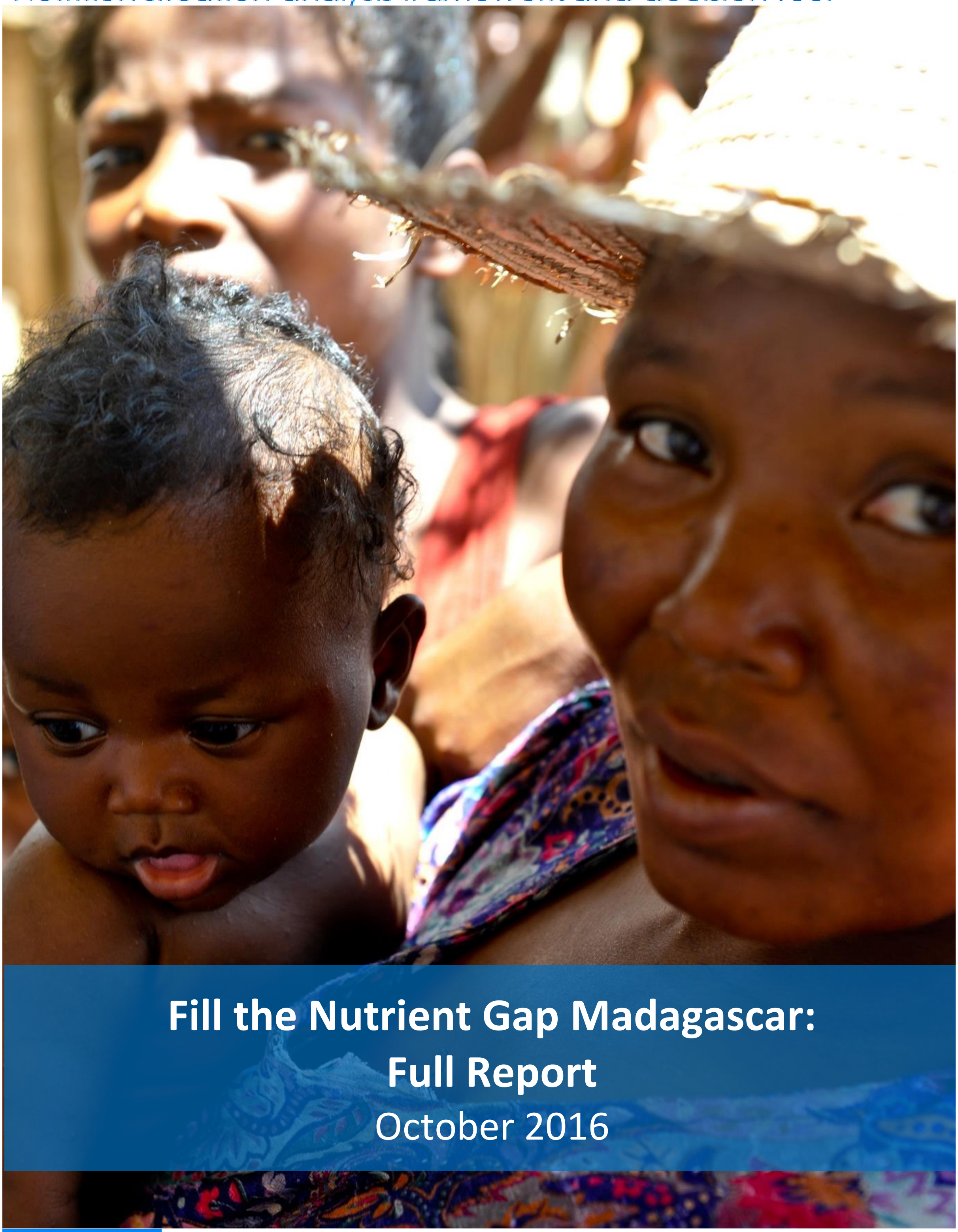
Fill the Nutrient Gap

Nutrition situation analysis framework and decision tool



Fill the Nutrient Gap Madagascar: Full Report

October 2016

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Fill the Nutrient Gap Madagascar

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- GRET
- FAO
- World Bank
- USAID

List of Acronyms

AR	Malagasy Ariary (local currency)
BMI	Body Mass Index
CNN	National Nutrition Council
CNW	Community Nutrition Worker
CoD	Cost of the Diet
DHS	Demographic and Health Surveys
ENSOMD	Madagascar Millennium Development Goals National Monitoring Survey
EU	European Union
FAO	Food and Agriculture Organization
FCS	Food Consumption Score
FNG	Fill the Nutrient Gap
GRSE	Regional Follow-Up and Evaluation Offices
HAZ	Height-for-Age Z-Score (indicator used to define stunting)
IFPRI	International Food Policy Research Institute
INSTAT	National Statistics Institute
IYC	Infants and Young Children
IYCF	Infant and Young Child Feeding
MICS	Multiple Indicator Cluster Survey
MMT	Multiple Micronutrient Tablet
MNP	Micronutrient Powder
NGO	Non-Governmental Organization
ONN	National Nutrition Office
ORN	Regional Nutrition Offices
PAUSENS	Project to Support Essential Services of Education, Nutrition and Health
PLW	Pregnant and Lactating Women
PNAN	National Action Plan for Nutrition
PND	National Development Plan
PNN	National Nutrition Policy
RNI	Recommended Nutrient Intake
SBCC	Social and Behaviour Change Communication
SC	Super Cereal
SNANS	National School Feeding and Nutrition Strategy
SNF	Specialised Nutritious Food
SNUT	Staple-Adjusted Nutritious Diet
SUN	Scaling-Up Nutrition
TBA	Traditional Birth Attendant
USAID	United States Agency for International Development
UNFPA	United Nations Population Fund
UNICEF	United Nation’s Children’s Emergency Fund
WASH	Water, Sanitation and Hygiene
WAZ	Weight-for-Age Z-Score (indicator used to define underweight)
WFP	World Food Programme
WHO	World Health Organization
WHZ	Weight-for-Height Z-Score (indicator used to define wasting)
WRA	Women of Reproductive Age

Background

'Fill the Nutrient Gap' (FNG) is a decision-making tool to support the identification of context-specific strategies for improving nutritional intake of vulnerable populations, especially during the first 1,000 days. The tool builds on a comprehensive situation analysis and has been developed by WFP, UC Davis, IFPRI, EPICENTRE, Harvard, Mahidol and UNICEF. FNG follows a stepwise process of secondary data review and linear programming analysis to understand a country's nutrition situation, compare the potential impact of interventions and identify programme and policy entry points addressing inadequate dietary intake (Figure 1).

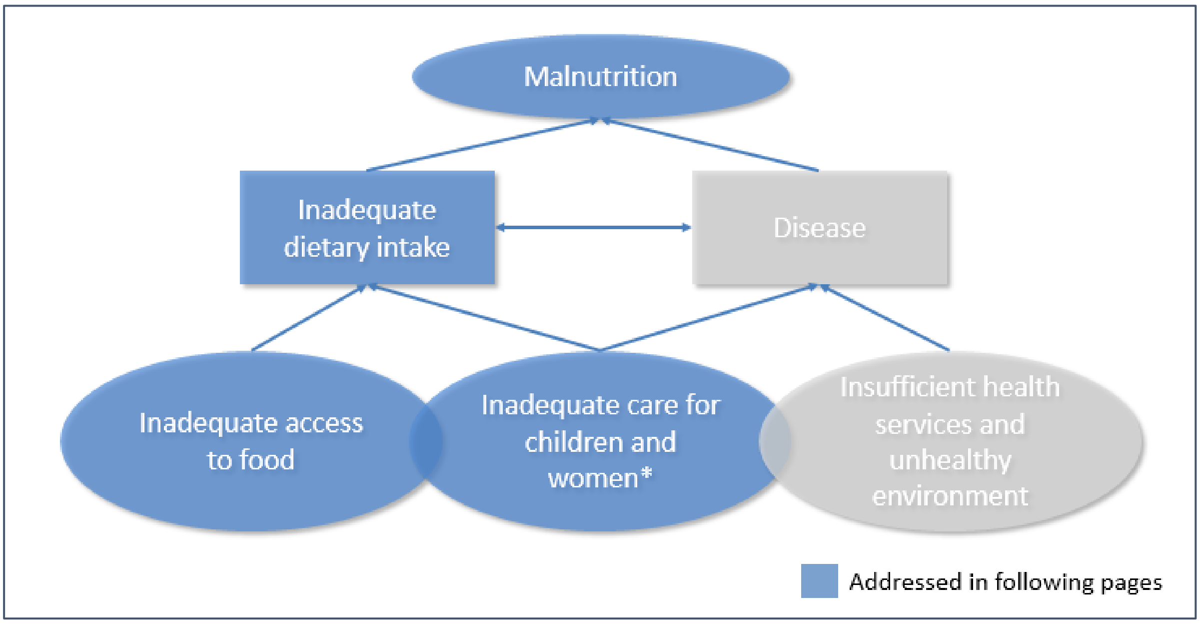

Figure 1: UNICEF Conceptual Framework for Causes of Malnutrition in Society. (Source: UNICEF)

The framework for analysis depicted in Figure 2 guides consolidation and analysis of secondary data at country level based on the following categories:

i) **Malnutrition Characteristics** - Prevalence data on malnutrition characteristics (stunting, wasting, anaemia, underweight, overweight) and if possible data on micronutrient deficiencies. Seasonal patterns of various nutritional problems within populations can be considered. Malnutrition characteristics are reviewed in the initial stage to define target groups for the analysis.

ii) **Enabling Policy Environment** – National policy, legal and regulatory frameworks and identified policy gaps to assess whether the policy environment adequately facilitates access and availability of nutritious foods. This section identifies current or potential entry points for nutrition interventions. Enforcement of policies and regulations is key to the analysis; for example, there may be a mandatory national fortification policy that has low compliance.

iii) **Availability of nutritious foods in the local market** – Information on local availability of nutritious foods (natural and fortified) as well as on local production and processing capacity to assess whether it would be possible to meet nutrient needs from locally available foods.

iv) **Access to Nutritious Foods** – Can target groups access nutritious foods in lean and non-lean seasons? This section seeks to gain a better understanding of nutrient intake at the household level and the ability of households to cope with shocks.

v) **Nutrient Intake** - Likely or confirmed gaps in nutrient intake at the individual level, in particular related to infant and young child feeding practices (IYCF) and the coverage of supplementation and fortification programmes. Each age group has different nutrient requirements (e.g. a 6-11 month old child will require a diet with much greater nutrient density in iron and zinc per 100 kcal than an adult male).

vi) **Local Practices** - Socioeconomic and cultural factors influencing food purchasing patterns and feeding practices that act as barriers to adequate nutrient intake or could in the future limit the effectiveness of certain food-based interventions, particularly among target groups. Information gathered with tools such as ProPAN can be useful to gain insights into local preferences and inform strategies such as social and behaviour change communication (SBCC) to improve feeding practices. Focus ethnographic studies or focus group discussions carried out by local academia or non-governmental organizations (NGOs) can provide key insights into this often overlooked area of analysis.

vii) **Cost Optimization** - Linear programming tools such as Optifood and Cost of the Diet (CoD) estimate the minimum cost of a locally available nutritious diet, with insight on what proportion of the population can afford this diet in different geographic areas or among social safety net beneficiaries compared to non-beneficiaries. CoD can be used to model possible intervention options to improve affordability, such as introduction of fortified foods and/or specialised nutritious foods (SNFs) through market channels or social protection programmes and cash transfers.

After the secondary data has been consolidated and analysed context-specific optimal packages of policy and programmatic interventions can be identified. Strategies and possible entry points can be collectively identified by different stakeholders when preliminary results of analysis are available.

Pilot testing of the “Fill the Nutrient Gap” tool is currently ongoing in El Salvador, Ghana and Madagascar. Early learning from the initial pilots demonstrates that the operationalization of the framework at country level varies by context. The piloting phase and consolidation of lessons learnt is anticipated to last until the end of Q3 2016. After this point a further roll out is envisioned, based on findings from the pilot phase.

The analytical and decision-making framework is provided below in Figure 2 showing the different steps of analysis reflected in the structure of this report.

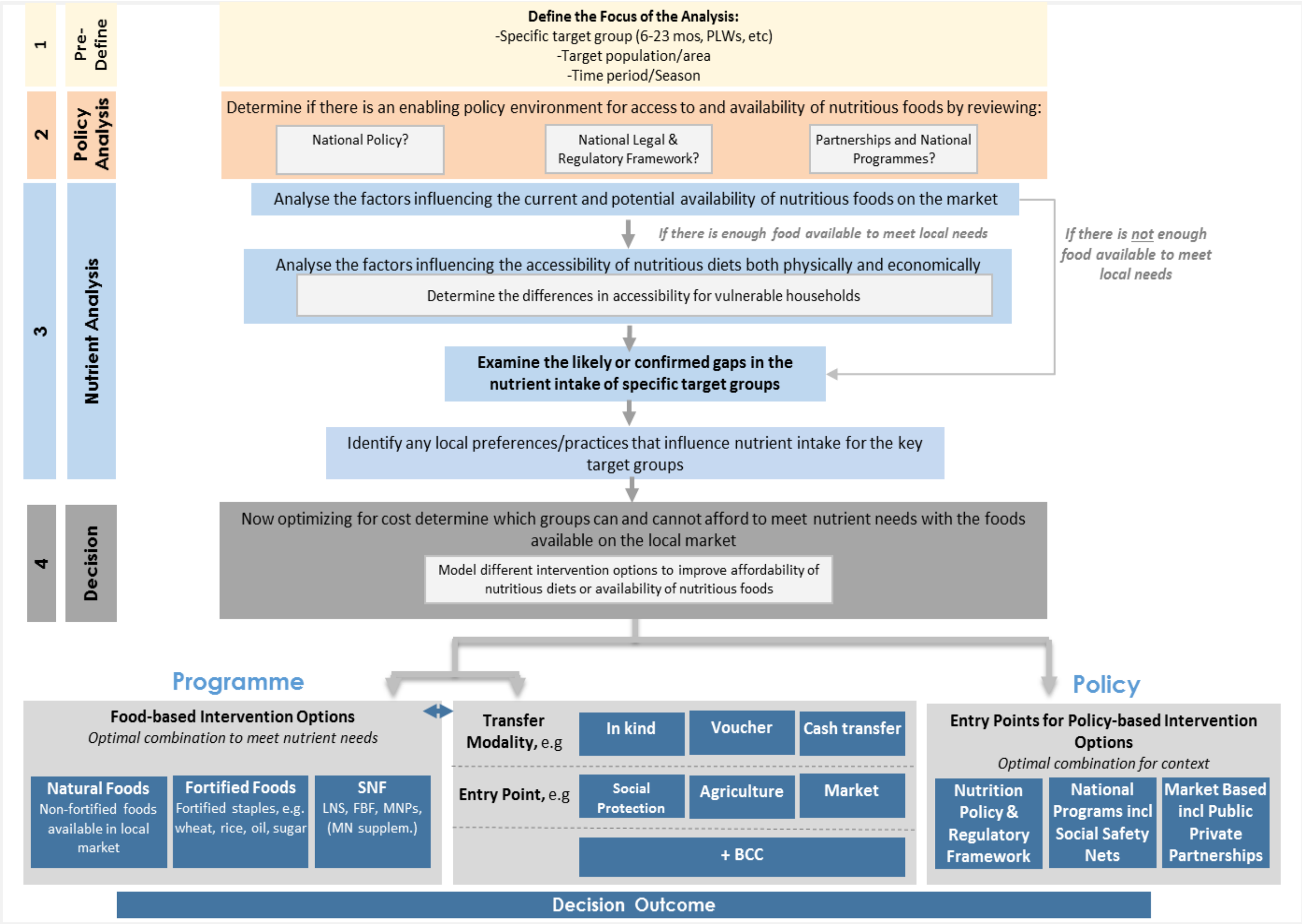

Figure 2. "Fill the Nutrient Gap" analytical and decision-making framework

Introduction

Madagascar remains one of the ten poorest countries in the world with an annual per capita GDP of $411 (The World Bank 2016). An estimated 92 percent of the country's 23 million people live below the international poverty line (WFP 2016a). Political instability following Madagascar's independence in 1960 has limited economic growth, socio-economic development and national programming capacity. The recent economic crisis has led to increased national debt, decreased purchasing power, reduced social services, and overall social instability. The national budget for social protection has decreased dramatically from 13 percent in 2007 to less than 3 percent in 2010 (Situation de la Malnutrition). Health spending decreased by 30 percent and 15 percent of primary care facilities closed, resulting in a 20 percent decrease in community health centre attendance and a 22 percent decrease in vaccination coverage. Reduced access to basic social services between 2009 and 2013 has further reduced the population's capacity to prevent and recover from shocks.

Decreases in private investments (previously averaging 5 percent per year) and reduced foreign aid have also reduced economic growth, costing the Malagasy economy $8 billion (The World Bank 2013). The Malagasy economy is primarily based on farming, fishing and forestry. Agriculture is dominated by small-scale subsistence farming, with seven out of ten smallholder farmers owning less than 1.2 hectares of land (WFP 2016a).

Roughly one quarter of the population, around five million people, live in areas prone to cyclones, floods and drought and the loss of 85 percent of Madagascar's rainforest further exacerbates the risk of natural disaster (Freudenberger 2010; WFP 2016a).

Due to the economic, social and trade complexities and their influence on nutrient intake, Madagascar is an appropriate context to further study the nature and scope of the nutrient gap and decide on strategies to address it.

The Process in Madagascar

Phase 1: Introduction of the FNG process to key government stakeholders and CoD preliminary analysis

The framework and analysis methodology was presented to key government partners – the National Nutrition Office (ONN, which sits under the Office of the Prime Minister and serves as the SUN focal point in country) and the National Bureau of Statistics (INSTAT) – in December 2015. The concept was also introduced to the SUN UN and donor platform in country, comprised of UNICEF, WHO, UNFPA, FAO, WFP, USAID, the EU and the World Bank. In collaboration with INSTAT and ONN, preliminary analysis of CoD was started using data that had been collected in August 2015.

Phase 2: Secondary data compilation through bilateral follow-up with key stakeholders and desk review, affordability analysis and intervention modelling using CoD, and presentation of preliminary findings to key government partners and UN partners

Secondary data was compiled based on the data mapping attached in the Annex, through follow-up bilateral stakeholder meetings and additional key informants, such as the World Bank, PSI and other NGOs and development partners. A modelling plan of existing and potential interventions was established and validated by the ONN. Further analysis of the information gathered was carried out and intervention modelling and affordability analysis were conducted using CoD. The preliminary findings from the secondary data analysis and the CoD results were presented in May 2016 at a meeting with ONN and INSTAT and another meeting with UN agencies.

Phase 3: Finalisation of report and recommendations, and incorporation into the development of the national nutrition policy and plan

Following the headquarters mission in May 2016, the intervention modelling and affordability analysis was further refined based on the comments collected from the different stakeholders. The study report was finalised in collaboration with the WFP Country Office. The findings and recommendations in this report are intended to feed into the planning for the ongoing national nutrition policy and plan review. A multi-stakeholder workshop was organized in October 2016 in collaboration with the ONN, to jointly review insights and findings from the analysis and jointly agree on a set of recommendations, to feed into the Nutrition Policy and Plan review. Following working sessions to support the ONN, recommendations were implemented and strategic areas were identified to increase the new policy influence in improving nutrient intake.

Malnutrition Characteristics

Madagascar is suffering a high malnutrition burden in which an estimated 47.3[1] percent of all children under the age of five are stunted and stunting prevalence is the fifth-worst of any country in the world (International Food Policy Research Institute 2016)[2]. Madagascar ranks 98th out of 104 countries scored on the Global Hunger Index[3] and 104th out of 113 countries on the Global Food Security Index, with the third-worst score for affordability[4] and the second-worst score for quality and safety[5] (International Food Policy Research Institute 2015; The Economist 2016).

Nutritional status of children

The nutritional status of children in Madagascar is characterised by a severe prevalence of anaemia (50 percent), a very high underweight prevalence (32.6 percent) and a wasting prevalence of 8%, in addition to the very high stunting prevalence already stated (ENSOMD 2012-13).

Stunting

Nationally, an estimated 47.3 percent of children under five in Madagascar are stunted[6], having low height for age (ENSOMD 2012-13). Of 126 countries with stunting data in the Global Hunger Index only Timor-Leste, Burundi, Eritrea and Papua New Guinea have higher stunting prevalence than Madagascar; these countries are much smaller, so the absolute number of stunted children in Madagascar is likely higher than in the other countries. In 2009 approximately 1,631,000 children under 5 were estimated to affected by Stunting (Global Nutrition Report 2014). Figures 3-5 suggest little improvement in stunting rates over the past 20 years. Stunting has experienced a slightly slower decrease compared to underweight prevalence (measured as low weight for age), in particular in the period 2009-2012 (Figure 5). The prevalence of stunting is comparable across wealth groups (Figure 3), except for slightly lower prevalence among the highest wealth quintile (ENSOMD 2012-13; DHS 2008-9). Even in the wealthiest quintile, however, it should be noted that the stunting prevalence is high. Interestingly stunting prevalence is lower in the bottom quintile

[1] Based on the latest data available at the national level (ENSOMD 2012-13).
[2] Rankings use a predictive stunting value of 49.2% based on 2008-2009 survey data (UNICEF, WHO and World Bank 2015).
[3] The Global Hunger Index measures a country's hunger situation based on 4 indicators: Undernourishment, Child Wasting, Child Stunting and Child Mortality. A higher score indicates a worse hunger situation, so the country ranked 104th will have the worst hunger situation of the countries assessed.
[4] Affordability scores take into account the ability of consumers to purchase food, their vulnerability to price shocks, and the presence of programmes and policies to support consumers when shocks occur.
[5] Food quality and safety scores take into account the variety and nutritional quality of average diets and the safety of food.
[6] Based on the latest available national data (ENSOMD 2012-13).

than the second or third quintile; it is possible that this could results from differences in practices, wherein the poorest households have a more diverse diet by default and wealthier households have higher rice consumption. This could also be an effect of interventions targeted only to the poorest quintile. Stunting prevalence in cities, particularly in the capital, is almost as high as in the rural areas of the country and given the relative population density the absolute numbers of stunted children is higher in urban areas. (Figure 4) (ENSOMD 2012-13; DHS 2008-9). The rural- urban divide appears to also have widened from 2008 to 2012. Stunting prevalence appears to be highest in the Centre and South of the country (Figure 6).

A comparison of stunting by region in 2008-2009 Demographic Health Survey (DHS) data and the 2012-13 Madagascar Millennium Development Goals National Monitoring Survey (ENSOMD) shows surprising declines in areas that did not experience improvements in the prevalence of low birthweight, complementary feeding practices (characterised by minimum acceptable diet) and food security (Figure 7) (ENSOMD 2012-13). When the 2012-13 ENSOMD regional disaggregated figures for stunting were compared to the Southern regions surveyed in the 2012 Multiple Indicator Cluster Survey (MICS) the reported prevalence for these areas was also inconsistent (INSTAT 2013b). Consequently, for regional comparisons of stunting prevalence used in the later section on diet affordability, data from the 2008-2009 DHS data was used.

A multivariate logistic regression analysis carried out for the Scaling Up Nutrition (SUN) Movement in 2015 on key determinants of stunting in Madagascar identified inadequate dietary quantity and quality, low birthweight and low maternal education as key factors positively correlated with stunting outcomes[7] (Odds ratio<1). Factors that had a protective effect[8] (Odds ratio<1) were self-reported health seeking behaviours, pre- and post-natal care attendance, access to tap water for drinking, and dairy consumption or minimum dietary diversity for children (SUN 2015a).

[7] The presence of these factors were associated with a greater likelihood of these children being stunted
[8] Factors that were associated with a lower likelihood of these children being stunted

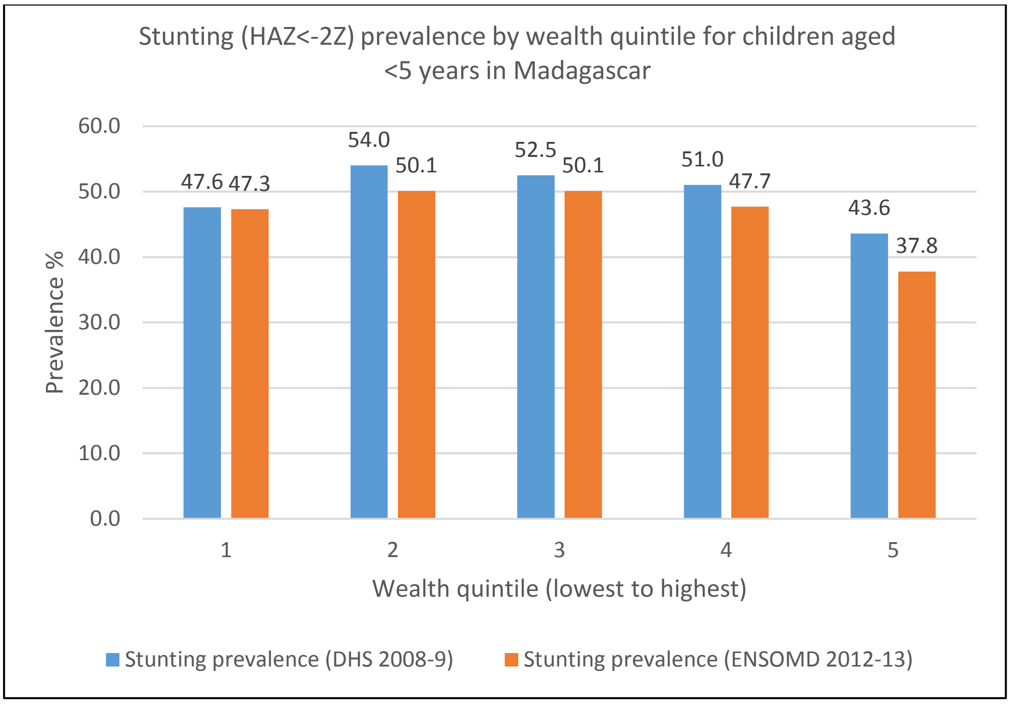

Figure 3: Prevalence of stunting[9] by wealth quintile among children under 5 in Madagascar (INSTAT 2009; INSTAT 2014)

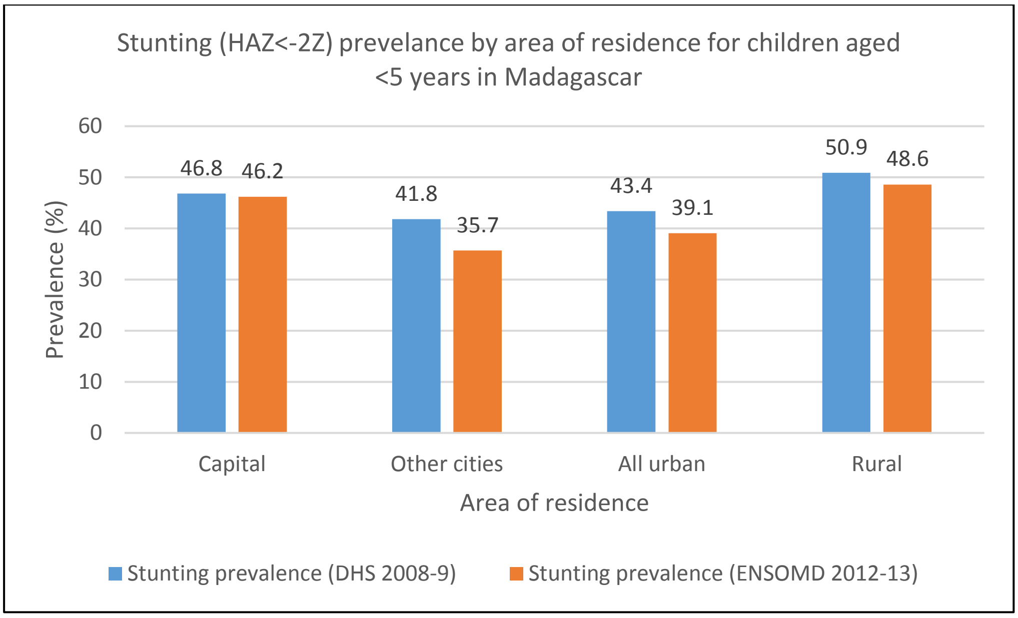

Figure 4: Prevalence of stunting in children under 5 by area in Madagascar (INSTAT 2009; INSTAT 2014)

[9] Stunting defined by Height for Age Z score (HAZ) of <-2 as per WHO standards (WHO 2006)

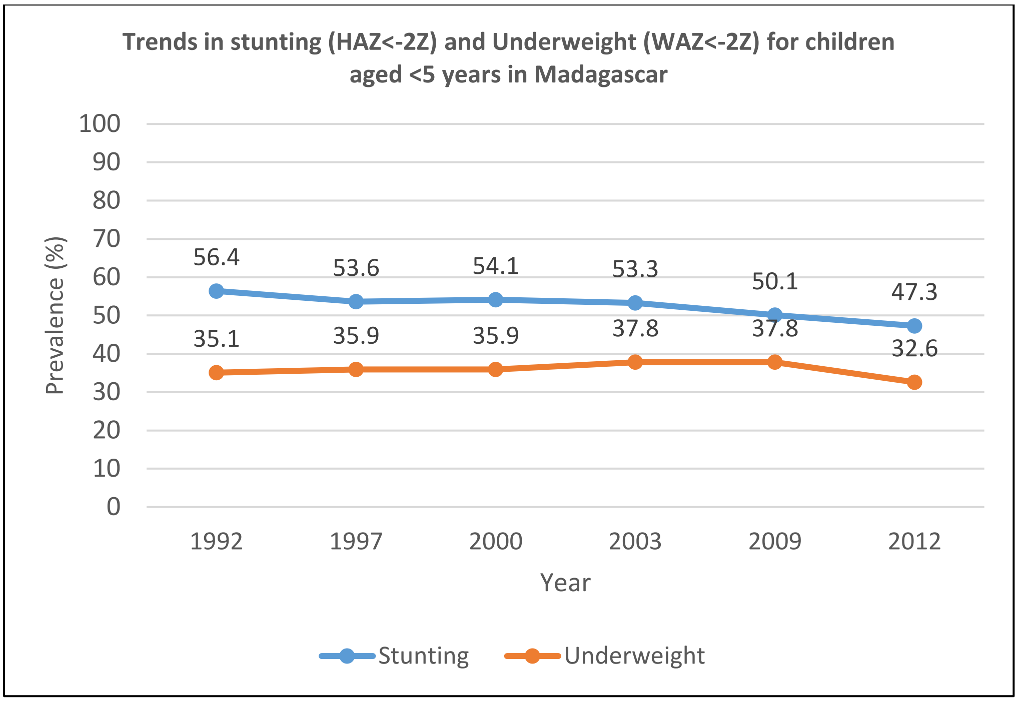

Figure 5: Trends in malnutrition indicators for children under 5 in Madagascar from 1992-2012: Stunting and Underweight[10] (INSTAT 2014)

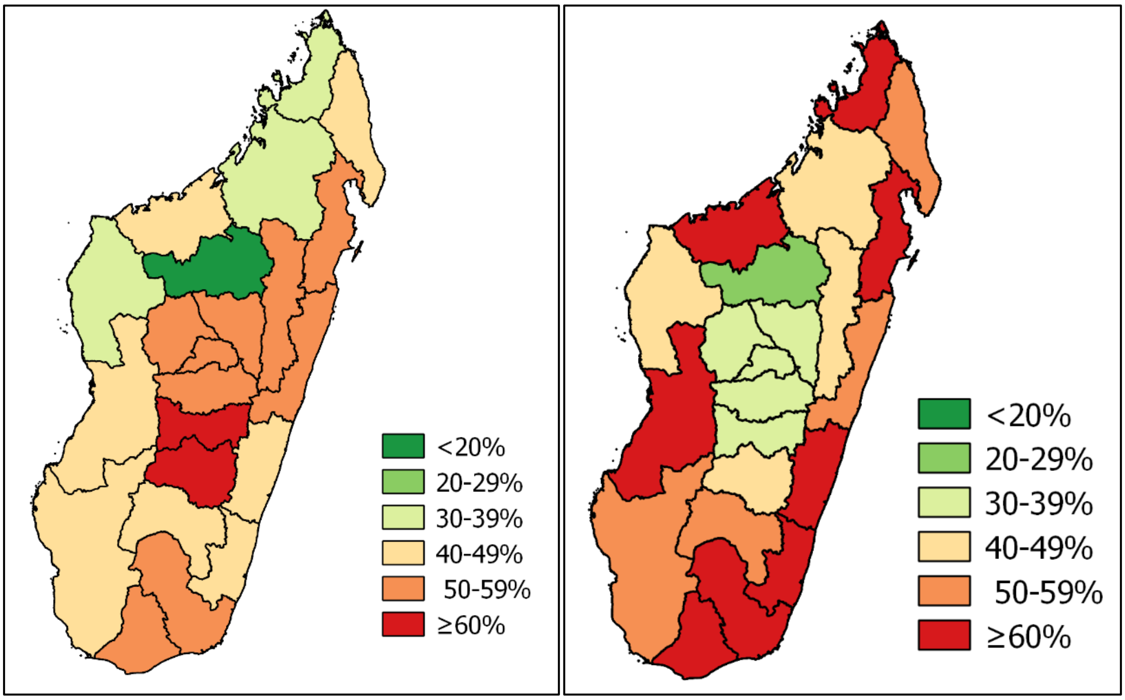

Figure 6 : Prevalence of stunting (left) and anaemia (right) for children under 5 by region in Madagascar (DHS 2008-9)

[10] Underweight defined by Weight for Age Z score (WAZ) of <-2 as per WHO standards (WHO 2006)

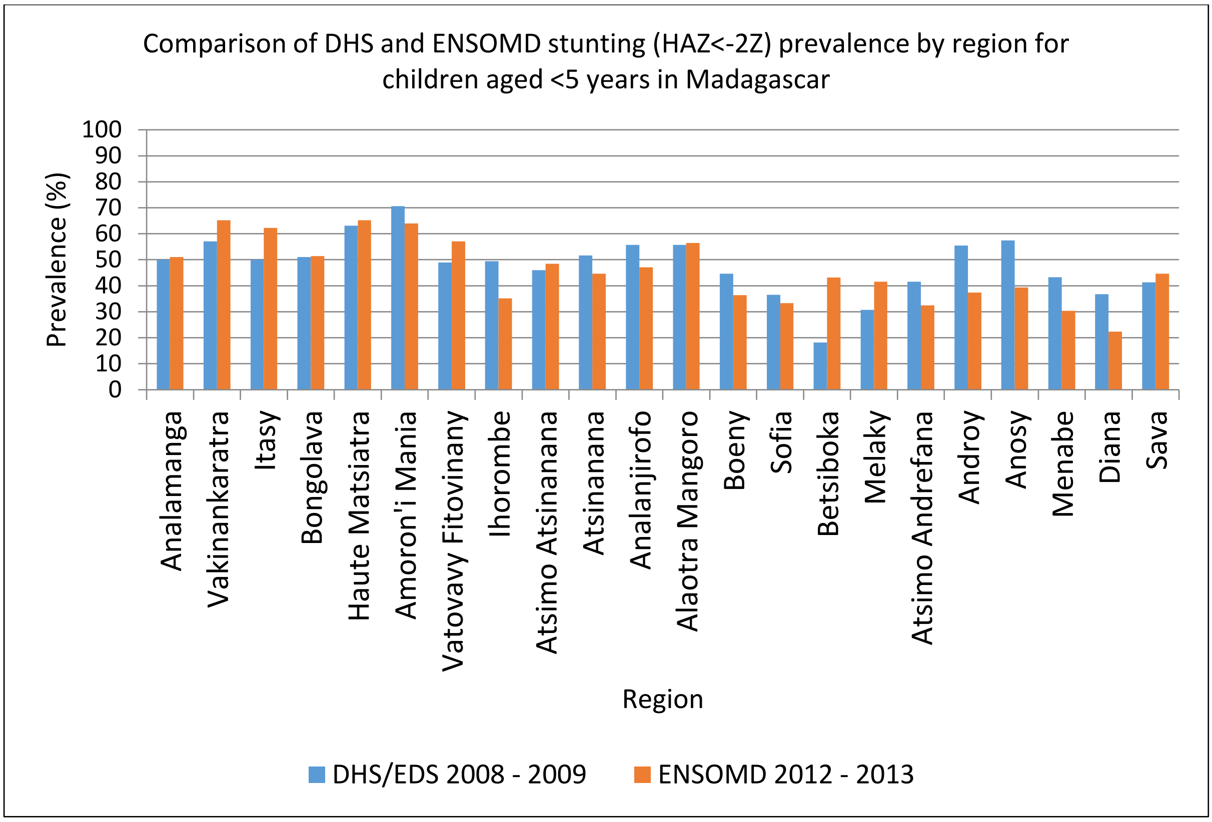

Figure 7: Prevalence of stunting[11] *region among children under 5 in Madagascar* (DHS 2008-9; ENSOMD 2012-13) [12]

Underweight
Prevalence of underweight in children under 5 is very high nationally (32.6%) and has shown little improvement over the last 20 years. (Figure 5) (INSTAT 2014a).

Anaemia
Anaemia for children under five is at severe levels (50 percent)[13] across Madagascar, with the highest prevalence seen in the far North and South of the country (as high as 70 percent in Diana and 67 percent in Menabe) and moderate levels in Central Madagascar (Figures 6 and 8). A negative correlation between regional anaemia prevalence and consumption of iron rich foods (-.32) suggests diet can explain some of the high anaemia prevalence, and that improving access to and consumption of iron-rich foods could help reduce anaemia in children (Figure 9).

[11] Stunting defined by Height for Age Z score (HAZ) of <-2 as per WHO standards (WHO 2006)
[12] It should be noted that the data quality of the ENSOMD 2012-2013. Finish the sentence. There has been no audit of the data quality of the ENSOMD. Maybe only mention low likelihood of significant improvements in nutrition indicators during the political crisis.
[13] Prevalence of anaemia, defined as haemoglobin of 11g/dl or less, of 40% or higher, as per WHO guidelines (WHO et al. 2011)

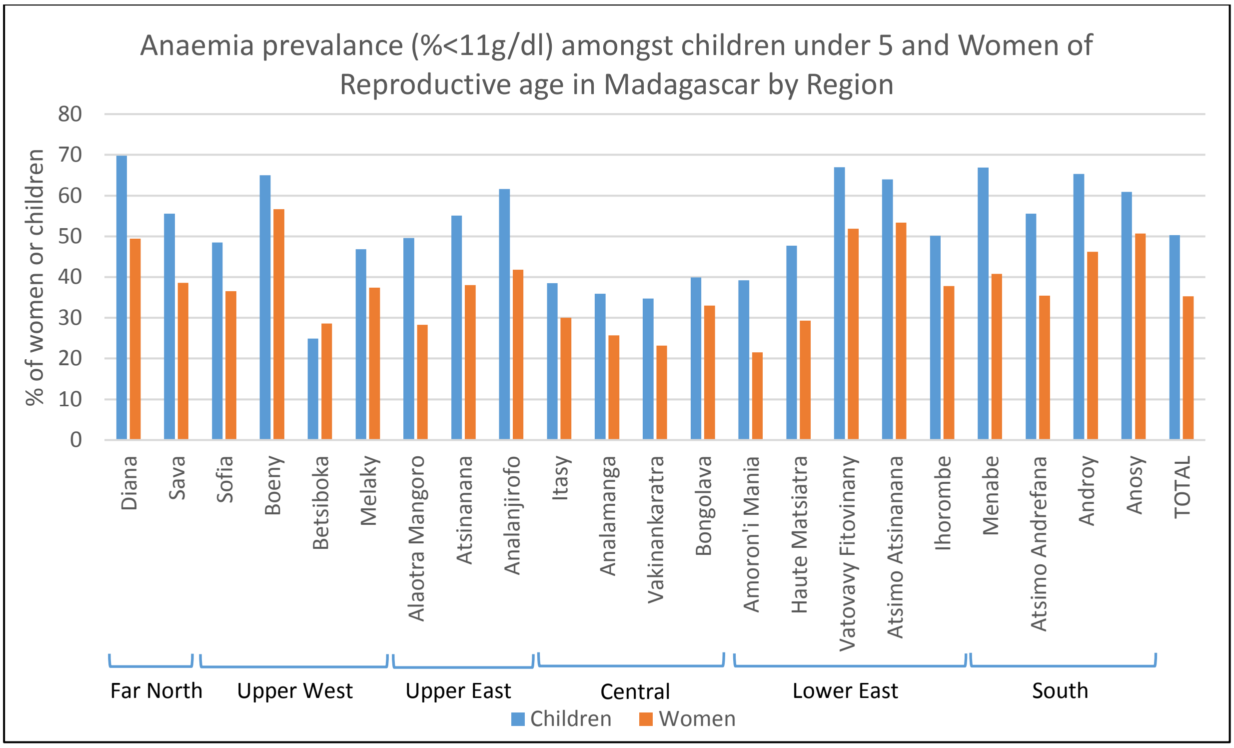

Figure 8: Prevalence of anaemia in children under 5 and Women of Reproductive age in Madagascar by region and geographical area (DHS 2008-9)

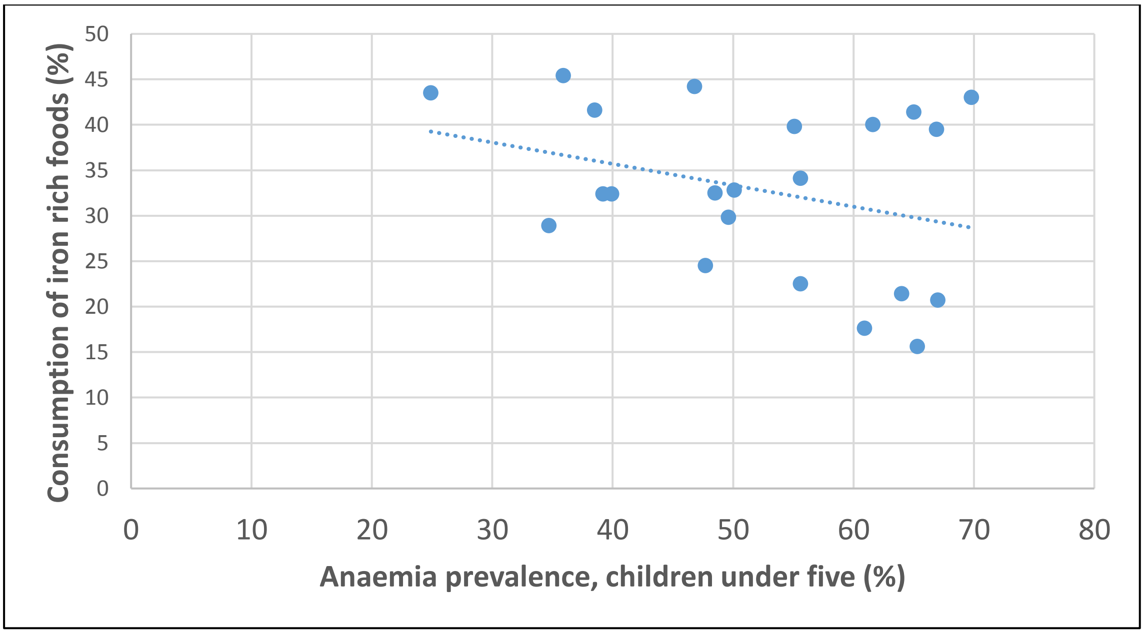

Figure 9: Prevalence of anaemia in children under 5 and consumption of iron-rich foods by region in Madagascar (DHS 2008-9)

Wasting

The prevalence of wasting[14] for children under five is 8 percent nationally, with 1 percent severely wasted (ENSOMD 2012-13). Most regional rates are medium to high across Madagascar, as shown in Figure 10. Prevalence is normal (< 5 percent) in only one region (Haute Matsiatra) and high (>10

[14] Wasting defined by Weight for Height Z score (WHZ) of <-2 as per WHO standards (WHO 2006)

percent) in the three regions of Boeny (13 percent), Vakinankaratra and Atsinanana (both 12 percent) (ENSOMD 2012-13). Wasting in the South is affected by seasonality. A WFP intervention to address acute malnutrition in infants and young children (IYC) found peaks in prevalence and severity of wasting during the lean season for intervention and control groups in Ampanihy (Figure 11) (GRET 2016).

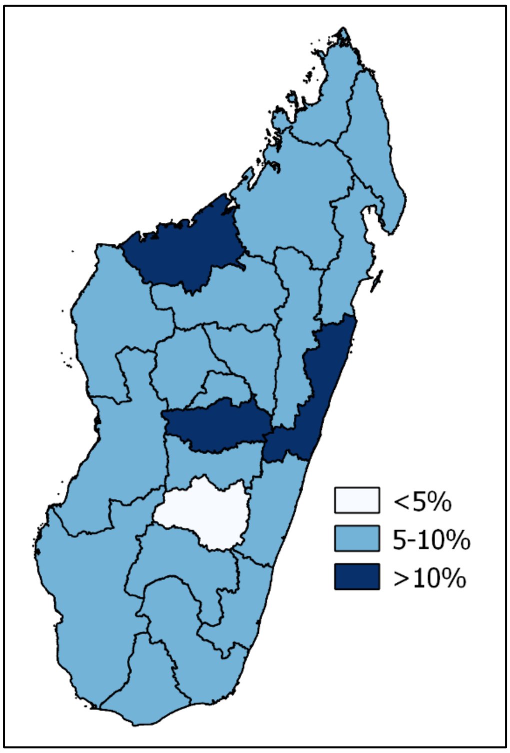

Figure 10: Wasting (WHZ<-2Z) prevalence among children under 5 in Madagascar (INSTAT 2014)

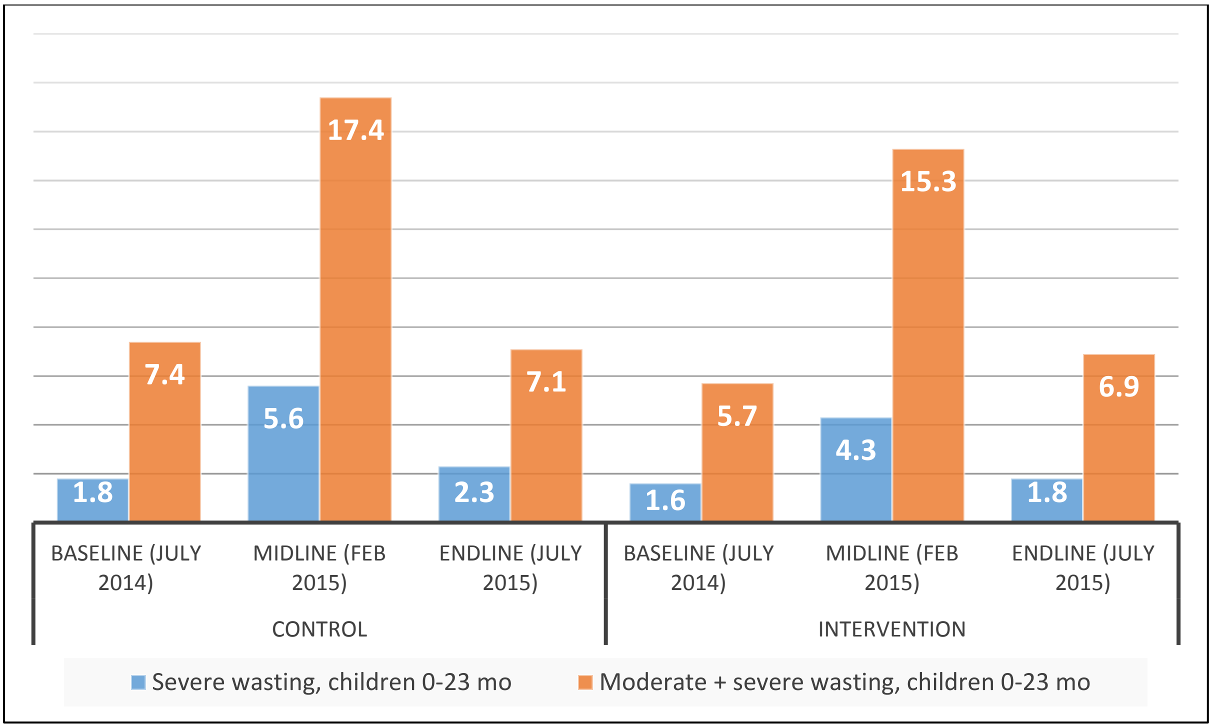

Figure 11: Effects of seasonality on wasting prevalence (WHZ<-2Z) for children under 2 in Ampanihy district, South Madagascar (GRET 2016)

Low birthweight

Nationally, 11 percent of children are born with low birthweight (<2500g) according to the 2012-13 ENSOMD (INSTAT 2014). Rates are highest in Boeny (22 percent) in the Upper West and lowest in Bongolava (6 percent) in the Centre (Figure 12). Low birthweight has been associated with stunting prevalence later in infancy (Figure 13). According to the most recent DHS, birthweight is recorded only 40 percent of the time nationwide, while the ENSOMD found that birthweight is only recorded for 14.5 percent of births across Madagascar; stated prevalence of low birthweight should thus be approached with caution and may not be applicable nationwide (ENSOMD 2012-13, DHS 2008-9). According to the DHS, birthweight is recorded most frequently at births in urban areas (74 percent), among mothers with at least secondary education (72 percent), and among the wealthiest quintile (83 percent); because these are also the groups in which fewer children have low birthweight, it is likely that actual national prevalence is much higher (DHS 2008-9).

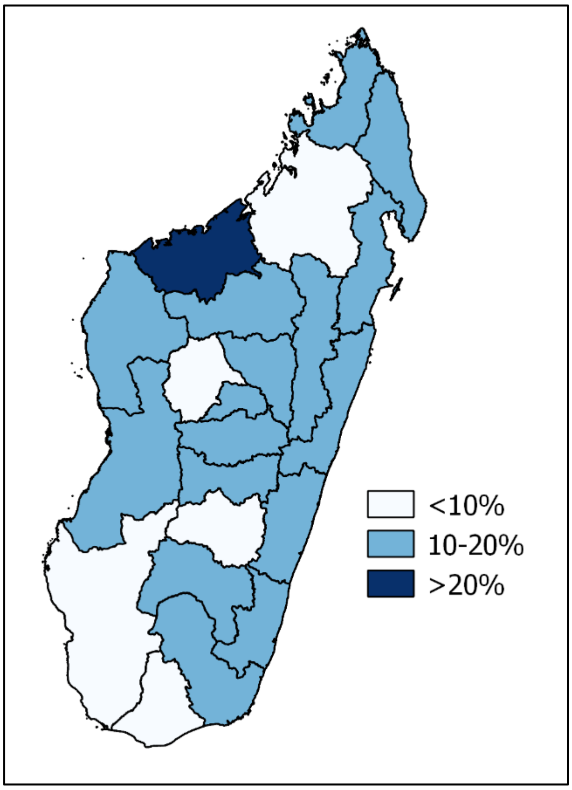

Figure 12: Prevalence of low birthweight (<2500g) by region in Madagascar (2008-09) (DHS 2008-9)

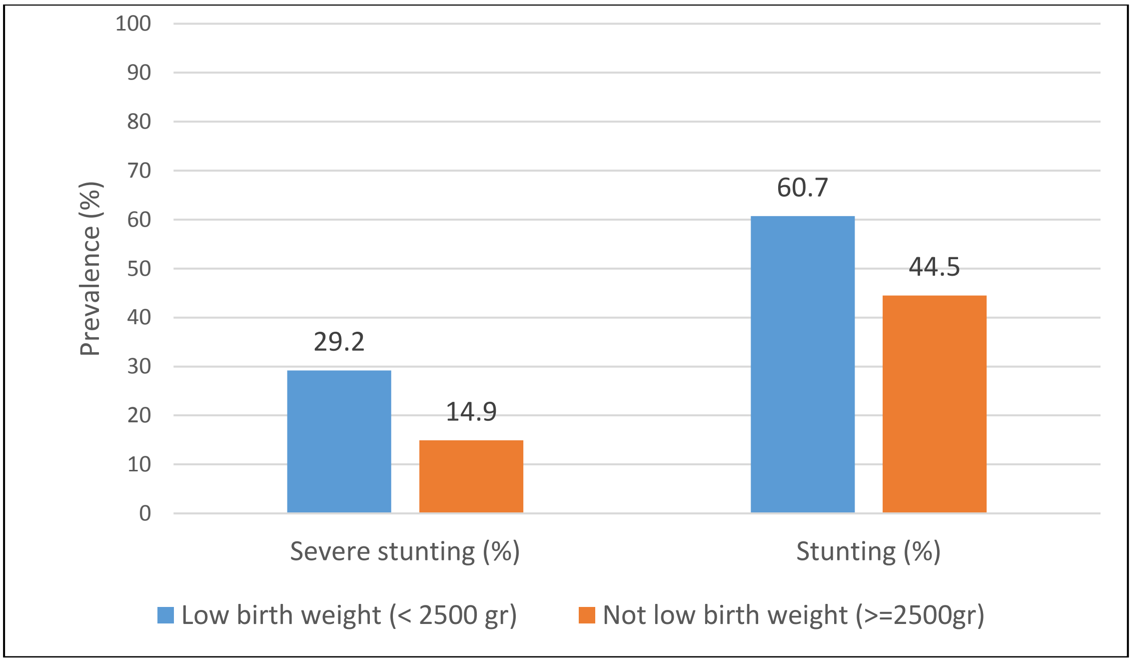

Figure 13: Prevalence of stunting and severe stunting by adequacy of birthweight in Madagascar (2012-13) (ENSOMD 2012-13)

Disease prevalence among children

Poor sanitation and water quality can lead to diarrhoea and other diseases that result in nutrient losses. Madagascar has the third-lowest sanitation coverage in the world (World Bank 2015). Nationwide only 12 percent of the population has access to improved sanitation and coverage is especially poor in rural areas where 70 percent of the population uses open defecation (JMP 2015). In rural areas 18 percent of the population has access to improved drinking water, compared to 84 percent in urban areas. National coverage of improved drinking water is 34 percent.

Nutritional status of Women of Reproductive Age (WRA)

High levels of stunting are indicative not only of poor nutrition for IYC but also poor dietary intake and nutritional status of women, especially during pregnancy and lactation. Little data exists on the nutritional status of pregnant and lactating women (PLW) in Madagascar. Minor studies suggest weight gain during pregnancy is low and in rural areas especially PLW nutritional status is of great concern; some of this may be due to attempts to limit foetal growth by restricting dietary intake, as discussed further below (Ravaoarisoa 2010).

At the national level 37 percent of women aged 15-19 are pregnant or have a baby (UNICEF & SALOHI 2015; ENSOMD 2012-13). The highest rates are in the four southern regions of Anosy, Menabe, Androy and Atsimo Andrefana, where 51 percent of 15-19-year-olds are pregnant or have a baby (MICS 2012). Nationally, the proportion of teenage pregnancies is higher in rural than in urban areas (36 percent vs. 14 percent) and among girls who have lower levels of educational attainment (58 percent among girls with no education vs. 49 percent primary vs. 18 percent secondary or higher) (ENSOMD 2012-13; MICS 2012).

Coverage of prenatal care is high nationally, with 86 percent of pregnant women seen by a trained professional (INSTAT 2009). This is higher in urban areas (95 percent vs. 85 percent in rural areas) and varies by region, maternal educational attainment, and economic quintile (73 percent of women in the poorest quintile vs. 97 percent of the wealthiest). 60 percent of prenatal visits were with a nurse or midwife, 27 percent were with a doctor, and only 5 percent were with a traditional birth attendant. However, only 49 percent of women had four or more prenatal visits, as recommended by WHO, only 27 percent of women had their first visit before the fourth month of pregnancy.

Underweight and overweight

The most recent national data on underweight and overweight among women is found in the 2008-2009 DHS. Among WRA, 24 percent of women were underweight, with a Body Mass Index (BMI)[15] less than 18.5. Prevalence of underweight was higher among women in in rural areas (28 percent), those without education (33 percent), and those from the bottom two economic quintiles (33 percent and 34 percent, respectively). Regionally, underweight was most prevalent among women in Amoron'i Mania (42 percent), Haute Matsiatra (38 percent), Analanjirofo (37 percent), Atsimo Atsinanana (37 percent) and Vatovavy Fitovinany (36 percent).

National prevalence of overweight in the 2008-2009 DHS was low. Excluding women who were pregnant or had given birth in the previous two months, 5 percent of WRA were overweight (BMI of 25 or greater), including 1 percent who were obese. Prevalence was greater among women in the top economic quintile (12 percent). The region with the greatest prevalence of overweight was Boeny (13 percent).

Anaemia

Over a third (35 percent) of women in Madagascar are anaemic, with the highest prevalence found in the North-West and South of the country (Figures 8 and 14). All regions of Madagascar have moderate (>20 percent) or severe (>40 percent) anaemia prevalence (WHO et al. 2011).

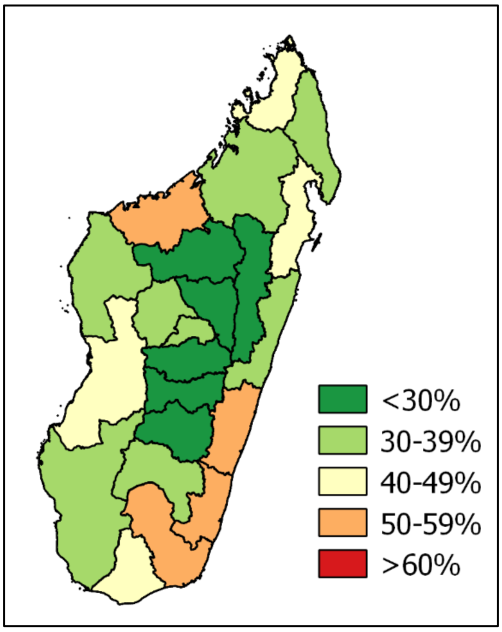

Figure 14: Severity of anaemia prevalence for women of reproductive age (WRA, 15-49 years) by region in Madagascar (INSTAT 2009)

[15] A measure of body fat based on height and weight

Define focus and malnutrition characteristics

Key highlights:

The key target groups for analysis were identified in collaboration with stakeholders based on consideration of current malnutrition characteristics across Madagascar.

Key Target Groups

Children 6-23 months

- Stunting: 47.3%, with little reduction in the past 5 years and higher levels in rural areas and the capital. Given the high population density in urban areas, the absolute numbers are likely very high.
- Wasting: 8% among children under 5 (very high)
- Anaemia: 50% (severe)

Pregnant and lactating women (PLW)

- Anaemia: 35% (moderate) among women of reproductive age (WRA, 15-49 years)
- Underweight: 24% (severe) among WRA

Adolescent girls (10-19 years)

- Adolescent pregnancy rates: 37% are pregnant or have a baby; this is higher in the 4 southern regions (51%)

Nutrition-related policies, programmes and regulatory framework

National Policy

Madagascar adopted a National Nutrition Policy in 2004 (PNN 2005-2015) and has implemented two National Plans of Action for Nutrition: PNAN 2005-2009 (extended until 2011) and PNAN II 2012-2015 (Madagascar National Nutrition Office 2015; SUN 2015; UNICEF 2014). The Prime Minister presides over the National Nutrition Council (CNN), which brings together stakeholders from multiple government sectors and NGOs, donors and other technical and financial partners (SUN 2015a). The CNN supervises the National Nutrition Office (ONN) represented across Madagascar's 22 regions by Regional Nutrition Offices (ORN) and Regional Follow-up and Evaluation Offices (GRSE).

Madagascar joined the Scaling Up Nutrition (SUN) movement in 2012. Madagascar scored 75 percent in three of four SUN progress markers in 2015[16]: 1) bringing people together into a shared space for action, 2) ensuring a coherent policy and legal framework, and 3) aligning actions around a Common Results Framework. The final progress marker 4) financial tracking and resource mobilisation saw virtually no improvements from 2014 and remained at 54 percent (SUN 2015b).

Nutrition features prominently in the National Development Plan (PND 2015-2019), but achieving relevant targets will require important acceleration of current efforts and strong financial support (Madagascar Ministry of the Economy and Planning 2015; INSTAT 2013a). The national rate of chronic malnutrition among children under five years of age decreased on average by only 0.5 percent per year from 1992-2012; the current PND target would require an annual drop of 3 percent from 2015-2019 (INSTAT 2009).

PNN and PNAN II both ended in 2015. Both documents were based on global evidence, particularly the Lancet series, and thus had little impact. Revision of PNN according to country-specific evidence is expected to conclude in November 2016 with presentations of the new Policy and eventual Action Plans. PNAN II is currently being evaluated (SUN 2015b), and key initial recommendations include:

1) Adopting an intersectoral approach, with an action plan that comprises three elements: nutrition-specific, nutrition-sensitive, and coordination and monitoring;
2) Defining clear implementation platforms which partners are required to join;
3) Coordination by ONN, including period multisectoral meetings with all implementation platforms and regular briefings to the Conseil de Gouvernement;
4) Financing school meals as a key intervention to reduce stunting (but not the only intervention), including development of agriculture, livestock, and fishing at the local level, and 100 percent coverage of school meals in the seven most vulnerable districts;
5) Prioritizing a package of high-impact, proven interventions; and
6) Accompanying every nutrition intervention with an income-generating program.

Nutrition has also been integrated into sectoral policies such as the Sectoral Plan for Agriculture, Livestock and Fisheries (Madagascar Ministries of Agriculture; Fisheries; and Livestock 2016).

[16] These markers are self-evaluated by the country.

National Legal and Regulatory Framework

A National Decree to regulate the marketing of breastmilk substitutes was approved and adopted in 2011[17].

Regulations for food quality and safety are insufficient and frequently not applied (Situation de la Malnutrition). Inadequate infrastructure for analysis and inspection of food items leads to frequent seizures, rejections of imports and exports and cases of food poisoning (Situation de la Malnutrition).

Iodisation of salt is mandatory, but there are no other national standards for food fortification (SUN 2015a). Compliance with the fortification requirements for iodised salt is not always consistent, according to existing monitoring reports; only 52 percent of households report using iodized salt and the government no longer covers the cost of iodization (mapping spreadsheet). A government community nutrition program (PNNC) previously distributed flour enriched with a corn-soya blend, but has ceased operation except at 125 sites supported by the World Bank in nine regions (Fernald et al. 2014). PNNC distributes two home fortificants not currently available on the market: Kalina Zaza and Kalina Reny (both small quantity liquid-based nutrient supplements).

Rice fortification is worth considering due to the high consumption of rice (on average, 283 grams per capita daily), although feasibility is a concern (FFI & GAIN 2016). Nearly all rural households grow rice, with the exception of the South where maize is more common. In rural areas 70 percent of rice is for self-consumption and 30 percent is commercialized. About 90 percent of domestic rice is husked at the village level either in small motorized or foot-powered mills or by hand pounding. The feasibility of fortification for local rice that is hand-pounded or husked in small village mills would need to be assessed, as the use of formalized semi-industrial rice mills has declined in recent years because of difficulties competing with informal mills that do not pay taxes. Intense price competition among local millers could undermine willingness to cooperate in fortification. Nationwide 13 percent of total rice consumed is imported, with most of this consumed in urban areas where imports account for at most two-thirds of per capita daily intake of rice. Nearly all imported rice (97 percent) comes from India and Pakistan. A mandate that all imported rice be fortified would require strong regulatory monitoring from Customs.

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[17] Projet de Décret No.2011-629 portant Réglementation de la Commercialisation des Substituts du Lait Maternel. Source: WHO Global Database for the Implementation of Nutrition Actions (GINA).

Partnerships and National Programmes

Quite a number of public private partnerships have been established to improve the availability and access of different types of complementary foods and home fortificants through the market.

ONN, the Ministry of Health, and PSI co-piloted an MNP social marketing project called Fortidom from February 2013-August 2015, with the support of UNICEF. The project, piloted in two rural areas and two urban areas (Vavatenina and Fénérive-Est, and Antananarivo and Fianarantsoa, respectively) comprises promotion of optimal IYCF and distribution of Zazatomady, a locally branded MNP used for home fortification of complementary foods for children 6-23 months (PSI n.d.). The endline study of the pilot found significant decreases in anaemia prevalence among target children (from 75 percent in 2012 to 64.5 percent in 2014) and particularly girls (from 80.6 percent to 64.8 percent), significant improvements in percentage of children who had received minimum acceptable diet in the last 24 hours (from 6.6 percent to 38 percent), and significant improvements in knowledge of IYCF practices among caretakers, such knowledge about the benefits of diversifying the food intake of children (from 49.9 percent to 66.1 percent) (PSI 2014).

Kalina was a pilot study designed as a randomized control trial, conducted through a partnership between the World Bank and PNNC to test the comparative effectiveness of different nutrition programme packages, including a small quantity lipid-based nutrient supplement (LNS) for both children 6-23 months and PLW. 125 communities across five regions were randomly assigned to one of four intervention groups, or to the control group, to test the effectiveness of counselling, LNS for children 6-18 months and/or PLW, and/or early stimulation. Children in the LNS groups were given Kalina Zaza for prevention of malnutrition and PLW were given Kalina Reny; a partnership with Nutriset provided scope for eventual local production.

Another public-private partnership between GRET and social company Nutri'Zaza promoted the sustainability of an extensive network of "restaurants for babies" initially established as part of the NutriMad project, which are preparing and selling a locally produced fortified blended food, called Koba Aina. The retail points are now available in several urban and rural areas of the country.

WFP, UNFPA, ONN and the Minsitry of Health distributed Nutributter, a small quantity lipid-based nutrient supplement, to children 6-24 months of age for two years in Itampolo and Fotadrevo communes in Ampanihy district. The project, MIARO, aimed to prevent chronic malnutrition among children under the age of two and PLW; it also provided a ration of vitamin A-fortified oil and Super Cereal to PLW.

The Ministry of Education is currently piloting a Home Grown School Feeding (HGSF) Programme, with the support of WFP, which aims to reach 20,000 children at 60 schools in selected regions during the school year starting October 2016 (WFP 2016b). A national school feeding policy is being developed for finalization in August 2016. WFP also supports the Government's School Feeding, Nutrition and Health Programs (PNANSS) and National School Feeding and Nutrition Strategy (SNANS); however, these currently cover only 11 school districts out of 119 nationally (SUN: Madagascar 2014).

Policy analysis

Key highlights

National policy, legal and regulatory framework

- ➔ National Nutrition Policy (2005-2015) and National Plan of Action for Nutrition (2005-2011, 2012-2015): both under revision.
- ➔ Previous plans were based on international evidence (Lancet series, 2008) but did not prioritise context-specific needs.
- ➔ National Nutrition Council under Office of Prime Minister, oversees the National Nutrition Office (ONN), represented nationwide by Regional Nutrition Offices.
- ➔ National Decree to regulate the marketing of breastmilk substitutes: approved and adopted in 2011.
- ➔ Scaling Up Nutrition: joined in 2012.
- ➔ Mandatory fortification: only salt iodisation, with highly variable compliance.
- ➔ Food quality and safety: low scores on the Global Food Security Index, with insufficient regulation and monitoring.

PPP for Fortified Complementary Foods and Specialised Nutritious Foods

- ➔ Several public-private partnerships to make specialised nutritious foods for women and children available; these currently operate in select areas and aim to scale up in the future.
- ➔ Kalina Zaza and Kalina Reny, SQ-LNS (World Bank-PNNC partnership).
- ➔ Koba Aina, FBF (GRET-Nutri'Zaza partnership).
- ➔ Zazatomady, MNP (ONN-Ministry of Health-PSI partnership).

School Feeding

- ➔ Home-Grown School Feeding Programme: Ministry of Education programme with WFP support, currently reaches 300,000 children.

Availability of Nutritious Foods

General availability

An anthropological study in Moramanga, Farafangana and Morondava found that in all three districts a diverse household diet would be possible in terms of availability (Institut Pasteur de Madagascar 2015). However, in reality high food prices and generalised poverty prevent the majority of households from accessing a diverse diet, especially during the lean season.

Availability of nutritious food differs by urban or rural location (Institut Pasteur de Madagascar 2015). In urban areas a wide variety of foods are available in local markets including staples, animal-source foods, vegetables, leafy-greens, fruits, pulses, seafood (some areas only[18]) and commercially produced infant foods and formulas, including Koba Aina, Nutri'Zaza and Farilac FBFs and Zaza Toamdy MNP, described below. In rural areas small-holder farmers grow rice, tuberous roots, green vegetables and fruit. Other vegetables and pulses are generally purchased in local markets

Production

In Madagascar 78 percent of the labour force works in agriculture yet agriculture accounts for less than 30 percent of GDP (Epstein G. et al 2010). It is estimated that only 5 percent of land is cultivated at any one time, due to mountainous terrain, tropical weathering of soil and inadequate or irregular rainfall (Vololona et al. 2013). Production of some food and non-food crops (bananas, sugarcane, cotton, tobacco) is dominated by large-scale plantations, but most food production of crops such as rice, cassava, maize and potatoes is done by small-scale subsistence farming. Production is hampered by the use of inefficient or inadequate farming and post-harvest practices and limited access to inputs, credit, technical services, markets and market information (FAO & WFP 2015). Climate shocks are an annual threat and financial shocks have been a historical concern; Figures 15-17 show the decreases in production of rice, maize and cassava from 2014-2015 due to particularly severe climactic challenges. Rice is the main dietary staple, however local production is insufficient to meet demand and Madagascar is a net importer (FFI & GAIN 2016).

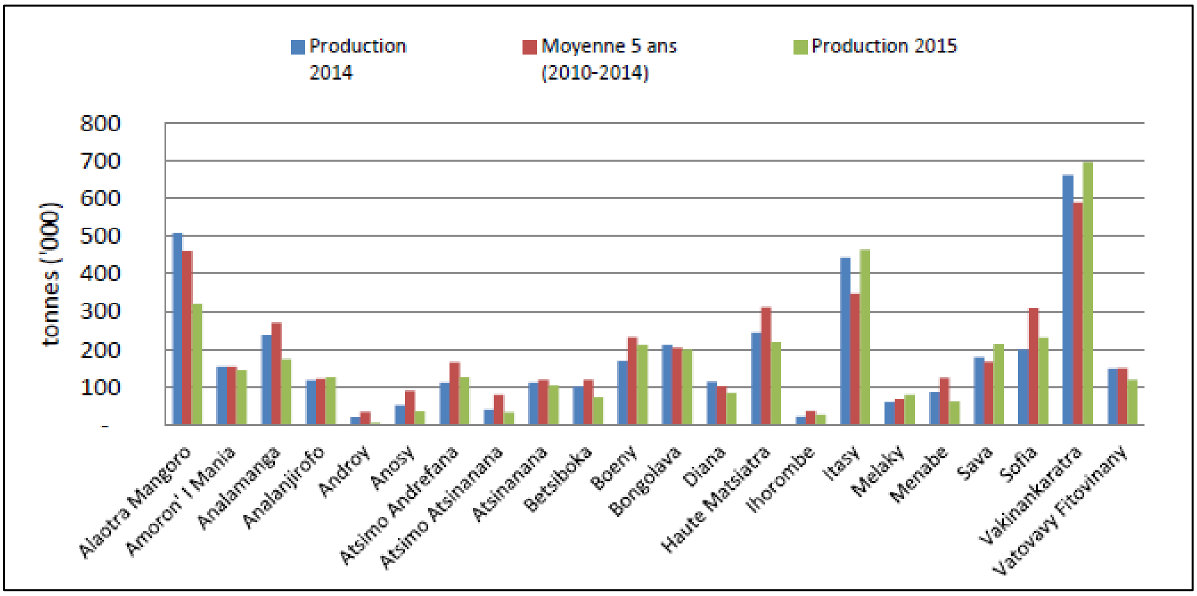

Figure 15: Rice production by region in 2014, 2015, and the average of the years 2010-2014 (FAO & WFP 2015)

[18] In two out of the three districts studied (Farafangana and Morondava) seafood was found in the urban areas

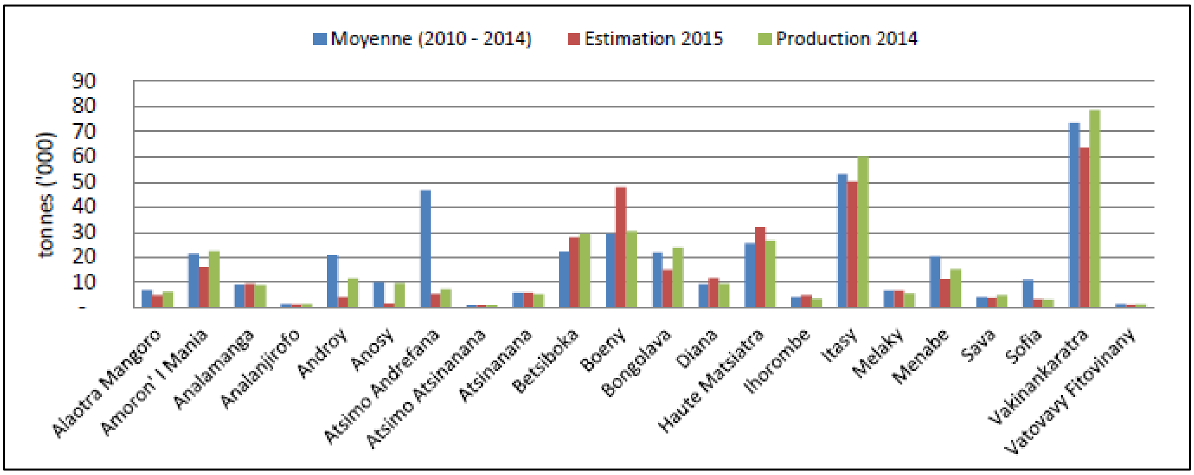

Figure 16: Maize production by region in 2014, 2015, and the average of the years 2010-2014 (FAO & WFP 2015)

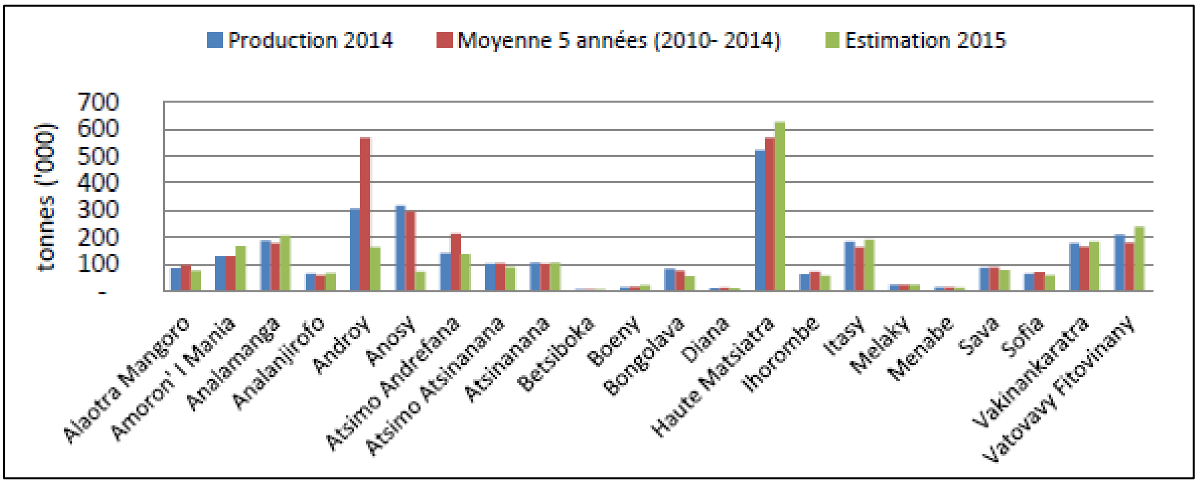

Figure 17: Cassava production by region in 2014, 2015, and the average of the years 2010-2014 (FAO & WFP 2015)

The importance of agricultural production varies by region. In Analamanga, only one third of households practice agriculture compared to approximately 95 percent in Androy and Amoron'i Mania (INSTAT 2014). Some disparities are due to agroecological and socioeconomic differences: in Amoron'i Mania periurban agriculture plays an important role. The principal zones of rice cultivation are Boeny, Alaotra Mangoro and Atsimo Andrefana (INSTAT 2014).

Seasonality of production

Production is greatly affected by seasonality, with timing similar for most crops except wheat (Figure 18). The lean season generally occurs during the first four months of the year, when farming families rely on markets for food. Food is generally abundant during the harvest season from May to July; however, storage of rice or other crops to prepare for the lean season is not common (FAO & WFP 2015). As a result of the lack of crop storage subsistence farmers in rural areas are often not prepared for the lean season (Institut Pasteur de Madagascar 2015).

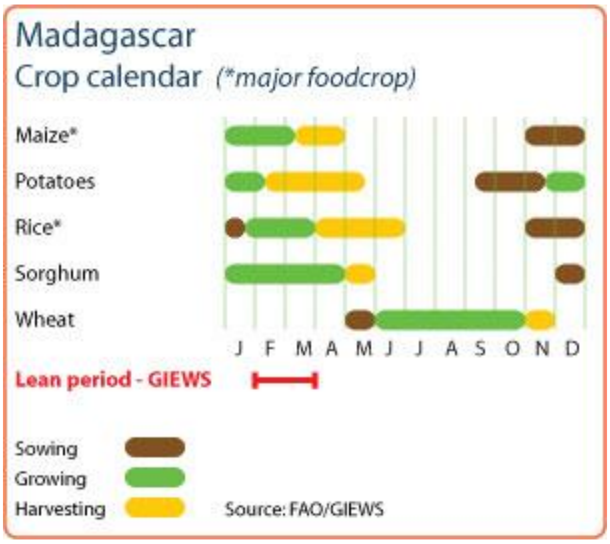

Figure 18: Madagascar Crop Calendar (FAO GIEWS 2015)

Effect of weather patterns and natural disasters on food availability

Madagascar is one of the ten countries in the world most vulnerable to natural disasters, with one-quarter of the population living in areas highly prone to cyclone, floods or drought (Table 1) (WFP 2016a). The high incidence of severe weather conditions has a significant impact on staple production, agricultural diversity and food security. Conditions are further exacerbated by climate change and climatic events, such as the 2014-2016 El Niño effect. Weather and climate vary dramatically throughout the country and some regions are more affected than others.

Crisis	Year	Population affected	Area
Cyclones and floods	2012-13	40154	
	2011-12	492869	
	2010-11	267000	
	2009-10	195000	
	2008-09	114537	
	2007-08	525000	
	2006-07	2000000	North, North West and East Coast
	2004	988139	
	2002	526200	
	2000	736200	
	1997	6000000	
Drought	2010	720000	Southern regions
	2009	381000	
	2006	262690	
	2002	600000	
Locust plague	2011-12	2000000	Southern regions
	2010-11	13000	
Famine	2005	14000 children <5 years	

Table 1: Key disasters in Madagascar 1999-2003 (UNICEF 2014)

In 2015, the Southern regions of Androy, Anosy and Atsimo Andrefana, located in the chronically arid Grand Sud area, suffered excessive rains followed by severe drought. These El Niño conditions have led to severe implications for crops and livestock in the region, impacting food availability, prices and livelihoods. Production declines of 60-80 percent were registered for rice, maize and cassava (WFP 2016c; FAO & WFP 2015). In contrast, over the same time period, satisfactory seasonal rains were experienced across northern and central regions of Madagascar and a close to average rice yield is expected in 2016 (FAO & WFP 2015).

Availability of specialised nutritious foods

A number of specialised nutritious foods for children 6-23 months are currently available in local markets across Madagascar (Institut Pasteur de Madagascar 2015; PSI Madagascar 2013; Fernald et al. 2014; Fernald et al. 2016). Koba Aina, a fortified blended complementary food, can be found in both urban and rural areas, and is produced and distributed through a public-private partnership involving GRET, IRD, the University of Antananarivo, ONN, the NUTRIMAD project, and social enterprise Nutri'Zaza. It comes in two formats: 35-gram sachet that is sold for 400 Ar, or a ready-made porridge of which one portion (the equivalent of 35 grams) costs 250 Ar. Farilac, another fortified blended complementary food, is distributed through the private sector by Socolait. Available only in urban areas, it is sold for 600 Ar per 25-gram sachet. Nutributter, a small quantity lipid-based nutrient supplement, was distributed for two years in two communes of Ampanihy district, through a program implemented by WFP and UNFPA.

Home fortificant Zaza Tomady, a micronutrient powder, is available through a partnership between PSI and UNICEF. It is currently available in four urban and rural areas (Analanjirofo, Antananarivo urban, Atsimondrano and Avaradrano, and Menabe) with planned expansion to Vakinankaratra by the end of 2016. Zaza Tomady is sold in cartons of 30 1-gram sachets, or a month's supply, for 200 Ar in rural areas and 1000 Ar in urban areas.

Two additional products are not yet available on the market, but are currently distributed in-kind by partners including the University of California (Davis and Berkeley), the World Bank, IFPRI, PNNC, and Nutriset. Kalina Zaza and Kalina Reny are both home fortificant small quantity lipid-based nutrient supplements, for children 6-23 months and PLW (up to six months), respectively. Kalina Zaza comes in 20-gram sachets, while Kalina Reny is available in 40-gram sachets. Distribution is currently in rural areas of five regions: Amoron'i Mania, Androy, Atsimo Atsinanana, Haute Matsiara, and Vatovavy Fitovinany. There is good potential for future market availability of both of these products, particularly if production is moved from France to a Plumpy Field factory in Madagascar.

Availability to food and nutrients

Key highlights

A wide range of nutritious foods are available in Madagascar and production is diverse, but it is highly vulnerable to seasonality impacting the quantities produced. This results in seasonal food insecurity which is exacerbated by climatic shocks, particularly in the South.

Availability

- ➔ Rice is the main staple.
- ➔ Agricultural production mostly small-scale and for subsistence only.
- ➔ Storage of crops for lean season is uncommon.
- ➔ Production hampered by use of inefficient or inadequate farming and post-harvest practices and limited access to inputs, credit, technical services, markets, and market information.

Market Access

Infrastructure is not always adequate for market access. In zones where roads do exist, they are often impassable, particularly during the rainy season (ENSOMD 2012-13). In rural areas, it may take two hours to walk to the nearest market (INSTAT & WFP 2014). Nationally 14 percent of farmers reported that they felt isolated from markets (ENSOMD 2012-13).[19]

Affordability of nutritious foods

In 2012, food accounted for 68 percent of total consumption nationwide, illustrating Madagascar's high poverty rates (ENSOMD 2012-13). Food expenditure is more than 80 percent of total expenditure in four regions (Vatovavy Fitovinany, Amoron'i Mania, Vakinankaratra, and Atsimo Atsinanana) and is lowest in Analamanga (55 percent); the percentage is higher in rural areas (73 percent) than in urban areas (57 percent) (ENSOMD 2012-13). Among farming households, food expenditure ranges from 75-79 percent of total expenditure (ENSOMD 2012-13).

Seasonality of food access

Financial difficulties and food insecurity are both seasonal, with differences between urban and rural settings (USAID 2016). In urban areas day-to-day and monthly labourers receive late payment for work during the rainy season. In rural areas the lean season comprises up to eight months out of the year. During the lean season meal size and frequency decrease, households purchase food in the market and sometimes replace rice as the staple with cassava, mixed maize, jackfruit and breadfruit. Most people sell the greater part of their agricultural production during the harvest season to earn money to buy staple products, pay school fees and pay off debt. Because most households do not store rice, farmers are forced to buy food in markets at higher prices during the lean season.

Food Insecurity

Madagascar ranks 104th out of 113 countries on the Global Food Security Index, with the third-worst score for affordability and the second-worst score for quality and safety (The Economist 2016). An estimated 48 percent of households are considered vulnerable to food insecurity[20], including 35 percent of households that are chronically affected (WFP 2011). In the southern regions of the country, where droughts are most frequent, food insecurity affects up to 68 percent of households (WFP 2011). A 2015 joint FAO/WFP Crop and Food Security Assessment Mission (CFSAM 2015)

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[19] It should be kept in mind that isolation is a subjective measure.

[20] "People are considered food secure when they have availability and adequate access at all times to sufficient, safe, nutritious food to maintain a healthy and active life." Food security analysis looks at availability, access, and utilization of food. (https://www.wfp.org/node/359289)

estimated that food insecurity in Southern regions Anosy and Androy was at 90 percent and 76 percent respectively and concluded these regions required emergency assistance for food and nutrition security and livelihood support (FAO & WFP 2015). Food insecurity in the south is typically a concern in the lean season, with data showing that wasting prevalence is much higher in February than in July. (GRET 2016; ENSOMD 2012-13). There is also variation by livelihood group, with food insecurity most prevalent among households engaged in agricultural practices (36 percent of households) (Figure 19). Food insecure households spend more than 75 percent of their household budget on food (WFP & FAO 2014).

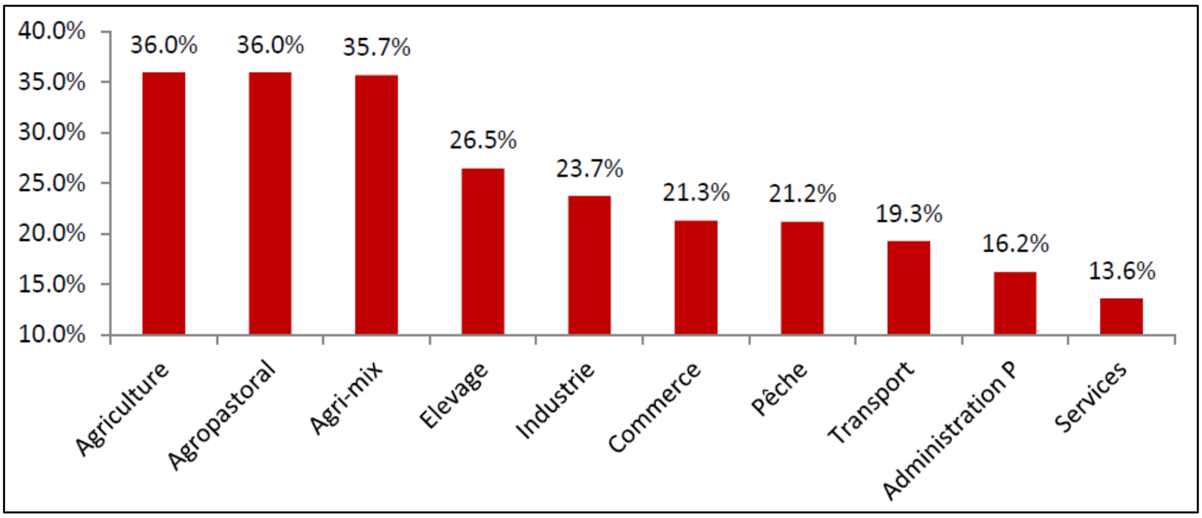


Figure 19: Food insecurity by livelihood group (ENSOMD 2013)

Food insecurity in Madagascar is affected by extreme climate and weather patterns, low per capita GDP, high poverty levels, poor access to financing for farmers and low public expenditure on agricultural research and development (The Economist, 2016). Recent food insecurity conditions throughout Madagascar have been attributed to decreased cereal supply (FAO & WFP 2015). Three consecutive years of reduced crop production combined with weak purchasing power of households, further eroded by high inflation rates, has forced families to employ multiple coping strategies including consuming reduced quantities of rice (FAO & WFP 2015).

Access to a nutritious diet

Key highlights

92% of the population in Madagascar live on less than $2 USD a day, so economic access is a major nutritious foods. Poor infrastructure further reduces market access, making it difficult for many to attain a diet that meets their nutrient needs.

Access

- ➔ The South particularly suffers from seasonal food insecurity, with up to 68% of households affected
- ➔ Insecurity is exacerbated by El Niño
- ➔ Economic access is a major barrier to nutrient intake: high levels of poverty combined with high food prices and inflation make nutritious diets inaccessible for large parts of the population
- ➔ Poor infrastructure inhibits market access, with some communities a 2-hour walk from the closest market

Nutrient Intake

Undernutrition

An estimated 8 million people (33 percent of the population) in Madagascar are undernourished, meaning they are not able to access enough food to meet their energy requirements [21] (FAO et al. 2015). Both the total number of undernourished people and the prevalence have increased since 1990, when 3 million people (27 percent of the population) were undernourished.

Household dietary diversity

The CFSAM analysis of Food Consumption Scores (FCS) found that in regions surveyed 54 percent of households had acceptable food consumption, 35 percent had borderline consumption and 10 percent had poor consumption (Figure 20). Poor consumption was more prevalent in Androy and Anosy, with 33 percent and 39 percent of households affected respectively. Analysis of household dietary quality showed that households in all three FCS groups consumed cereals and tubers (rice, manioc or maize) with nearly the same frequency, but the group with an acceptable FCS score consumed animal-source protein two days more per week than the borderline group, and four days more per week than the group with a poor FCS score (FAO & WFP 2015). The latter households had a

[21] The proportion of the population whose daily food intake falls below that minimum energy requirement, as defined by FAO (FAO 2003)

daily consumption of staples and some vegetables and fruits, with rare consumption of legumes, foods rich in sugars and oils every two weeks, and nearly no dairy.

On average, the CFSAM found that households in the regions surveyed had access to five or six food groups (out of eight total food groups) every week. This number was lower in Androy and Anosy, where the average number of weekly food groups was four and three, respectively. Overall, rural households had good access to foods rich in vitamin A such as leafy vegetables, which were consumed daily by 52 percent of households across the surveyed regions (Figure 21). However, less than one third of the households in the surveyed regions had access to foods rich in protein; in Anosy, only a negligible proportion of households had daily access to these foods, and a large share of households never consumed them (Figure 22). Less than 10 percent of households consumed iron-rich foods (such as fish and meats) on a daily basis, and in Anosy nearly 75 percent of households never consumed them (Figure 23) (FAO & WFP 2015).

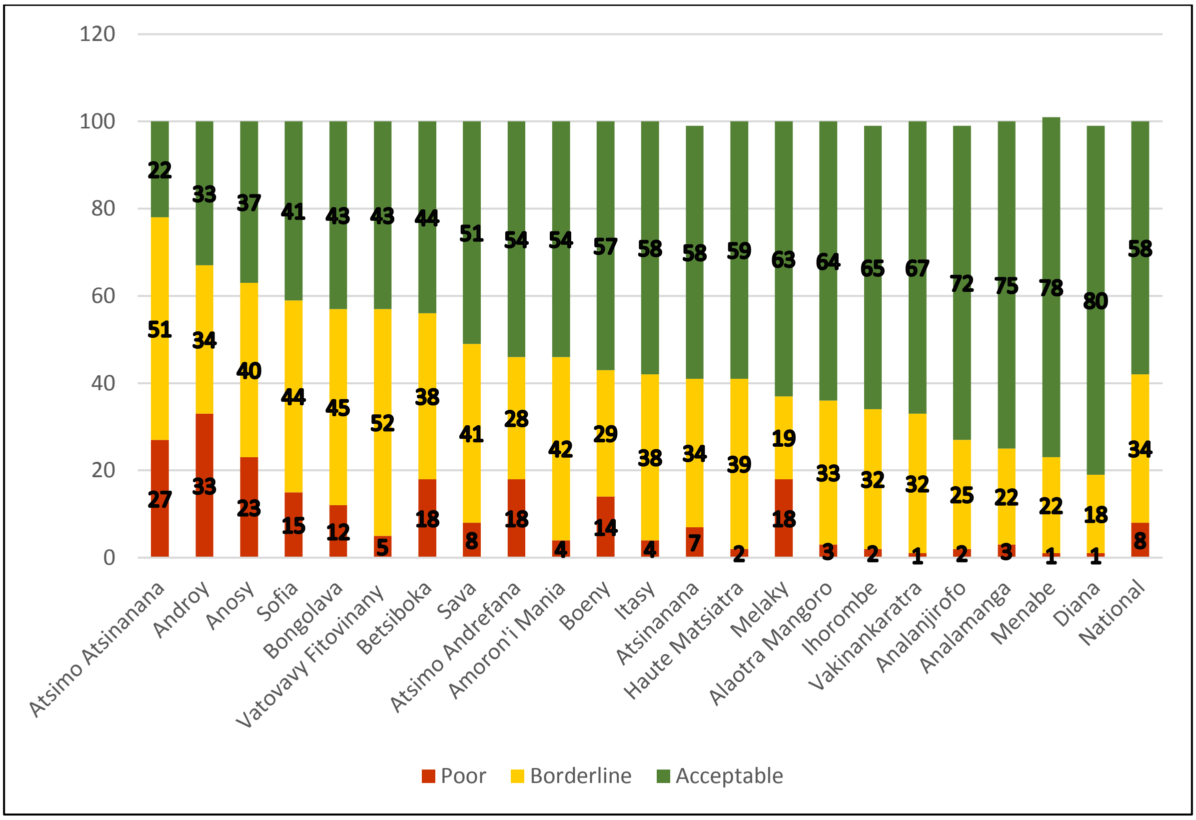


Figure 20: Percentage of Households Characterized in Three Categories of Food Consumption Scores (ENSOMD 2012-2013)

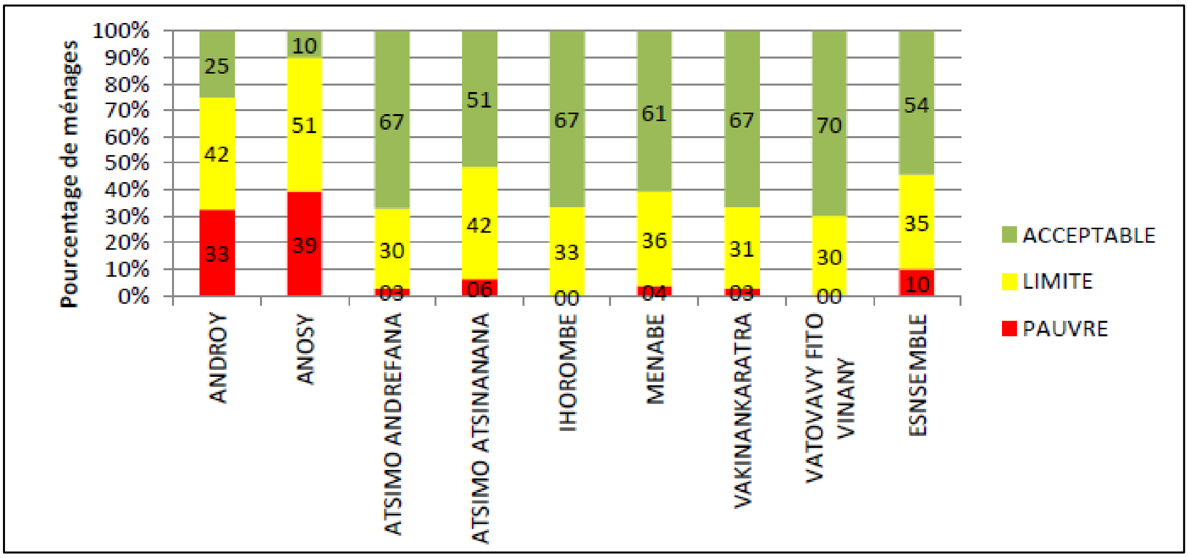


Figure 20: Household Food Consumption by region (FAO & WFP 2015)

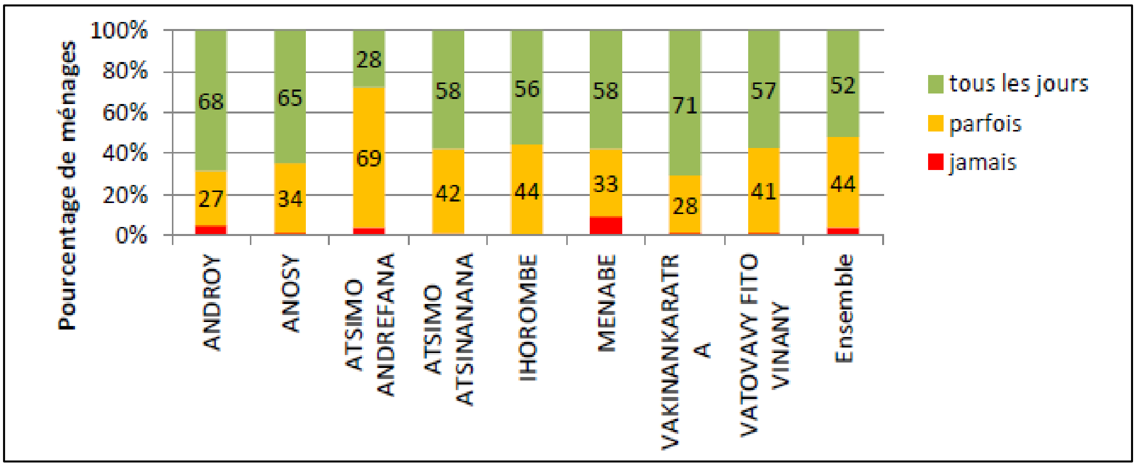


Figure 21: Household access to vitamin A-rich foods, by region (FAO & WFP 2015)

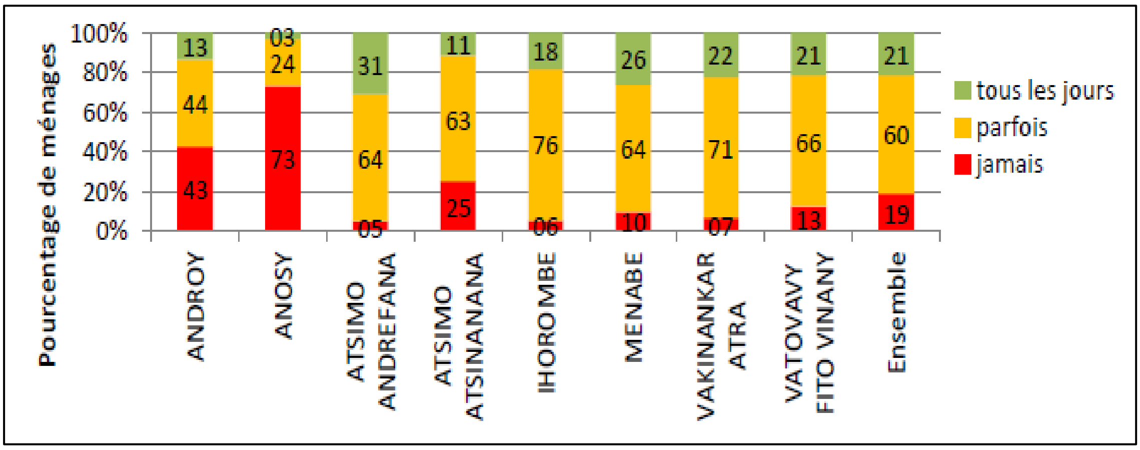


Figure 22: Household access to protein-rich foods, by region (FAO & WFP 2015)

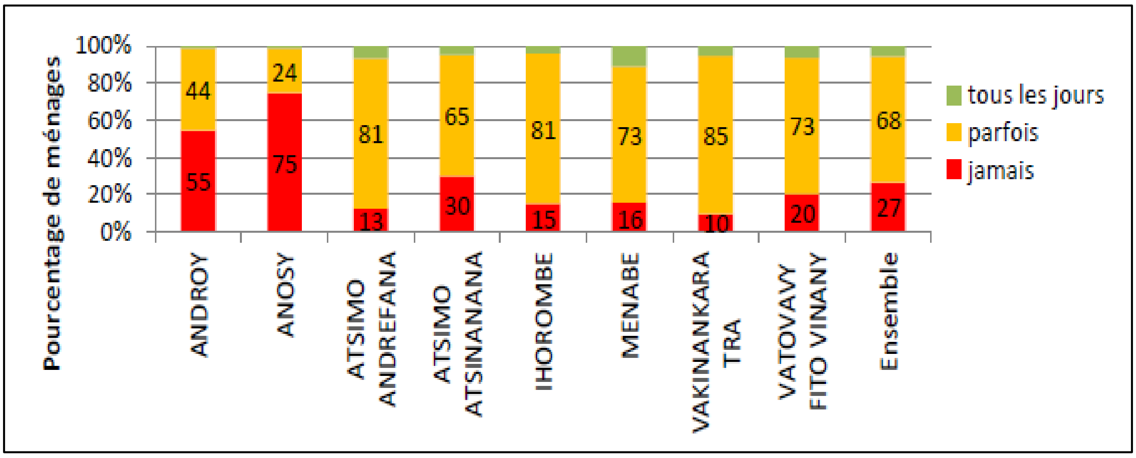


Figure 23: Household access to iron-rich foods, by region (FAO & WFP 2015)

Child feeding and micronutrient intake

High levels of stunting and anaemia in Madagascar are suggestive of poor micronutrient intake and feeding practices for infants and young children. Although 99 percent of children were breastfed nationally, only 66 percent were breastfed in the first hour following birth; 88 percent were breastfed in the first 24 hours after birth (INSTAT 2014). Early initiation of breastfeeding was less common in rural areas, among mothers with less education, and at homebirths. Most children (83 percent) are breastfed until two years of age and rates are generally consistent across the country (INSTAT 2014). However, less than half of children are exclusively breastfed until six months of age (Figure 24). Rates of exclusive breastfeeding are lowest in the Far North (26 percent) and South (30 percent) and highest in the Centre (47 percent) and Upper East (47 percent). Results from a survey conducted for the World Bank funded Emergency Project to Support Essential Services of Education, Nutrition and Health (PAUSENS) in five of the nine project regions suggest that many women stop exclusive breastfeeding when children are between three to five months of age, when many children receive other liquids in addition to breast milk, and four to five months of age, when many children receive solid or semi-solid foods (Fernald et al. 2014).

According to the 2012-2013 ENSOMD, when children began complementary feeding less than a third (30.9 percent) of them nationally met minimum dietary diversity standards (Figure 25). The ENSOMD also shows correlation of minimum dietary diversity in children aged 6-23 months with household dietary diversity and food consumption scores; only 20 percent of children in households with poor food consumption scores met minimum dietary diversity, and in households with poor dietary diversity scores the proportion was just 11 percent (Figure 26).

Minimum meal frequency and minimum acceptable diet are not included in the 2012-2013 ENSOMD, so the most recent data used for these indicators is found in the 2008-2009 DHS. The DHS found that among breastfed and non-breastfed children aged 6-23 months, only 3.9 percent met minimum recommended meal frequency (at least twice per day for children 6-8 months, at least three times per day for breastfed children 9-23 months, and at least four times per day for non-breastfed children 9-23 months). Although minimum dietary diversity is shown as higher in the DHS than the ENSOMD because of different frequency cut-offs[22], the extremely low frequency still brings minimum acceptable diet down to 2.7 percent. Frequency is higher, but still unusually low, among children whose mothers have secondary education (8.9 percent) and who belong to higher wealth quintiles (11 percent). Thus quantity seems to be a greater problem than quality of diet, but improvements to both are necessary to provide adequate nutrient intake for young children.

According to ENSOMD, only a third (36 percent) of children aged 6-23 months had consumed iron-rich food in the previous 24 hours and only 46 percent had consumed Vitamin A-rich food (INSTAT 2014). Results from the PAUSENS survey suggest that although dietary diversity improved each month after the first six months most diets consist of foods from the 'grains' and 'other fruits/vegetables' groups, with <20 percent of children at all age groups eating animal protein legumes and vitamin A-rich food and very few (<5 percent) consuming dairy (Figure 27) (Fernald et al. 2014).

Current coverage of supplementation with vitamin A is low, with only 43 percent of children reportedly receiving supplements (ENSOMD 2012-13).

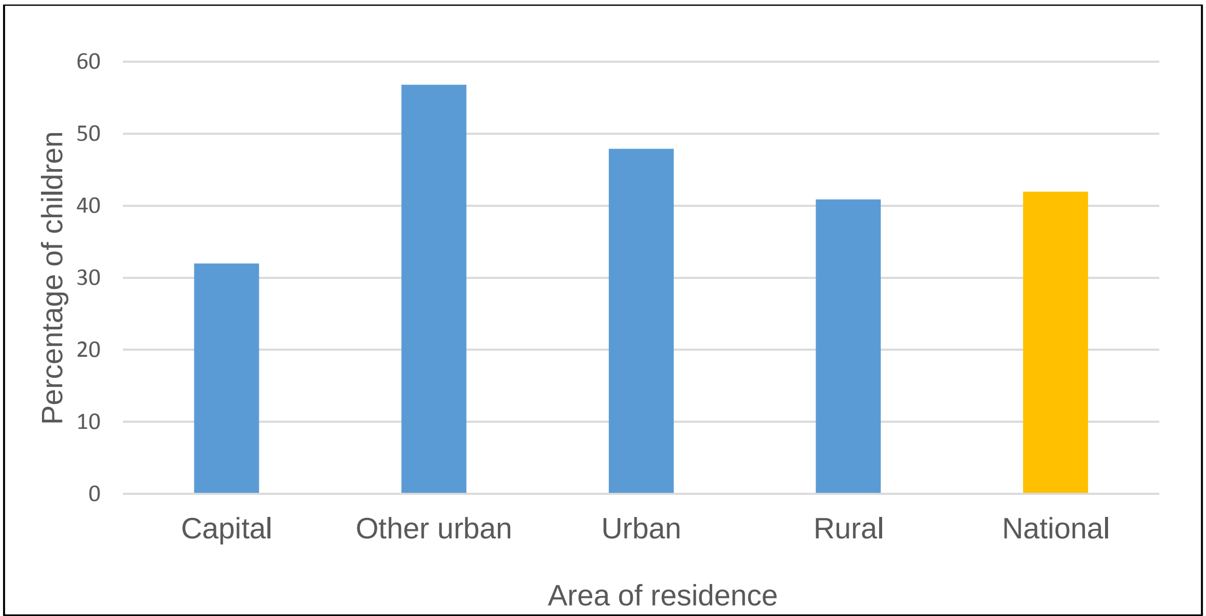


Figure 24: Percentage of children exclusively breastfed (only breastmilk given until six months of age), by area[23] (ENSOMD 2012-13)

[22] ENSOMD considers minimum diversity to be ≥4 food groups for all children, while DHS uses ≥3 food groups for breastfed children and 3-4 food groups for all children.
[23] Where "capital" refers to Antananarivo, "other urban" refers to all urban areas *except* Antananarivo, and "urban" refers to all urban areas *including* Antananarivo

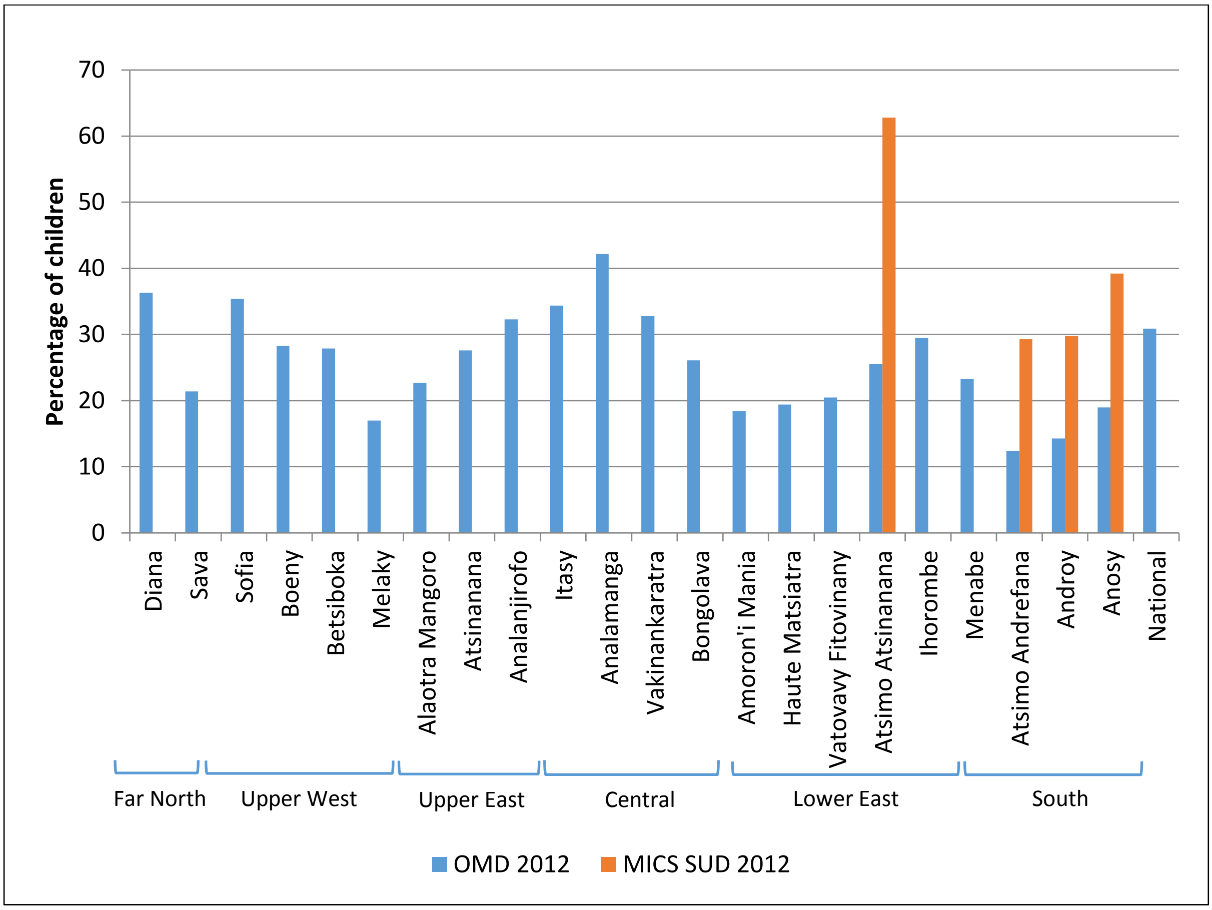


Figure 25: Percentage of children aged 6-23 months with adequate dietary diversity scores (consumed foods from 4 or more food groups in dietary recall) in Madagascar by region (ENSOMD 2012-13, MICS 2012)

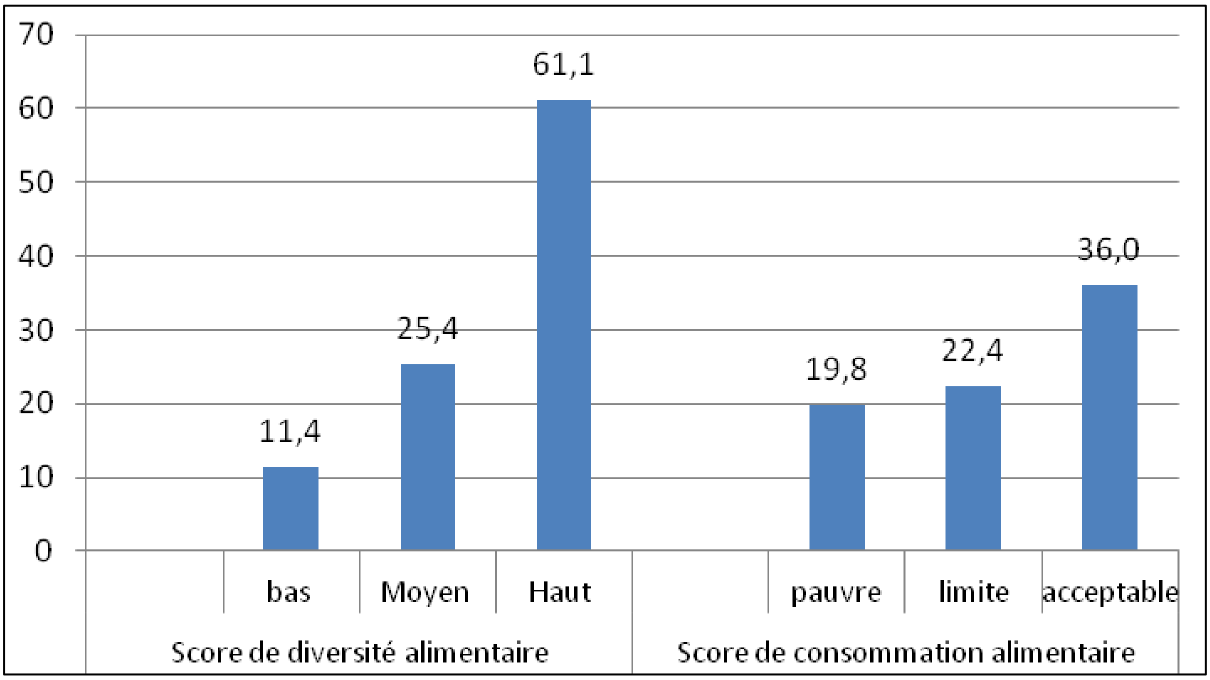


Figure 26: Minimum dietary diversity in children 6-23 months by level of dietary diversity and food consumption at the household level (INSTAT 2014)

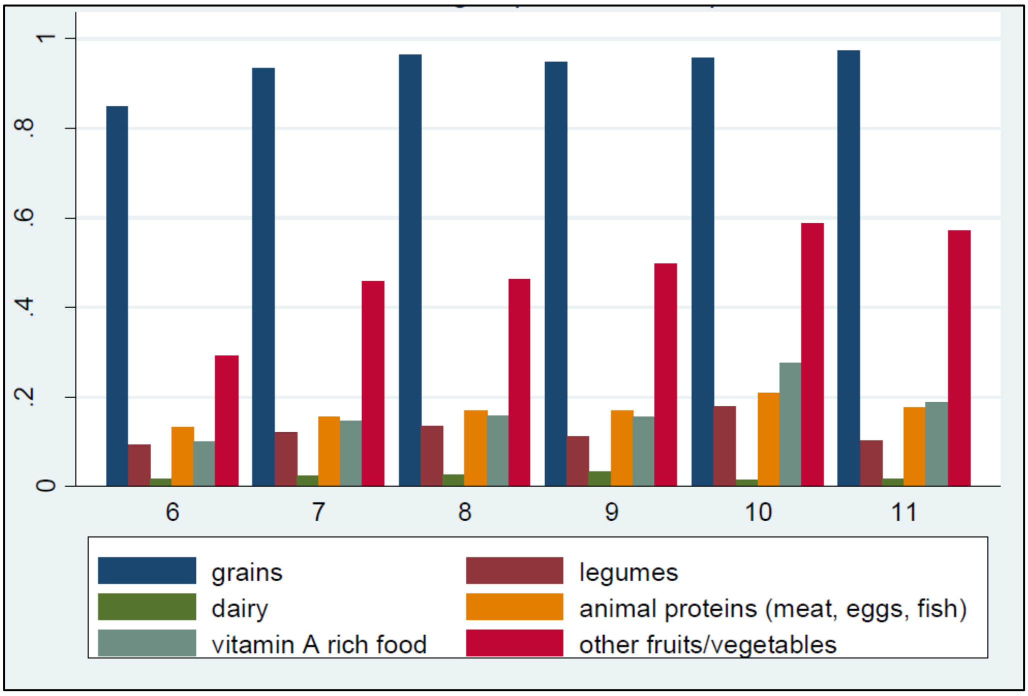


Figure 27: Consumption of different food groups in the previous 24 hours by children, by age group (months), findings from the PAUSENS study in 5 regions[24] of Madagascar, 2014 (Fernald et al. 2014)

Micronutrient intake and dietary practices of PLW

In a national survey on dietary intake only half of women respondents had consumed iron-rich food in the previous 24 hours; three-quarters (77 percent) had eaten vitamin A-rich food (INSTAT 2014).

Foods rich in vitamin A were consumed more often by women with a secondary education or higher (85 percent), by women living in urban areas (81 percent), by women in the highest wealth quintile (86 percent), and by women in households with acceptable FCS scores (80 percent). Regionally, there was wide variation in consumption of vitamin A-rich foods, from 59 percent in SAVA to 95 percent in DIANA. Consumption of iron-rich foods was higher among women with secondary education or higher (63 percent), in urban areas (67 percent), and in some regions (DIANA – 68 percent, Betsiboka – 64 percent, Analanjirofo – 63 percent) (ENSOMD 2012-13).

Very few pregnant women (7 percent) received recommended iron supplements for 90 days or more (2012-13 ENSOMD). Most pregnant women (42 percent) received less than 60 days of iron supplements and over a third of women (38 percent) received no supplements (ENSOMD 2012-13) (Figure 28). Coverage of iron supplementation for pregnant women was lowest in the Upper West (Melaky and Sofia), Far North (Sava) and Lower East (Vatovavy).

[24] Amoron'I Mania, Androy, Atsimo Atsinanana, Haute Matsiara and Vatovavy Fitovinany

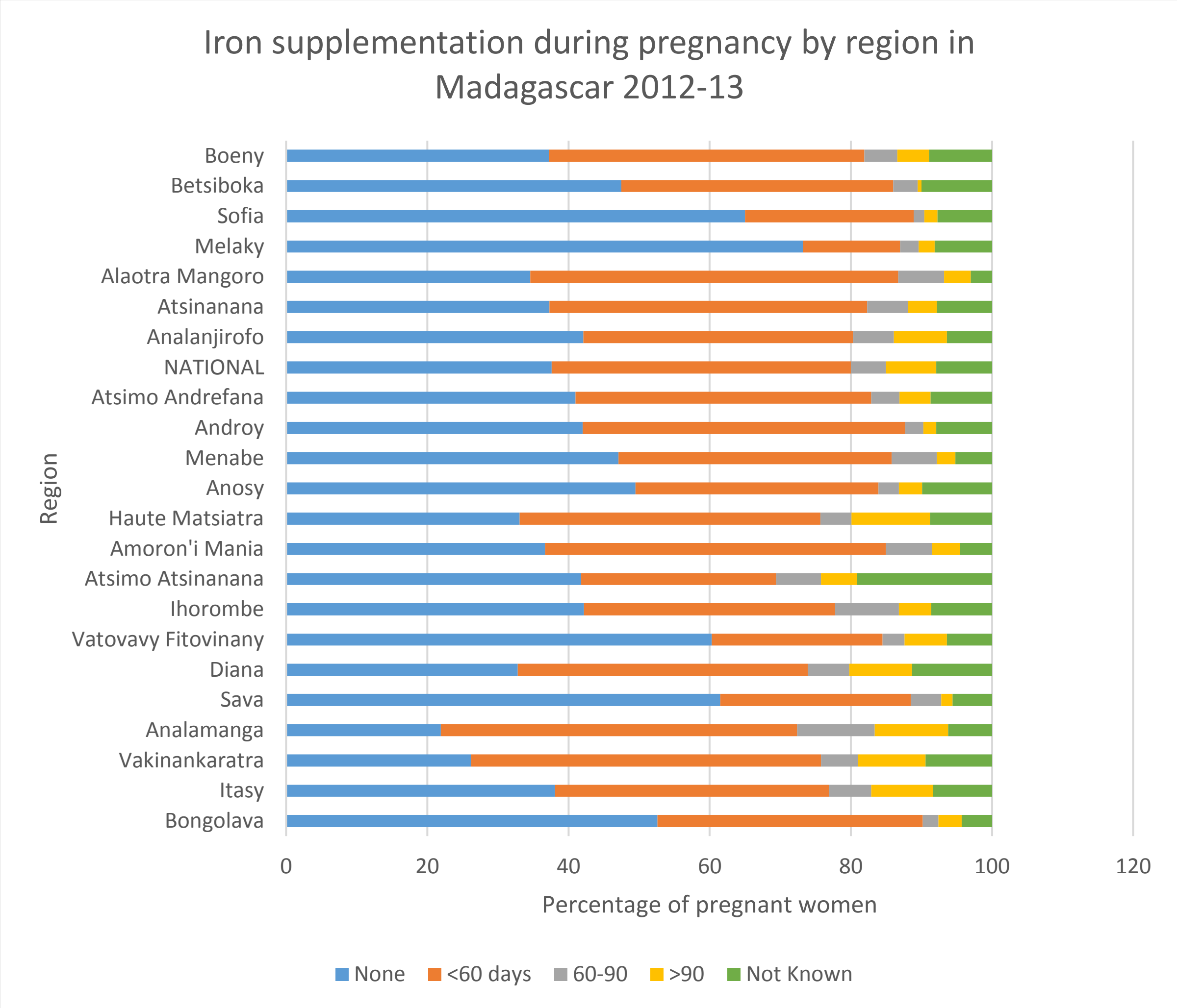


Figure 28: Coverage of iron supplementation for pregnant women by region and by number of days of supplementation provided

Nutrient intake

Key highlights

- ➔ Almost all children are breastfed, but early initiation is practiced by only 2/3 of mothers.
- ➔ When complementary feeding begins, minimum dietary diversity is met by only 1/3 of children.
- ➔ Analysis of determinants of stunting carried out for SUN found inadequate dietary intake and pre-natal factors to be key determinants correlated with stunting.

Local practices

To investigate Madagascar's high stunting prevalence the Institut Pasteur de Madagascar conducted a socio-anthropological survey with semi-structured interviews of mothers and grandmothers of stunted and non-stunted children aged 0-24 months, focus groups with fathers, and interviews with traditional birth attendants (TBAs), midwives, community health/nutrition workers (CNWs) and traditional healers (Institut Pasteur de Madagascar 2015). Investigators conducted 153 interviews, 15 focus groups and 63 direct observations on child feeding practices and household hygiene in three districts of Madagascar (Moramanga, Farafangana, Morondava) in the East and South-East of the country from 2014 to 2015.

The study found that local perceptions and practices affected the nutrition status of children beyond food insecurity. Inadequate complementary feeding practices linked to negative beliefs about colostrum, exclusive breast feeding and the importance of rice consumption for infants, especially in rural areas, may have contributed to high stunting in areas that have sufficient availability of nutritious foods.

Among surveyed population, including some health professionals, stunting was not recognized as a form of malnutrition. Most respondents said small height was a genetic legacy and a consequence of physical activity.

Grandmothers and TBAs were highly influential on mothers' knowledge and practices concerning maternal and infant health care and nutrition. There were suggestions that this influence could have negative consequences on nutrition outcomes; most mothers who said that grandmothers, and not health professionals, were their main source of childcare and nutrition information had a child that was stunted. Fathers appeared to have little to no influence on childcare or feeding practices.

Although many mothers knew complementary feeding should start at six months they had little autonomy and were likely to defer to practices suggested by grandmothers and TBAs. These practices rarely complied with international recommendations, especially in rural areas. Some mothers considered colostrum dirty and threw it away because it was stored in the breast for too long and would make their child sick. Instead of colostrum, many respondents reported giving newborns sugary tea.

After birth, women and their newborns entered a period of confinement, referred to as "keep warm", in the family home lasting from 15 days to three months, depending on the area. During this period, mothers were not allowed to move. Mothers rested and ate as frequently as possible.

Women and babies did not leave the home and generally did not attend postnatal or vaccination clinic visits.

When the confinement period ended, mothers returned to work and breastfeeding was determined by mothers' availability and not infants' demands. Some mothers believed a child was ready to receive foods other than breastmilk if the child cried after being breastfed, indicating hunger. Mothers who reported early complementary feeding claimed they produced insufficient breast milk, especially to nourish boys. Mothers were unaware that frequent breastfeeding was required to stimulate lactation. Early complimentary feeding for boys may explain why boys were more vulnerable to stunting than girls. This was also suggested in a UNICEF report which found many women believed complementary foods 'make children strong' and were more important for boys (UNICEF & SALOHI 2015).

The Institut Pasteur de Madagascar study found that 6-24-month-old children who were stunted were more likely to have received foods other than breast milk during their first four months of life, to have shown recurrent symptoms of diarrhoea and fever and to have parents who self-medicated children despite the severity of diseases (Institut Pasteur de Madagascar 2015). In contrast, mothers of non-stunted children were more likely to recognize the danger associated with fever and diarrhoea symptoms and see a doctor as soon as possible. The younger a mother was the more likely she was to have a stunted child.

Mothers were frightened of having a difficult delivery and adopted various strategies including: reduced consumption of starchy foods, dairy products and salt from the fifth month of pregnancy; remaining physically active during pregnancy (maintaining field work and carrying heavy things); and drinking herbal teas to restrict the unborn child's growth. As a result, women were likely to be undernourished during pregnancy and when they gave birth, which negatively impacts both the nutritional status of the child and the quality of the mother's breastmilk. Most women chose to deliver babies with TBAs and not in health centres. Antenatal visits and child-immunization periods were the main contact point for PLW and biomedical health workers. TBAs and biomedical health workers did not customarily interact with one another.

Nationwide rice is the primary staple, comprising 85 percent of cereal carbohydrates consumed and many households surveyed in this study said rice was the only food considered satiating and capable of providing energy necessary for heavy work in the fields (FFI & GAIN 2016; Institut Pasteur de Madagascar 2015). Households prioritized the quantity of rice consumption and not a diverse diet. When respondents were asked what type of food they would buy if there were no economic obstacles the major answer in all three regions was rice. In rural areas of Moramanga animal-source foods were rarely eaten, there was an ancestral taboo about cow's milk and industrial complementary foods were rarely consumed.

Stunting was not limited to households with food shortage and financial difficulty. Although nationally, food insecure households were four times as likely to have a stunted child, a smaller survey conducted in three districts found that in one of districts, households with food insecurity were more likely to have a non-stunted child than a stunted child (Institut Pasteur de Madagascar 2015). This could suggest that childhood stunting was related to more than food insecurity and that there is a need for education to address knowledge and beliefs.

Local practices and beliefs

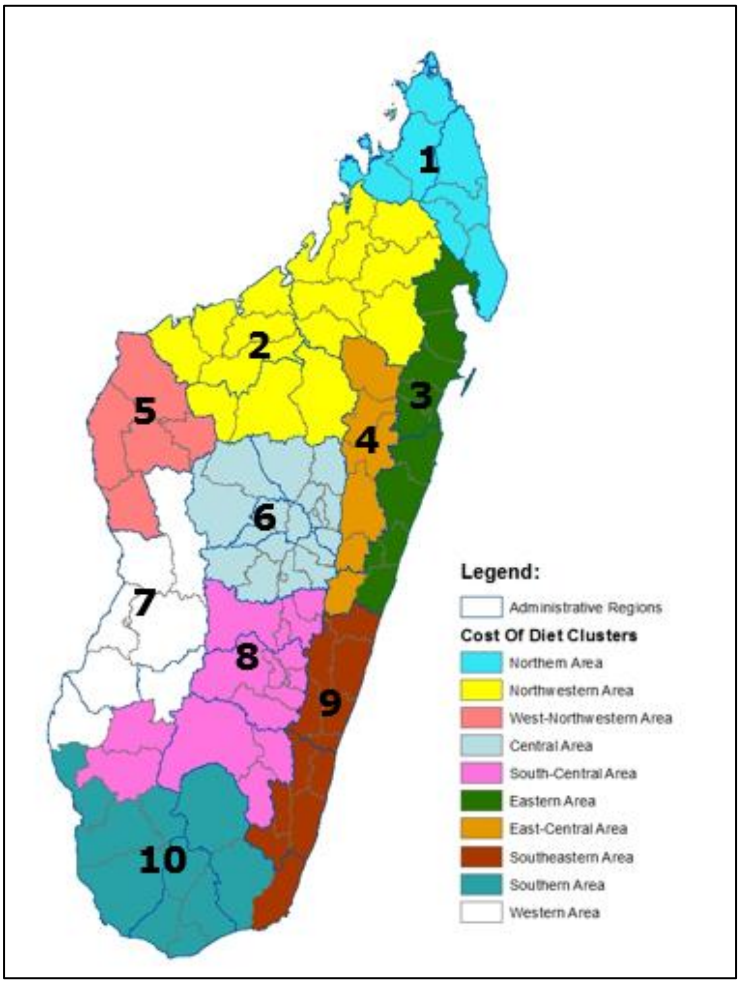
Key highlights

- ➔ Culture and local beliefs play a significant role in infant feeding practices and the perception of malnutrition.
- ➔ Grandmothers and traditional birth attendants are highly influential.
- ➔ Negative community perceptions of colostrum and exclusive breastfeeding are common.
- ➔ Stunting is not well recognized as a form of malnutrition.
- ➔ Pregnant women often limit dietary intake in an attempt to restrict fetal growth.

Cost Optimization and Modelling

Cost of the Diet Methodology

Cost of the Diet (CoD) software developed by Save the Children UK was used to estimate minimum cost nutritious diets at the regional level through linear optimization. CoD models the cheapest possible diet based on locally available foods for each household member to meet individual Recommended Nutrient Intakes (RNI) with realistic portion sizes. Initial models are based on price market data from a WFP survey conducted in collaboration with INSTAT in 14 of Madagascar's 22 regions: 10 rural zones (see Figure 29) and 4 urban zones: Antananarivo Urbain; Tamatave Urbain; Fianarantsoa Urbain; Tulear Urbain .



Rural Zones

1. Sava Diana
2. Boeny
3. Est
4. Alaotra Mangoro
5. Melaky
6. Antananarivo Rural
7. Menabe
8. Fianarantsoa Rural
9. Sud Est Rural
10. Atsimo Adrefana

Figure 29: Cost of the Diet Livelihood Zones

Based on the market survey data 138 key commodities were assessed. Regional household composition and household expenditure data provided by INSTAT were used to estimate the percentage of households that could not afford a nutritious diet. Actual food expenditure from INSTAT data was used for all regions, which was adjusted according to the household size modelled.

A staple-adjusted nutritious diet (SNUT) was modelled to meet the recommended intakes for energy, protein, fat and 13 micronutrients for each individual household member. One characteristic of the SNUT diet that is different from a minimum cost nutritious diet is that it must include a minimum amount of staple foods that will generally be eaten every day for all household members except young children. Key staples were those consumed at a standard portion and at least once a day, which were identified from the review of the secondary data and were validated by key informants in the country. For the Madagascar SNUT, the key staple constrained was rice for all zones except for zone 10 (Atismo Andrefana), where maize and cassava were constrained as key staples. The SNUT diet also constrains for foods that would be taboo for specific household members. It should be noted that for preliminary analysis in Madagascar no taboos were included as constraints; initial informant interviews did not identify taboos strong enough to be particularly relevant.

Household composition for modelling was based on INSTAT data. Four-person households were modelled in urban areas and five-person households were modelled in rural areas, due to the average household size in each area. For rural areas the five-person model included a child 9-11 months old, a child 6-7 years old, a lactating woman 30-59 years old (lactation period of 7-12 months), an adult man 30-59 years old and an adolescent girl 14-15 years old. A pregnant woman was also modelled as an alternative to the lactating woman, and costs were found to be similar; so the lactating woman was ultimately modelled to keep the lactation period consistent with the age of the child (Figure 30).The four-person model for urban areas included was the same except it did not include the adolescent girl.

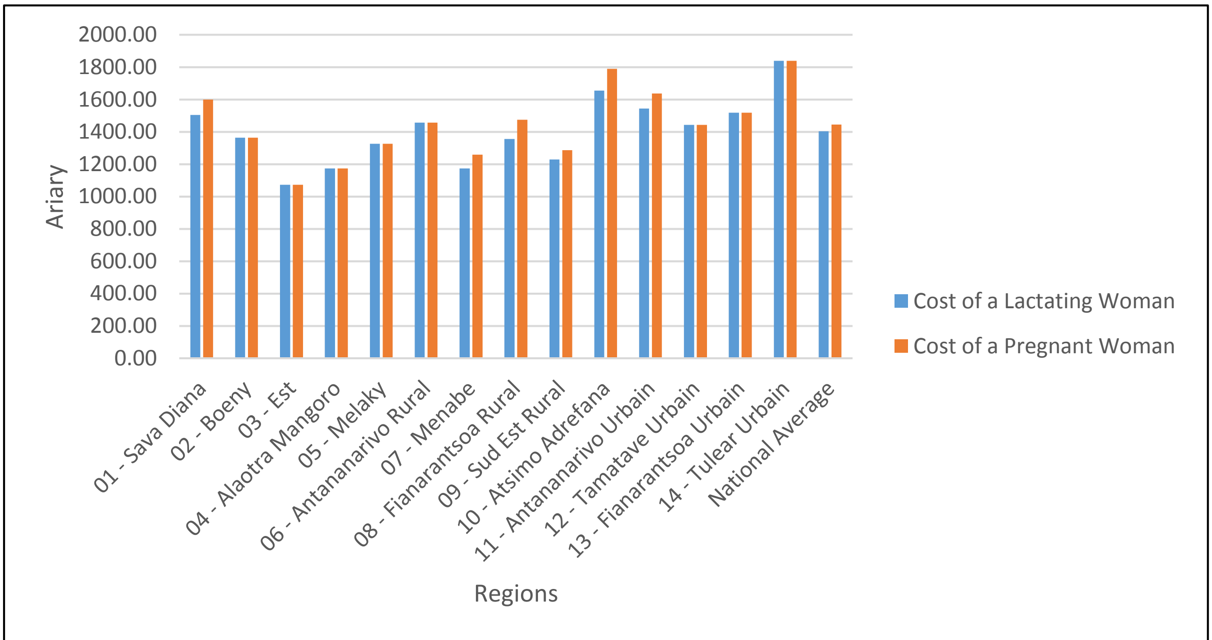


Figure 30: Daily cost of the diet of a lactating woman vs. pregnant woman

Results of Affordability Analysis

Diets modelled for urban settings had a higher cost for all individual household members than those modelled for rural settings (Figure 31). In urban zones the SNUT diet was 44 AR more expensive for infants 9-11 months old than in rural zones, 151 AR more expensive for children aged 6-7 years, 480 AR more expensive for adolescent females, 238 AR more expensive for lactating women and 546 AR more expensive for men.

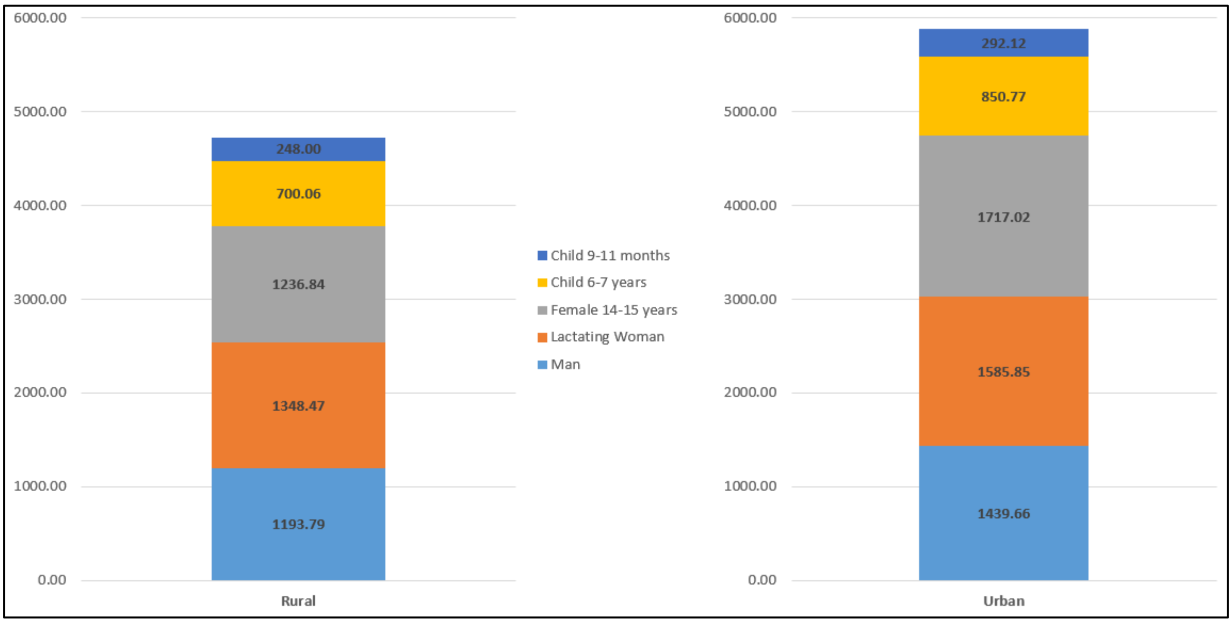


Figure 31: Average daily cost of SNUT diets for each household member in rural and urban zones

In all 14 regions assessed it was possible to meet nutrient requirements using the SNUT diets. However, there were high levels of non-affordability of nutritious diets in most of the regions assessed. In Atsimo Adrefana 97 percent of households could not afford the SNUT diet (Figure 32). In 7 out of 14 regions modelled, more than 84 percent of households could not afford the SNUT diet and only one region (Tamatave Urbain) had less than 50 percent non-affordability[25].

[25] It should be noted that in the urban areas non-affordability was assessed using a four person household (not including an adolescent girl) against income for a four person household and in rural areas non-affordability was assessed using a five person household (including an adolescent girl) against income for a five person household, but as the adolescent girl is usually the most expensive member of the household the inclusion of her in the household could impact the relative non-affordability in rural areas and make it seem higher than in urban areas. It should be noted, however, that urban zones 13 (Fianarantsoa Urbain) and 14 (Tulear Urbain) still have very high levels of non-affordability that is similar or higher than that in rural areas

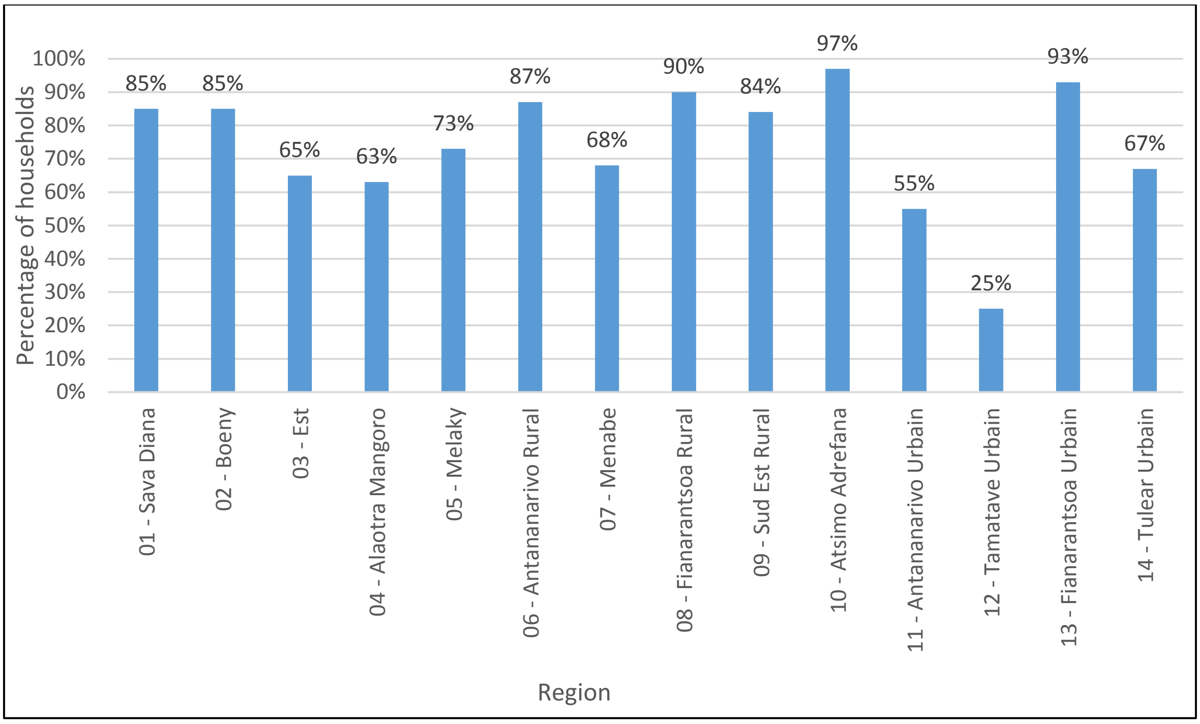


Figure 32: Percentage of households that would not be able to afford the SNUT diet for 14 modelled regions

There was a positive correlation between non-affordability of SNUT diet and prevalence of severe stunting, and a negative correlation between non-affordability of SNUT and household dietary diversity (Figures 33&34), which further indicates that economic access to nutritious foods on the market is a key barrier to adequate nutrient intake and a driver of the high chronic malnutrition rates in the country. Figure 35 also illustrates the relationships between SNUT non-affordability, stunting prevalence, and anaemia prevalence in selected regions, while Figure 36 shows the disparities in cost of a diet that meets nutrient needs (SNUT) versus a diet that meets only energy requirements.

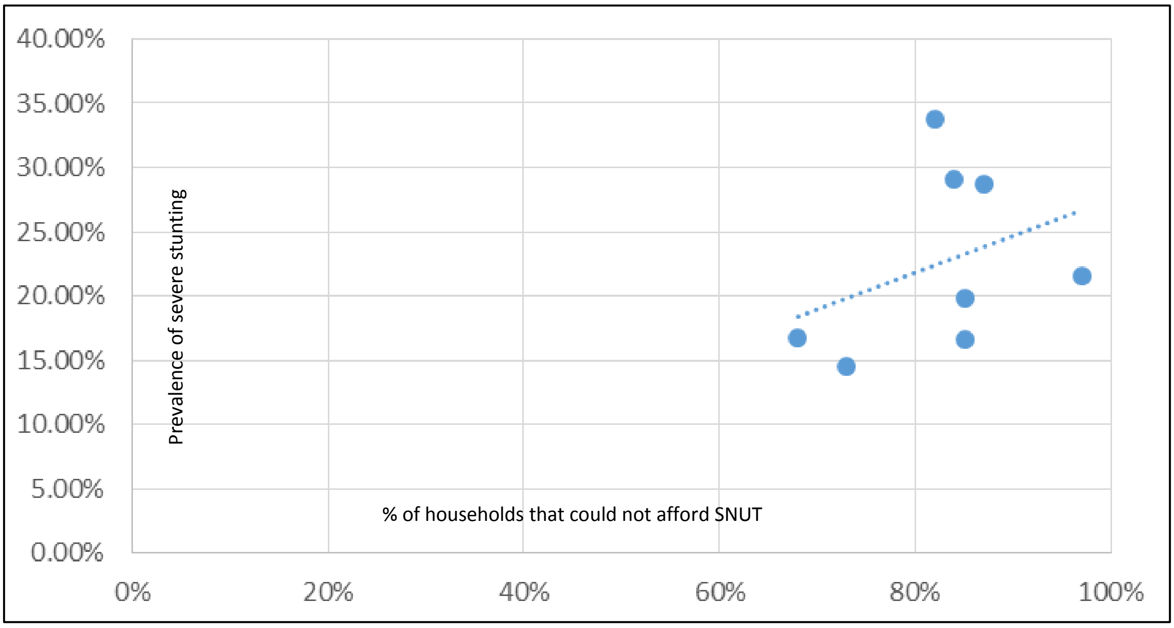


Figure 33: Correlation between non-affordability of a SNUT diet and prevalence of severe stunting (defined as a HAZ ≤-3Z) per zone (correlation=0.4)

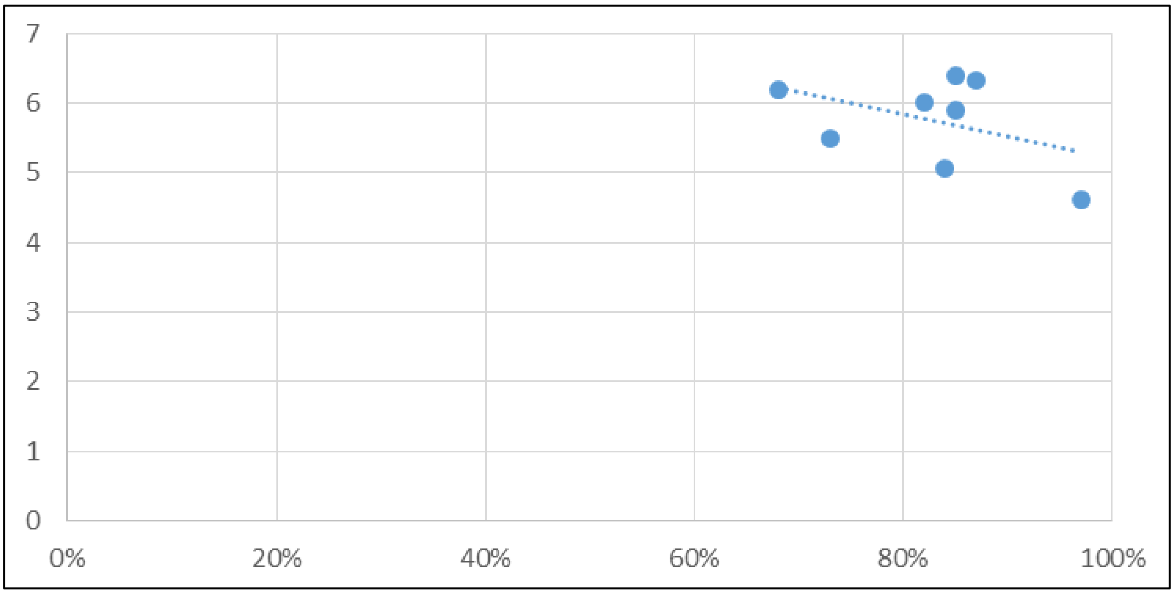


Figure 34: Correlation of non-affordability of a nutritious diet (SNUT) with household dietary diversity score

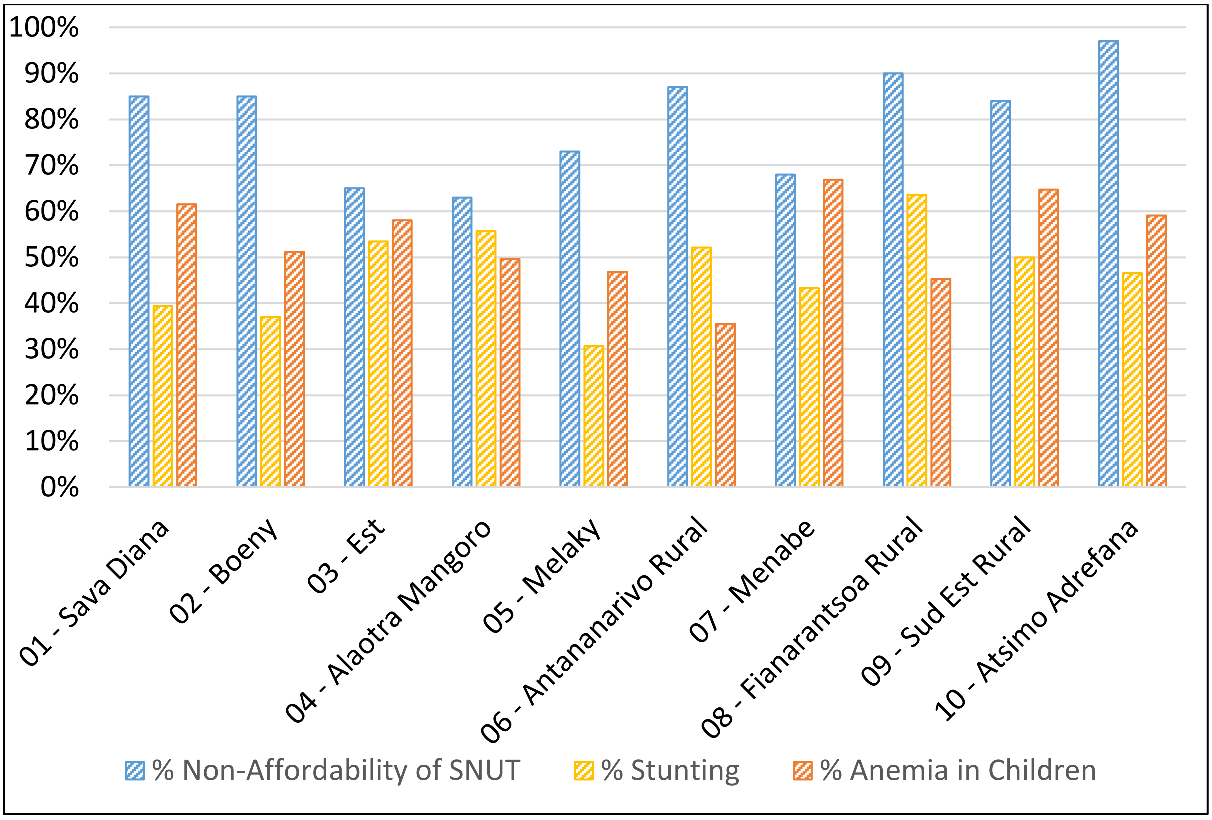


Figure 35: Percentage of households that cannot afford SNUT and characteristics of malnutrition, by region

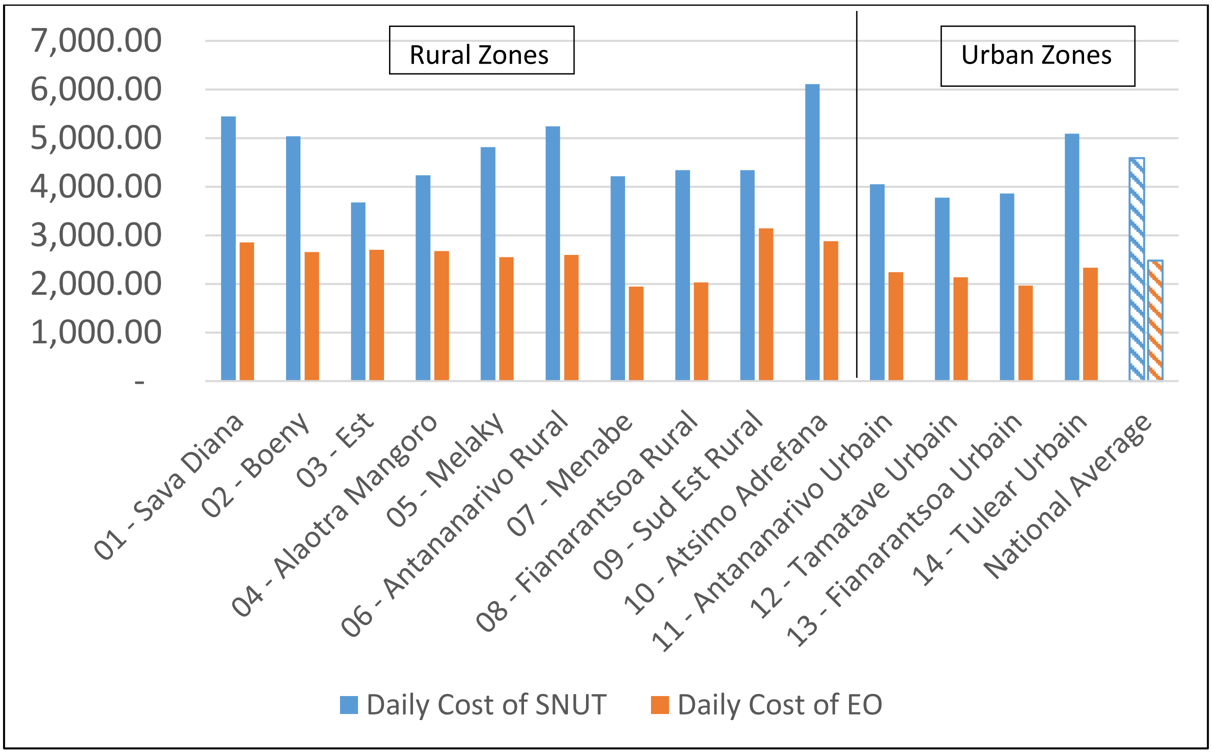


Figure 36: Daily cost of a nutritious diet (SNUT) vs. a diet meeting only energy needs (EO), by region

Limiting Nutrients

CoD analysis identified limiting nutrients, meaning nutrients for which requirements would be difficult to meet for all or some household members using locally available foods without exceeding the energy threshold, in each of the 14 regions (Table 2). Nutrients for which adequacy was met by a small margin (100-102% of RNI met) were classified as limiting nutrients; further provision of these nutrients was not possible in optimised diets without affecting the intake of other nutrients. Calcium, iron and fat were limiting nutrients in all regions for nearly all vulnerable groups within the household. Zinc was a major limiting nutrient for children under two in most rural areas.

LZ number	LZ name	Target group	Protein	Fat	Vitamin A	Vitamin C	Vitamin B1	Vitamin B2	Niacin	Pantothenic acid	Vitamin B6	Folic acid	Vitamin B12	Calcium	Iron	Magnesium	Zinc
LZ01	Sava Diana	PLW		X						X				X	X		
	Sava Diana	Adolescent girl		X									X	X	X		
	Sava Diana	Child 9-11 months		X						X				X	X		0
LZ02	Boeny	PLW		X				X		X			X	X	X		X
	Boeny	Adolescent girl															
	Boeny	Child 9-11 months		X										X	X		X
LZ05	Melaky	PLW		X			X	X		X				X	X		
	Melaky	Adolescent girl		X									X	X	X		
	Melaky	Child 9-11 months		X							0			X	X		X
LZ07	Menabe	PLW		X		X					X	X		X	X		
	Menabe	Adolescent girl		X	X	X					0	X		X	X		
	Menabe	Child 9-11 months		X	X									X	X		X
LZ08	Fianarantsoa	PLW		X								X	X	X	X		
	Fianarantsoa	Adolescent girl		X								X		X	X		
	Fianarantsoa	Child 9-11 months												X	X		
LZ10	Atsimo Adrefana	PLW		X						X				X	X		
	Atsimo Adrefana	Adolescent girl		X						X		X		X			
	Atsimo Adrefana	Child 9-11 months		X										X			X

Table 2: Limiting nutrients [a] found for lactating women, children aged 9-11 months and adolescent girls in 6 regions
[a] X indicates nutrients for which 100% RNI was met but not exceeded and 0 represents nutrients for which >100% and <102.1%of RNI were met

Key local food sources of nutrients

Key sources of nutrients identified by CoD software included the following locally available foods: cassava (leaves and regular cassava), pork offal (lungs and liver), small fish, soy beans, cowpeas, animal fat and maize. It is likely there may be an even lower intake of key nutrients because optimal diets included some foods that may or may not reflect typical consumption and local practices.

Modelling Plan

The following interventions were considered to increase nutrient affordability:

- Targeting specific groups with high needs (PLWs, Children Under 2, Adolescent Girls)
- Targeting specific households based on income
- Improving household or individual access to fresh foods, processed foods and/or fortified foods
- Improving availability on the market of fortified staples such as wheat, rice and oil, and bio-fortified crops such as Orange Flesh Sweet Potato
- Supporting market-based, in-kind (through social safety nets) or combined approaches

Specifically, the following food based interventions were considered based on current and/or potential availability of these products in the local market or through public/internationally supported programmes (please see previous sections on availability of SNF and fortified food in local markets): multi micronutrient tablets (MMT), iron and folic acid supplements, Nutributter[26], Plumpy Doz[27], Kuba Aina[28], Farilac[29], micronutrient powders (MNP), Super Cereal (SC)[30] and fortified oil, fortified wheat, fortified rice, fortified oil, orange flesh sweet potatoes at market prices, fresh fish and legume vouchers and fresh meat(offal) and legume vouchers, and home gardening[31] (Table 3).

Effectiveness of the different interventions is compared, based on the reduction in the cost to meet nutrient needs for key vulnerable groups, as well as based on the improvement of the overall affordability of a nutritious diet at the household level.

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[26] Nutributter is a paste based on peanuts, sugar, vegetable fat, skimmed milk powder, maltodextrin and whey, enriched with a vitamin and mineral complex

[27] Plumpy Doz is a ready-to-use food *consisting of* peanut paste, vegetable fat, skimmed milk powder, whey, maltodextrines and sugar

[28] Kuba Aina is a locally-produced, energy dense flour for children based on maize, rice, peanut, sugar and fortified with a micronutrient mix

[29] Farilac is a commercially produced fortified complementary food

[30] Super cereal is a formulated supplementary food for children above 24 months and adults containing maize (64 per cent), whole soya beans (24 per cent), sugar (10 per cent), vegetable oil, and vitamin & mineral premix Supercereal provides 380 kcal/ 100g dry product (14 per cent protein and 6 per cent fat).

[31] Orange Flesh Sweet Potato and Cowpeas were selected as nutritious foods feasible to grow in a home garden. Due to the relatively small yields in a home garden and as these crops will only be harvested at certain times of the year, only one free portion a week targeted at the PLW alone was modelled to not overstate too much the impact this intervention would have on affordability.

Food Based Intervention	Target Group	Modality	Quantities
MMT	PLW	In-kind	Daily
	Girl		Daily
Iron + Folic Acid Supplement	PLW	In-kind	Daily
	Girl		Weekly
Nutributter	PLW	Voucher	Daily 20g
	U2		Daily 20g
Plumpy Doz	U2	Voucher	Daily 46g
Kuba Aina	U2	Voucher	Daily 63g
Farilac	U2	Voucher	Daily 50g
MNPs (Zazatomady)	U2	Voucher	3/4 week
SC & Fortified Oil	PLW	Voucher	Daily (SC 150g and Oil standard Portion)
Vitamin A Supplement	PLW	In-kind	Daily
	U2		Daily
Wheat Fortification (iron and folic acid)	HH	Market	Standard Portion
Fortified Rice	HH	Market	Replaces Staple, Standard Portion
Fortified Oil	HH	Market	Standard Portion
Orange Flesh Sweet Potato	HH	Market	Standard Portion
Small Fish (66) + Cowpeas (33)	PLW	Voucher	One portion a day
Pork Lung (60) + Cowpeas (33)	PLW	Voucher	Once portion a day
Home Garden (Orange Flesh Sweet Potato and Cowpeas)	PLW	Home Production	One portion a week

Table 3: Modelling plan of interventions to improve the affordability of a nutritious diet

Interventions were modelled to reduce the daily cost of the SNUT diet were conducted separately for rural and urban zones. Rural zones were characterized by aggregating analysis from five regions (Sava Diana, Menabe, Fianarantsoa, Sud Est and Atsimo Adrefana). Urban zones were characterized by analysing Antananarivo.

Modelling Results

For children under two the most effective interventions in rural zones was a voucher for a daily portion of Koba Aina or Plumpy Doz, though Kalina was also highly effective (Figure 36). Both Koba Aina and Plumpy Doz could reduce the daily cost of the SNUT diet for children under two by 69 percent, from 250 AR to 78 AR, and Kalina could reduce the cost by 64 percent. In urban zones a voucher for Plumpy Doz was most effective, though Koba Aina and Kalina were also highly effective. Plumpy Doz could reduce the cost of the SNUT diet for children under two by 69 percent from 280 AR to 88 AR, Kalina and Koba Aina could reduce the cost by 66 percent and 65 percent respectively.

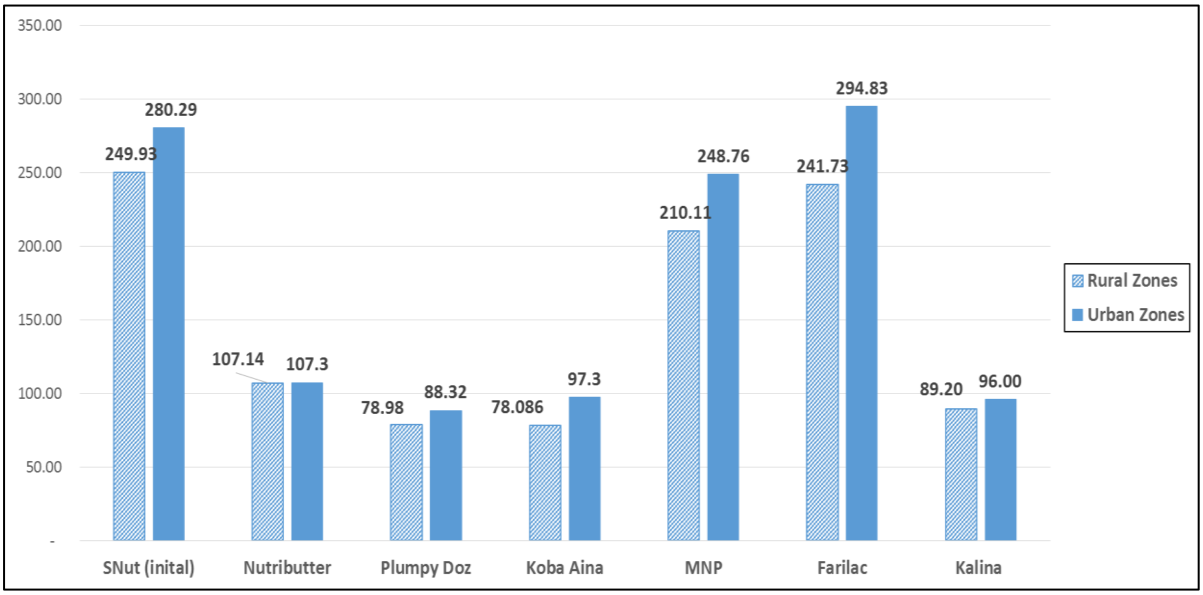

Figure 36: The daily cost of the SNUT diet for 6-23mo children with modelled interventions in rural and urban zones of Madagascar

Adolescent girls were targeted in rural areas but not urban areas based on average household demographic data. Adolescent girls were the most expensive members of the household, due to nutrient requirements related to growth that occurs in this period and as she is not able to consume as much food as an adult woman. For adolescent girls in rural areas the most effective intervention was in-kind provision of MMT that could reduce the cost of the SNUT diet by 8 percent, from 1423 AR to 1314 AR (Figure 37).

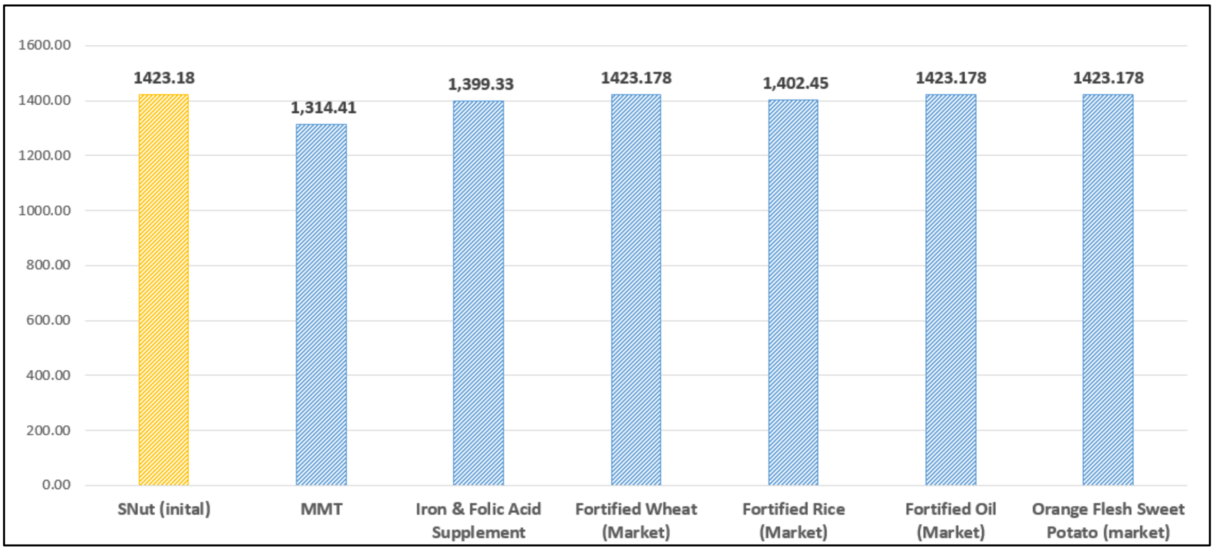

Figure 37: The daily cost of the SNUT diet for adolescent with modelled interventions in rural zones of Madagascar

For PLW in rural and urban zones the most effective intervention was a voucher for a daily portion SC and fortified oil (Figure 38). In rural zones the voucher reduced the cost of the SNUT diet by 43 percent, from 1384 AR to 792 AR. In urban zones the voucher reduced the cost of the SNUT diet by

43 percent, from 1543 AR to 881 AR. Kalina was also very effective and reduced costs in rural areas by 38 percent and urban areas by 32 percent.

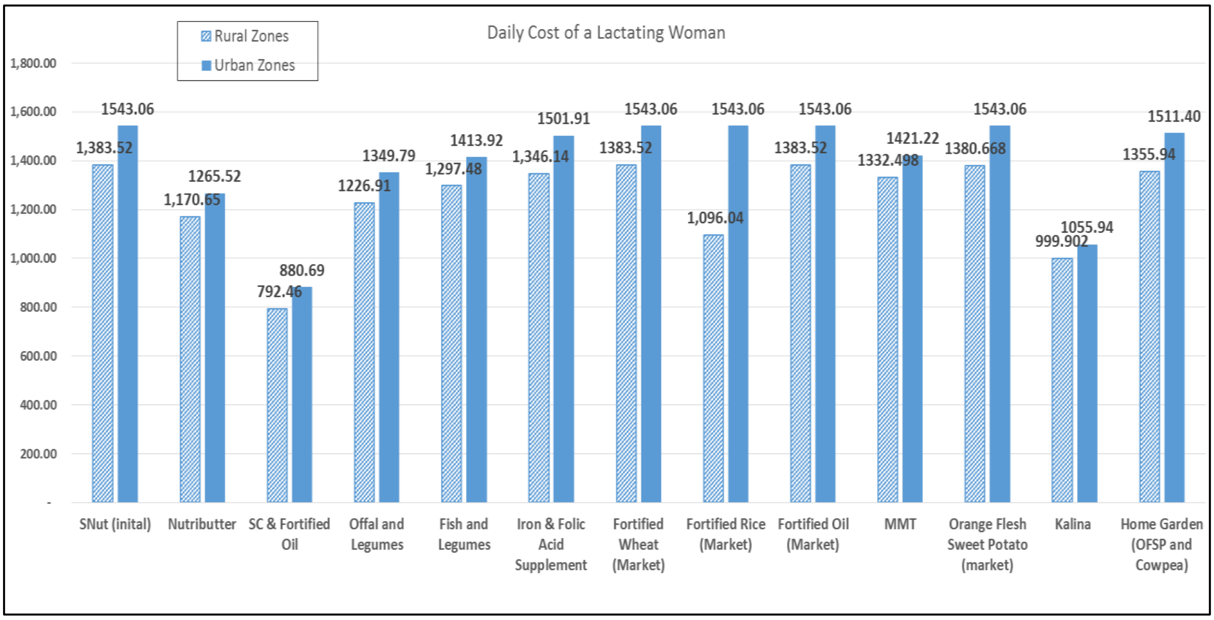

Figure 38: The daily cost of the SNUT diet for PLW with modelled interventions in rural and urban zones of Madagascar

Based on the analysis the following intervention package was identified as the one of the most effective: provision of Koba Aina for children 6-23 months old, SC and fortified oil for PLW in rural and urban areas and the provision of MMTs for adolescent girls in rural areas. This intervention package could reduce the percentage of households unable to afford the SNUT diet by 20 percentage points in the urban zone of Antananarivo (Figure 39). In the five rural zones modelled the intervention package could reduce the percentage of households unable to afford the SNUT diet by an average of 9 percentage points.

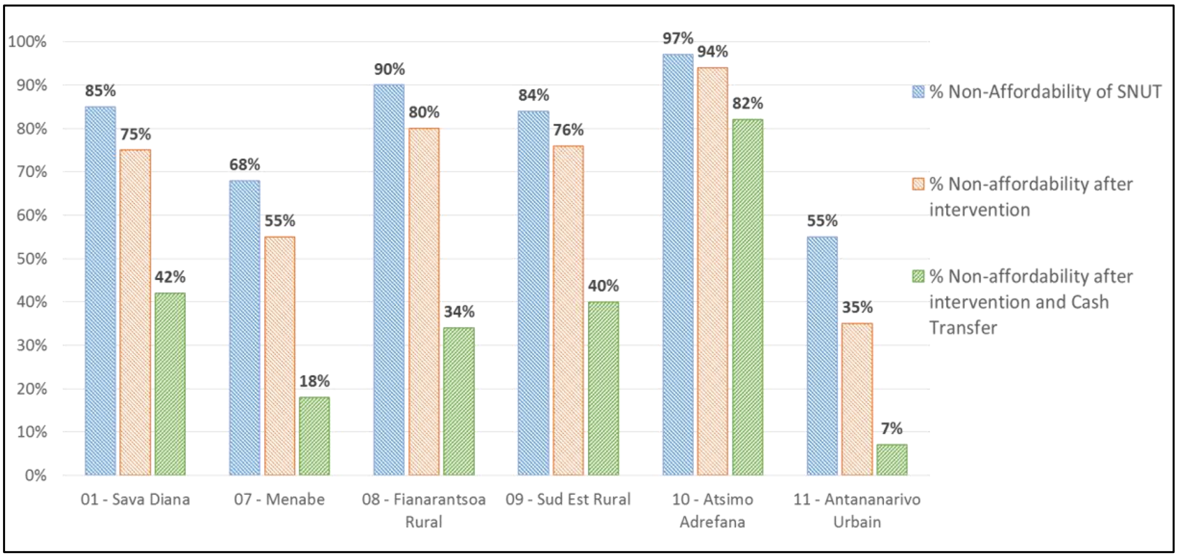

Figure 39: Change in the percentage of households that would not be able to afford the SNUT diet after the introduction of an optimal packet of interventions (Koba Aina, SC & fortified oil/MMT) and a cash transfer of 60,000AR per month per household

A monthly cash transfer of 60,000 AR per household could further reduce the percentage of households unable to afford the SNUT diet by an additional 28 percentage points in Antananarivo. In rural zones the cash transfer could reduce the percentage of households unable to afford the SNUT diet, on average, by an additional 33 percentage points. It is important to bear in mind, however, the logistical and programmatic complications inherent to unconditional cash transfers. There is little literature supporting improved nutritional outcomes from giving cash only, and the effect of the cash transfer modelled here assumes both that the full amount would be spent on nutritious food and that this food would be shared within the household, according to the specific needs of each household member. Also given the high rates of non-affordability in Madagascar this amount of cash would have to be given to up to 97% of the population in some zones. Given these limitations, if a cash transfer were to be implemented it is crucial that it be paired with nutrition-specific interventions.

It should be noted that Kalina was found to be highly effective for both the PLW and child under 2, so programmatically it may be an easier intervention to pursue as this analysis has not taken into consideration programme costs. Also given the high food insecurity in the South (represented by Zone 10) and the likely large macronutrient gaps and the effectiveness already displayed in the CoD modelling at the individual level Plumpy Doz for the Child Under 2 and SC and fortified oil for PLW would appear to be the most appropriate intervention specifically for zone 10. For this reason the following package of interventions were modelled: MMT for Adolescent Girl (all zones); Kalina for PLW & U2 (all zones except 10); SC& Fortified Oil for PLW and Plumpy Doz for U2 (zone 10) (Figure 40). This intervention was also highly effective in reducing non-affordability as shown in Figure 40 (on average reduced non-affordability by 8 percentage points). This was also coupled with a cash transfer of 30,000 Ar (which might be a more feasible amount to provide to a larger group of people. This further reduced non-affordability by 15 points on average, previously mentioned about the limitations of providing cash would also apply.

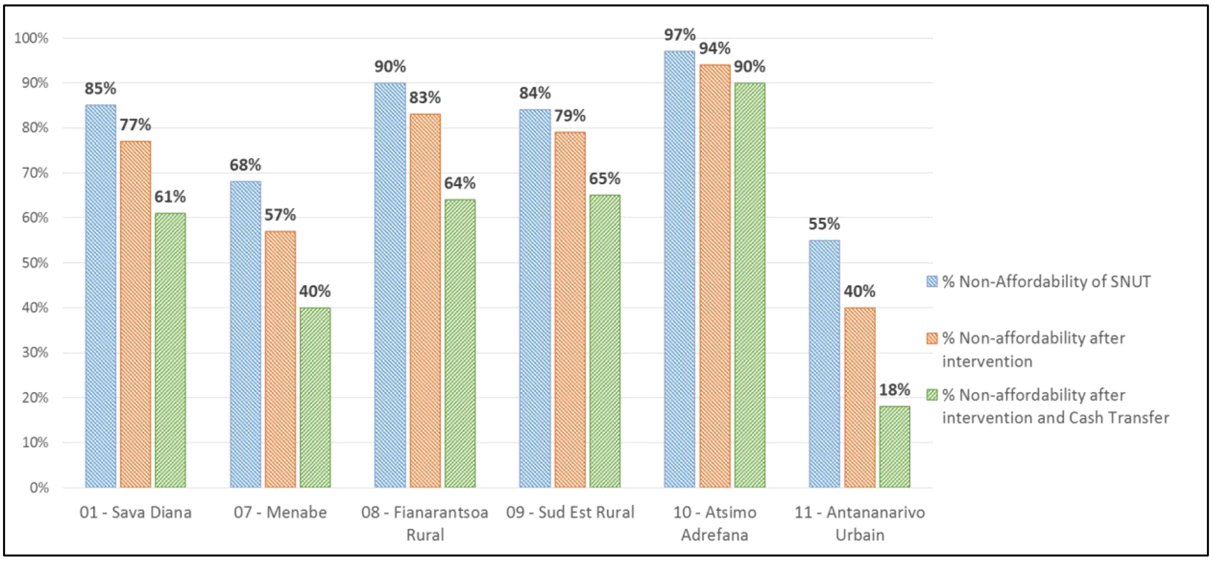

Figure 40: Change in % of HHs that cannot afford a nutritious diet after the optimal package of interventions MMT for Adolescent Girl (all zones); Kalina for PLW & U2 (all zones except 10); SC& Fortified Oil for PLW and Plumpy Doz for U2 (zone 10); with a Cash Transfer 30,000 AR/month.

These findings show the possibility of improving household's economic access to nutrients through food-based interventions provided by the public sector, in combination with the market. However, development of programmes would require additional complementary analysis on the feasibility and cost-effectiveness of the interventions. Model diets are theoretical and behaviour change is required to encourage necessary dietary practices to meet nutrient needs.

Cost of diet and intervention modelling to fill the nutrient gap

Key highlights

The ability of optimised diets based on locally-available foods to meet nutrient needs for chosen target groups was assessed using CoD with market price data from 14 regions. Livelihood Zone household composition and expenditure data was provided by INSTAT.
For standard households in each region, CoD modelled lowest cost diets to meet energy needs only and lowest cost diets to meet requirements for energy, protein, fat and 13 micronutrients, with at least one serving per day of the key local staples (SNUT). For all of the livelihood zones with the exception of the in south (zone 10), this was rice.

It was possible to meet nutrient requirements using the SNUT diets in all regions, however, at least 84% of households could not afford this diet in 7 of these regions.

Limiting nutrients, meaning those for which requirements are difficult to meet for some household members using the foods assessed, were calcium, iron and fat, as well as zinc for children 6-23 months in most rural areas. Pantothenic Acid was also a limiting nutrient for lactating women in most zones.

To improve the affordability of nutritious household diets, a combination of interventions targeting individual target groups or entire house-holds was modelled using CoD. The modelled interventions included multi micronutrient tablets (MMT), iron and folic acid supplements, specialized nutritious foods, fortified foods, orange-flesh sweet potato (OFSP), natural nutritious foods such as vegetables and eggs and home gardening, as detailed in the box below. Separate modelling was conducted for rural and urban zones in each region. Cash Transfers to the household were also modelled.

Children 6-23 months: Free provision of locally available specialized foods with vouchers was modelled (Figure 4). The most effective were a voucher for a daily portion of Koba Aina, Plumpy Doz or Kalina, which each reduced diet costs (SNUT) for this group by around 69%.

Pregnant and Lactating Women: The most effective interventions were a voucher for a daily portion of Super Cereal (SC) & fortified oil, which reduced the cost of SNUT for this target group by 43% in both rural and urban zones (Figure 5). Kalina was also highly effective.

Adolescent girls: Adolescent girls were targeted in rural but not urban areas, based on average household demographic data. Their nutrient needs were the most expensive to meet in all households, due to increased requirements for growth during this period. The most effective intervention was in-kind provision of multi micronutrient tablets (MMT), which reduced the cost of SNUT for adolescent girls by 8% (Figure 6).

These interventions were combined to form packages. These findings show the possibility of improving household's economic access to nutrients through food-based interventions provided by the public sector, in combination with the market. Model diets are theoretical and behaviour change is required to encourage necessary dietary practices to meet nutrient needs.

Recommendations

Recommendations on context-specific strategies to effectively address nutrient gaps in the identified target groups in Madagascar were identified and agreed upon during a multi-stakeholder workshop, held in October 2016, based on the key insights from the analysis described before. Multi-sectoral nutrition strategies and interventions were formulated to improve nutrient intake listed as follows:

1. Targeted strategies to improve the nutrient intake of adolescent girls
2. Targeted strategies to improve the nutrient intake of pregnant and lactating women
3. Increase demand, availability and access to nutritious and safe foods for children under two
4. Improve awareness and behaviors to improve nutrient intake through a communication for behavior change strategy
5. Food fortification
6. Nutrition multi-sectoral collaboration
7. Strengthen the Policy and Strategy on nutrition and food security
8. Mitigating food insecurity
9. Develop specific strategies to fight undernutrition in urban areas

1. Targeted strategies to improve the nutrient intake of adolescent girls

Adolescent girls require high and specific nutrient needs related to growth and menstruation. In addition to sensitizing the general population on adolescent needs and issues, specific need for this groups should be recognized and provided for, ensuring adequate intake of micronutrients, good health, diet awareness and reproductive health knowledge. It is recommended nutrition-specific interventions are implemented, such as the provision of multi-micronutrient tablets (MMTs). In addition, channels should be identified and take into consideration the diversity in this group including: out-of school girls and in-school girls, younger adolescents (10-14), older adolescents (15-19). For in-school girls, it is recommended to use school platforms as an entry point to deliver fortified meals, promote dietary diversity, educate on (reproductive) health, deliver MMTs. School feeding also constitutes an incentive to keep adolescents in schools. For girls not in school, using peer/role model education, building on past experience from community nutrition sites and health facilities to deliver education on nutrition, and using reproductive health and IYCF as delivery channels for MMTs is suggested. Food fortification for the general population also benefits adolescent girls

2. **Targeted strategies to improve the nutrient intake of pregnant and lactating women**

Pregnant and lactating women are groups of individuals who require high nutrient needs related to pregnancy, lactation and own growth in the case of teenage pregnancies. Specific needs for this group include adequate nutrient intake throughout the pregnancy, knowledge of nutritional needs during pregnancy/lactation/IYCF, access to good quality antenatal care early and throughout the pregnancy, weight monitoring during pregnancy, obstetric care, birth spacing and family planning. Nutrition specific interventions should deliver a combination of micronutrient supplements such as MMT (or iron folic acid) and balance protein energy supplements (e.g. Super Cereal, Kalina…) for women at risk of poor birthweight. Strengthening ANC for micronutrient supplementation (MMTs) and linking ANC (conditionality) with food supplementation (balanced protein energy supplement) to support antenatal care early and throughout pregnancy is also strongly suggested. In the case of teenage pregnancies, ANC should be sensitive to the needs of adolescent girls. In addition, food fortification for the general population will also benefits women of reproductive age. Potential channels for interventions include: health facility, nutrition sites, trained traditional birth attendant and food system including markets.

3. **Increase demand, availability and access to nutritious and safe foods for children under two**

Nutrient needs vary per age-group:

- 0-5 months requires: early initiation and exclusive breastfeeding, knowledge on benefits of adequate breastfeeding practices and enabling the women to breastfeed exclusively,
- 6-23 months requires: continued breastfeeding until 2 years or beyond, adequate dietary diversity and meal frequency, using fortified commodities to ensure adequate nutrient content in the diet.

Expanding and strengthening existing initiatives to improve availability and affordability of fortified complementary foods in markets, fortified blended foods (e.g. Koba Aina, other commercial products), small quantity LNS (e.g. Kalina), and MNPs (e.g. Zaza Tomady) is recommended. Additionally, expanding and strengthening SBBC on IYCF can increase demand for nutritious foods and improve practices. Potential intervention channels include: health facilities, nutrition community sites, food systems including markets, and links with social protection. Interventions can include a mix of channels (urban, rural, remote, etc.) and variety of cost interventions (subsidized price, market price, and for free) depending on the context

4. **Improve awareness and behaviours to improve nutrient intake through a communication for behaviour change strategy**

Communication messages should focus on dietary diversity, benefits of fortified foods, high needs among pregnant women, lactating women and young children, and the importance of food safety. Target groups, to be defined, should include adolescents, pregnant and lactating women, other caretakers, men as head of households with decision power and other influencers in the community. Channels to reach target groups should be implanted according to context and groups. Expanding and strengthening existing SBCC programmes is recommended in addition to increasing the number of CNWs and their coverage area, supporting growth monitoring as entry point for CNWs to educate mothers and grandmothers on best practices for breast feeding and complementary feeding. Mobilizing CNWs to train TBAs and community health workers is also suggested. In order to move beyond traditional health platforms to change behaviours in this area, using points of sale of complementary foods such as the Koba Aina sales points for BCC related to complementary feeding is suggested. Other community entry points could be further explored, based on formative research, such as small holder farmers' trainings used to incorporate some key messages related to nutrition, crop diversity.

5. **Food fortification**

Food fortification will require collaboration between public and private sectors in order to set nutrient targets, formulate feasible standards and regulations, ensure food safety, and consider costs. Foods for the general population may include: staple foods (Rice / Wheat / Noodles / other staples) and condiments (Vegetable oil / Salt / Sugar). Special foods for specific target groups may include: porridge (children under 2 years), lipid-based nutrient supplements, and micronutrient powder. Fortifying 100% of a commodities may not be feasible, however, it is important to prioritize fortification where it is feasible and, preferably, reaches the most vulnerable (e.g. food provided in emergencies, used for school feeding, purchased by the poorer segment of the population). Conducting commodity landscape analyses to assess the food processing chain (e.g. of rice, wheat flour or noodles) is vital in identifying opportunities to fortify and identify which consumers are reached by specific commodities (e.g. high vs lower quality rice). Considering specific contexts (e.g. urban, rural, remote) with combinations of market based and public sector (food assistance/social protection, community nutrition sites) channels is important in identifying entry points. Accessing market penetration of existing market-based initiatives (e.g. Koba Ain) is also vital and may vary by commodity (foods for special target groups vs for general population).

6. Nutrition multi-sectoral collaboration

In addition to nutrition-specific interventions delivered through ONN programming, multi-sectoral collaboration is required to enhance impact, including throughout the food system and by adding additional deliver platforms, and to impact underlying and basic factors that affect nutrition. Key entry points include: health, social protection, education, the private sector, agriculture and infrastructure.

- Social protection: Place nutrition at the heart of social protection schemes, since poverty & low purchasing power are major drivers of inadequate nutrient intake and malnutrition. Combine household support (e.g. cash) with (voucher for) special nutritious food for PLW / U2.
- Health: Better integrate policies for health and nutrition at community level; Improve coverage of micronutrient supplementation (VAC, Fe/FA or MMT); Increase awareness of importance of adequate nutrient intake requiring diverse, nutritious diet, including fortified commodity for u2; Link food and health systems, e.g. through providing vouchers for specific nutritious foods available in the market; Ensure services are adolescent friendly
- Education: Continue support for school feeding; Add nutritional outcome as an aim; Ensure school meals are nutritionally balanced by also having adequate micronutrient content, e.g. by using MNP for point of use fortification; Encourage establishing school vegetable gardens; Include nutrition and (reproductive) health education. Develop national training for nutritionists.
- Agriculture: Improve availability, access and storage & preservation of vegetables, fruits, animal source foods; Increase income of small holder farmers through increasing production; increase awareness of importance of diverse diet
- Water, Sanitation and Hygiene (WASH): Reducing incidence and severity of illness is very important for improving nutritional status. Increase coverage and use of improved water sources, latrines, and hygiene awareness, especially in rural settings.
- Private sector: Engage food companies to produce nutritious foods; reach work force to raise awareness on healthy diet and provide supplements (e.g. MMT to WRA)
- Infrastructure: Increase exposure to media, transport and trade of goods, delivery of social services.

7. Strengthen the Policy and Strategy on nutrition and food security

In order to strengthen policy and strategy on nutrition and food security, the new National Nutrition Policy and Plan (PNAN) will be reviewed and the SUN coordination mechanisms to increase multi sectorial collaboration will be implemented. It will also be important to ensure coordination of multi-sectoral efforts at decentralized level (through decentralized coordinating bodies of the ONN), for effective multi-sectoral action at local level, develop national fortification strategy, and ensure nutritional quality and food safety of processed foods through developing standards and appropriate regulation, and monitoring by competent authorities (national FDA). In addition, developing independent capacity for nutrient, microbiological and toxin analysis, and manufacturer auditing is vital. It is recommended to better integrate policies for nutrition and health at the community level and secure funding necessary to achieve outcomes based on immediate and longer-term priorities.

8. Mitigating food insecurity

In order to mitigate food insecurity during emergencies, it is recommended that the timing of social safety net interventions, such as cash transfers or provision of natural food, fortified food and SNF, responds to periods of greatest need such as: rainy season in urban areas, lean season in rural areas and the period following a climate emergency, such as drought, flood. In addition, it is vital to focus on the first 1000 days of life during emergencies.

In order to enhancing overall food security and resilience, it is important to take into consideration that roughly 78 percent of the labour force in Madagascar works in agriculture, mostly at the small-scale level and that most households do not store food for the lean season. Interventions should therefore target safe, improved food storage methods to address food security for small-holder farmers during the lean season and should promote techniques for food conservation and processing, community gardens, to stabilize livelihoods

9. Develop specific strategies to fight undernutrition in urban areas

Assessments for reaching market based approaches (% that accesses, which households, what foods for specific target groups, how often etc.), and IYCF and caring practices (characteristics specific for urban areas, what are constraints to providing adequate care, e.g. time, crowding) is recommended and should take into account specific periods and determinants of household vulnerability. Using a variety of media to strengthen SBCC and linking nutrition interventions to efforts to improve water and sanitation facilities to prevent disease is also suggested, and should consider areas of high population density such as larger urban and periurban areas.

Outputs

Following working sessions with the ONN in October 2016, 6 strategic areas for the National Nutrition Policy Plan were identified and implemented into the working draft. Strategic areas identified are as follows:

- Strategic Area 1 : Improve food and nutrient security with specific attention for the nutritionally vulnerable (in the thousand days and chronically ill)
- Strategic Area 2 : Provision of nutrition services in the community: channels according to coverage and context to reach scale
- Strategic Area 3: Increase the extent to which other sectors contribute to nutrition outcomes
- Strategic Area 4: Increase households resilience to emergencies, including treatment and prevention of acute malnutrition
- Strategic Area 5: Reinforcing the National Communication strategy for nutrition
- Strategic Area 6: Improve the enabling environment to fight against malnutrition

Annex

Pregnant Women (19-50y)				
		SC	**LNS Kalina Remy (PLW)**	**Nutributter**
		150 g/day	**40g/day**	**20g/day**
Nutrient	**RNI**	**% RNI**	**% RNI**	**% RNI**
Energy				
Total Fat (g/d)	n/a			
Carbohydrates (g/d)	175			
Protein (g/d)	71	29.6	2.8	4.1
Fiber (g/d)	28	21.4		
*Calcium (mg)	1000	54.3	11.2	13.0
Phosphor (mg)	700	60.0	10.9	0.0
Magnesium (mg)	360	0.0	7.2	5.0
Zinc (mg)	11	68.2	109.1	40.0
Iodine (mcg)	220			
Copper (mcg)	1000	0.0	160.0	22.0
*Iron (mg)	27	36.1	29.6	37.0
Selenio (mcg)	60			
Manganese (mg)	2	0.0	52.0	0.0
Vitamin A (mcg RE)	770	202.4	138.4	259.5
*Pantothenic Acid	6	40.0	13.3	46.7
Vitamin E (mg)	15			
Vitamin C (mg)	85	158.8	47.1	88.2
Tiamin (mg)	1.4	21.4	80.0	42.9
Riboflavin (mg)	1.4	150.0	80.0	37.1
Vitamin B6 (mg)	1.9	78.9	10.5	21.1
Vitamin D (mcg)	15			
Niacin (mg)	18	66.7	13.3	31.1
Biotin (mcg)	30			
Vitamin B12 (mcg)	2.6	115.4	80.0	23.1
Vitamin K (mcg)	90			
Folate (mcg)	600	27.5	44.4	30.6
Potassium (mg)	4700	4.5	2.1	0.0

(a) Based on most recent specs

Figure 1: Percentage of RNI for Pregnant Women met by each SNF

Lactating Women (19-50y)				
		SC	LNS Kalina Remy (PLW)	Nutributter
		150 g/day	40g/day	20g/day
Nutrient	**RNI**	**% RNI**	**% RNI**	**% RNI**
Energy				
Total Fat (g/d)	n/a			
Carbohydrates (g/d)	175			
Protein (g/d)	71	29.6	2.8	4.1
Fiber (g/d)	28	20.7		
*Calcium (mg)	1000	54.3	11.2	13.0
Phosphor (mg)	700	60.0	10.9	0.0
Magnesium (mg)	360	0.0	8.1	5.6
Zinc (mg)	11	62.5	100.0	36.7
Iodine (mcg)	220			
Copper (mcg)	1000	0.0	123.1	16.9
*Iron (mg)	27	108.3	88.9	111.1
Selenio (mcg)	60			
Manganese (mg)	2	0.0	40.0	0.0
Vitamin A (mcg RE)	770	119.9	82.0	153.7
*Pantothenic Acid	6	34.3	11.4	40.0
Vitamin E (mg)	15			
Vitamin C (mg)	85	112.5	33.3	62.5
Tiamin (mg)	1.4	21.4	80.0	42.9
Riboflavin (mg)	1.4	131.3	70.0	32.5
Vitamin B6 (mg)	1.9	75.0	10.0	20.0
Vitamin D (mcg)	15			
Niacin (mg)	18	70.6	14.1	32.9
Biotin (mcg)	30			
Vitamin B12 (mcg)	2.6	107.1	74.3	21.4
Vitamin K (mcg)	90			
Folate (mcg)	600	33.0	53.3	36.7
Potassium (mg)	4700	4.1	1.9	0.0

(a) Based on most recent specs

Figure 2: Percentage of RNI for Lactating Women met by each SNF

6-8 mo**							
		SC	LNS Kalina ZAZA	Farilac	Nutributter	Plumpydoz	Kuba Aine
		45 g/day	20 g/day	50g/day	20g/day	46g/day	63g/day
Nutrient	**RNI**	**% RNI**	**% RNI**	**% RNI**	**% RNI**	**% RNI**	**% RNI**
Energy	686	27.8	3.8	31.1	17.7	38.1	26.3
Total Fat (g/d)	30	9.0	6.4	0.0	25.2	55.2	5.6
Carbohydrates (g/d)	95						
Protein (g/d)	9.6	69.2	5.7	64.3	31.9	80.9	63.5
Fiber (g/d)	n/a						
*Calcium (mg)	400	40.7	14.0		32.5	61.5	24.8
Phosphor (mg)	275	45.8	13.8		0.0	75.3	36.0
Magnesium (mg)	54	0.0	14.8	30.0	33.3	127.8	75.0
*Zinc (mg)	4.1	54.9	39.0	19.8	107.3	123.4	92.9
Iodine (mcg)	130						
Copper (mcg)	220	0.0	30.9		100.0	292.7	92.0
*Iron (mg)	9.3	31.5	12.9	37.2	107.5	49.5	113.0
Selenio (mcg)	20						
Manganese (mg)	0.6	0.0	40.0	0.0	0.0	92.0	92.3
Vitamin A (mcg RE)	400	116.9	66.6	67.5	499.5	210.6	160.3
Pantothenic Acid	1.8	40.0	22.2	23.4	155.6	102.2	18.8
Vitamin E (mg)	5						
Vitamin C (mg)	30	135.0	20.0	17.3	250.0	92.0	33.8
Tiamin (mg)	0.3	30.0	33.3	35.3	200.0	153.3	55050.0
Riboflavin (mg)	0.4	157.5	25.0	29.8	130.0	241.5	33187.5
Vitamin B6 (mg)	0.3	150.0	33.3	46.8	133.3	276.0	55650.0
Vitamin D (mcg)	10						
Niacin (mg)	4	90.0	30.0	31.6	140.0	149.5	56.7
Biotin (mcg)	6						
Vitamin B12 (mcg)	0.7	128.6	25.7	11.6	85.7	177.4	30085.7
Vitamin K (mcg)	2.5						
Folate (mcg)	80	61.9	62.5	29.1	229.2	189.8	39.1
Potassium (mg)	700	9.0	5.7		0.0	59.1	27.5

* Limiting Nutrient- This nutrient was difficult to meet in the diet prior to the introduction of the SNF
** RNIs are not corrected for breastmilk intake. When correcting for BM intake, the contribution of these complementary foods to energy and nutrient intakes (%RNI-CF) would be higher

Figure 3: % of RNI covered by the modelled SNF for a child aged 6-8 months

9-11 mo**							
		SC	LNS Kalina ZAZA	Farilac	Nutributter	Plumpydoz	Kuba Aine
		52 g/day	20 g/day	50g/day	20g/day	46g/day	63g/day
Nutrient	**RNI**	**% RNI**	**% RNI**	**% RNI**	**% RNI**	**% RNI**	**% RNI**
Energy	686	28.8	3.4	32.2	15.9	38.7	27.3
Total Fat (g/d)	30	10.4	6.4	0.0	25.2	62.4	6.5
Carbohydrates (g/d)	95						
Protein (g/d)	9.6	75.8	5.4	70.4	30.2	86.7	69.6
Fiber (g/d)	n/a						
*Calcium (mg)	400	47.1	14.0		32.5	69.6	28.6
Phosphor (mg)	275	52.9	13.8		0.0	85.1	41.6
Magnesium (mg)	54	0.0	14.8	34.7	33.3	144.4	86.7
*Zinc (mg)	4.1	63.4	39.0	22.8	107.3	139.5	107.3
Iodine (mcg)	130						
Copper (mcg)	220	0.0	30.9		100.0	330.9	106.4
*Iron (mg)	9.3	36.3	12.9	42.9	107.5	55.9	130.6
Selenio (mcg)	20						
Manganese (mg)	0.6	0.0	40.0	0.0	0.0	104.0	106.6
Vitamin A (mcg RE)	400	135.1	66.6	78.0	499.5	238.1	185.3
Pantothenic Acid	1.8	46.2	22.2	27.0	155.6	115.6	21.7
Vitamin E (mg)	5						
Vitamin C (mg)	30	156.0	20.0	20.0	250.0	104.0	39.0
Tiamin (mg)	0.3	34.7	33.3	40.7	200.0	173.3	63613.3
Riboflavin (mg)	0.4	182.0	25.0	34.5	130.0	273.0	38350.0
Vitamin B6 (mg)	0.3	173.3	33.3	54.1	133.3	312.0	64306.7
Vitamin D (mcg)	10						
Niacin (mg)	4	104.0	30.0	36.5	140.0	169.0	65.5
Biotin (mcg)	6						
Vitamin B12 (mcg)	0.7	148.6	25.7	13.4	85.7	200.6	34765.7
Vitamin K (mcg)	2.5						
Folate (mcg)	80	71.5	62.5	33.6	229.2	214.5	45.2
Potassium (mg)	700	10.4	5.7		0.0	66.9	31.8

* Limiting Nutrient- This nutrient was difficult to meet in the diet prior to the introduction of the SNF
** RNIs are not corrected for breastmilk intake. When correcting for BM intake, the contribution of these complementary foods to energy and nutrient intakes (%RNI-CF) would be higher

Figure 4: % of RNI covered by the modelled SNF for a child aged 9-11 months

12-23 mo**							
		SC	LNS Kalina ZAZA	Farilac	Nutributter	Plumpydoz	Kuba Aine
		52 g/day	20 g/day	50g/day	20g/day	46g/day	63g/day
Nutrient	**RNI**	**% RNI**	**% RNI**	**% RNI**	**% RNI**	**% RNI**	**% RNI**
Energy	686	26.4	2.6	29.5	12.2	26.2	25.4
Total Fat (g/d)	30						
Carbohydrates (g/d)	95						
Protein (g/d)	9.6	79.6	4.8	73.9	26.6	67.5	74.3
Fiber (g/d)	n/a	13.1					
*Calcium (mg)	400	44.9	11.2		26.0	49.2	27.7
Phosphor (mg)	275	37.7	8.3		0.0	45.0	30.1
Magnesium (mg)	54	0.0	13.3	37.2	30.0	115.0	94.5
*Zinc (mg)	4.1	75.6	39.0	27.2	107.3	123.4	130.0
Iodine (mcg)	130						
Copper (mcg)	220	0.0	20.0		64.7	189.4	83.4
*Iron (mg)	9.3	69.5	20.7	82.1	172.4	79.3	253.7
Selenio (mcg)	20						
Manganese (mg)	0.6	0.0	20.0	0.0	0.0	46.0	64.6
Vitamin A (mcg RE)	400	161.1	66.6	93.0	499.5	210.6	224.5
Pantothenic Acid	1.8	49.6	20.0	29.0	140.0	92.0	23.6
Vitamin E (mg)	5						
Vitamin C (mg)	30	186.0	20.0	23.8	250.0	92.0	47.3
Tiamin (mg)	0.3	24.8	20.0	29.1	120.0	92.0	46242.0
Riboflavin (mg)	0.4	173.6	20.0	32.9	104.0	193.2	37170.0
Vitamin B6 (mg)	0.3	124.0	20.0	38.7	80.0	165.6	46746.0
Vitamin D (mcg)	10						
Niacin (mg)	4	82.7	20.0	29.0	93.3	99.7	52.9
Biotin (mcg)	6						
Vitamin B12 (mcg)	0.7	137.8	20.0	12.4	66.7	138.0	32760.0
Vitamin K (mcg)	2.5						
Folate (mcg)	80	45.5	33.3	21.4	122.2	101.2	29.2
Potassium (mg)	700	28.9	13.3		0.0	138.0	89.9

* Limiting Nutrient- This nutrient was difficult to meet in the diet prior to the introduction of the SNF
** RNIs are not corrected for breastmilk intake. When correcting for BM intake, the contribution of these complementary foods to energy and nutrient intakes (%RNI-CF) would be higher

Figure 5: % of RNI covered by the modelled SNF for a child aged 12-23 months

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