FANTA III

FOOD AND NUTRITION TECHNICAL ASSISTANCE

USAID FROM THE AMERICAN PEOPLE

SUMMARY REPORT

Development of Evidence-Based Dietary Recommendations for Children, Pregnant Women, and Lactating Women Living in the Western Highlands of Guatemala

October 2013

FANTA
FHI 360
1825 Connecticut Ave., NW
Washington, DC 20009-5721
Tel: 202-884-8000 Fax: 202-884-8432
fantamail@fhi360.org www.fantaproject.org

fhi 360 THE SCIENCE OF IMPROVING LIVES

SUMMARY REPORT

Development of Evidence-Based Dietary Recommendations for Children, Pregnant Women, and Lactating Women Living in the Western Highlands of Guatemala

October 2013

Food and Nutrition Technical Assistance III Project (FANTA)
FHI 360 1825 Connecticut Avenue, NW Washington, DC 20009-5721
T 202-884-8000 **F** 202-884-8432 fantamail@fhi360.org www.fantaproject.org

This report is made possible by the generous support of the American people through the support of the Office of Health, Infectious Diseases, and Nutrition, Bureau for Global Health, U.S. Agency for International Development (USAID) and USAID/Guatemala, under terms of Cooperative Agreement No. AID-OAA-A-12-00005, through the Food and Nutrition Technical Assistance III Project (FANTA), managed by FHI 360.

October 2013

Recommended Citation

FANTA. 2013. *Summary Report: Development of Evidence-Based Dietary Recommendations for Children, Pregnant Women, and Lactating Women Living in the Western Highlands in Guatemala.* Washington, DC: FHI 360/FANTA.

Contact Information

Food and Nutrition Technical Assistance III Project (FANTA)
FHI 360
1825 Connecticut Avenue, NW
Washington, DC 20009-5721
T 202-884-8000
F 202-884-8432
fantamail@fhi360.org
www.fantaproject.org

Acknowledgments

The following people were instrumental in the process of using Optifood to develop the evidence-based dietary recommendations for children, pregnant women, and lactating women in the Western Highlands of Guatemala and in the development of this report: Manolo Mazariegos (Instituto de Nutrición de Centro América y Panamá [INCAP]) and Maggie Fischer, Camila Chaparro, Monica Woldt, and Gilles Bergeron (Food and Nutrition Technical Assistance III Project [FANTA]) for the design of the protocol used to collect the data to develop the food-based recommendations; Manolo Mazariegos, Ana Victoria Román, Jorge Pernillo, Gladys Miranda, Maya Ferris, Blanca Sulecio, Nidia Ivette Patzan, Brenda Lorena Castillo, Maura Hernández, Blanca Lidia Escobar, Deisy Dionicio Ruyan, Elia Yolanda Castillo, Maribel Ortiz, and Toribia Lorenzo Hernandez (INCAP) for data collection for the cross-sectional survey and market surveys; Humberto Mendez, Vanessa Echevarria, and Lucy Merida (INCAP) for processing and analysis of cross-sectional survey data and for preparation of data for use in Optifood; Elaine Ferguson (London School of Hygiene and Tropical Medicine [LSHTM]), Alison Tumilowicz and Maggie Fischer (FANTA), and Manolo Mazariegos, Vanessa Echeverria, and Jorge Pernillo (INCAP) for Optifood analysis; Alison Tumilowicz (FANTA), Elaine Ferguson (LSHTM), and Manolo Mazariegos (INCAP) for interpretation of Optifood results and writing of significant portions of the report; and Maggie Fischer, Monica Woldt, Luisa Samayoa, Kali Erickson, Gilles Bergeron, and Sandra Remancus (FANTA) for technical input and reviews of earlier drafts of the report.

Abbreviations and Acronyms

BMI	body mass index
CDC	United States Centers for Disease Control and Prevention
CSB	corn-soy blend
ENMICRON	Encuesta Nacional de Micronutrientes (National Survey of Micronutrients)
ENSMI	Encuesta Nacional de Salud Materno Infantil (National Survey on Maternal-Child Health)
FANTA	Food and Nutrition Technical Assistance III Project
FAO	Food and Agriculture Organization of the United Nations
FBR	food-based recommendation
FCT	food composition table
FTF	Feed the Future Initiative
g	gram(s)
GOG	Government of Guatemala
GTQ	Guatemalan quetzal
HHS	Household Hunger Scale
INCAP	Instituto de Nutrición de Centro América y Panamá (Institute of Nutrition of Central America and Panama)
INE	Instituto Nacional de Estadística (National Statistics Institute)
kcal	kilocalorie(s)
LSHTM	London School of Hygiene and Tropical Medicine
µg	microgram(s)
mg	milligram(s)
ml	millimeter(s)
MNP	multiple micronutrient powder(s)
MSPAS	Ministerio de Salud Pública y Asistencia Social (Ministry of Public Health and Social Assistance)
n.d.	no date
NGO	nongovernmental organization
PEC	Programa de Extensión de Cobertura (Program for Extended Coverage)

*Pro*PAN	Process for the Promotion of Child Feeding
RDA	recommended dietary allowance
RVC	Rural Value Chain Project
SD	standard deviation(s)
TIPs	Trials by Improved Practices
U.S.	United States
UNU	United Nations University
USAID	U.S. Agency for International Development
USDA	U.S. Department of Agriculture
WFP	World Food Programme
WHO	World Health Organization

1. Background

Nearly half of Guatemalan children under age 5 are stunted, indicating a high level of chronic malnutrition with severe consequences for the physical and cognitive development of affected children, their communities, and the country overall (Ministerio de Salud Pública y Asistencia Social [MSPAS], Instituto Nacional de Estadistica [INE], United States Centers for Disease Control and Prevention [CDC] 2010; Black et al. 2013). Anemia is also of critical importance; nationally, 48% of children under 5 are anemic (MSPAS, INE, CDC 2010). Iron deficiency anemia contributes substantially to maternal deaths, perinatal mortality, and low birth weight and is related to decreased cognitive development and lower future earnings (Stolzfus 2003).

Through its Zero Hunger Plan (*Pacto Hambre Cero*), the Government of Guatemala (GOG) has committed itself to dramatically reduce chronic malnutrition among children under 5 years, with a goal of a 10% reduction by 2015 and a 24% reduction by 2022 (GOG n.d.). As part of the United States Government's Feed the Future Initiative[1] (FTF), the U.S. Agency for International Development (USAID) is supporting the GOG to implement the Zero Hunger Plan through integrated health, nutrition, agriculture, and local governance projects in the Western Highlands. Specifically, these activities are focused in the five priority departments of Huehuetenango, Quetzaltenango, Quiché, San Marcos, and Totonicapán. According to the 2008–09 Encuesta Nacional de Salud Materno Infantil (ENSMI) (National Survey on Maternal-Child Health), four of the five departments in the Western Highlands have stunting prevalence among children under 5 years of age greater than the national averages (Table 1). Three of the five departments—Huehuetenango, Quiché, and Totonicapán—are among the four departments with the highest prevalence of stunting in the country (MSPAS, INE, CDC 2010). Anemia prevalence in children under 5 is also highest in the Western Highlands, ranging from 40% in Quetzaltenango to 62% in Totonicapán (MSPAS, INE, CDC 2010).

Table 1. Prevalence of stunting and anemia in the Western Highlands in children 3–59 months old (stunting) and children 6–59 months old (anemia)

	Huehuetenango	Quetzaltenango	Quiché	San Marcos	Totonicapán	National
Prevalence (%) of stunting	70	43	72	54	82	50
Prevalence (%) with anemia	48	40	47	53	62	48

[1] http://www.feedthefuture.gov/.

Given the pervasiveness of stunting and anemia in Guatemala, it is useful to question whether current dietary practices and available local foods are capable of meeting dietary needs, particularly during the 1,000-day window of opportunity from conception to age 2. Along with optimal breastfeeding practices, adequate nutrition during pregnancy and complementary feeding through age 2 are recognized as key interventions to reduce chronic malnutrition. In Guatemala, stunting rapidly increases after age 6 months, when complementary feeding is initiated, and continues to rise during the second year of life. Optimal complementary feeding is especially crucial during this period, requiring foods that provide sufficient calories and nutrients, are prepared hygienically, and are fed in the amounts required by the child.

To support the Zero Hunger Plan's interventions to reduce chronic malnutrition, USAID/Guatemala requested assistance from FHI 360's Food and Nutrition Technical Assistance III Project (FANTA) to identify strategies using locally available foods to improve the nutritional quality of the diet in the Western Highlands for pregnant and lactating women and children 6–23 months of age. During 2012–13, in partnership with the Instituto de Nutrición de Centro América y Panamá (INCAP) (Institute of Nutrition of Central America and Panama) and the London School of Hygiene and Tropical Medicine (LSHTM), FANTA conducted an activity using the Optifood computer program to identify a set of evidence-based, population-specific, food-based recommendations (FBRs) that could be promoted to improve the nutritional status of women and young children in the Western Highlands.

Optifood. Optifood is linear programming software that uses mathematical optimization to identify the lowest-cost combination of local foods that meets or comes as close as possible to meeting nutrient needs of specific target groups. Optifood was developed by the World Health Organization (WHO) in collaboration with LSHTM, FANTA, and Blue-Infinity, an information technology company. The goal of Optifood is to identify FBRs that provide guidance on the number of average servings per week from local foods to ensure that specific target groups—typically, children under 2 years of age, pregnant women, and lactating mothers—benefit from an adequate dietary intake. Optifood also indicates the limits within which locally available foods can provide the essential nutrients to each group and provides information that can be used to identify products—fortified foods, micronutrient supplements, animal source foods, biofortified crops, etc.—that could be added to the local diet that would result in an adequate diet. Lastly, Optifood identifies the lowest-cost combination of local foods that will meet or come as close as possible to meeting the nutrient needs of specific target groups.

There are five main steps in the process of using Optifood to develop FBRs, as shown in **Figure 1**. This summary report describes the methods and results of the information-gathering activity to collect data on local dietary patterns and food costs for analysis in Optifood (Step 1) and the analysis of these data to create dietary recommendations in Optifood (Step 2) for children 6–23 months old, pregnant women, and lactating women with infants under 6 months. The report also discusses considerations for the next step (Step 3) in which the GOG, USAID/Guatemala, and partners review the results of the Optifood analysis and decide on a final set of FBRs to be tested, and Step 4 in which the feasibility of the FBRs is evaluated during household trials called Trials of Improved Practices (TIPs).[2]

[2] TIPs is a consultative process that involves requesting households or individuals to attempt a particular set of behaviors and follow-up visits using qualitative methods to understand the feasibility and acceptability of the proposed behaviors. More information can be found at http://www.manoffgroup.com/resources/summarytips.pdf.

Figure 1. Process to use Optifood to develop FBRs

STEP 1	STEP 2	STEP 3	STEP 4	STEP 5
Collect dietary and food cost data that will inform model parameters in Optifood	Complete analysis in Optifood	Review results of Optifood analysis with local stakeholders and decide on a final set of FBRs that are feasible and affordable	Evaluate feasibility of success-fully promoting FBRs via community trials, using, for example, Trials of Improved Practices (TIPs)	Develop and implement a social and behavior change communication (SBCC) strategy to promote FBRs

The analysis in Optifood provides the following categories of results:

1. **Best food sources.** Based on locally available foods and dietary patterns, Optifood determines which local foods are good sources of nutrients for a given target group.
2. **"Problem nutrients."** Problem nutrients refer to nutrients that are likely to remain low in diets due to the availability of and/or access to local food sources and existing dietary patterns (see below for the list of nutrients considered by Optifood).[3]
3. **FBRs.** Based on the best food sources and taking into account the problem nutrients for each target group, alternative sets of FBRs are tested by Optifood using linear programming and compared based on the adequacy of the nutrients they provide and the cost. Through this process, Optifood can develop a set of FBRs that ensures, or comes as close as possible to ensuring, a nutritionally optimal diet for individuals in the target group.
4. **"Lowest-cost diet that meets or comes as close as possible to meeting nutrient needs."** The lowest-cost diet that meets or comes as close as possible to meeting nutrient needs is a diet in which the Optifood program uses the cost data from the Process for the Promotion of Child Feeding (*Pro*PAN)[4] market survey to minimize cost while meeting (or coming as close as possible to meeting) nutrient needs in the diet. This result provides information about the affordability of this diet for specific target groups from study area, based on the average of three market costs at the time the data were collected.

---

[3] The Optifood analysis helps identify the cause of inadequate dietary intakes—whether related to food choices, inadequate household access to nutrient-dense foods, etc. Qualitative research then helps identify how to most appropriately support dietary improvement. For example, if inadequate dietary intake relates to food choices, a focus on behavior change is indicated; if related to inadequate access to appropriate foods, a focus on alternative strategies (e.g., micronutrient or food supplementation, agricultural, and/or income generation interventions) in addition to behavior change is indicated.

[4] *Pro*PAN is a tool to design, implement, and evaluate interventions and programs to improve infant and young child diet and feeding. It includes 1) a field manual with step-by-step guidelines on how to apply quantitative and qualitative research methods; 2) an Epi Info™-based software program for data entry and analysis; and 3) a software user's guide. More information about *Pro*PAN can be found at: http://www.paho.org/hq/index.php?option=com_content&view=article&id=5668&Itemid=40004&lang=en. Note that *Pro*PAN was recently updated, and the ProPAN tools used in this activity were draft updated versions.

2. Methods

Step 1. Methods for information gathering on local dietary patterns and local food costs

The dietary patterns of the target groups in the Guatemalan highlands were established by collecting information through a cross-sectional survey of caregivers of children 6–11 months (n = 202), children 12–23 months (n = 190), pregnant women (n = 75), and lactating women with infants under 6 months (n = 80). Data collection occurred from July to September 2012 in 40 rural communities of nine municipalities in the departments of Huehuetenango and Quiché. The departments were selected from FTF and GHI areas of interventions, with respondents chosen from among participants in the USAID FTF Rural Value Chain Project (RVC) and the MSPAS Programa de Extensión de Cobertura (PEC) (Program for Expanded Coverage). The RVC works through local farmers' associations to improve nutrition and food security by promoting economic growth through supporting the production of horticulture and coffee. Therefore, RVC participants were selected because they may have greater dietary diversity due to their income-generating and horticulture activities and represent a broad range of dietary patterns in the area. Participants were also selected from the PEC, a government program that contracts nongovernmental organizations (NGOs) to provide health services to rural areas where the government health system has a small footprint. Families receiving PEC services represent the majority of the population in these communities and are often the poorest and most vulnerable, and consequently at high risk of chronic malnutrition. The dietary pattern of PEC participants may be different from RVC participants who may have more resources (e.g., land and income). Although some families were participants in both RVC and PEC, survey respondents were selected randomly from a list of participants in either of the programs. Households surveyed in Huehuetenango were predominantly of the Mam ethnolinguistic group, and in Quiché predominantly of the Ixil and Quiché ethnolinguistic groups.

Several survey instruments were used:

1. A **household survey** to collect socioeconomic, demographic, and health information. Understanding the characteristics of the selected households is important for establishing the feasibility of implementing FBRs that require accessing additional foods or increased quantities.
2. The **Household Food Insecurity Access Scale** (Coates et al. 2007) was used to determine the level of food insecurity experienced by the target population at the time of the survey, thereby providing insight about the potential feasibility of families to adopt Optifood FBRs. A subset of three core questions comprising the Household Hunger Scale (HHS) focused on lack of food in the household, while additional survey questions looked at family concerns about accessing sufficient food and affording a diverse diet.
3. A **24-hour dietary recall tool** to collect high-quality dietary data by requesting respondents to name all food items and quantities consumed during the previous day and night. To estimate serving sizes, fieldworkers worked with respondents to estimate portion sizes using foods present in the household during the survey and estimating portion weights using digital scales. If a reported food was not available for weighing at the time of the survey, average portion weight was used. Given that Optifood requires information on the weekly frequency of foods consumed, each reported food item was further described to determine how many times the food had been consumed during the week prior to the survey.
4. An **anthropometric survey** to collect data on the nutritional status of women and children. The data on average weight for each target group were also used by the Optifood program to determine recommended calorie and protein needs per kilogram of body weight.

5. A **market survey instrument** was adapted from the *Pro*PAN tool to collect data on the local names for foods, local costs, seasonality, and availability of food. Market surveys were carried out in the main markets of each of the nine municipalities included in the cross-sectional survey during the first week of September 2012. The study was carried out during the rainy season, when native green leaves and fruits are more readily available in home gardens or purchased in the market. However, the cross-sectional survey captures only a subset of foods available in that location—those available at the time of the survey. A further step involves exploring seasonality as a variable to meet the FBRs.

Step 2. Methods for conducting the analysis in Optifood

Thirteen key nutrients are considered by the Optifood analysis: total fat, total protein, iron, zinc, calcium, vitamin A, vitamin C, thiamin, riboflavin, niacin, vitamin B6, folate, and vitamin B12. Some important nutrients/factors in the diet cannot yet be analyzed in Optifood due to a lack of adequate food composition table (FCT) data or because exact requirements have not yet been established by international, regulatory organizations. These include selenium, iodine, biotin, vitamins K and D, essential fatty acids, and protein quality.

The data used by Optifood to set the model parameters for realistic FBRs include actual dietary patterns, reference values for recommended dietary allowances (RDAs), and cost information about each food considered in the FBRs. These Optifood data requirements and their sources for the analysis presented in this report are summarized in **Table 2**.

Table 2. Data requirements for Optifood and the sources used in Guatemala

Data Requirements	Data Sources for the Guatemala Analysis
• List of foods	24-hour dietary recall[a]
• For each food:	
▪ Average serving size (g/day or g/meal)	24-hour dietary recall
▪ Maximum number of times per week consumed[b]	24-hour dietary recall
▪ Cost per 100 g edible portion	Market survey
• Food group patterns (low, median, and high number of servings per week from different food groups)	24-hour dietary recall
• Food subgroup patterns (low and high number of servings per week from different food subgroups)	24-hour dietary recall
RDA	INCAP Daily Dietary Recommendations (Menchú et al. 2012)
FCT values	INCAP Central American FCT (INCAP 2007) Optifood FCT U.S. Department of Agriculture (USDA) FCT (USDA 2010) USDA Retention Factors[c]

[a] The 24-hour recall was collected in the cross-sectional survey described above.
[b] The 24-hour recall included a question on the frequency of consumption during the past week for each food reported during the 24-hour recall.
[c] Nutrient content of raw foods in the Guatemalan FCT, which were consumed in a cooked state, were adjusted for cooking losses using the retention factors presented in USDA 2007.

The process of using the Optifood tool for data analysis has four steps. The first step is to enter the data requirements listed in Table 2 and check to be sure that the model parameters are accurate by conducting an initial analysis to see if adjustments are needed. The second step is to conduct the analysis to identify two realistic dietary recommendations that meet or come as close as possible to meeting nutrient needs, with one based on current dietary patterns and one requiring dietary changes. The third step is to test alternative dietary recommendations to select which dietary recommendations may be the best for the target population, taking into consideration nutrient needs and cost, if cost is included in the analysis. Last, a cost analysis is conducted to identify the lowest cost diet that meets or comes as close as possible to meeting nutrient needs, comparing foods based on cost to meet the nutrient requirements.

3. Results

Results from Step 1. Information gathering on local dietary patterns and local food costs

Socio-demographic data. Survey results showed that selected communities were characterized by modest dwellings (61% of families had flooring in their home of sand, dirt, or clay), limited access to quality health services (no specific survey data available), and a predominance of Maya ancestry (86%) with strong traditional practices in terms of health and nutrition. **Table 3** shows selected socio-demographic characteristics of households and of women respondents. A larger percentage of households in Huehuetenango reported having access to electricity (84%) than did households in in Quiché (53%). A larger percentage of households in Quiché than in Huehuetenango reported having a home garden (45% and 24%, respectively) and livestock (87% and 79%, respectively). Reflective of the demographic profile of the surveyed communities, there were also a larger percentage of indigenous women respondents in Quiché (100%) than in Huehuetenango (73%) and smaller percentage of women respondents in Quiché spoke Spanish (54%) than in Huehuetenango (80%).

Table 3. Selected socio-demographic characteristics of households and women respondents

Characteristics		Huehuetenango	Quiché	Total
Households				
Number of people living in the household (mean)		7.3	7.4	7.3
House owned by respondent or spouse (% yes)		68.8	86.8	77.6
Flooring material is sand, dirt, or clay (% yes)		59.5	62.3	60.8
Access to electricity (% yes)		84.4	53.3	69.2
Household effects (% yes)	Radio	68.8	59.1	64.0
	Television	34.2	25.7	30.0
	Mobile telephone	82.9	78.2	80.6
Access to piped water (% yes)		74.4	90.7	82.3
Purify water using acceptable method (% yes)[p]		95.5	91.1	93.4
Access to latrine or toilet and sewage system (% yes)		87.4	77.9	82.7
Home garden (% yes)		24.3	45.1	34.5
Use of food produced in home garden (% yes)	Sold	7.8	4.4	5.5
	Consumed	65.8	75.2	71.9
	Sold and consumed	25.9	20.6	22.6
Livestock (% yes)		78.9	86.8	82.8
Type of livestock (% yes)	Chickens	93.3	96.9	95.1
	Pigs	37.8	45.3	41.7
	Goats/sheep	14.8	11.2	13.0
	Cows	2.9	7.0	5.3
Use of livestock and livestock products (%)	Sold	10.4	16.1	13.3
	Consumed	72.2	57.0	64.4
	Sold and consumed	17.5	26.9	22.3
Women respondents				
Age, years (mean)		26.2	27.8	26.9
Education (%)	Primary or less	58.9	49.0	54.1
	Never attended	28.2	42.0	34.9
Ethnic group is indigenous by enumerator observation (% yes)		72.9	99.6	85.9
Speaks Spanish (% yes)		79.9	53.7	67.1
Language of the interview (%)	Spanish	65.9	45.5	55.9
	Ixil	0.0	33.85	16.7
	Mam	34.1	0.0	17.3
	Quiché	0.0	20.6	10.2

[5] Acceptable methods of water purification were defined as boiling, using chlorine, or solar disinfection.

Perceptions of household food security. Roughly half of households reported anxiety or concerns regarding food insecurity in the 30 days preceding the survey. As shown in **Table 4**, in Quiché, 84% of households reported worrying about the amount of food in the household and 77% reported a family member eating a less-diverse diet, as compared to 53% and 46%, respectively, in Huehuetenango. Therefore, a large percentage of households, especially in Quiché, reported experiencing problems of food insecurity. This finding is important, as it indicates that even when nutritious foods are locally available, they may not be accessible to a large percentage of the households. However, as assessed by the three core HHS questions, only 3% of households were classified as having experienced moderate hunger, and none with severe hunger.

Table 4. Perceptions of household food insecurity

Occurrence questions	Frequency-of-occurrence[a]		Huehuetenango	Quiché	Total
Reports worrying that the food would run out before having money to buy more in the last 30 days (%)	No		47.0	15.6	31.6
	Yes	Rarely	20.2	17.1	18.7
		Sometimes	26.5	53.7	39.8
		Often	6.3	13.6	9.9
Reports family member not being able to eat foods of animal origin, such as eggs or meat, because there was not enough money to buy them in the last 30 days (%)	No		66.0	31.5	49.1
	Yes	Rarely	14.2	16.7	15.4
		Sometimes	16.8	38.9	27.6
		Often	3.0	12.8	7.8
Reports not giving foods of animal origin, such as eggs or meat, to children because there was not enough money to buy them in the last 30 days (%)	No		71.9	37.0	54.6
	Yes	Rarely	11.4	16.0	13.7
		Sometimes	13.7	36.6	25.0
		Often	3.0	10.5	6.7
Reports family member eating a less-diverse diet because there was not enough money to buy a variety of foods in the last 30 days (%)	No		54.5	23.0	39.1
	Yes	Rarely	17.2	15.2	16.2
		Sometimes	26.9	48.3	37.3
		Often	1.5	13.6	7.4
Reports family member eating foods that they did not like because there was not enough money to buy food in the last 30 days (%)	No		66.0	31.5	49.1
	Yes	Rarely	18.0	16.3	17.2
		Sometimes	15.4	45.1	30.0
		Often	0.8	7.0	3.8
Reports family member eating less quantity of food because there was not enough money to buy food in the last 30 days (%)	No		75.8	36.2	56.4
	Yes	Rarely	12.3	16.3	14.3
		Sometimes	9.7	35.8	22.3
		Often	2.2	11.7	6.9
Reports family member skipping meals because there was not enough money to buy food in the last 30 days (%)	No		88.4	82.5	85.5
	Yes	Rarely	5.6	11.3	8.4
		Sometimes	5.6	5.8	5.7
		Often	0.4	0.4	0.4

[a] "Rarely" is once or twice in the past 30 days.
"Sometimes" is 3–10 times in the past 30 days.
"Often" is more than 10 times in the past 30 days.

Anthropometric findings. Anthropometric data from the cross-sectional survey confirm the results of the 2008–09 ENSMI regarding the severity of chronic malnutrition in Huehuetenango and Quiché. By the end of the first year of life, almost half of children (47%) are already stunted. In the second year of life, the prevalence of stunting increases to 71% of children. However, the prevalence of stunting among children 6–23 months is significantly higher in Quiché (64%) than in Huehuetenango (53%) ($p = 0.02$). By contrast, the overall prevalence of wasting among children 6–23 months was very low at 1.3%.[6]

Approximately two-thirds of non-pregnant women surveyed in Huehuetenango and Quiché have a body mass index (BMI) within a normal range (67%) and almost one-third have a BMI classified as overweight or obese (29%). However, the percentage of women classified as overweight or obese may be overestimated since the sample includes lactating women with infants under 2 months.[7] Few women were classified as underweight (4%).

24-hour dietary recall. For the purpose of the summary report, the dietary intake results refer only to energy, protein, and minerals like iron and zinc, despite the fact that the full analysis included additional vitamins and minerals considered in INCAP's FCT.

- **Foods consumed.** The types of foods consumed by all the target groups and in both departments were very similar. The most frequently consumed foods included sugar, tortilla and other maize products, tomatoes, onions, eggs, black beans, and potatoes. Less frequently reported were enriched and fortified foods (except for sugar), such as pasta, instant fortified oats, and Incaparina,[8] and green leafy vegetables, such as nightshade (hierbamora) and amaranth leaves. Animal-source foods, except for eggs, were almost completely absent from the diets. Despite a majority of families reporting production of livestock, mostly for consumption, frequency of consumption of animal-source foods is low, and portion sizes are small. Few "junk foods" were consumed by the women and children surveyed.
- **Breastfeeding and complementary feeding**. Almost all (96%) of the children 6–11 months old were breastfed at the time of the survey,[9] while among children 12–23 months old, 75% were being breastfed. Therefore, for data analysis and for development of FBRs, the group of 6–11 months included only breastfed children, whereas the age group of 12–23 months was disaggregated into breastfed and non-breastfed children. Dietary diversity was low among the children surveyed: only 36% of children 6–8 months old, 49% of children 9–11 months old, and 37% of children 12–23 months old consumed food from at least four food groups in the 24 hours preceding the survey. A smaller percentage of children in Quiché (32%) had adequate dietary

[6] Wasting is defined as weight-for-height < −2 SD from the median of the 2006 WHO Child Growth Standards; see http://www.who.int/childgrowth/en/.

[7] The Demographic and Health Surveys supported by ICF Macro measure BMI in women 15-49 years of age who are 3 months or more postpartum. That is, BMI is not measured in pregnant women or women within 2 months postpartum due to changes in body composition during the postpartum period.

[8] Incaparina is a fortified corn- and soy-based flour commercially produced in Guatemala by Alimentos S.A. It is fortified with iron, zinc, calcium, thiamine, riboflavin, niacin, vitamin B12, vitamin B6, folic acid, and vitamin A in four formulations. Incaparina is consumed by family members, as a complementary food for children 6–23 months, and by pregnant and lactating women. The instant fortified oats are fortified with iron, zinc, calcium, vitamin B12, niacin, folic acid, thiamine, and vitamin A.

[9] Breast milk consumption was not measured in this study; instead, the estimations of breast milk intake were determined by subtracting the mean energy intake from complementary foods from the average energy requirements for each age group. The average energy requirement was from the INCAP Daily Dietary Recommendations. The average energy intakes from complementary foods were estimated from the 24-hour recall data. The energy content of breast milk used in these calculations was 0.7 kcal/g.

diversity as compared to Huehuetenango (47%). In contrast, 96% of all children 6–23 months old consumed the minimum number of meals per day for their age.

- **Protein consumption of children.** Looking at the nutrient density of the complementary food consumed, the average protein density in the diet was 2.9, 2.9, and 3.1 for children 6–8 months, 9–11 months, and 12–23 months, respectively. According to the reference authority used (WHO/Food and Agriculture Organization of the United Nations [FAO]/United Nations University [UNU] 2007), the average desired values are 1.0, 1.0, and 0.9 for each respective target group, which suggests that the protein content in the diets of each of the child age groups is adequate. On the other hand, the values observed in this study group were higher than those previously reported for Guatemalan children by Dewey and Brown (2003). Additionally, the nutrient density approach to evaluate protein intake does not take into account the quality of the protein consumed. Although protein intake from complementary foods for all child target groups in both departments was in the "adequate" range, the quality of protein may be inadequate considering that the majority of the protein in the diet was from maize and that that very few animal-source foods were consumed. Additionally, grains and legumes were not often consumed together, an important distinction, as this combination provides the essential amino acids for a complete protein. However, analysis of essential amino acids in the diet was beyond the scope of this activity. As shown in **Table 5**, the principal protein sources for young children are as follows.
  - Breastfed children 6–8 months. Maize was present in all food preparations, with almost 40% of the total protein contribution from maize; potatoes (9.5%), chicken eggs (7.5%), black beans (6.2%), and Incaparina (4.1%) combined to make up about 67% of the protein contribution. Interestingly, within the top 16 foods comprising 80.5% of the protein contribution, chicken eggs were the only animal product.
  - Breastfed children 9–11 months. Maize (all food preparations), with almost 30% of the total protein contribution for this group; black beans (10.4%), potatoes (9.0%), chicken eggs (7.8%), , and rice (3.9%) combined to make up about 61% of the protein contribution. Within the top 15 foods, which make up 80% of the protein contribution, only chicken eggs (top 3) and cow milk (top 14) were animal products.
  - Breastfed children 12–23 months. Maize (all food preparations), with 36.7% of the total protein contribution, chicken eggs (11.3%), black beans (10.5%), potatoes (4.7%), and Incaparina (4.0%) combined make up about 67% of the total protein contribution. Within the top 15 foods, which make up 80% of the protein contribution, only chicken eggs, beef, and cow milk, corresponded to an animal product, which combined represented about 15% of protein contribution.
  - Non-breastfed children 12–23 months. Maize (all food preparations), with 33.9% of contribution, chicken eggs (8.9%), black beans (6.5%), Incaparina (6.4%), and potatoes (5.5%) combined make up about 61.2% of the total protein contribution. Within the top 14 foods, which make up 80% of the protein contribution, only three foods—chicken eggs (top 2), cow milk (top 10), and beef (top 12)—corresponded to an animal product, which combined represented about 15% of protein contribution.

Table 5. Food sources of protein for children 6–23 months

	Breastfed 6–8 months		Breastfed 9–11 months		Breastfed 12–23 months		Non-breastfed 12–23 months	
Rank	**Food**	**%**	**Food**	**%**	**Food**	**%**	**Food**	**%**
1	Maize products	39.7	Maize products	29.6	Maize products	36.7	Maize products	33.9
2	Potatoes	9.5	Black beans	10.4	Egg	11.3	Egg	8.9
3	Egg	7.5	Potatoes	9.0	Black beans	10.5	Black beans	6.5
4	Black beans	6.2	Egg	7.8	Potatoes	4.7	Incaparina	6.4
5	Incaparina	4.1	Rice	3.9	Incaparina	4.0	Potatoes	5.5

- **Protein consumption of women.** Regarding women´s protein intake, the mean ± SD (median) intake in pregnant women was 68.2 ± 28.9 (69.0) g for Huehuetenango and 67.8 ± 37.3 (58.7) g for Quiché, meeting about 78% and 66% of required adequacy for each area, respectively. The mean ± SD (median) intake in lactating women was 70.8 ± 33.4 (66.9) g and 77 ± 22.4 (75.6) g for Huehuetenango and Quiché, respectively, with adequacies of 98% and 80%, respectively. Protein intake is comparable among pregnant and lactating women in Huehuetenango, but in Quiché, lactating women have a higher intake than pregnant women. However, for all groups, the intake is relatively low. These findings suggest that different patterns exist in the dietary intake of women during the reproductive cycle in these two neighboring departments, with lactating women from Huehuetenango facing the highest risk of protein deficiency. As shown in **Table 6**, for pregnant and lactating women the top five foods sources of protein were as follows.
  - In pregnant women, maize (all food preparations), with 52.4% of contribution, black beans (11.8%), chicken eggs (3.9%), potatoes (3.7%), and pasta (2.4%) combined to make up about 74% of total protein contribution. Notably, within the top nine foods, which make up 80% of the protein contribution, only chicken eggs (top 3), chicken (top 6), and beef (top 9) corresponded to an animal product, which combined represented about 7.5% of protein contribution.
  - For lactating women, the top 5 foods sources of protein are maize (all food preparations), with 59.8% of contribution, black beans (10.4%), chicken eggs (6.0%), potatoes (2.3%), and pasta (1.3%), which combined make up about 80% of contribution. Within the top 5 foods, which make up 80% of the protein contribution, only chicken eggs (top 3) and chicken (top 6) corresponded to an animal product, which combined represented about 7.3% of protein contribution.

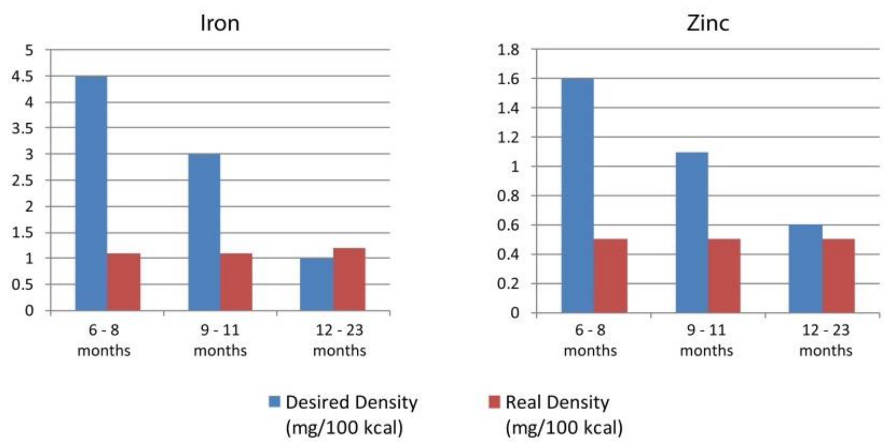
Table 6. Food sources of protein for pregnant women and lactating women with infants under 6 months

	Pregnant women		Lactating women	
Rank	**Food**	**%**	**Food**	**%**
1	Maize products	52.4	Maize products	59.8
2	Black beans	11.8	Black beans	10.4
3	Egg	3.9	Egg	6.0
4	Potatoes	3.7	Potatoes	2.3
5	Pasta	2.4	Pasta	1.3

Overall, the protein intake of pregnant and lactating women is suboptimal, and therefore presents a risk of protein deficiency. In addition, it is important to highlight the quality of the protein in the diet given the predominance of plant-based source in this population, in which maize is the main source, accompanied by limited animal food.

- **Micronutrients.** Information is provided in **Figure 2** on the average iron and zinc densities of the complementary foods consumed by breastfed children 6–8, 9–11, and 12–23 months and recommended energy densities for complementary foods for children in these age ranges (Dewey and Brown 2003). These results suggest that the iron and zinc content in the diet is suboptimal for breastfed children 6–11 months.

Figure 2. Average iron and zinc densities (mg/100 kcal) from 24-hour dietary recall of children's complementary foods in comparison to recommended densities by WHO



In Quiché, 37.7% of children 6–23 months reportedly consumed a multiple micronutrient powder (MNP), known locally as "Chispitas," in the 24 hours prior to the survey. In Huehuetenango, only two children reportedly consumed Chispitas, perhaps because the distribution of Chispitas by the health extension coverage program was in its initial stage of implementation when the survey was carried out. A similar percentage of pregnant women in Huehuetenango and Quiché reported receiving micronutrient supplements as a part of their antenatal care (81.6% and 86.8%, respectively). MSPAS protocols include iron and folic acid supplementation for pregnant women and for women 6 months postpartum (MSPAS 2004). However, a smaller percentage of women reported receiving micronutrient supplements postpartum in Huehuetenango than in Quiché (32.4% and 55.3%, respectively).

Results from Step 2. Analysis in Optifood

Result 1. Best food sources of nutrients. Our survey data yielded a total of 61 different foods consumed by the target groups. Of those, 35 were good sources of at least one nutrient. **Table 7** shows the foods providing at least 5% of RDA for one of the 13 micronutrients being considered.

Result 2. Problem nutrients. As mentioned above, problem nutrients refers to nutrients that are likely to remain low in diets due to their availability in local food sources and/or to existing dietary patterns among given target groups. Optifood results show that pregnant women are unlikely to consume adequate amounts of iron, zinc, folate, and vitamin B12; lactating women are unlikely to consume adequate amounts of zinc, vitamin B12, and vitamin C; breastfed children under 2 years of age, especially those 6–8 months of age, are unlikely to consume adequate amounts of iron, zinc, and niacin; and non-breastfed children under 2 years of age are unlikely to consume adequate amounts of iron, vitamin B12, and niacin.

A summary of problem nutrients by target group is presented in **Table 8**. In terms of protein, the mean ± SD (median) intake for breastfed children ranged from 9.2 ± 6.9 (8.2) g in children 6–8 months old to 11.7 ± 7 (10.7) g for children 9–11 months old and 18.1 ± 10.6 (16.2) g for those 12–23 months old. Without taking into account the contribution of breast milk, protein intake from complementary foods corresponded to an average of 61.1%, 77.8%, and 113.0% of references values for each group, respectively. For non-breastfed children 12–23 months, protein intake was 27.9 ± 16 (25.6) g, with an adequacy of 115% of reference values.

Result 3. Food-based recommendations. To address the identified shortcomings of local diets, Optifood proposes recommendations that establish the quantity and frequency of consumption of available foods—and, if those are insufficient, what additional products could be added to complete the diet. In our analysis, two sets of FBRs were developed and tested, the first set using a scenario that included foods commonly consumed by the target groups, including fortified blended flours such as Incaparina, fortified oats, and fortified sugar, but without micronutrient supplementation,[10] while the second set included the same as above, plus micronutrient supplements.

- **FBRs without micronutrient supplementation.** In the first analysis, for all target groups, a combination of four to seven individual FBRs was required to meet or come as close as possible to meeting nutrient needs for individuals in the target group. The FBRs for children are shown in **Table 9** and the FBRs for women are shown in **Table 10**. If the FBRs were adopted by the target groups as presented in the tables, they would ensure a nutritionally adequate diet for almost all target groups, except for children 6–8 months old and for pregnant women. For children 6–8 months old, it was not possible to meet iron and zinc requirements even following the FBRs, without also providing micronutrient supplementation. For pregnant women, it also was not possible to meet iron requirements with FBRs alone and no micronutrient supplementation.

[10] The oats are fortified with iron and zinc. The sugar is fortified with vitamin A. In some areas of the country, sugar is also fortified with iron. However, fortification of sugar with iron is not mandatory and has not been scaled up in the country, and sugar does not contribute a substantial amount of iron to the diet.

Table 7. Foods providing > 5% of the total micronutrient content of the Optifood diet that met or came as close as possible to meeting nutrient needs

Calcium	Iron	Zinc	Vitamin C	Vitamin A	Vitamin B12
Tortilla, or other maize products Incaparina Amaranth leaves Nightshade leaves (hierbamora) Milk, powder Cabbage Crotalaria/chipilin leaves Cheese	Tortilla, or other maize products Incaparina Amaranth leaves Nightshade leaves (hierbamora) Black beans Bread, sweet Oats, instant, fortified	Tortilla, or other maize products Incaparina Black beans Amaranth leaves Chayote fruit	Chayote fruit Potatoes Pumpkin, yellow Amaranth leaves Nightshade leaves (hierbamora) Cabbage Crotalaria leaves Beans, snap green Tomato, red Tomato tree Onions, bulbs and tops Oranges, sweet	Sugar, fortified Amaranth leaves Pumpkin, yellow Nightshade leaves (hierbamora) Carrots Oats, instant, fortified Crotalaria leaves Turnip greens Eggs, whole Liver Incaparina	Incaparina Milk, powder Eggs, whole Chicken, meat and skin Lamb, meat Frankfurter, beef and pork Liver
Thiamin	**Riboflavin**	**Niacin**	**Folate**	**Vitamin B6**	
Tortilla, or other maize products Incaparina Oats, instant, fortified Black beans Nightshade leaves (hierbamora) Broth, beans Pasta, enriched Oranges, sweet	Eggs, whole Incaparina Milk, powder Oats, instant, fortified Amaranth leaves Tortilla, or other maize products Nightshade leaves (hierbamora) Bread, sweet Crotalaria leaves Liver Pasta, enriched	Tortilla, or other maize products Incaparina Potatoes Oats, instant, fortified Chicken, meat and skin Liver Pasta, enriched Oats, not fortified	Incaparina Chayote fruit Black beans Oats, instant, fortified Amaranth leaves Nightshade leaves (hierbamora) Pumpkin, yellow Oranges, sweet Cabbage Beans, snap green Broth, beans Corn grains, yellow Pasta, enriched	Tortilla, or other maize products Potatoes Black beans Nightshade leaves (hierbamora) Oats, instant, fortified Amaranth leaves Cabbage Crotalaria leaves Chayote leaves and shoots	

Table 8. Problem nutrients in modeled Optifood diets that came as close as possible to meeting nutrient needs

	Breastfed Children 6–8 Months Old	Breastfed Children 9–11 Months Old	Breastfed Children 12–23 Months Old	Non-Breastfed Children 12–23 Months Old	Pregnant Women	Lactating Women with Infants under 6 Months
Iron	Not possible to meet requirement	Not possible to meet requirement without fortified blended flour	Not possible to meet requirement without fortified blended flour	Not possible to meet requirement without fortified blended flour	Not possible to meet requirement	
Zinc	Not possible to meet requirement	Not possible to meet requirement without fortified blended flour	Not possible to meet requirement without fortified blended flour		Not possible to meet requirement without fortified blended flour	Not possible to meet requirement without fortified blended flour
Vitamin B-12				Not possible to meet requirement without fortified blended flour	Not possible to meet requirement without liver	Not possible to meet requirement without liver
Folate					Not possible to meet requirement without fortified blended flour	Not possible to meet requirement without fortified blended flour
Vitamin C						Not possible to meet requirement without oranges
Niacin	Not possible to meet requirement without fortified blended flour	Not possible to meet requirement without fortified blended flour	Not possible to meet requirement without fortified blended flour	Not possible to meet requirement without fortified blended flour		

Fortified blended flour includes Incaparina or any other blended flour with the same micronutrient content as Incaparina.

Table 9. FBRs without including micronutrient supplementation for children

In combination with other foods, breastfed children 6–8 months should consume at a minimum:
(Note: This diet does not meet iron and zinc requirements)

Food	Frequency per week	Servings per day	Estimated serving size (g)[a]	Total quantity per day (g)
Tortilla or other maize products	7	3	20	60
Vegetables	7	4	20	80
Potatoes	7	1	55	55
Beans	7	1	25	25
Fortified blended flour as porridge[b]	7	2	10	20
Meat, poultry, or eggs	7	1	20	20

In combination with other foods, breastfed children 9–11 months should consume at a minimum:

Food	Frequency per week	Servings per day	Estimated serving size (g)[a]	Total quantity per day (g)
Tortilla or other maize products	7	3	25	75
Vegetables	7	4	25	100
Potatoes	7	1	60	60
Beans	7	1	25	25
Fortified blended flour as porridge[b]	7	2	10	20
Meat, poultry, or eggs	7	1	30	30

In combination with other foods, breastfed children 12–23 months should consume at a minimum:

Food	Frequency per week	Servings per day	Estimated serving size (g)[a]	Total quantity per day (g)
Tortilla or other maize products	7	3	25	75
Vegetables	7	4	35	140
Potatoes	7	1	60	60
Beans	7	1	30	30
Fortified blended flour as porridge[b]	7	2	15	30
Meat, poultry, or eggs	7	1	35	35

In combination with other foods, non-breastfed children 12–23 months should consume at a minimum:

Food	Frequency per week	Servings per day	Estimated serving size (g)[a]	Total quantity per day (g)
Tortilla or other maize products	7	3	50	150
Vegetables	7	4	40	160
Potatoes	7	1	75	75
Beans	7	1	60	60
Fortified blended flour as porridge[b]	7	2	15	30
Meat, poultry, or eggs	7	1	40	40

[a] The estimated serving sizes are based on the dietary data collected in Huehuetenango and Quiché.
[b] The fortified blended flour should have similar micronutrient content to Incaparina.

Table 10. FBRs without micronutrient supplementation for pregnant and lactating women

In combination with other foods (particularly tortillas and other maize products), pregnant women should consume at a minimum: (Note: This diet does not meet iron requirements)				
Food	**Frequency per week**	**Servings per day**	**Estimated serving size (g)[a]**	**Total quantity per day (g)**
Vegetables	7	4	85	340
Potatoes	7	1	120	120
Beans	7	1	90	90
Fortified blended flour[b]	7	2	25	50
Liver[c]	1	1	90	90
In combination with other foods, lactating women should consume at a minimum:				
Food	**Frequency per week**	**Servings per day**	**Estimated serving size (g)[a]**	**Total quantity per day (g)**
Vegetables	7	4	80	320
Potatoes	7	1	170	170
Beans	7	1	90	90
Fortified blended flour[b]	7	2	30	60
Liver[c]	1	1	90	90
Oranges[d]	3	1	205	205

[a] The estimated serving sizes are based on the dietary data collected in Huehuetenango and Quiché.
[b] The fortified blended flour should have similar micronutrient content to Incaparina.
[c] Liver is included in the dietary recommendations so that pregnant and lactating women can meet vitamin B12 requirements.
[d] If oranges are seasonally unavailable, then a message to consume the same quantity of another vitamin C-rich fruits and vegetables could replace the messages for oranges.

Food-based recommendations with micronutrient supplementation

Here we present the second set of analyses that were carried out with Optifood to develop FBRs, but this time allowing for the addition of micronutrient supplements to the diet. This is in recognition of the fact that the nutrient needs of infants and young children are very high due to their rapid rate of growth and development during their first 2 years. Breast milk can make a substantial contribution to the total nutrient intake of children 6–23 months of age, particularly for protein and many of the vitamins, but breast milk is relatively low in several minerals, such as iron and zinc, even after accounting for bioavailability. Given that children 6–23 months of age consume relatively small amounts of complementary foods, the nutrient density (amount of each nutrient per 100 kcal of food) of complementary foods needs to be very high (Pan American Health Organization 2003).

FBR for children. The diets of children surveyed did not include sufficient animal-source foods and/or fortified complementary foods to meet their nutrient needs. In addition, local fortified foods like Incaparina were consumed as a thin gruel (*atole*), which is low in nutrient density. The inclusion of animal-source foods could increase the amount of iron and zinc in the diets of young children. However, the cost of animal-source foods is relatively high and may not be affordable for families in the Western Highlands. Furthermore, the amounts of animal-source foods that can feasibly be consumed by infants under 12 months of age are generally insufficient to meet iron and zinc requirements (Pan American Health Organization 2003; WHO/UNICEF 1998). Therefore, it is necessary to promote more nutrient-dense complementary foods, such as fortified complementary foods, prepared at the appropriate consistency, and/or micronutrient supplements.

MSPAS supplementation protocols mandate that children 6–59 months of age should be given MNP, but the composition that should be used is not specified in the norms (MSPAS 2004). At the time of the survey, MNP distribution was taking place in only a portion of the municipalities and included several different MNP formulations depending on the agency or donor. The Optifood analysis included the WHO recommendation for MNP composition of 12.5 mg of iron, 300 µg of retinol, and 5 mg of zinc (WHO 2011). The recommended duration and time interval for supplementation with MNP is one sachet per day for a minimum period of 2 months, followed by a period of 3–4 months off supplementation, so that use of the MNP is started every 6 months.

It is theoretically possible for all target groups to meet folate and vitamin C requirements from locally available foods. However, the analysis using Optifood and the market survey suggests that it would be complex (e.g., requiring the intake of at least four vegetable servings every day) and possibly too costly for some families living in the Western Highlands (see cost results below). Therefore, an MNP that contains folic acid and vitamin C, in addition to iron, vitamin A, and zinc, could be beneficial for the nutritional status of children 6–23 months. The composition of the Sprinkles Global Health Initiative's "Nutritional Anemia Formulation Sprinkle" includes: 12.5 mg of iron, 300 µg of retinol, 5 mg of zinc, 160 µg of folic acid, and 30 mg of vitamin C (Sprinkles Global Health Initiative 2008). The FBRs for children 6–23 months therefore include the Nutritional Anemia Formulation Sprinkle as summarized in **Table 11**.

Table 11. FBRs including micronutrient supplementation for children

Supplement[a]	Dosage[b]			
MNP	12.5 mg/day iron 300 µg/day retinol 5 mg/day zinc	160 µg/day folic acid 30 mg/day vitamin C		
In combination with other foods, breastfed children 6–8 months should consume at a minimum:				
Food	**Frequency per week**	**Servings per day**	**Estimated serving size (g)[c]**	**Total quantity per day (g)**
Tortilla or other maize products	7	2	20	40
Potatoes	3	1	55	55
Beans	3	1	25	25
Eggs	3	1	25	25
Fortified blended flour as porridge[d]	3	1	20	20
Meat, poultry, or fish[e]	7	1	20	20
In combination with other foods, breastfed children 9–11 months should consume at a minimum:				
Food	**Frequency per week**	**Servings per day**	**Estimated serving size (g)[c]**	**Total quantity per day (g)**
Tortilla or other maize products	7	2	25	50
Potatoes	3	1	60	60
Beans	3	1	25	25
Eggs	3	1	30	30
Fortified blended flour as porridge[d]	3	1	20	20
Meat, poultry, or fish[e]	7	1	30	30
In combination with other foods, breastfed children 12–23 months should consume at a minimum:				
Food	**Frequency per week**	**Servings per day**	**Estimated serving size (g)[c]**	**Total quantity per day (g)**
Tortilla or other maize products	7	4	25	100
Potatoes	4	1	60	60
Beans	4	1	30	30
Eggs	4	1	50	50
Green leafy vegetables	4	1	30	30
Fortified blended flour as porridge[d]	4	1	30	30
Meat, poultry, or fish[e]	7	1	35	35
In combination with other foods, non-breastfed children 12–23 months should consume at a minimum:				
Food	**Frequency per week**	**Servings per day**	**Estimated serving size (g)[c]**	**Total quantity per day (g)**
Tortilla or other maize products	7	4	50	200
Potatoes	4	1	75	75
Beans	4	1	60	60
Eggs	5	1	50	50
Green leafy vegetables	4	1	30	30
Fortified blended flour as porridge[d]	5	1	30	30
Meat, poultry, or fish[e]	7	1	40	40

[a] The composition of the multiple micronutrient supplement is based on the Sprinkles Global Health Initiative's "Nutritional Anemia Formulation Sprinkle."

[b] The WHO recommended duration and time interval for supplementation with MNP is one sachet per day for a minimum period of 2 months, followed by a period of 3–4 months off supplementation so that use of the MNP is started every 6 months.

[c] The estimated serving sizes are based on the dietary data collected in Huehuetenango and Quiché.

[d] The fortified cereal should have similar micronutrient content to Incaparina.

[e] This recommendation is not necessary to meet micronutrient requirements if an MNP is consumed. However, the recommendation is included because WHO recommends that children 6–23 months of age consume meat, poultry, fish, or eggs daily, or if daily consumption is not possible, as frequently as possible.

FBRs for pregnant women. The consumption of locally available foods generally cannot meet the nutrient requirements of pregnant women for iron and folate given their high requirements for those micronutrients. Therefore, WHO recommends that pregnant women consume iron and folic acid supplements during pregnancy (WHO 2012). In alignment with WHO recommendations, the MSPAS protocol is for pregnant and lactating women to consume 600 mg of ferrous sulfate and 5 mg of folic acid once per week (MSPAS 2004). The FBRs summarized in **Table 12** include the iron and folic acid supplementation as recommended by the MSPAS.

Table 12. FBRs with micronutrient supplementation for pregnant and lactating women

Supplement[a]	Dosage			
Iron and folic acid supplementation	600 mg/week ferrous sulfate 5 mg/week folic acid			
In combination with other foods, pregnant women should consume at a minimum:				
Food	**Frequency per week**	**Servings per day**	**Estimated serving size (g)[b]**	**Total quantity per day (g)**
Fortified cereal[c]	7	1	25	25
Vegetables	7	4	85	340
Potatoes	7	1	120	120
Liver[d]	1	1	90	90
In combination with other foods, lactating women should consume at a minimum:				
Food	**Frequency per week**	**Servings per day**	**Estimated serving size (g)[b]**	**Total quantity per day (g)**
Fortified cereal[c]	7	1	30	30
Vegetables	7	4	80	320
Potatoes	7	1	170	170
Liver[d]	1	1	90	90
Oranges[e]	3	1	205	205

[a] Supplement content and dosage is based on MSPAS 2004.
[b] The estimated serving sizes are based on the dietary data collected in Huehuetenango and Quiché.
[c] The fortified cereal should have similar micronutrient content to Incaparina.
[d] Liver is included in the dietary recommendations so that pregnant and lactating women can meet vitamin B12 requirements.
[e] Oranges could be replaced with another fruit or vegetable with high vitamin C content.

Result 4. Cost of the lowest-cost diet that meets or comes as close as possible to meeting nutrient needs. **Table 13** presents the total cost of the lowest-cost diet that meets or comes as close as possible to meeting nutrient needs, and the highest percentage of the RDA achievable in the diet.[11] These lowest-cost diets ranged from 1.8 GTQ/day (about US$0.23/day) for children 6–8 months old to 19.1 GTQ/day (about US$2.38/day) for lactating women.[12] Considering that average household size among the study population was seven people, that 51% of the population living in the five departments of the Western Highlands earn less than 25 GTQ/day (US$3.13/day), and that 15% of the population earn less than 12 GTQ/day (US$ 1.50/day) (INE 2011), it appears that a nutritionally adequate diet for young children and pregnant and lactating women is not affordable for many households in the Western Highlands.

[11] Note that only foods that contribute 10% or more of the total FBR cost are included here.
[12] The exchange rate at the time of writing this document was 7.90–8.01 GTQ per US$1, accessed August 27, 2013 at http://www.banguat.gob.gt.

Programs that provide micronutrient supplementation—using either fortified blended flours or MNP—and that are contemplated by the GOG can help in this regard.

Table 13. Lowest-cost diets that meet or come as close as possible to meeting nutrient needs for each target group

Target group	Cost (GTQ/day)	Foods that contribute ≥ 10% of cost[a]	Highest % of RDAs[b] achievable through FBR (nutrients < RDA)
Breastfed 6–8 months old	1.8	Tortilla, or other maize product (24%) Egg (11%) Incaparina (10%)	Calcium (97% RDA) Iron (94% RDA) Zinc (64% RDA)
Breastfed 9–11 months old	2.6	Egg (21%) Tortilla, or other maize product (10%)	Zinc (77% RDA)
Breastfed 12–23 months old	4.3	Egg (35%)	Iron (91% RDA)
Non-breastfed 12–23 months old	5.7	Eggs (17%) Tortilla, or other maize product (16%) Bread (13%)	n/a
Pregnant women	15.6	Tortilla, or other maize product (28%) Chicken (12%)	Folate (96% RDA) Zinc (90% RDA)
Lactating women	19.1	Tortilla, or other maize product (39%)	n/a

[a] Value in parentheses is the percentage of the total cost for that food.
[b] Value in parentheses is the high percentage of the RDA achievable and the value achieved in the lowest-cost diet that meets or comes as close as possible to meeting nutrient needs.

Fortified blended flours. Programs aimed at reducing chronic malnutrition in Guatemala often include distribution of fortified blended flours (often referred to in Guatemala as fortified complementary foods). For example, the World Food Programme (WFP) has supported the distribution of Vitacereal and the USAID-funded Title II Development Food Assistance Program distributes corn-soy blend (CSB) in limited geographic areas.[13] This type of product was not reported in the dietary survey. However, given that the GOG plans to reintroduce Vitacereal and that Title II programs in Guatemala distribute CSB, additional analysis was undertaken to assess whether Vitacereal or CSB could contribute to improve the

[13] Vitacereal is a fortified, maize soy meal produced in Guatemala and distributed by the GOG as part of their social programs. This complementary food is fortified with iron, zinc, calcium, thiamine, riboflavin, vitamin B6, vitamin A, vitamin D, vitamin E, vitamin C, niacin, folic acid, vitamin B12, and iodine. Vitacereal is specifically marketed as a complementary food for children 6–23 months of age and also for pregnant and lactating women. CSB is a fortified corn, soy flour that is provided in USAID Food for Peace Title II food assistance programs in Guatemala. CSB is fortified with vitamin A, vitamin D, vitamin E, vitamin K, thiamine, riboflavin, niacin, vitamin B6, folate, vitamin B12, vitamin C, biotin, iodine, iron, zinc, potassium, calcium, and phosphorus. Please note the CSB currently provided in Guatemala is not CSB+, which is a CSB product with improved amounts and forms of vitamins and minerals in the vitamin/mineral premix.

quality of the diet of the target groups with the highest nutrient requirements and the most limited gastric capacity (i.e., breastfed children 6–8 months old and breastfed children 9–11 months old). Vitacereal and CSB were tested separately in combination with various sets of FBRs based on the final set of FBRs for these age groups. The quantities of fortified blended flours tested were based on the serving size of a fortified complementary food, such as Incaparina, which was found in the cross-sectional survey prepared as thin watery drink. For the purpose of the analysis, the intake amount was increased by 50% to reflect a recommended thicker preparation of the fortified blended flour in porridge. For children 6–8 months old, Optifood analysis included an estimated serving per day of 27 g of a fortified blended flour with a nutrient composition similar to Incaparina. For children 9–11 months old, the estimated serving per day was 30 g.

For children 6–8 months, even when tested with the maximum number of FBRs allowable, Vitacereal could not meet iron and zinc requirements and CSB could not meet zinc requirements. For children 9–11 months old, all nutrient requirements were met with the full set of FBRs and Vitacereal. However, even with the full set of FBRs, CSB could not meet zinc requirements for children 9–11 months old.

Although they can contribute to improved nutrient intake, it is important to note that as an intervention to improve diet quality for young children, Vitacereal and CSB are suboptimal solutions for additional reasons, including their relatively large content of antinutrients and fibers; overall low fat content; low level of essential fatty acid levels; and lack of milk powder, which increasingly appears to contribute to linear growth of young children (De Pee and Bleom 2009). Other disadvantages of fortified blended flours available in Guatemala include the tendency to prepare them as a thin, watery drink called *atole* (e.g., just 75 g of Incaparina in 1,000 ml of water).

4. Summary of Results

- The women and children surveyed came from predominantly rural, indigenous households characterized by high prevalence of stunting and anemia.
- Roughly half of households experienced anxiety or concern regarding food security in the 30 days preceding the survey, although few households reported experiencing hunger according to the subset of questions focused on lack of food.
- The largest problems identified in the diets of the women and children surveyed related to diet quality, not to the quantity of food consumed in terms of energy and calories.
- The amount of energy for all child target groups in both departments was considered adequate.
- Although protein intake from complementary foods for all child target groups in both departments was in the "adequate" range, the quality of protein may be inadequate considering that the majority of the protein in the diet was from maize and that very few animal-source foods were consumed. Grains and legumes were not often consumed together, resulting in inadequate essential amino acids for a complete protein.
- The mean estimated energy and protein intake for pregnant and lactating women in both departments was low compared to their estimated requirements. However, given the variability in the amounts consumed, looking at average consumption makes it difficult to assess if actual intakes were low.
- The diets of the women and children surveyed were largely plant-based with few animal-source foods and fortified foods. A largely plant-based diet with few fortified foods is disadvantageous, because of the relatively high content of antinutrients that impede the uptake of other nutrients, the lower bioavailability of certain micronutrients, and the lack of specific nutrients and active compounds contained in animal-source foods (De Pee and Bleom 2009).
- The iron and zinc densities of complementary foods consumed by children 6–11 months old in the survey group were inadequate.
- Optifood analysis found similar results to previous studies in Guatemala with regard to problem nutrients (i.e., iron, zinc, folate, and vitamin B12) (Vossenaar and Solomons 2012; Dewey and Brown 2003). The problem nutrients identified by Optifood also coincide with deficiencies in iron, zinc, and vitamin B12 among children and women identified in the 2009–2010 Encuesta Nacional de Micronutrientes (ENMICRON) (National Survey of Micronutrients) (MSPAS 2011).
- For all target groups, it is necessary to combine FBRs with micronutrient supplements to meet nutrient requirements.
- In addition to micronutrient supplements, for all target groups, a combination of four to seven individual FBRs was required to ensure that dietary adequacy of all nutrients was met.
- For children 6–8 months old, the high densities of iron and zinc recommended in complementary foods could not be achieved through FBRs without including micronutrient supplementation. Even adding Vitacereal to the diet could not meet iron and zinc requirements. The addition of CSB could not meet zinc requirements.
- For children 9–11 months old, the addition of CSB to the diet could not meet zinc requirements. However, all nutrient requirements were met with the addition of Vitacereal.
- Locally available foods cannot meet the requirement for iron for pregnant women. Pregnant women should follow the MSPAS protocol to consume 600 mg of ferrous sulfate and 5 mg of folic acid once per week.
- Even with micronutrient supplementation, a nutritionally adequate diet may not be affordable for some households in the Western Highlands.
- Multiple constraints may prevent families from implementing the FBRs. Other constraints, such as time required to prepare food and fuel needed, should be further explored to develop effective strategies for supporting a nutritionally adequate diet for the most vulnerable groups.

5. Conclusions and Next Steps

The analysis provided technical information regarding problem nutrients, best food sources for nutrients, FBRs that could meet or come as close as possible to meeting the nutrient needs for individuals in the target groups, and the cost of consuming a diet that meets or comes as close as possible to meeting nutrient needs. However, questions remain regarding the feasibility and affordability of implementing the FBRs and strategies needed to bridge nutrient gaps in the local food supply. Therefore, an immediate next step for USAID/Guatemala, the GOG, and partners is to review the results of the analysis, in the context of their experience and current programs, and to develop an integrated plan to improve the nutrient intake of women and children through a range of options, which may include FBRs, promotion of agriculture or animal husbandry, fortification, supplementation, or other approaches. The following issues should be considered.

1. **Role of agricultural interventions.** The analysis identified several important food sources for problem nutrients that could be promoted through agricultural interventions, including green leafy vegetables, black beans, and animal-source foods. More information is needed regarding the feasibility of home production of these foods, including the quantities of foods that need to be produced, the time burden or opportunity cost required to produce or cook foods, current levels of production, seasonality, and requirements for production (e.g., seeds, inputs, water, etc.).
2. **Existing fortification and supplementation policies.** The GOG already has in place several fortification and supplementation policies. For example, MSPAS policies include commercial fortification of sugar with vitamin A; salt with iodine; and wheat flour[14] with iron, thiamine, riboflavin, niacin, and folate acid. Policies on supplementation include routine MSPAS provision of vitamin A every 6 months to children 6–59 months of age, iron and folic acid supplementation for pregnant and lactating women, and MNP for children 6–59 months of age (in place of iron and folic acid) (MSPAS 2000; MSPAS 2004). The MSPAS also provides zinc as a therapeutic treatment for children with diarrhea. These policies need to be analyzed for their complementarity (or redundancy) of micronutrient approaches, their effectiveness to meet desired objectives (e.g., prevent anemia, promote linear growth), and their relationship to the findings presented in this report.
3. **Complementary food supplements.** This analysis indicates that the iron and zinc densities of complementary foods consumed by young children surveyed are inadequate. In addition, it seems that locally available fortified blended flours do not meet the nutrient requirements of children 6–11 months old. Some households may not be able to consistently afford animal-source foods. Complementary food supplements, depending on the type (e.g., MNP, lipid-based nutrient supplements), provide essential micronutrients, amino acids, fatty acids, and/or active compounds (enzymes).[15] More analysis is required to evaluate the need for and the effectiveness and feasibility of complementary food supplements.
4. **Feasibility and affordability of FBRs.** More work is needed to ensure that the FBRs are realistic and practical. After consultation with USAID/Guatemala, the GOG, and partners to reach general consensus around the FBRs, the feasibility of successfully promoting these specific FBRs should

[14] Policy - Reglamento Técnico Centroamericano RTCA 67.01.15.07 Harinas. Harina de Trigo Fortificada. Especificaciones. https://extranet.who.int/nutrition/gina/en/node/14871. Accessed September 19, 2013.

[15] Complementary food supplements are defined as food-based supplements that can be mixed with or consumed in addition to the diet to add nutritional value. Adapted from De Pee and Bloem 2009.

be evaluated via household trials in the Western Highlands (Dicken and Griffiths 1997). Some of testing of the FBRs has already been initiated; from June to August 2013, NutriSalud, INCAP, and LSHTM, with technical input from FANTA, tested the feasibility of FBRs for children 6–11 months in Chiantla, one of the prioritized municipalities of Huehuetenango (Knight 2013). These trials found that mothers of children 6–11 months were willing to try several of the FBRs for this age group, particularly preparation of thick porridges and use of potatoes in children's food. Other FBRs were more challenging to implement, such as recommended daily consumption of beans and animal-source foods. Building on these results, during 2014, FANTA, INCAP, and NutriSalud will further develop the findings from the Optifood analysis, support additional household trials of FBRs, and provide technical assistance to partners to address nutrient gaps through policy and programming strategies. Further exploration is needed on FBRs for children 6–11 months, along with FBR trials for children 12–23 months. For example, in Quiché, alternatives to the recommendation for daily potato consumption should be explored given stakeholders' comments that potatoes are rarely produced at the household level in Quiché and are not readily available. Additional FBR trials are also required because of the different socio-ethnographic groups prevailing in Quiché (Ixil and Quiché) versus Huehuetenango (Mam). Trials of FBRs for women should address the feasibility of pregnant women consuming liver once a week and oranges daily, as per current FBRs. Furthermore, FBR trials for women are needed to assess their feasibility given women's other time commitments for child care and food production and the fuel requirements, among other considerations. Planned trials during 2014 will identify individual FBRs that are feasible for families to implement, as well as barriers and potential motivating factors to help encourage their adoption. The final outcomes from such trials will be a realistic set of evidence-based, population-specific FBRs, and the content for messages to promote them in the Western Highlands.

5. **Development of a social and behavior change strategy and program activities.** Based on the household trials and the resulting key messages, NutriSalud intends to develop a behavior change strategy and program activites can be designed to promote the FBRs for the target groups.
6. **Applicability of the FBRs to other areas of the Western Highlands**. Studies are needed to determine if the FBRs may be applicable to other areas within the Western Highlands. The data used to set the model parameters in Optifood through the cross-sectional survey came from a limited area of the Western Highlands. Despite the variation in ecological zones and ethnolinguistic groups between the two departments, the results of the cross-sectional survey show that the dietary patterns and locally available foods of the two study areas were similar. As a result, common dietary recommendations were developed for both study areas. However, the extent to which the dietary recommendations could be applied to other areas of the Western Highlands still needs to be assessed.
7. **Strengthening the agricultural/nutrition linkages.** The results provided here can inform government strategies in promoting the production and consumption of foods identified in the FBRs. Collaboration with the Ministry of Agriculture and Livestock in developing extension programs that support the production of nutrient-dense foods and with MSPAS in developing SBCC messages that help consumers optimally integrate those foods in their diets are promising areas of investment.
8. **Involving the private sector.** The Optifood results were shared with private sector companies in Guatemala that are involved in manufacturing complementary foods. The Optifood results generated their interest in tailoring some of their products using the micronutrient formulation suggested by Optifood. Further work is under way to extend this into collaboration to field test complementary foods products currently under development. There is excellent potential for such collaboration, in terms of increasing access to optimal products at scale.

6. Challenges in Using Optifood to Develop FBRs

Several challenges should be mentioned regarding this type of comprehensive dietary analysis with Optifood. First and foremost, considerable time is required to collect high-quality dietary data from a randomized sample of individuals from each target group to reflect the target population's actual food consumption practices. Having an experienced local partner and adapting previously validated instruments can reduce the time needed.

Another important challenge is the attention required to prepare the dietary data and FCT data for the analysis in Optifood. This process requires considerable effort to examine the quality of the FCT values, impute missing values, and prepare all dietary data for the Optifood analysis. It would be valuable to develop computer programs that simplify this process. Until this is done, the effort required for data preparation will remain a hurdle to using Optifood. Also, the time required to fully analyze each target group should not be underestimated, as at least 1–2 days per target group is required. Additionally, since some FBRs can be strategically proposed across various target groups, sufficient time is valuable to ensure that messages are consistent across target groups, when feasible.

Finally, it is important to acknowledge some limitations posed by a cross-sectional survey that captures a snapshot of dietary patterns and food cost/availability during only one agricultural season. Qualitative methods that explore diets during other periods of the year are essential to develop FBRs that accommodate seasonal variation. Given the scope of this project, another limitation was the small sample size for individual target groups, which meant that model parameters for FBRs were defined from a limited number of data points. Additional time to carefully scrutinize the consistency of model parameters both within and across target groups and regions would have been preferable. Further analysis is not likely to have changed the final results of the FBRs, but it might have increased the accuracy of the estimated average serving sizes of nutrient-dense foods. Despite the challenges mentioned, the high-quality data input into Optifood during the Guatemala work resulted in a quality analysis, providing valuable insight into recommended approaches to improve nutrient intake.

References

Black, R.E. et al. 2013. “Maternal and child undernutrition and overweight in low-income and middle-income countries.” http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(13)60937-X/abstract.

Coates, J.; Swindale, A.; and Bilinsky, P. 2007. *Household Food Insecurity Access Scale (HFIAS) for Measurement of Food Access: Indicator Guide.* Washington, DC: FHI 360/FANTA.

De Pee, S. and Bloem, M.W. 2009. “Current and potential role of specially formulated foods and food supplements for preventing malnutrition among 6- to 23-month old children and for treating moderate malnutrition among 6- to 59-month-old children.” *Food and Nutrition Bulletin*, Vol. 30, No. 3.

Dewey, K. and Brown, K. 2003. “Update on technical issues concerning complementary feeding of young children in developing countries and implications for intervention programs.” *Food and Nutrition Bulletin*, Vol. 24, No. 1.

Dicken, K. and Griffiths, M. 1997. *Designing by Dialogue: A Program Planners’ Guide to Consultative Research for Improving Young Child Feeding.* Washington, DC: Academy for Educational Development.

GOG. n.d. “El Plan del Pacto Hambre Cero.” http://www.sesan.gob.gt/pdfs/documentos/PLAN%20HAMBRE%20CERO%202012.pdf.

INCAP. 2007. *Tabla de Composición de Alimentos de Centroamérica.* Second Edition. Menchú, M.T. and Méndez, H. (eds.). Guatemala: INCAP/OPS.

INE. 2011. *Encuesta Nacional de Condiciones de Vida.* Guatemala: INE.

Knight, F. 2013. *Development of a set of population specific food based recommendations for 6–11 month old children in the Western Highlands of Guatemala.* LSHTM.

Menchú, M.; Torún, B.; and Elias, L.G. 2012. *Recomendaciones dietéticas diarias del INCAP.* Second Edition. Guatemala: INCAP.

MSPAS. 2011. *Informe Preliminar: Encuesta Nacional de Micronutrientes 2009–2010.* Guatemala: MSPAS.

———. 2004. *Normas de atención en salud integral para primero y segundo nivel.* Guatemala: MSPAS.

———. 2000. *Reglamento para la fortificación del azúcar con vitamina A.* Acuerdo Gubernativo, No. 021-2000. Guatemala: MSPAS.

MSPAS/INE/CDC. 2010. *Encuesta Nacional de Salud Materno Infantil 2008 (ENSMI) 2008/09.* Guatemala: MSPAS/INE/CDC.

Pan American Health Organization. 2003. *Guiding principles for complementary feeding of the breastfed child.* Washington, DC: Pan American Health Organization.

Sprinkles Global Health Initiative. 2008. *Micronutrient Sprinkles for Use in Infants and Young Children: Guideline on Recommendations for Use and Program Monitoring and Evaluation.*

Stoltzfus, R.J. 2003. “Iron Deficiency: Global Prevalence and Consequences.” *Food Nutr Bull*. 2003 Dec;24(4 Suppl):S99–103.

USDA. 2010. *USDA National Nutrient Database for Standard Reference, Release 23*. Beltsville, MD: USDA Agricultural Research Service.

———. 2007. "USDA Table of Nutrient Retention Factors, Release 6." http://ars.usda.gov/SP2UserFiles/Place/12354500/Data/retn/retn06.pdf.

Vossenaar, M. and Solomons, N.W. 2012. "The concept of 'critical nutrient density' in complementary feeding: the demands on the 'family foods' for the nutrient adequacy of young Guatemalan children with continued breastfeeding." *American Journal of Clinical Nutrition*, 95:859–66.

WHO. 2011. *Guideline: Use of multiple micronutrient powders for home fortification of foods consumed by infants and children 6–23 months of age*. Geneva: WHO.

———. 2012. *Guideline: Daily iron and folic acid supplementation in pregnant women.* Geneva: WHO.

WHO/FAO/UNU. 2007. *Protein and Amino Acid Requirements in Human Nutrition.* WHO Technical Report Series 935. Geneva: WHO.

WHO/UNICEF. 1998. *Complementary feeding of young children in developing countries: A review of current scientific knowledge.* Geneva: WHO, WHO/NUT/98.1, 1998.