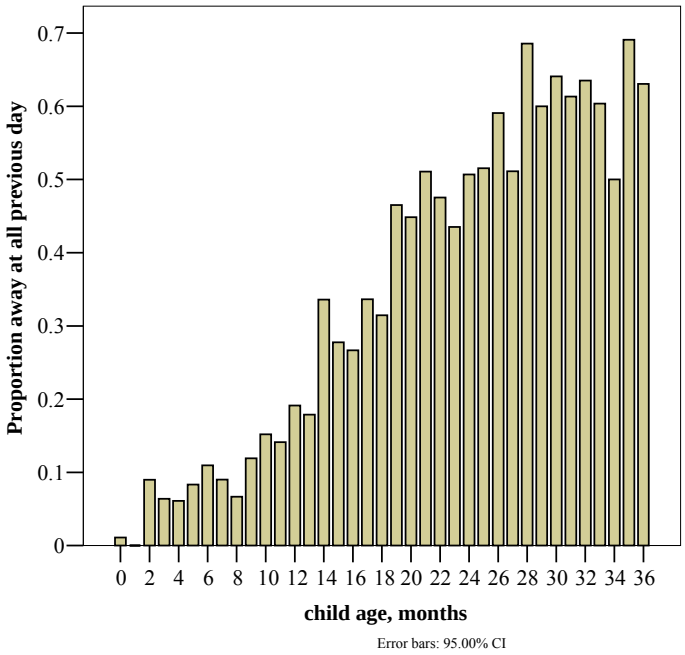
The time-consuming tasks for mothers include collecting water and wood and carrying out income-generating activities. Collecting water depends on the distance to water source and the season; some sources dry up during the dry season. The average time to collect water for all rounds is 2.2 hours per day, but in the dry season this increased to 2.7 hours on average. 10% of women spend more than 4 hours per day collecting water. Collecting wood is also a time-consuming activity; women spend 2 hours per day collecting wood.

These activities have several possible implications for mother and child. The relationships were particularly apparent in the pastoral dry season P2.

1. Women who spend longer collecting water consumed less meals per day than those taking less time ($r = -0.16$ $p<0.001$). This could be related to the time she needs to spend on preparation or the lack of food availability coinciding with poor water availability.
2. The mother's nutritional status is detrimentally associated with the time to collect water. Maternal MUAC is negatively correlated with time to collect water ($r = -0.12$ $p<0.001$). It is not clear whether this is due to the extra energy expended or to the lower number of meals consumed or both. In a multiple logistic regression model both time collecting water and mothers meals are predictors of maternal MUAC, suggesting that the water collection has an impact on maternal malnutrition that is independent of the meals she can consume.
3. The mother is unable to take older children with her during daily activities and they must be left behind, usually with a sister or grandmother. This affects the care she is able to give the child. The sibling is not able to provide the same standard of care, for example breast feeding is not possible.
4. Exclusive or predominant breast feeding for the under 6 month child is more likely in women who are not away from their children (44% vs. 32%).

The seasonal differences in time schedules are related to time collecting water (more in dry season). In addition women reported more time spent caring for animals in the dry season. The poor group also reported less time cooking during the dry season, an illustration that time is very limited for them during that season.

Figure 14
Proportion of mothers / carers who were away from their child at all on the previous day by age of child.



There were also wealth differences: the poor spend more time collecting wood to sell whereas some of the better off women will buy wood in the kebeles that are closer to a market. On average, however the better-off women spent more time away from their children compared to the poor (1.9 vs. 1.5 hours per day).

There would be several advantages for the children if mothers could reduce these time demands; they would be able to spend more time preparing food and feeding young children, breastfeeding and giving attention to hygiene and their own dietary and welfare needs.

The ORs for wasting and stunting and time spent away, however showed an unexpected protective association for time spent away from the child; even in the multiple logistic regression analysis (tables A6, A7). There is a complex relationship between time and malnutrition as the wealthier group of women were spending more time away from children than the poor. There could be a trade-off between income generation, for example, tending to animals (and its nutritional benefits) and time away from children (and its nutritional risks).

3.4.2.2.4 Knowledge constraints

Education is poor in the districts of Shinile and Dambal. 98% of mothers/carers and 75% of men received no education and the same proportions were illiterate. It was therefore not possible to assess the effect of female education on malnutrition in this population. We did not assess the level of education for children.

Knowledge of mothers
Knowledge of mothers was assessed by questions on appropriate weaning age, causes of diarrhoea and knowledge of oral re-hydration solution. The following percentages of women answered correctly:

- Appropriate weaning age (24%)
- Causes of diarrhoea (23%)
- Knowledge of ORS (80%)

From these individual questions, a score from 0 to 3 was constructed.
Those with a score of 0 (they did not answer any question correctly) had children who were, on average 20% wasted compared to 14% for those answering all questions correctly ($p = 0.08$). Knowledge score was higher in the pastoral than agro-pastoral surveys. The OR for overall knowledge score and wasting showed a protective association controlling for age and sex (table A4) but not for stunting (table A3). The associations between knowledge and malnutrition were only significant in round P2 when knowledge of age to start weaning and the causes of diarrhoea were important. In multiple logistic regression analysis knowledge was not significant in any of the models, suggesting that knowledge (at least about these particular issues) becomes overshadowed by practice in importance.

From FGDs, many additional issues of poor knowledge were identified, for example, women and men did not think exclusive breast feeding was beneficial for children, few women or men mentioned foods such as fruit, vegetables or pulses as being good foods for children. However with the lack of availability of these foods in the community it would be difficult for households to aspire to these foods.

3.4.2.2.5 Household priorities
Health Seeking Behaviour
In FGDs women were asked:
What do you do if your child has diarrhoea? Where do you take for treatment?
"to the nearest clinics or health facility because the child did not respond to all the traditional treatments and medicine, and if there is no improvement or the child did not recover, to Dire-Dawe hospital and then only when the family can afford it and the health situation is very critical"
In the men's groups a similar picture emerges:
Under what circumstances would you take your child to a health post or other health facility?
"In difficult circumstances only when the family can pay for treatment; when all other traditional treatments have failed; when the child's health deteriorates."

It is clear that the health posts are visited as a last resort when the local treatments fail. There are also very few functioning facilities meaning that long distances must be travelled to reach them, a further disincentive to seek treatment early.

In FGD with TBAs we asked about the treatments they recommend or dispense:
What do you advise for a child suffering from diarrhoea?
Amongst the pastoralists, none recommended to increase liquids, the main advice was for herbal remedies, burning the child around the stomach or killing the 'gedsare' bird which is believed to

be a cause of diarrhoea. The practice of burning relates to the belief that 'fire and disease cannot survive together'. They also practice milk tooth extraction as a remedy for diarrhoea. Modern medicines were not available to these practitioners. This advice was similar to the practices the women reported following diarrhoea in their children:

In FGD with women; they reported no change in amount of liquid consumption, but sour milk was given, or herbal leaves or some mentioned sugar water or ORS. Little change in feeding was reported, apart from giving over-cooked rice, *badhi* and some traditional leaves. Several groups also mentioned the burning of the stomach and spiritual water as a cure for diarrhoea. Some of the traditional practices are beneficial, others neutral and some harmful.

Household feeding order

The pastoral and agro-pastoral men and women of all wealth groups reported that the feeding order was: children, husband then woman. Some also mentioned that when meat was limited that it was prioritised to the men. For young children, the recommendation is to have frequent meals but this recommendation was not followed. There are, however, other constraints to more frequent feeding that have been described elsewhere.

Spending priorities

In initial FGDs we asked who decides spending priorities; we established that this was usually the male household head, so groups of men were asked about their spending priorities:

If you had more income (1000 birr per month, approximately $100) how would you spend it?
Pastoral group: The poor groups prioritized food items, sorghum, sugar, tea, oil, rice, spaghetti, fruit and vegetables. After food, their priorities were clothes and leather for shoes then finally money to start a business.
The middle income group also gave first or second priority to food and again sorghum, sugar and tea were the main items favoured. They also mentioned clothes and shoes then investments in animals and petty trade. There was just one mention of medications.

Agro-pastoral group: The poor group again prioritized food items, sugar, tea, pasta meat and animal milk, sorghum, wheat and barley.
The middle income groups also mentioned clothes and items that would build economic assets, for example parts for maintaining irrigation system, paying for labour, hiring a tractor, buying animals, buying seeds, construct a dam, starting small businesses. Only in 1 focus group was medication mentioned.

The food items mentioned were usually the main staples rather than nutrient dense foods. Vegetables or fruit were only mentioned by pastoralists. After food needs are satisfied, the men's main concern was income generating assets. Items that would improve hygiene (such as soap) or health, (such as medicine) were not prioritized.

The control over resources tends to be a role for the male head of household, but child care is the responsibility of women, therefore it is important to include men in informal education so they might consider prioritising expenditure on children. Women also need to receive education because it is they who will need to put the new information into practice.

3.4.2.2.6 Demographic factors

Household size and birth interval

Larger households were shown to be protective against stunting (OR = 0.93 reduction in stunting for each extra household member p=0.001). The possible explanation is that larger households offer some protection against shocks and offer economy of scale. This protection is also apparent in the multiple regression analysis, but only when the older children are included. For young children the household size is not protective (tables A6, A8). Short birth interval is potentially a risk factor for young children. In a subset of children under 12 months in P2 and AP2 where birth interval was assessed, there was a greater risk of stunting with short birth interval (OR = 1.02 for each extra month of birth interval p =0.039).

This means that for the youngest child there is more risk of malnutrition if the interval is short, and this effect could occur through competition for mother's resources of time, food, and care in general. Larger households therefore are only protective if the birth interval is also long.

The issue of family planning was not explored in this assessment.

Polygamous households

There was no relationship between stunting, wasting or underweight and monogamous or polygamous households in pastoral or agro-pastoral surveys.

3.4.2.2.7 Children as carers

Another constraint to adequate care is the necessity for mothers to leave their young children in the care of older children. These children are typically aged 7-13 years, but can be younger and it is the girls more than the boys who usually have the main responsibility.

In FGD with these children, they reported spending from 1 hour to 10 hours per day with their siblings who were usually over 1 year old (although three groups mentioned children less than this). This corresponds with information from the mothers who reported that they usually try to stay with the child who is less than 1 unless they must carry out petty trade or other duties that cannot accommodate the child. During their time with their younger sibling the girls also need to carry out other domestic tasks such as cleaning and processing sorghum.

To explore the adequacy of care provided by the children, we asked:

"*what do you do if the child does not want to eat or drink the food that is there for them?"*

"encourage to eat or drink, if he refuses again, beat them, leave and wait until the child wants to eat; encourage, singing to them if didn't work, beat them; usually we don't encourage them but give food only when the child needs to eat".

The encouragement to eat was not good amongst the children and beating was mentioned several times. The psychological care provided by children would limit the amount of food provided, for example for a child suffering from illness.

In contrast, the women, when asked a similar question all mentioned encouragement and holding the child and none mentioned beating.

3.4.2.3 Insufficient health services and unhealthy environment

3.4.2.3.1 Vaccination

Children who were vaccinated against measles had a reduced risk of stunting (OR = 0.80 p= 0.039). The coverage of vaccination was not uniform, but tended to focus on the more accessible kebeles, so there is concern that vaccination was just a marker of better access to communications in general. In the multiple logistic regression model, however, this association was also apparent, suggesting that the vaccination itself was protective against stunting.

3.4.2.3.2 Hygiene and sanitation

Malnutrition was not related to hygiene score in general, with the exception of the youngest group under 9 months. In these children those with low weight for age had a score of 0.82 compared with 1.26 for those who were not underweight (p=0.001). For this group, good hygiene practices (hygiene score) were protective against underweight in the multiple logistic regression model showing that this effect was independent of other variables. The important components of the hygiene score were: whether the house was free of animal faeces and whether the child faeces were disposed outside the compound. A clean environment was therefore apparently particularly important when the child starts to crawl. If the child is consuming soil, it is clearly very important that faeces are well disposed.

There was no general relationship between hygiene score and diarrhoea, but a slightly lower risk of diarrhoea with use of protected water (OR 0.87 p=0.21).

Latrines were so rare in the surveyed areas that it was not possible to assess their impact on nutrition or health. Soap was rarely used specifically on children, usually because of the absence of sufficient water.

From the FGDs of time schedules, women only mentioned washing clothes in the wet season and more time is spent cleaning the house during the wet season.

Hygiene practices are dependent not only on the behaviour of carers but on the provision of adequate water and sanitation facilities. In these communities the constraints to hygiene practice are both environmental and behavioural, requiring both improvements to water, provision of latrines and behavioural, requiring knowledge and time.

3.4.3 Basic causes

A thorough analysis of basic causes was not undertaken for this research project, so comments here are limited to the questions raised in interviews.

3.4.3.1 Food security information from key informants

In our first survey rounds P1 and AP1, according to key informants the previous *gu* rain performance (March – May 2005) was reported as poor or very poor with shortage of rains. The *karan* rains (July – Sept 2005) were reported as good or medium in the pastoral areas but poor or very poor in the agro-pastoral. The effect of the dry season (*jilaal*) in P2 was very bad over the

whole district surveyed. The *gu* rains (March –May 2006) were reported as very variable in the agro-pastoral surveys with a range of poor, medium and good rains reported in different kebeles.

Livestock condition varied due to seasonal changes. In P1 the livestock physical condition was poor or very poor by 12% of respondents. AP1 reported 47% as poor or very poor. P2 was the worst time, while 100% of the key informants reported poor or very poor livestock condition. By AP2 15% of the respondents reported poor or very poor livestock conditions in their locality. These trends follow the reporting of rain performance above, i.e. when the rain was poor, generally poor animal condition followed. In addition, veterinary services are very poor throughout the surveyed population. 94% of the key informants were reported complete lack of veterinary services. In the Agro-pastoral LZ the harvest was reported as poor in the AP1.

Food security varied with season following condition of animals; P2 was the worst season due to poor rain and livestock condition. According to livestock condition the best were AP2 and P1 and AP1 was intermediate. This ranking is very subjective, according to reports from key informants at each round.

The receipt of food relief also affects food security. 31% of households (excluding petty traders) were consuming food relief at the time of the survey, and more in the poor group (33%). There was no difference in wasting between those who were or were not consuming relief food, but slightly higher stunting rate in those receiving food relief (21.4 vs. 18.8 %), this difference probably related to poverty levels of those targeted for food relief.

Comparison of food security data at kebele and household level

The household food security variables collected were meals per day for the mother and mother's dietary diversity. These were compared by round. The household measures corresponded with the seasonal food security in broad terms; the mothers' meals and diversity was lowest in the poorest season (P2) and best in the season with the least percentage of poor or very poor condition livestock (P1). These seasonal differences also correspond with the percentage of wasted children; the highest percentage being in the P2 season and comparable percentages in the other seasons (table 7).

Table 7 comparison of seasonal and household food security indicators

	% livestock poor condition	Mothers' meals	Mothers' diversity	N
P1	12	2.52 ±0.53	2.97 ±0.75	813
AP1	47	2.50 ±0.52	2.46 ±0.79	1210
P2	100	2.10 ±0.45	2.09 ±0.89	1095
AP2	15	2.34 ±0.47	2.50 ±0.76	1206
Ave		**2.36 ±0.52**	**2.47 ± 0.85**	**4324**

3.4.3.2 Formal and Non-formal institutions

Education facilities

According to key informants from each kebele visited, approximately half had a school, although the facilities and staffing were limited. The education level of household heads and carers show that availability of education resources was very poor for their cohort.

Health facilities
There are four functioning[30] clinics and five newly constructed (non-functional) in Shinile district. Dambal district has four clinics; none of them are functional due to lack of manpower and medical supplies. A mobile health clinic supported by HCS was operational in Shinile district at the time of this assessment but not in Dambal. No Health Extension workers were seen during the surveys. In Shinile town there were some routine vaccinations for BCG and measles and vitamin A supplementation, but in Dambal none run by the Health Bureau. Vaccination campaign coverage is also very low, apart from in the kebeles of Dambal district served by the EOS that provides measles vaccination, vitamin A and de-worming and targeted supplementary feeding. MCH clinics do not exist at all. Maternal deaths caused by pregnancy related problems are common in Dambal district. The top 5 diseases reported by the Health Bureau in Shinile for under 5s were malaria, diarrhoea, respiratory tract infection, intestinal parasites, skin diseases and in Dambal, acute respiratory tract infection, diarrhoea, lower respiratory tract infection, intestinal parasites and eye infections. These agree broadly with the symptoms we identified at the household level.

In the absence of a local facility, the average time to walk to functioning health facility was reported as 4.8 days, longer in pastoral (5.6 days) than agro-pastoral (4.1 days). Most key informants mention Dire Dawe, Shinile town Dambal or Jijiga or Borama (in Somaliland) as the nearest health facilities they visit.

There was no significant difference in the levels of stunting or wasting in kebeles that did or did not have health facilities, probably because the health facilities were either not functioning or poorly functioning. The poor health facilities are very likely to be contributing to the high morbidity and related malnutrition in the surveyed areas, but it is not possible to demonstrate this through statistical analysis at the household level because overall coverage was so poor.

Markets
The time to walk to a market (for selling livestock) was reported as on average 3.8 days; 4.8 in pastoral areas and 2.9 days in agro-pastoral. Vegetables and fruit were not generally available at the small kebele shops with the exception of occasional potatoes, onions, garlic and tinned tomatoes.

3.4.6 Micronutrient deficiencies

Micronutrient deficiencies, such as iron, vitamin A, iodine, zinc were not specifically assessed in the survey, but through an analysis of the main food sources available locally it is possible to make predictions of the main deficiencies that are likely in the population. Using the SCUK developed 'cost of diet' software and based on linear programming, research designed to calculate the optimum balance of foods to meet nutrient requirements, we can make a good approximation of the adequacy of the diets[31].
This analysis was carried out using the following foods: breast milk, goat's milk, sorghum, wheat, sugar, small amounts of tomato, potato and onion. The main nutrient deficiencies

[30] We define 'functioning' as a health facility with minimum services of staff and equipment
[31] Feeding of non breast fed children from 6-24 months in developing countries. WHO technical background paper, Food and Nutrition Bulletin vol 25 no 4 2004, the United Nations University

predicted by these foods for the 12-23 month child, for example, are iron and folic acid, making anaemia a particular risk. Zinc and vitamin C are marginal and iodine is not assessed by this analysis. To improve these nutrients, greater consumption of meat and vegetables or fruit is recommended; addition of legumes would also improve the protein quality and micronutrients. Milk is a good source of many nutrients, but will to satisfy all nutrient requirements of the child over 6 months.

3.4.4 Comments on seasonal and LZ differences

3.4.4.1 Seasonal differences

The seasonal differences are detailed in table A2. There are several constraints to good nutrition that occur during the dry seasons that could account for the higher prevalence of wasting of children

- There was more migration (both in and out) in the dry season and movement of animals that separates milking animals from the place where children stay.
- The food security situation in general is poor in the dry season, related to condition of animals that results in less milk available for children. Household meals and frequency was less during the dry season.
- Water sources dry up resulting in longer time to collect water and less access to protected water sources.
- Childhood cough was greater in the dry season and maternal and paternal illness was also greater then.
- Women's time is more constrained due to time required to fetch water and care for animals resulting in more time away from children.
- Wild foods are more available after the wet season
- The mother's levels of stress from time constraints, illness and malnutrition are greater in the dry season
- Wealth differentials are less in the dry season; perhaps due to sharing of scarce resources during hardship.

3.4.4.2 Livelihood zone differences

The livelihood zone differences are detailed in table A1. There are several differences that would mean that different factors are more important in each LZ. The malnutrition data cannot be used to assess inherent differences between LZs because the only usable survey from the pastoralists was in the dry season.

- Household size is larger in the agro-pastoral region, and birth interval shorter; these will have positive and negative effects on children at older and younger ages respectively
- Cough and fever were higher in the agro-pastoral LZ and diarrhoea about the same.
- Measles vaccination and vitamin A coverage and supplementary food distributions were higher in the agro-pastoral due to the EOS programme operating in Dambal. Interestingly BCG is also higher in Dambal although this is not part of the EOS programme
- Women believe complimentary foods should start later in the pastoral than agro-pastoral LZs and this difference is also there in practice.
- Agro-pastoral women are more frequently away from their children and for longer periods than pastoral, although time to collect water is less

- Markets and functioning health facilities are further away from pastoralist compared to agro-pastoralists.

3.4.4.3 Comparisons between causes of malnutrition in Somali Region and Amhara (more sedentary farmers)

The causes of malnutrition identified by this research in the Somali Region of Ethiopia have similarities and differences compared to the SCUK's findings from research in Amhara[32].

- In Amhara the women practice exclusive breast feeding more than in Somali region where the milk consumption is greater; but in both regions non-exclusive breast feeding is a risk factor.
- There is an increase in malnutrition with age and malnutrition develops during the time children start weaning foods in both Regions.
- In both regions complementary foods are poor quality, but in the Somali Region foods are given even later than in Amhara, with both regions starting these foods later than recommendations.
- Poor health is a risk factor for malnutrition in both regions. Fever and diarrhoea both related to malnutrition clearly. The direction of causality is not clear as there is a vicious cycle between illness and malnutrition; for optimum effect, both need to be tackled simultaneously.
- Access to health services is poor in both regions but in Somali region health services are nearly completely absent and in Amhara there are financial and quality limitations of the health services.
- In Somali region access to clean water is a big constraint in terms of cleanliness and time required to fetch. Distances are not so great in Amhara.
- In Amhara education and knowledge played a key role; in Somali region it was not possible to assess the effect of education due to the almost universally poor educational status of women. The knowledge questions in Somali region were a weak predictor of malnutrition; however there were many gaps in the women's knowledge on caring practices.
- Mothers nutritional status is related to the child's nutritional status in both regions
- Wealth is related to malnutrition in both Regions, although the differences in Somali region are not as marked as in Amhara.
- Women's time limitations are present in both regions and have several implications for the time for child care.
- In Amhara stunting is more prevalent than in Somali Region, possibly due to higher consumption of milk. This hypothesis needs to be tested by a combined analysis of both regions.

3.4.4.4 Comparison between causes of stunting and wasting

Table 8 summarizes the main statistical analyses for stunting and wasting from the multiple logistic regression analysis. The factors that cause stunting are those that affect children over a long period, and are reasonably constant over different seasons. Those that affect wasting include those that change seasonally.

[32] Wealth, Health and Knowledge: determinants of malnutrition in North Wollo, SCUK 2002

The longer-term factors that were related to stunting were child sex, child age, diarrhoea, vaccination, household size, mother's nutritional status and time away from the child. These factors are more likely to be present and exerting an influence on malnutrition independent of the season. It is important to note that diarrhoea is included in this list; suggesting that diarrhoea assessed at one time point is a marker for a long term nutritional problem. The same is true for maternal malnutrition and the time the mother is away from the child; these are also fairly constant issues.

The factors that were related to wasting were child age, fever, mother's nutritional status and mother's illness. From this, we can see that fever and mother's illness are likely to be the more seasonal factors that relate to wasting but not stunting.

For programmes, this is important because, although all these potential causes of malnutrition need to be addresses, some issues relate to more transient problems (e.g. fever, mothers illness) and some to more constant problems (e.g. diarrhoea, vaccination, mothers nutrition).

3.5 SUMMARY OF RESULTS

Table 8
Summary of results

	Relationship to WHZ	**Relationship to HAZ**	**Comment**
IMMEDIATE CAUSES			
Child factors			
Child sex (male=1 female=2)	NS	-ve	Males more malnourished than females
Child age (months)	-ve	-ve	Older children more malnourished
Child Feeding			
Milk consumption	+ve	NS	Milk protective for most children but for <6 months a risk factor
Overall feeding score (max 6)	NS	NS	Feeding score is protective against wasting in the age-sex adjusted model but in multiple logistic model NS
Morbidity			
Diarrhoea last 2 wks (>6 mo only)	-ve	-ve	Diarrhoea a risk factor
Fever last 2 wks	-ve	NS	Fever a risk factor
Vaccinated for measles (>9 mo)	NS	+ve	Vaccination protective against stunting
UNDERLYING AND BASIC CAUSES			
Demographic			
Household size	NS	+ve	Larger household protective

Birth interval (months)	NS	NS	short birth interval a risk factor for underweight in children <12 mo
Household Food security			
Mother's meals daily	NS	NS	Mothers meals only protective against wasting for P2 round
Mother's dietary diversity (0-4)	NS	NS	Mothers diversity, protective against wasting in the age, sex adjusted model, but in the full regression model was NS
Maternal / paternal factors			
Maternal MUAC (mm)	+ve	+ve	Better nourished mothers protective
Mother or carer sick	-ve	NS	Sick mothers: a risk factor
Father sick	NS	NS	
Hygiene and Sanitation			
Overall hygiene score (max 4)	NS	NS	Hygiene score: protective for children <9 mo
Knowledge and Education			
Knowledge score (max 3)	NS	NS	In the statistical models knowledge is not a significant predictor of malnutrition; but general levels of knowledge are poor
Time factors			
Time away from child (hr)	NS	+ve	Time away is unexpectedly protective against stunting
Wealth (1=better off 2=middle 3=poor)	NS	NS	Poor children were more wasted than better off in age-sex adjusted model, but in the full regression model wealth was NS

3.6 Key issues raised by the research

Pastoral / agro-pastoral livelihoods systems in the Somali Region have the benefit of providing valuable animal products for growing children. The systems are, however, vulnerable and acute malnutrition levels are likely to rise when there are shocks to livelihoods. Therefore, early warning information needs to be collected and nutrition assessments carried out on a regular basis. Emergency food, nutrition and health programmes will always be necessary.

The immediate, underlying and basic causes need to be addressed to prevent chronic malnutrition and to guard against shocks. This will require action at all levels: national, regional, district, kebele and household. The implementation of the draft National Nutrition Strategy for Ethiopia will help to coordinate policies and actions of different government departments, such as Health,

Water and Sanitation, Agriculture, Pastoral Affairs, Education, Disaster Prevention and Preparedness. Existing initiatives need to be implemented within the Somali Region such as the Essential Nutrition Actions, the Integrated Management of Childhood Illnesses, the Health Extension Package and the Productive Safety Nets Programme.

Because stunting develops during the first 2 years of life and is reversible during this time, efforts to prevent chronic malnutrition need to concentrate on this age range. From the data we see that although stunting is theoretically reversible, catch up growth does not occur due to continued deprivation. This does not mean other age groups should be neglected, but if, for example, we wait for school feeding programmes we will miss the critical time for intervention.

Several causes of malnutrition operate through poverty. Food security and health, for example are affected by poverty in this population therefore any intervention to address long term causes will need to include livelihoods interventions or other means of improving the economic condition, such as market access and improvements to trade.

Food availability and affordability is very poor; there appear to be no suitable weaning foods. Energy and nutrient dense weaning foods need to be developed; in the short term these will need to use local food resources, perhaps by introducing appropriate technology to process maize and sorghum for consumption as complementary foods. With the limited range of available nutrient dense foods it will be necessary to improve access to other foods, such as pulses, vegetables and meat to improve the quality of the diet. Having more income may be necessary for some households, availability of foods in markets is also necessary. There may also be some limited scope for production of vegetables and fruit with micro-irrigation. The consumption of meat for children on a more regular basis is also desirable if animals could be used more often for food; the constraints to doing this were not fully explored in FGDs.

The health of children and their mothers/ carers is a limiting factor. For children the main symptoms we assessed (diarrhoea, fever, cough) are related to most of the main causes of illness identified in the districts: malaria, acute respiratory tract infection, diarrhoea and intestinal parasites. Similarly the women and men cited symptoms of these common illnesses. Basic preventative and curative services are almost totally lacking in the areas of the assessment and there are no MCH clinics or services, therefore people suffer from easily preventable and treatable illnesses. Given that both child illness and maternal illness are related to child malnutrition it is essential that health services are improved to tackle malnutrition of mothers and children.

In addition to providing basic health services, it is also essential that access to clean water is improved to prevent water-borne diseases. Both quantity and quality of water needs improvement. During the dry season households must limit all but essential water uses, thus all hygiene practices are limited by lack of water. In addition, improved water access should help to reduce women's' workload and time constraints. Collecting water not only keeps women from child care but also stresses their own energy requirements, thus reducing their personal resources. Agro-pastoralists and pastoralists water issues are different; and may need to be addressed in different ways.

Women and men's knowledge on personal care, child care, health and nutrition is limited and often there is resort to traditional practices, some of which are beneficial, some neutral and some harmful. There needs to be sensitive work to promote the beneficial and discourage the harmful. The strength of belief in these practices is likely to be linked to the lack of medical services in these communities. Education for both children and adults is needed with nutrition and health topics included; girls' enrolment needs to improve to redress the balance of female and male education; adult education on personal care, child care health and nutrition is required in the meantime.

Women are responsible for child care but have limited resources to carry out this task adequately. They have many domestic roles to fulfil, such as collecting water and wood, caring for animals and income generation. Decisions over household expenditure, health seeking and food purchase tend to be taken by the male household head. Daily care of young children is often the responsibility of older siblings who have less capacity. Efforts to reduce the workload of women and to give them more control over resources would enable them to improve child care. During pregnancy and lactation, women need particular support to prevent maternal depletion syndrome.

4. CONCLUSIONS

Rates of wasting (low weight for height in children under 3 yrs) changed seasonally and were highest in the second pastoral survey following the bad *jilaal* dry season (21.3 % overall and 2.7% severe). Average for 3 rounds was 15.9% overall and 1.8% severe. Stunting (low height for age) was more consistent across the seasons with 19.6 % overall stunted and 4.1 severely stunted in the 3 rounds. Underweight (low weight for age) was on average 30.1% overall and 6.8% severely underweight in the 3 rounds.

Wasting, stunting and underweight all increased with age, particularly from 6-12 months. At this age illness is at its highest rate, weaning foods have either not started or are of inadequate quality and mothers start to leave the children with other carers. Catch up growth is inadequate thereafter as stunting remains high until 36 months (although wasting tends to improve after about 24 months). Boys tend to be more malnourished than girls at most ages, although this is not understood to be related to any differences in practices or conditions but rather to biological differences.

Prevalence of wasting was higher on average in poorer groups compared to the better-off. Key differences associated with wealth were: milk consumption, dietary diversity and health.

Breastfeeding practice did not follow international recommendations for exclusive breast feeding for the first 6 months due to early milk consumption. Solid and semi-solid foods are started later than recommended 6 months, are of poor quality and are not given frequently enough. This is due to a lack of special weaning foods, and methods to prepare suitable foods, time constraints and a belief in the benefits of milk. The type of diet consumed by these children is likely to result in micronutrient deficiencies and anaemia. Children suffering from common symptoms, fever and diarrhoea were more likely to be malnourished.

One hypothesis resulting from the research is that the consumption of animal products could be contributing to lower rates of stunting compared to other regions of Ethiopia where animal products are not as available. The availability of animal products, especially milk is the positive aspect of diets that needs emphasizing, and the communities are well aware of this and prize milk above most other foods.

Vaccination coverage was poor, particularly for BCG (5%) and health services in general are lacking in the communities surveyed. Hygiene and sanitation conditions are poor and clean water is rarely available. Poor hygienic conditions were particularly relevant for younger children who are vulnerable to infections.

Most women carers were uneducated and illiterate and their knowledge of good caring practices and causes of diarrhoea limited. The statistical association between knowledge and malnutrition was, however, weak suggesting that other resources were needed to apply good knowledge.

Mother's time constraints affect feeding and care in several ways: Collecting water for long hours is associated with the number of meals the mother can consume, her nutritional status and her ability to practice exclusive breast-feeding. Mothers' chronic illness and poor nutritional status are associated with child malnutrition.

Poor food security is a basic cause of malnutrition that is a major constraint to sufficient household food security and hence adequate feeding practice; this was particularly apparent in the harsh conditions of the dry season in the pastoral areas in early 2006 when the whole Somali Region was experiencing severe drought. At this time, in addition to poor food security, more children and mothers were ill. This shows that emergency consideration should always be given to health issues when there is a food crisis.

There were some differences between pastoralists and agro-pastoralists that either improve or worsen the risk of malnutrition. Pastoralists had, less fever & cough and spent less time away from children; factors that would benefit nutrition. On the other hand, they had smaller households, less vaccination coverage, were further from markets and health facilities and started weaning foods late; factors that would worsen malnutrition.

The constraints of food availability, economic resources, time, knowledge, health services, hygienic environment, health and nutrition of the mother all have an impact on the nutritional status of children. There are clearly many factors that limit good nutrition from the 3 main underlying causes: insufficient household food security, inadequate mother and child care, insufficient health services and an unhealthy environment. In order to tackle malnutrition the issues from all the underlying causes identified above will need to be addressed. It is difficult to give priority to any issue when all need to be satisfied to improve malnutrition.

5. RECOMMENDATIONS

The report highlights the need to address many issues simultaneously to tackle chronic malnutrition comprehensively: policy changes and improved implementation of existing policies in the Somali region are necessary.

5.1 Recommendations for SCUK programmes

The precise mix of interventions required will depend on what is feasible, what other organizations are doing on the ground, and the specific context of different communities and livelihood zones. Broadly the recommendation is to implement programmes with the following components in the same communities, recognizing that to prevent malnutrition the programme components need to all converge at the child level. This means that geographic coverage needs to match for each component. Some issues need to be addressed at the household level, and some that will focus on children and their mothers. Livelihood interventions, for example, need to be targeted at the household whereas health services need to prioritize children and their mothers.

1. Assessment and treatment of acute malnutrition; continuation of nutrition and early warning information systems followed by response
2. Livelihood initiatives, delivered through livestock and rangeland management, but possibly including alternative income sources, e.g. cash transfers and support to micro-enterprise. Livelihood initiatives should take into consideration women's work load, so any initiative aimed at women should not reduce time for care of children.
3. Support to health services, particularly Maternal and Child Health and health extension, immunization and vitamin A supplementation.
4. Safe water and sanitation programme to improve hygiene, prevent infections and also reduce the time required by women to fetch water
5. An initiative to improve dietary diversity. This may be approached through support to markets, small scale home gardening and education linked to improved income generated through livelihoods initiatives.
6. Informal education to improve knowledge on nutrition and health. This should emphasize breast feeding information, how to prepare weaning foods and increase dietary diversity using local foods, nutrition during pregnancy and lactation, hygiene education, HIV prevention. If possible all household members including men, women and older children should be included.
7. Gender initiatives to empower women as decision makers within the communities through support to women's groups.

There are strong links between these recommendations, for example, a livelihood component would also support women if their workload was reduced, small irrigation and reduce women's time. Health services could improve both child and maternal health, enabling women to provide better care. With nutrition education, the demand for a more diverse diet could increase.

5.2 Community recommendations

Following the initial analysis of survey results, the research team revisited 5 communities to feedback results and to ask about the communities' priorities for addressing malnutrition. Group discussions were carried out with women and men separately. First they were asked to brainstorm all their ideas for projects and then to prioritize, as a group, the three most important projects. Following this, a score was given for each of the communities' top priorities and these were then ranked in total.

Women's top priorities:

1. Health facilities
2. General food distribution and supplementary food for children
3. Safe water
4. Education formal and informal

Men's top priorities:

1. Safe water
2. Health facilities
3. Education; formal and informal
4. General Food distribution and supplementary food for children

Other ideas suggest by men:

- Restocking, animal health support
- Agricultural inputs: plough oxen, water, seeds and fertilizer, training
- environmental management for gully erosion and pastures and thorny bush control
- Communications, radio or telecom and roads
- Training for TBAs

Other ideas suggested by women

- Restocking
- Agricultural inputs
- Income generation and credit schemes
- Attention for the elderly including food distribution
- Support for women's associations
- Environmental sanitation: latrines
- Road construction

The top priorities suggested by women and men were the same, albeit with different priorities. Livelihood interventions were also mentioned by both men and women and included agricultural inputs (for agro-pastoralists) and restocking and income generation, although these were not given top priority. These ideas accord well with the recommendations from the surveys; programmes developed around these themes are likely to be acceptable to the communities.

5.3 Future Programmes suggested by the findings and the communities' priorities:

We have identified some of the main underlying causes of malnutrition in the pastoral and agro-pastoral communities in Shinile zone. The next step is to design then implement an integrated programme that will address these causes. This future programme should be well monitored and evaluated to assess the extent to which the different components contribute to a reduction in malnutrition and the cost-effectiveness of such a programme. This information could then be used to guide the design of future nutrition programmes. Specific policy recommendations for addressing malnutrition in pastoral communities need also to be developed.

6.0 Appendix

1. Methods
2. Household and child questionnaire formats from last survey round AP2
3. A1 Key data from all rounds, pastoral and agro-pastoral comparison
4. A2 Key data from all rounds, seasonal comparisons
5. A4A Malnutrition Results
6. A3 Odds ratios for key variables for all rounds and stunting
7. A4 Odds ratios for key variables for all rounds and wasting
8. Multiple logistic regression models

Methods

Infant feeding scores: ideal feeding patterns

There are no internationally accepted guidelines on how many different types of food children should eat. It is possible to have a complete diet by mixing just a few types of food together judiciously. However, in general it is considered good to have as varied a diet as possible so as to obtain different nutrients. IFPRI [33] has described the following norms (Table 2) for Ethiopian children aged 0-36 months. Whenever food is mentioned it also includes milk, so milk is one of the food groups considered for dietary diversity. When referring to weaning foods, however these should be solid or semi-solid foods so milk alone is not sufficient to be considered a weaning food.

Food groups for dietary diversity assessments

The following food groups were defined for dietary diversity scores, taken from [34]

1. Grains, roots and tubers
2. Legumes and nuts
3. Vitamin A rich fruits and vegetables
4. Other fruits and vegetables
5. Dairy foods
6. Eggs
7. Meat, poultry fish and shell fish
8. Foods cooked with fat or oil

We combined eggs with meat, poultry and fish due to very low consumption of all these foods. Any consumption >10g of at least 1 food from any group counts toward the dietary diversity score. For example, if milk, wheat and sorghum are consumed, the dietary diversity is 2 because wheat and sorghum are in the same group. The maximum score for dietary diversity was therefore 8.

[33] Summary Indicators for Infant and Child Feeding Practices: An example from the Ethiopia Demographic and Health Survey 2000 M Arimond M Ruel International Food Policy Research Institute / FANTA 2002

[34] Generating indicators of appropriate feeding of children 6 through 23 months form the KPC 2000+ . M Arimond & M Ruel . Washington DC, Food and Technical Assistance Project, Academy for Educational Development, 2003

'Mother's dietary diversity' score was based on monthly consumption of just cereal, meat milk and vegetables, with a maximum of 4.

Table 1
Norms of dietary frequency and diversity for children aged 0-36 months in Ethiopia

Age group (months)	Diversity of foods	Frequency of feeding
0-5.9	Breast milk only	On demand
6-8.9	Breast milk + at least 2 other foods	At least 2 times a day
9-11.9	Breast milk + at least 3 other foods	At least 3 times a day
12-36	Breast milk + at least 4 other foods	At least 4 times a day

Note that in this analysis we have taken the lowest limit for the feeding frequency at each age (for example, among the 6-8 month age group the recommendations are that children are fed solid or mushy foods between 2-3 times per day (in addition to breast milk) and we have taken a cut-off of 2 meals as adequate. This means that we are defining "acceptable frequency" and "acceptable diversity" at their lowest limits. The overall score allowed for an intermediate score for each practice with a total possible feeding score of 6 (table 3)

Table 2
Construction of the overall feeding score

Age group (months)	Breast feeding	Diversity of foods	Frequency of feeding	Total possible
0-5.9	not calculated	not calculated	not calculated	not calculated
6-8.9	yes = 2	0=0; 1=1; 2=2 or more	0=0; 1=1; 2= 2 or more	6
9-11.9	yes = 2	0=0; 1=1 or 2 2=3 or more	0=0; 1=1 or 2 2= 3 or more	6
12-36	yes = 1	0= 0 or 1 ; 1= 2 or 3 2= 4 or more	0=0 or 1; 1=2; 2=3; 3= 4 or more	6

Maternal knowledge score
Knowledge of mothers was assessed by the following answers.

1. Appropriate weaning age is 4-6 months (latest recommendation is for 6 months, but the answer based on old recommendations was considered satisfactory)
2. Causes of diarrhoea; related to food preparation, hygiene practice, washing hands and other plausible answers
3. Knowledge of ORS

From these individual questions, a score from 0 to 3 was constructed.

Hygiene score

A hygiene score was developed with a maximum score of 4 for

i) use of protected water
ii) use of soap for children
iii) no animal faeces near the house or animals in the house
iv) safe disposal of child faeces (outside the compound or in a latrine)

HIV/AIDS

The issue of HIV AIDS was difficult to incorporate into the analysis as there is little awareness of its importance in Shinile and no HIV testing. In FGD we assessed general levels of awareness of the causes and possible prevention. In the household surveys we collected proxy indicators of HIV status:

1. orphans living in the household
2. mother or father has been chronically sick for >= 3 months in the past year
3. mother or father are dead

Malnutrition cut-offs

Malnutrition is measured by wasting (low weight for height), stunting (low height for age) and underweight (low weight for age). In this assessment we measured age, height, weight and MUAC, thus all these indices could be determined. Z scores were used to assess severity of malnutrition; these are the number of standard deviations a particular child's weight or height is from those measures in the reference population[35]. The cut-off point used to define moderate malnutrition for was <-2 and >=-3 z-scores and for severe <-3. Underweight was assessed by weight for age z score (WAZ), stunting by height for age z score (HAZ) and wasting by weight for height z score (WHZ). Moderate low MUAC is defined as <125mm and severe low MUAC is defined as <110mm. For maternal malnutrition the cut-off of 210mm for the MUAC was used to define malnourished.

Wealth

Wealth was assessed by reference to the Household Economy Assessment methodology[36]; FGDs were held to determine the typical wealth breakdown of better-off, medium and poor households. This was done separately for pastoralists and agro pastoralist elders in four different communities in each LZ and the information used to define these groups. During the household surveys the interviewer asked about ownership of assets and the households were categorised accordingly. The pastoralist's wealth breakdown relies mostly on animal ownership, number of wives and household size. Similarly for agro-pastoralists animal ownership was important, but the different wealth groups require fewer animals and in addition land cultivated was also important. We also added a category for petty traders; those living in the kebeles who were not dependent on animals but on small trade. After the first round, this group was largely excluded because the purpose of the research was to identify patterns of malnutrition in those dependent on pastoralism or agro-pastoralism rather than the petty trade. (Table 4)

[35] National Center for Health Statistics reference population, WHO 1978
[36] The household economy approach; A resource manual for practitioners SCUK 2000

Table 3
Wealth breakdown for pastoralists

	Poor	**Middle**	**Better-off**
Shoats	15-25	40-60	100-120
Cattle	0-1	3-5	6-10
Camels	0-2	4-6	10-12
Donkeys	1	1-2	2
Wives	1	1-2	2+
HH size	4-5	6-8	10-12

Wealth breakdown for agro-pastoralists

Animals	Poor	Middle	Better off
Shoats	3-8	10-15	20-30
Cattle	1-2	3-5	7-10
Camel	0-1	0-3	4-6
Oxen	0	0-1	2
Donkey	1	1-2	2
Qoodi of land (4 qoodi = 1 ha)	2	3-6	6-10

Questionnaire formats

AGRO-PASTORAL
CARER QUESTIONNAIRE

District: _____ Kebelle: _____ _____ Kebelle code _____

Village/Tullo: _____ Date of survey: ____/____/____

Team number_____ Team Leader _____

Head of HH name: _____ HH number: _____

Sex of household head: (Male=M, Fem =F) _____

Mother/Carer's name: _____ Mother number : ___

Sex of Mother/ Carer's (Male = M, Fem =F) _____ Age of mother/carer_____ years

Demographic questions

1	Were you interviewed previously for this survey?	Yes……..1 No……0	
2	How many children under 36 months slept in this HH last night? _____ *(these are the ones to be included in child interview)*	_____	
3	What is the household mainly dependent on? *(do not read out)* *(record just one answer)*	Agriculturalist……..….1 Animals…….2 Agriculture & Animal...3 Trade or salary……..4 Labour……...5 Relief Food……6 Family Support……..7 Animal and Trade……...8 Agriculture and Trade ….9 Agriculture + Animal + Firewood sale ……..10 Other specify……	
4	Is this your usual home location?	Yes……..1 No……0	>>7
5	If no, where have you come from?	Within this zone……4 Within this region…….1 Outside the region but within the country……..2 Another country……3 Other……....	
6	Why did you come here?	Look for food……...1 Look for labour…….2 Look for water or grazing…….…3 Other , *specify*……....	
7	Does the head of household have any other wives?	Yes……..1 No……0 No father ……8	>>9 >>9
8	If yes, How many other wives?	……	

9	How many family members are there in this household? *(include husband and those who are away but not guests)*	……	
10	How many usual household members have migrated from the HH now?	…… If none	>>12
11	What was the main reason for migration? *(do not read out)*	Look for food……...1 Look for labour……2 Look for water or grazing……..…3 Education……..4 Other , *specify*……..	
12	Have you (the mother/carer) been sick or disabled for >= 3 months during the past year?	Yes……..1 No……0	>>15
13	For sick mother: When she is sick, is she unable to carry out her usual work due to the sickness?	Unable to work……1 Can carry out light work only…..2 Able to work……3	
14	What is the illness/ disability of the mother/carer? *(do not read out)*	Cough/cold/TB……1 Fever/ malaria……..2 Rash……3 Diarrhoea……4 Joint/ back pain……5 Abdominal pain……6 Other…… Don't know……..…99	
15	Has the father been sick or disabled for >= 3 months during the past year?	Yes……..1 No……0 No father ……8	>>18 >>18
16	For sick father: When he is sick, is he unable to carry out his usual work due to the sickness?	Unable to work……1 Can carry out light work only…..2 Able to work……3	
17	What is the illness/ disability of the father? *(do not read out)*	Cough/cold/TB……1 Fever/ malaria……..2 Rash……3 Diarrhoea……4 Joint/ back pain……5 Abdominal pain……6 Other…… Don't know……..…99	

Children *For questions 18-21 If interviewee is mother or father or grandparent, if knowledgeable*

18	How many times have you (or mother of child) given birth? *Exclude still births*	_____	
19	How many children are still alive?	_____	
20	How old is your first born child ? *If the child is dead, how old would they be now*	_____ years _____months	

21	How old is your youngest child? *If the child is dead, how old would they be now*	_____ months	

For all

22	Total number of children living in household aged <18 yrs	……..	

Water and Hygiene questions

23	What is the main source of drinking water for the members of this HH at this time? *Only circle one answer* *(do not read out)*	Standpipe..…… …….1 Hand pump ……..……... …2 Protected dug well… ……. …3 Unprotected dug well ……..…4 Spring…… ……..…5 Rain water collection……. …6 River/stream…….……7 Birka ……8 Lass……..10 Dam…….11 Pond……12 Other-specify…….……..	
24	Who usually collects water?	Mother (self)…….…….....1 Other carer (self)……..10 Any other person……...15 *Buys water……..97*	 >>26 >>26
25	How long does it take to collect water in a day (go, queue, come back)? *If they go several times, add up all times together*	----------Hours, ----------Minutes	
26	How many days per week do you/they collect water?	…… days	
27	How many litres of water did you/they collect the last day you/they collected water?	_____ litres	
28	Of total litres collected how many have you used for human consumption?	_____litres	
29	Have you used soap today or yesterday?	Yes……..……..1 No…….0	 >>31
30	When you used soap today or yesterday, what did you use it for? *(Encourage them by asking what else did you use the soap for, but do not read answers. Circle all answers given.* *If a general answer is given then you should probe for a more specific answer, but do not read the answers)*	Washing clothes……..…..… …A Washing my body…...…….B Washing my children……...……C Washing child's bottom…….....D Washing child's hands……..…...E Washing hands after defecating... F Washing hands after cleaning child…….... G Washing hands before feeding child…….H Washing hands before preparing food…… ……I Washing hands before eating…… ……J	

		Washing utensils……M Washing face……..O Other……	
31	Are animals living in the house with you?	Yes……..……..1 No…….0	
32	*OBSERVATION ONLY: ARE THERE ANY ANIMAL FAECES AROUND THE FRONT OF THE HOUSE (WITHIN 3M OF THE FRONT DOOR)?*	Yes……..……..1 No…….0	

Maternal/carer knowledge questions

33	**When do you think it is best to start giving semi-solid food to children (food other than breast milk/animal milk)?**	_____Months	
34	What causes **Diarrhoea**? *(Circle all answers given as first response . Do not probe)* Weather change ……..K Geed Sare (spiritual belief) ……L Eating mixed foods ……M Eating soil ……..N Bottle feeding ……O Loss of weight ……....P Drinking water while standing ……...Q Sexual intercourse while lactating ……..R Eating wild foods called (Asho Ado) …….S	Dirty water & food..... A Food which has been left out ….B Dirty dishes for eating……C Evil eye…….…….....D Teething.……..…....E Lack of hygiene……....F When exposed to sun light …..…G Lack of animal food…….H Intestinal parasites……I Houseflies (CHF) ……J Other…… Don't know……...Z	
35	**Have you ever heard of, or seen, a special product called** ORS **that you can get for the treatment of diarrhoea?** *(show packet of ORS)*	Yes……..……..1 No…….0	>>37
36	**Have you ever used** ORS **for treatment of diarrhoea?**	Yes……..……..1 No…….0	

Maternal/carer anthropometry

37	MUAC *(all mothers and female carers)*	---------- mm Not applicable □
38	Is the mother/carer pregnant > 6 months?	Yes > 6months.……1 No <= 6months……..……..2 Not pregnant …….…...0 Not applicable……88
39	Is the mother/carer lactating < 6 months?	Yes <= 6months……..……1 No (> 6 months)……..…...2 Not lactating…….….0 Not applicable……88

Food security

40	How many meals per day do you (the mother/carer) eat at this time?	____	
41	How many times in a month do you eat the following foods:	Times	
A	Meat	…….	
B	Eggs	……..	
C	Milk	……..	
D	Vegetables	……..	
E	Fruit	……..	
F	Pulses/ beans	……..	

	FOOD TYPE AND SOURCES		
42	What is your main staple food at this time of the year? (2 most in order of importance if they mention more than one) (do not read out) Sorghum……1 Wheat ……...2 Maize ……...….4 Milk ……..5 Meat……..….6 Rice……7 Spaghetti……....8 Other - specify)……	Staple 1 _____ Staple 2 _____	
43	What is the source of your staple foods? (list 2 main sources if they mention 2 sources) Own Production……1 Cereal purchase ……...….2 Own animal product…….….3 Animal product purchase…..4 Relief food……5 Labour exchange……...6 Borrowed……7 Remittance……8 Other –specify……..	Source1 Source 2 Staple 1 _____, _____ Staple 2 _____, _____	
	ANIMALS		
44	How many of the following animals do you have in your own household with you (the ones that are controlled by this woman only) (Bah) *(write down number)*	Shoats _____ Cattle _____ Camels _____ Donkeys ____ Oxen _____	
45	How many *Qodis* of land do you cultivate? (4 qoodis = 1 hectare)	. …….. Qoodi If none >> 47	
46	What are the main crops that this household cultivates? (list the 3 main crops, most important first) no cultivation……...……0 sorghum…….……..1	_____ _____ _____	

	wheat……..2 maize……..4 vegetables/fruit……5 barley……6 forage crops……7 chat……8 chick peas……10 lentils……11 other- *specify*……		
47	Wealth group	Better-off……1 Medium……2 Poor……3 Petty trade ……4	

AGRO- PASTORAL Shinile/ Dambal
CHILDREN AGED 0-36 MONTHS

District: _____ Kebelle: _____ Kebelle code _____

Village/Tullo: _____ Date of survey: ____/____/____

Team number_____ Team Leader _____

Head of HH name: _____ HH number: _____

Mother/Carer's name: _____ Mother number: _____

Child name: _____ Child number (in HH):_____

Age of the child: (in months) _____

Was (NAME) measured in the last survey? ____ (no=0 yes= 1)

Child's anthropometry

1	When was (NAME) born? (*Use Gregorian calendar check the month of birth with local calendar; be as precise as possible)*	--------/--------/--------	
2	What sex is (NAME)?	Male……...……M Female……...……F	
3	Who is the primary carer of the child?	Mother…….....1 Father…..……2 Grandmother ……...3 Other specify……..	>>5
4	If not the mother, is the mother still alive?	Yes ……..……1 No…….0	
5	Is the primary carer the one who is being interviewed?	Yes ……..……1 No…….0	>>7
6	If No, who is the interviewee?	Father…..……2 Grandmother ……...3 Sister…….5 Other specify……..	
7	Has (NAME) been vaccinated for measles? *(only ask if child is >=9 months, circle one answer)*	Yes, with card.……...…...1 Yes, without card ….....…2 No……..……0 Child < 9 months…...…….7	
8	Has (NAME) received a vitamin A capsule in the past 6 months? *(only ask if child is >= 6 months, show capsule)*	Yes……....……...1 No…….……0 Child < 6 months…….…...8	
9	Weight	_____kg	
10	Height / length *(don't measure if child less than 6 months old)*	_____cm	

11	MUAC *(don't measure if child less than 6 months old)*	_____mm	
12	Oedema	Yes……..……...1 No……..0	
13	*OBSERVATION ONLY: DOES THE CHILD HAVE RINGWORM OR SCABIES?*	Yes……..……...1 No……..0	
14	*OBSERVATION ONLY: ARE THERE ANY LICE OR EGGS IN THE SEAMS OF THE CHILD'S CLOTHES?*	Yes……..……...1 No……..0	
15	*OBSERVATION ONLY: HAS THE CHILD BEEN VACCINATED FOR BCG?*	Yes……..……...1 No……..0	

Infant and young child feeding practices

16	Have you ever breastfed (NAME)?	Yes ……..1 No ……..0	>> 20A
17	How soon after (NAME) was born did you put him/her to the breast?	---------- Hours ---------- Days	
18	Since this time yesterday, have you breastfed (NAME)?	Yes ……1 No ……0 Stopped breastfeeding ……3	>> 20A >> 20A
19	If stopped breastfeeding… When did you cease breastfeeding (NAME) completely?	---------- months Can't remember ……...98	

Dietary Diversity

	Since this time yesterday has (NAME) received any of the following?	**Yesterday** (0= No, 1=Yes) *IF NO →*	**Last 7 days** (0= No, 1=Yes, 8=N/A)
20A	Tinned or powdered milk	0 1	0 1 8
B	Baby formula	0 1	0 1 8
C	fresh milk (not breastmilk or powdered milk)	0 1	0 1 8
D	Tea with milk	0 1	0 1 8
21	How many times did (NAME) consume animal milk, tinned or baby milk or tea with milk yesterday	_____	If none >> 25

22	How many cups (asrile) of animal milk did (NAME) consume yesterday *(include milk given by secondary carer and tinned milk made up with water)*	_____	
23	How many cups (asrile) of tea with milk did (NAME) consume yesterday *(include milk given by secondary carer and tea made with tinned milk)*	_____	
24	What type of milk was it? Circle a maximum of 2 types of milk	Camel…….7 Cow's ……8 Goat's …….10 Sheep…….11 Tinned milk ..12 Other…….	

	Since this time yesterday has (NAME) received any of the following?	**Yesterday** (0= No, 1=Yes) *IF NO →*	**Last 7 days** (0= No, 1=Yes, 8=N/A)
25A	Plain water	0 1	0 1 8
B	Sweetened or flavoured water, sugar/honey water	0 1	0 1 8
C	Tea or infusion (without milk)	0 1	0 1 8
D	Any other liquids (include soups and broth)	0 1	0 1 8
E	Vitamins, mineral supplements, medicines, ORS	0 1	0 1 8

26	**Have you started weaning foods for (NAME)?** (mushy or solid foods (not including animal milk)	Yes……...1 No……0	>>33
27	At what age did you start weaning foods to (NAME)	---------- months	
28	Did (NAME) receive any weaning foods (mushy or solid foods) yesterday?	Yes……...1 No……0	>> 29
28A	In the past 7 days did (NAME) receive any weaning foods?	Yes……...1 No……0	>>33
29	Since this time yesterday how many times has (NAME) received mushy or solid foods? (24 hours)	_____times	

	Since this time yesterday has (NAME) received any of the following?	**Yesterday** (0= No, 1=Yes) IF NO →	**Last 7 days** (0= No, 1=Yes, 8=N/A)
30	Any food made from cereals e.g. rice, porridge, wheat, barley, sorghum, maize	0 1	0 1 8 If none >>32

31	What cereal was it? *Circle a maximum of 2 types of cereal*	Sorghum……1 Wheat ……..…...……...2 Maize ……...….4 Rice……...……7 Spaghetti or macaroni…...…...8 Teff ……10 Other specify…… .

	Since this time yesterday has (NAME) received any of the following?	**Yesterday** (0= No, 1=Yes) *IF NO* →	**Last 7 days** (0= No, 1=Yes, 8=N/A)
32A	Any food made from carrots, red sweet potatoes, green leafy vegetables (including wild vegetables orange, red or green)	0 1	0 1 8
B	Any food made from tubers or roots, e.g. white potatoes, local roots/tubers, onions	0 1	0 1 8
C	Any food made from legumes (lentils, beans, soybeans, pulses, peas, vetch, linseed, niger seed, sesame	0 1	0 1 8
D	Any other vegetables, including wild vegetables	0 1	0 1 8
	Since this time yesterday has (NAME) received any of the following?	**Yesterday** (0= No, 1=Yes) *IF NO* →	**Last 7 days** (0= No, 1=Yes, 8=N/A)
E	Fruits e.g. orange, lemon, banana, papaya cambe shoog, wild fruits	0 1	0 1 8
F	Meat	0 1	0 1 8
G	Eggs	0 1	0 1 8
H	Poultry	0 1	0 1 8
I	Cheese or yoghurt	0 1	0 1 8
J	Fish	0 1	0 1 8
K	Any food made with oil, butter or ghee	0 1	0 1 8

Health (Child's illness)

33	Has (NAME) had diarrhoea in the last 2 weeks? *(passed >3 times liquid stools in a day)*	Yes ……1 No……0 Don't know…….…… 99	
34	Has (NAME) had fever in the last 2 weeks?	Yes ……1 No……0 Don't know…… ….99	

35	Has (NAME) had a cough/difficulty breathing caused by an illness in the chest in the last 2 weeks?	Yes ……..……..……1 No…….……..……0 Don't know……. …99	
36	Has (NAME) had measles in the last 2 weeks? *Ask to see the child to confirm*	Yes ……1 No ……..0 Don't Know ……99	
37	Were you away from (NAME) at all yesterday?	Yes ….……..……1 No…….……..……0	>>40
38	What is the longest time you were away from (NAME) yesterday?	---------- Hours ----------mins	
39	When you were away from (NAME) who was with him/her? (relationship to child)	Father…..……...…1 Grandmother …….……...2 Grandfather……...…3 Sister…….....4 Brother……..5 Other carer……..10 Neighbour……11 No-one……...……..12 Other specify……..	

Faeces disposal

40	Is there a latrine available to the household?	Yes ……..……1 No…….……..……0	
41	The last time (NAME) passed stools where were the faeces disposed of? *Only circle one answer*	Dispose in compound…..……1 Dispose outside compound…...2 Buried in compound..……3 Buried outside compound..……..4 Disposed in the latrine……..6 Don't know…….…….99 Other……	

Table A1
Key data from all rounds summarized for pastoral and agro-pastoral LZs

	Pastoral	**Agro-pastoral**	**P value for difference**
Demographic (4 rounds)			
Head of HH age	39.5 ± 10.7	38.1 ± 9.5	0.0004
No of HH members	6.03 ± 2.20	6.16 ± 2.24	0.036
No of children under 3 yr	1.16 ± 0.38	1.17 ± 0.38	0.29
Households with >1 wife	18.1%	10%	0.021
Households that have in-migrated	5.6%	1.0%	<0.001
Households with >=1 member migrated	11.9%	8.6%	0.009
Maternal factors (4 rounds)			
Carer age	29.4 ± 6.1	29.6 ± 6.1	0.30
Carer is mother	97.8%	97.7%	>0.05
Carer is pregnant	15.1%	15.4%	0.794
Carer is lactating	61.0%	59.8%	0.464
Maternal MUAC (mm)	240.7 ± 28.2	243.4 ± 25.7	0.0033
Low maternal MUAC	9.9%	5.8%	<0.001
Parity of mother	4.2 ± 2.6	4.3 ± 2.6	0.19
Birth interval (months)	27.0 ± 9.7	25.6 ± 10.0	0.0011
Number of children died in HH	0.45 ± 0.93	0.61 ± 1.00	0.0002
Child factors (3 rounds)			
Child sex % Male	50.7%	52.6%	0.201
Child age (months)	17.0 ± 10.0	17.7 ± 10.1	0.075
Child malnutrition (3 rounds)			
Children 6-36 months moderate or severely stunted (low HFA)	18.9	19.9	0.496
Children 6-36 months moderate or severely wasted (low WFH)	21.3	13.5	<0.001
Children 6-36 months moderate or severely wasted (low MUAC)	7.2	6.6	0.689
Children 0-36 months moderate or severely underweight (low WFA)	34.3	28.3	<0.001
Morbidity and Mortality (3 rounds)			
Diarrhoea last 2 wks (>6 mo only)	22.2%	22.8%	0.729
Cough last 2 wks	24.8%	35.9%	<0.001
Fever last 2 wks	18.8%	31.6%	<0.001
Ringworm visible	6.5%	8.5%	0.042
Lice visible	1.4%	3.1%	0.003
Vaccinated for measles (with or without card) >9 mo	22.0%	33.0%	<0.001
Received vit A >6 mo	19.8%	36.5%	<0.001
BCG scar visible	2.9%	7.0%	0.001
Mother or carer sick (> 3 mo)?	7.6%	5.8%	0.099
Father sick (>3 mo)?	3.0%	1.8%	0.10
Hygiene and Sanitation (4 rounds)			
Protected water source	18.8%	18.4%	0.76
Soap use in HH yesterday	23.0%	21.8%	0.449
Soap use on child	8.9%	9.8%	0.341
House free of animal faeces	3.4%	3.7%	0.603

Safe disposal of stool	89.8%	84.6%	<0.001
Latrine available	2.3%	0.6%	<0.001
Overall hygiene score (max 4)	1.36 ± 0.81	1.21 ± 0.71	<0.001
Child Feeding (3 rounds)			
Delay before breastfeeding initiation (hr)	8.13	7.25	0.296
Breastfed at 12-24 months	60.8%	56.7%	0.169
Milk consumption at < 6 months	49.2%	57.7%	0.059
Weaning food given at 6-12 months	30.3%	20.9%	0.016
Milk consumption at 6-36 months	67.9%	86.4%	<0.001
Dietary diversity (ave) > 6 months	2.23	2.27	0.376
Overall feeding score (0-6)	2.37 ±1.13	2.65±1.07	<0.001
Knowledge and Education (4 rounds)			
Mother has no education	97.3%	98.6%	0.095
Father has no education	77.5%	75.0%	0.43
Knows at least one correct cause of diarrhoea	21.7%	22.0%	0.846
Has heard of ORS	65.7%	92.2%	<0.001
Knows weaning age 4-6 months	19.3%	27.7%	<0.001
Average age carers believe weaning foods should start (mo)	10.1 ± 3.8	9.8 ± 3.6	0.0019
Knowledge score (max 3)	1.09 ± 0.82	1.42 ± 0.70	<0.001
Time factors (4 rounds)			
Mother/ carer collects water	87.1%	85.6%	>0.05
Time to collect water (hr)	2.43	2.05	<0.0001
Average time away (hr)	1.58	1.65	0.6114
Food Security (4 rounds)			
Mother's meals daily	2.27 ± 0.52	2.42 ± 0.51	<0.001
Mother's dietary diversity (0-4)	2.44 ± 0.93	2.47 ± 0.77	0.156
Wealth (4 rounds)			
Poor	10.23%	10.70%	
Medium	26.50%	31.80%	
Better-off	57.66%	57.07%	
Petty traders	5.62%	0.44%	
Animals			
Shoats	33.9 ± 32.2	13.7 ± 18.2	<0.0001
Camels	1.7 ± 3.6	1.3 ± 2.6	0.0002
Cattle	3.1 ± 5.1	3.2 ± 4.5	0.63
Donkeys	1.4 ± 1.2	1.3 ± 1.2	0.12
Oxen	Not applicable	0.4 ± 0.7	
Kebele level information			
Time to walk to functioning health facility (days)	5.6 ± 4.2	4.1 ± 4.0	0.108
Time to walk to market (days)	4.8 ± 3.5	2.9 ± 2.1	0.024
Free food distribution in past 6 months	91.3%	85.0%	0.52
Supplementary food distribution in past 6 months	13.0%	47.4%	0.014
Cash for work or food for work	0	0	

Table A2 Summary of data from all rounds: different SEASONS

	Wet	Dry	P value
Demographic			
Households that have in-migrated	1.04%	4.77%	<0.001
Households with >=1 member migrated	7.77%	11.97%	<0.001
Maternal factors			
Carer is pregnant	14.0%	16.4%	0.047
Carer is lactating	58.8%	61.7%	0.065
Maternal MUAC (mm)	245.5± 27.5	239.3± 26.0	<0.001
Low maternal MUAC	5.5%	9.4%	<0.001
Child malnutrition (3 rounds)			
Children 6-36 months moderate or severely stunted (low HFA)	21.9%	18.4%	0.02
Children 6-36 months moderate or severely wasted (low WFH)	14.1%	16.9%	0.049
Children 6-36 months moderate or severely wasted (low MUAC)	7.6%	6.2%	0.249
Children 0-36 months moderate or severely underweight (low WFA)	32.1%	29.1%	0.067
Morbidity and Mortality (3 rounds)			
Diarrhoea last 2 wks (>6 mo only)	23.4%	22.2%	0.482
Cough last 2 wks	26.5	35.6%	<0.001
Fever last 2 wks	28.8	27.0	0.257
Ringworm visible	8.8%	7.4%	0.138
Lice visible	2.2%	2.7%	0.302
Vaccinated for measles (with or without card) >9 mo	59.6%	14.6%	<0.001
Received vit A >6 mo	60.5%	15.7%	<0.001
BCG scar visible	7.2%	4.9%	0.006
Mother or carer sick (> 3 mo)?	5.8%	7.6%	0.099
Father sick (>3 mo)?	1.8%	3.0%	0.100
Hygiene and Sanitation			
Protected water source	20.5%	17.0%	0.006
Soap use in HH yesterday	28.0%	18.6%	<0.001
Child Feeding (3 rounds)			
Delay before breastfeeding initiation (hr)	7.4	7.6	0.755
Breastfed at 12-24 months	56.7%	58.8%	0.486
Milk consumption at < 6 months	60.3%	52.5%	0.082
Weaning food given at 6-12 months	21.9%	24.9%	0.439
Milk consumption at 6-36 months	93.1%	74.0%	<0.001
Dietary diversity (ave) > 6 months	2.55	2.11	<0.001
Overall feeding score 0-6	2.68 ± 1.04	2.62 ± 1.09	0.259
Time factors (4 rounds)			
Mother/ carer collects water	87.3%	85.4%	
Time to collect water (hr)	1.84	2.58	<0.001
Mother away from child at all during previous day	34.2%	33.4%	0.646
Average time away (hr)	1.39	1.65	0.0176
Food Security (4 rounds)			
Mother's meals daily	2.41 ± 0.51	2.30 ± 0.53	<0.001
Mother's dietary diversity (0-4)	2.67 ± 0.78	2.28 ± 0.86	<0.001

Table A2A
Weight for age (underweight), height for age (stunting), Weight for height (wasting) and MUAC (wasting) in children in Shinile in 4 rounds of survey data. P1 first pastoral; AP1 first agro-pastoral P2 second pastoral AP2 second agro-pastoral

	AP1	P2	AP2	Total
underweight				
<-2 z scores %	24.4	34.3	32.1	30.1
<-3 z scores % or oedema	4.8	9.0	6.7	6.8
N	1,211	1,095	1,206	3,512
stunting				
<-2 z scores %	17.9	18.9	21.9	19.6
<-3 z scores %	3.5	4.4	4.6	4.1
N	1,006	918	1,022	2,946
wasting				
<-2 z scores %	12.9	21.3	14.1	15.9
<-3 z scores % or oedema	1.1	2.7	1.7	1.8
N	1,005	913	1,021	2,939
Wasting by MUAC				
<125mm %	5.6	7.2	7.6	6.8
<110mm % or oedema	0.6	0.3	0.3	0.4
N	1,007	918	1,027	2,952

Table A3
Odds ratios for STUNTING (Low height for age, <-2 z scores vs >= -2 z scores) and key variables adjusted for age and sex

	Odds Ratio and (p value) Age and sex-adjusted Odds Ratios for key variables			
Immediate causes of malnutrition				
yes =1 no=0 for all	**AP1**	**P2**	**AP2**	**Overall**
Demographic				
Child factors (3 rounds)				
Child sex Male =1 Female=2 adjusted for age	0.738 (0.072)	0.699 (0.037)	0.844 (0.265)	0.763 (0.004)
Child age (months) adjusted for sex	1.026 (0.004)	1.053 (0.000)	1.023 (0.008)	1.033 (0.000)
Child Feeding (3 rounds)				
breast fed <24 months only	2.254 (0.007)	1.764 (0.080)	1.852 (0.016)	1.924 (0.000)
Weaning frequency score	0.799 (0.044)	0.852 (0.257)	1.073 (0.565)	0.881 (0.065)
Milk consumption (times per day)	0.932 (0.729)	1.157 (0.451)	1.299 (0.446)	1.145 (0.279)
Dietary diversity score	0.754 (0.099)	1.121 (0.505)	0.986 (0.928)	0.984 (0.860)
Received vit A >6 mo	0.621 (0.098)	0.923 (0.724)	0.916 (0.583)	0.977 (0.823)
Overall feeding score (0-6)	0.793 (0.005)	0.992 (0.919)	1.070 (0.409)	0.945 (0.233)
Morbidity and Mortality				
Diarrhoea last 2 wks (>6 mo only)	1.315 (0.166)	1.666 (0.009)	1.538 (0.012)	1.520 (0.000)
Fever last 2 wks	1.480 (0.022)	1.181 (0.780)	1.188 (0.294)	1.275 (0.016)
Vaccinated for measles (with or without card) >9 mo	0.337 (0.006)	0.806 (0.338)	0.661 (0.011)	0.799 (0.039)
Underlying and basic causes				
Household size	0.925 (0.051)	0.995 (0.899)	0.888 (0.001)	0.932 (0.001)
Household food security				
Mothers' meals	0.987 (0.934)	0.757 (0.144)	1.176 (0.311)	0.972 (0.759)
Mothers' dietary diversity	0.919 (0.451)	0.919 (0.356)	0.879 (0.222)	0.920 (0.146)
Maternal / paternal factors				
Maternal MUAC (mm)	0.995 (0.14)	0.993 (0.059)	0.995 (0.120)	0.995 (0.009)
Mother or carer sick (> 3 mo)?	0.647 (0.245)	1.149 (0.684)	1.476 (0.195)	0.995 (0.980)
Father sick (>3 mo)?	0.769 (0.545)	0.846 (0.765)	1.068 (0.347)	0.893 (0.693)

Hygiene and Sanitation				
Protected water source	0.789 (0.268)	0.669 (0.168)	1.210 (0.374)	0.888 (0.373)
Overall hygiene score (0-4)	1.030 (0.790)	0.893 (0.460)	1.195 (0.162)	1.090 (0.224)
Knowledge and Education				
Knows at least one correct cause of diarrhoea	1.050 (0.809)	0.460 (0.006)	1.273 (0.181)	0.967 (0.781)
Knows weaning age 4-6 months	1.250 (0.227)	0.655 (0.088)	1.232 (0.218)	1.088 (0.443)
Knowledge score (0-3)	1.119 (0.333)	0.732 (0.008)	1.176 (0.161)	1.010 (0.880)
Time factors (4 rounds)				
Mother away from child at all during previous day	0.692 (0.053)	0.861 (0.462)	0.858 (0.339)	0.795 (0.028)
Average time away (hr)	0.926 (0.013)	0.978 (0.455)	0.948 (0.069)	0.949 (0.002)
Wealth (4 rounds)				
1 -3 (better-off=1 poor=3)	1.131 (0.318)	0.941 (0.648)	0.926 (0.510)	1.001 (0.987)

Table A4
Odds ratios for WASTING (Low weight for height, <-2 z scores vs >= -2 z scores) and key variables adjusted for age and sex.

	Odds Ratio and (p value) Age and sex-adjusted Odds Ratios for key variables			
Immediate causes of malnutrition				
yes =1 no=0 for all	**AP1**	**P2**	**AP2**	**Overall**
Demographic				
Child factors (3 rounds)				
Child sex Male =1 Female=2 adjusted for age	0.706 (0.073)	1.006 (0.973)	0.860 (0.409)	0.871 (0.177)
Child age (months) adjusted for sex	1.006 (0.565)	1.041 (0.000)	1.022 (0.027)	1.023 (0.000)
Child Feeding (3 rounds)				
breast fed <24 months only	2.254 (0.007)	1.270 (0.429)	1.103 (0.757)	1.433 (0.049)
Weaning frequency score	0.945 (0.660)	0.933 (0.608)	1.399 (0.016)	0.956 (0.548)
Milk consumption (times per day)	0.820 (0.381)	0.525 (0.000)	0.943 (0.870)	0.600 (0.000)
Dietary diversity score	0.746 (0.117)	0.696 (0.019)	1.178 (0.353)	0.836 (0.065)
Received vit A >6 mo	1.464 (0.158)	0.539 (0.009)	1.035 (0.854)	0.853 (0.155)
Overall feeding score (0-6)	0.881 (0.165)	0.759 (0.001)	1.153 (0.118)	0.866 (0.006)
Morbidity and Mortality				
Diarrhoea last 2 wks (>6 mo only)	1.402 (0.113)	2.450 (0.000)	2.117 (0.000)	2.006 (0.000)
Fever last 2 wks	1.652 (0.008)	2.105 (0.000)	2.574 (0.000)	1.859 (0.000)
Ringworm visible				
Lice visible	1.169 (0.713)	0.443 (0.283)	0.988 (0.982)	0.804 (0.471)
Vaccinated for measles (with or without card) >9 mo	0.653 (0.278)	0.757 (0.195)	1.051 (0.796)	0.872 (0.237)
BCG scar visible	0.936 (0.850)	0.743 (0.517)	1.163 (0.620)	0.882 (0.537)
Underlying and basic causes				
Demographic				
Household size	0.955 (0.287)	0.990 (0.793)	0.937 (0.141)	0.959 (0.086)
Household food security				
mothers' daily meals	1.087 (0.651)	0.516 (0.002)	1.721 (0.004)	0.839 (0.116)
mothers' dietary diversity	1.005 (0.971)	0.848 (0.087)	1.114 (0.346)	0.888 (0.071)
Maternal / paternal factors				

Maternal MUAC (mm)	0.990 (0.023)	0.987 (0.001)	0.995 (0.235)	0.990 (0.000)
Mother or carer sick (> 3 mo)?	0.609 (0.230)	2.835 (0.000)	2.030 (0.022)	1.612 (0.008)
Father sick (>3 mo)?	0.976 (0.959)	1.156 (0.755)	2.104 (0.200)	1.143 (0.643)
Hygiene and Sanitation				
Protected water source	1.752 (0.008)	0.652 (0.128)	0.873 (0.600)	1.002 (0.991)
hygiene score (0-4)	1.245 (0.078)	0.817 (0.211)	1.148 (0.334)	1.112 (0.145)
Knowledge and Education				
Knows at least one correct cause of diarrhoea	1.252 (0.305)	0.710 (0.170)	0.985 (0.944)	0.915 (0.495)
Knows weaning age 4-6 months	0.986 (0.947)	0.804 (0.334)	0.903 (0.626)	0.847 (0.175)
Overall knowledge score (0-3)	1.021 (0.874)	0.800 (0.045)	0.972 (0.836)	0.837 (0.014)
Time factors				
Mother away from child at all during previous day	0.876 (0.532)	1.086 (0.661)	0.902 (0.600)	0.887 (0.291)
Average time away (hr)	0.971 (0.377)	1.012 (0.637)	0.929 (0.052)	0.973 (0.121)
Wealth				
1 -3 (better-off=1 poor=3)	1.468 (0.011)	0.997 (0.979)	1.252 (0.150)	1.228 (0.010)

Multiple logistic regression models

1. Methods

The purpose of carrying out multiple logistic regression models was to determine the importance (statistical significance) of many possibly important factors simultaneously. For example, if 2 variables are statistically significant in the model then we can be reasonably sure that both of these factors are important in their association with the anthropometric index. This analysis is necessary to determine if various factors are associated independently with malnutrition. Odds ratios were used[37]. These models were constructed to explain variability in wasting, stunting and underweight. In addition, a model for underweight in the children under 9 months was constructed since there were different causes for this age group; only underweight could be measured in this group. The children aged 6-12 months were particularly vulnerable to wasting so a special analysis for that group was also undertaken.

First simple logistic models were run for stunting and wasting adjusted for age and sex with the immediate and underlying variables shown in figure 2 (Tables A3 and A4). From this analysis it was possible to identify the most important factors that relate to malnutrition. Using these results, multiple logistic regression models were constructed. First the immediate causes of malnutrition were used for the model and then a further statistical model constructed by including the underlying causes from the framework. By adding the variables in two stages it was possible to determine the changes in the odds ratios of the immediate variables that occurred by addition of more possible explanatory variables. The SVYLOGIT command in STATA was used for this and the primary sampling unit (PSU) set to the household because children within a household are not independent. Although some of the same children appeared in the first and second agro-pastoral surveys they are both included in the model because a dummy variable for round was also included. Only the final models are shown here that include both immediate and underlying variables that were found to be related to anthropometric indices using simpler models adjusted for just age and sex (table A3 A4). The same variables for stunting, wasting and underweight were used. Data from P1 were excluded due to the poor age data.

The immediate variables included were: child sex (1=male 2= female), child age (months), breast fed yesterday (y/n), milk consumption yesterday (y/n), overall feeding score (0-6), diarrhoea (y/n), fever (y/n) in the past 2 weeks. In addition a dummy variable was added for round 2 and round 3 to capture any differences between the different survey rounds that was not explained by the immediate variables; round 4 was the reference category.
The variables representing underlying causes were: measles vaccination (y/n), household size (#), mother's daily meal frequency, mothers dietary diversity (0-4), maternal MUAC (mm), sickness of mother (y/n), time away from child (hr) , and wealth (1-3, 1=better off).

For the younger group (<9 months) an extra analysis was carried out. In this model, milk consumption is included but feeding score omitted as it is not so relevant for this group. Diarrhoea is omitted as it is assessed only in children >6 months. The simple away (y/n) was used instead of away time as most children were with their mothers. Measles vaccination is

[37] In this analysis, the lower the p value, the more significant the variable in the model. A low odds ratio means that the risk associated with the factor is less, for example if for diarrhoea the odds ratio is 1.2 it means for those with diarrhoea the odds of being malnourished is 20% more likely compared to a child without diarrhoea

omitted as vaccination only happens after 9 months. Hygiene and knowledge scores are included as they could be relevant for this group.

An additional analysis was also carried out for wasting in the 6-18 months age group because this was the group where development of wasting was fastest. The question being posed is whether any particular issues are important in this age group.

2. Wasting

Wasting; immediate causes

From this analysis, older children were more wasted, milk consumption was protective, diarrhoea and fever were both risk factors (Table A5).

Wasting: underlying causes

Mothers with better nutritional status were associated with less wasted children and mother's sickness was a risk factor.

Not significant in this model were child sex, breast feeding, feeding score, measles vaccination, household size, number of mother's meals, mother's dietary diversity, time spent away from the child and wealth.

Differences between pastoral, agro-pastoral and the different seasons

Even accounting for these variables, there were aspects of wasting in round 3 that were worse than in round 4.

The relationship between wasting and milk consumption was strongest in P2, and in this round feeding score was also protective against wasting. Also in P2 having a sick mother was a strong risk factor.

The strength of association between immediate causes and wasting did not change after inclusion of the underlying causes, suggesting that maternal malnutrition and sickness were operating through different influences than the immediate causes we measured.

Hygiene score and knowledge score were not significant predictors of wasting (data not shown), as was expected by their lack of association in the simple logistic regression analysis shown in table A4

Table A5
Multiple logistic regression results for wasting in children 6-36 months; both pastoral and agro-pastoral for 3 rounds. Immediate and underlying causes.
Those variables that are bolded have p value of < 0.1

Wasting	**OR**	**95%**	**C.I.**	**P>t**
Child sex	0.847	0.682	1.053	0.135
Child age	**1.019**	**1.000**	**1.040**	**0.050**
Breast fed	0.961	0.677	1.362	0.821
milk	**0.634**	**0.479**	**0.838**	**0.001**
Feeding score	0.954	0.850	1.071	0.430
diarrhoea	**1.591**	**1.243**	**2.037**	**0.000**
fever	**1.721**	**1.352**	**2.190**	**0.000**
Measles vaccination (y/n)	0.885	0.677	1.159	0.375
Hh size	0.971	0.922	1.023	0.276
Mothers meals	0.979	0.759	1.262	0.869
Mothers diversity	1.122	0.976	1.290	0.105
Maternal MUAC	**0.990**	**0.985**	**0.995**	**0.000**
Sick mother	**1.475**	**1.017**	**2.141**	**0.041**
Time away	0.980	0.944	1.017	0.278
Wealth	1.101	0.937	1.295	0.243
AP1 dummy	**0.705**	**0.515**	**0.966**	**0.030**
P2 dummy	**1.482**	**1.126**	**1.950**	**0.005**

3. Stunting

Stunting : immediate causes
Boys were more stunted than girls, increasing age was again a risk factor for stunting. Unexpectedly breastfeeding was a risk factor in this model; the odds ratio for breast-feeding was 2.5. Breast-feeding is very age-dependent and when children are breastfed beyond 12 months, the practice is associated with less consumption of animal milk and cereals. The association of breast feeding with stunting is likely to reflect a practice that is associated with constraints to resources. The same pattern was present in each round. Diarrhoea was also a risk factor.
Stunting: underlying causes
Measles vaccination and larger family size was protective against stunting. Mother's nutritional status was again protective against stunting in children. More time spent away from the child was unexpectedly protective.
Not significant in the model were milk consumption, feeding score, fever, mother's meals and diversity, sickness of the mother and wealth. Also excluded from the model, but not shown here were, knowledge and hygiene scores.

Differences between pastoral, agro-pastoral and the different seasons
Stunting was less severe in AP1 and P2 compared to AP2 as shown by the low odds ratios of the dummy variables for those 2 rounds.
There was little difference in the direction or strength of association of the different variables across the seasons or between pastoral and agro-pastoral. Measles vaccination was protective in AP1 and AP2 (the agro-pastoral surveys). This is probably related to the greater coverage in Dambal than Shinile districts where the EOS service is operational. Measles vaccination could

also be a proxy for other services that are received in the more accessible kebeles that usually receive vaccination coverage. Also in AP1 diarrhoea was not significant in the statistical model whereas in the other rounds it was important.

The inclusion of the underlying causes in the statistical model did not change the direction of association of the immediate causes, suggesting again that the underlying causes of household size, mother's nutritional status and time away were influencing stunting independently of the immediate causes.

Table A6
Multiple logistic regression results for stunting both pastoral and agro-pastoral for 3 rounds. Immediate and underlying causes.

Stunting	OR	[95% Conf.	Interval]	P>t
Child sex	**0.800**	**0.656**	**0.975**	**0.027**
Child age	**1.077**	**1.057**	**1.097**	**0**
Breast fed	**2.374**	**1.699**	**3.316**	**0**
milk	1.190	0.898	1.577	0.227
Feeding score	0.921	0.827	1.026	0.135
diarrhoea	**1.419**	**1.115**	**1.806**	**0.004**
fever	1.109	0.882	1.395	0.375
Measles vaccination (y/n)	**0.636**	**0.493**	**0.822**	**0.001**
Hh size	**0.923**	**0.879**	**0.969**	**0.001**
Mothers meals	1.087	0.866	1.363	0.473
Mothers diversity	0.926	0.809	1.060	0.265
Maternal MUAC	**0.995**	**0.991**	**0.999**	**0.009**
Sick mother	1.048	0.714	1.539	0.811
Time away	**0.965**	**0.931**	**1.000**	**0.048**
Wealth	0.918	0.790	1.066	0.26
AP1 dummy	**0.622**	**0.474**	**0.817**	**0.001**
P2 dummy	**0.705**	**0.535**	**0.928**	**0.013**

4. Underweight

Underweight: immediate causes
As for stunting, underweight was less in girls than boys and increased with age. The relationship with breast feeding was again in the unexpected direction (as described for stunting). Better feeding score was protective against underweight. The risk of underweight was 0.87 for each extra feeding score. Diarrhoea and fever were both risk factors.
Underweight: underlying causes
Larger household size was protective against underweight. Mother's nutritional status was also protective.

Not significant (p>0.1) in the model were milk consumption, measles vaccination, mother's meals and dietary diversity, sick mother and wealth. (Table 11) Hygiene and knowledge score were again not included as predictors of underweight (data not shown).

Differences between pastoral, agro-pastoral and the different seasons
In AP1 underweight was not as severe as in AP2. There were slight differences in the magnitude of the associations for different rounds. Feeding score was more important in AP1 and P2, diarrhoea in P2 and AP2 and fever in AP1 and AP2. The direction of the associations were however the same for all rounds.

The inclusion of the underlying causes in the statistical model did not change the direction of association of the immediate causes, suggesting again that the underlying causes of household size, mother's nutritional status and time away were influencing underweight independently of the immediate causes.

Table A7
Multiple logistic regression results for underweight both pastoral and agro-pastoral for 3 rounds. Immediate and underlying causes.

Underweight	Odds Ratio	[95% Conf.	Interval]	P>t
Child sex	**0.822**	**0.695**	**0.972**	**0.022**
Child age	**1.075**	**1.058**	**1.092**	**0**
Breast fed	**1.808**	**1.376**	**2.375**	**0**
milk	1.114	0.879	1.411	0.374
Feeding score	**0.874**	**0.801**	**0.953**	**0.002**
diarrhoea	**1.643**	**1.331**	**2.028**	**0**
fever	**1.376**	**1.127**	**1.680**	**0.002**
Measles vaccination (y/n)	0.867	0.701	1.073	0.189
Hh size	**0.957**	**0.919**	**0.996**	**0.032**
Mothers meals	0.991	0.816	1.202	0.923
Mothers diversity	0.957	0.853	1.073	0.451
Maternal MUAC	**0.990**	**0.987**	**0.994**	**0**
Sick mother	1.157	0.844	1.585	0.364
Time away	**0.956**	**0.927**	**0.985**	**0.004**
Wealth	0.972	0.855	1.104	0.66
AP1 dummy	**0.606**	**0.478**	**0.768**	**0**
P2 dummy	1.025	0.815	1.289	0.832

5. Special analysis for children under 9 months, using underweight

Immediate causes
As for the other analyses, girls were less underweight than boys and the difference was even starker with OR of 0.48. Even within this restricted age band, older children are more underweight, consumption of milk is a risk factor here rather than a protective factor (as was apparent for wasting in the older children).
Underlying causes
Mother's nutritional status was also protective; better nourished mothers tending to have less underweight children. Having a sick mother was an important risk factor. Hygiene score was protective for this age group when it was not important for the older children in these models.
Differences between pastoral, agro-pastoral and the different seasons

Compared to AP2, AP1 and P2 have worse underweight, even after accounting for these variables. The strength of association was slightly different in the different survey rounds. In P2 fever was a strong risk factor for underweight in the under 9 months children (OR 3.46 p=0.044).

Table A8
Special analysis for children under 9 months, using underweight

Underweight	Odds Ratio	[95% Conf.	Interval]	P>t
Child sex	**0.485**	**0.286**	**0.821**	**0.007**
Child age	**1.106**	**1.002**	**1.221**	**0.045**
milk	**1.724**	**0.945**	**3.146**	**0.076**
fever	1.541	0.882	2.693	0.129
Hh size	1.050	0.939	1.174	0.392
Mothers meals	0.991	0.574	1.712	0.976
Mothers diet diversity	1.038	0.715	1.508	0.843
Maternal MUAC	**0.988**	**0.978**	**0.999**	**0.025**
Sick mother	**2.353**	**1.039**	**5.330**	**0.04**
Hygiene score	**0.637**	**0.419**	**0.968**	**0.035**
Knowledge score	0.849	0.574	1.255	0.41
Mother away (yn)	0.666	0.178	2.486	0.544
wealth	0.773	0.555	1.076	0.127
AP1 dummy	**0.482**	**0.253**	**0.918**	**0.026**
P2 dummy	**0.561**	**0.299**	**1.051**	**0.071**

6. Special analysis of wasting for 6-18 month children

From the above analysis, using the same variables as in the other regressions, sex and age are again related as for the other analyses. Milk in this age group is important protective factor. Fever is particularly important in this group and maternal malnutrition is important.

The overall feeding score is not related to wasting. This suggests, as shown in previous analyses that this is not a good measure for distinguishing between the children. Milk consumption is more important. This lack of relationship for feeding score could be explained by the *universal* poor availability of weaning foods. Diarrhoea is not as important in this age group as in the slightly older children.

Table A9
Special analysis for wasting for children 6-18 months old

Wasting	Odds Ratio	[95% Conf.	Interval]	P>t
Child sex	**0.612**	**0.436**	**0.860**	**0.005**
Child age	**1.235**	**1.169**	**1.304**	**0.000**
Breast fed	0.986	0.611	1.591	0.952
Milk	**0.615**	**0.410**	**0.923**	**0.019**
Feeding score	1.128	0.960	1.326	0.143
Diarrhoea	1.367	0.928	2.014	0.114
Fever	**1.775**	**1.232**	**2.557**	**0.002**
Hh size	1.008	0.932	1.091	0.840

Mothers meals	1.042	0.700	1.550	0.840
Mothers diversity	0.997	0.808	1.229	0.975
Maternal MUAC	**0.991**	**0.983**	**0.998**	**0.013**
Sick mother	1.495	0.844	2.647	0.168
Time away	0.949	0.853	1.056	0.336
wealth	1.168	0.888	1.536	0.268
Dummy for AP1	.9651	0.616	1.511	0.876
Dummy for P2	1.377	0.917	2.069	0.123

Seasonal calendars for the pastoral and agro-pastoral livelihood zones

Figure 1: Seasonal Calendar for the Shinile Pastoral FEZ

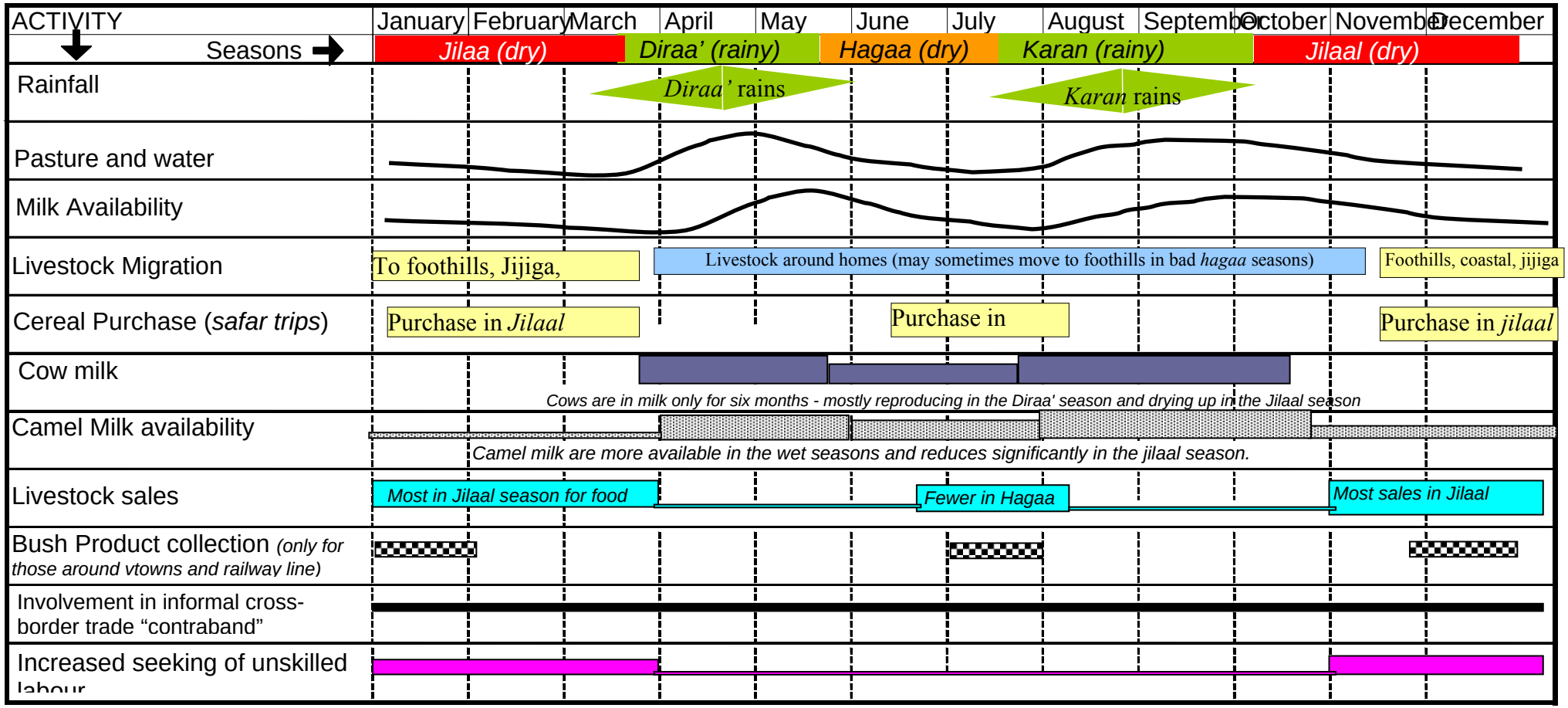


Figure 2: Seasonal Calendar for Shinile agro-pastoral livelihood zone