

# Considering Seasonal Variations in Food Availability and Caring Capacity when Planning Complementary Feeding Interventions in Developing Countries

Ramani Wijesinha-Bettoni, Gina Kennedy, Charity Dirorimwe and Ellen Muehlhoff\*

*Nutrition Education and Consumer Awareness Group, Nutrition Division, Food and Agriculture Organization of the United Nations, Viale delle Terme di Caracalla, 00153 Rome, Italy*

**Abstract:** During early childhood, adequate nutrition is critical for preventing and reducing chronic undernutrition and micronutrient deficiencies. Seasonal food availability, access to diverse food and maternal workload are among the known constraints to successful infant and young child feeding practices. In rural areas in developing countries, many populations experience seasonal food shortages, which often coincide with an increase in food prices and a peak period for agricultural labour. Seasonal pressure on women's time can negatively impact cooking and caring practices and intra-family food distribution. These factors combine to affect the nutritional status of especially children and women. This paper shows how seasonal food availability data are collected and utilized in designing complementary feeding interventions. Examples are drawn from FAO food and nutrition security projects in Afghanistan, Cambodia, Laos and Zambia which began with formative research using Trials of Improved Practices. Methods include use of seasonal food availability calendars and development of season-specific dishes and recipes. How seasonal variations in food availability and caring capacity feature in the educational materials developed by these projects is also reported. Finally, we provide practical ideas for incorporating coping strategies for dealing with seasonal effects when planning such interventions.

**Keywords:** Seasonality, infant and young child feeding, complementary feeding, trials of improved practices (TIPs), developing countries.

## INTRODUCTION

### Background

Adequate nutrition during infancy and early childhood is critical for optimal growth, health and cognitive development of children. Complementary feeding (CF) is the process which starts when breastmilk alone is no longer sufficient to meet the nutritional requirements of infants. Additional foods are needed to complement breastmilk intake from 6-23 months of age [1]. Infant and young child feeding (IYCF) interventions to prevent and address moderate malnutrition include nutrition education on CF practices, fortification of complementary foods with micronutrients, provision of complementary foods offering extra energy, and various processing/preparation techniques for enhanced nutrient density/bioavailability [2]. CF interventions with a food-based, comprehensive approach may be more effective, safer and sustainable than programmes targeting individual nutrient deficiencies in contexts where food insecurity is not a major constraint [3-4].

Seasonal availability and access to different foods were identified among the constraints to successful IYCF interventions in a WHO/UNICEF technical meeting [5]. Two of the five goals in the new Zero Hunger Challenge launched by the UN Secretary-General in 2012 are: 100% access to adequate food all year round (Goal 1) and Zero stunted children less than 2 years (Goal 2), "ensuring universal access to nutritious food in the 1000-day window of opportunity between the start of pregnancy and a child's second birthday, supported by nutrition-sensitive health care, water, sanitation, education and specific nutrition interventions, coupled with initiatives that enable empowerment of women"[6]. Seasonality affects the quantity and types of food available; seasonal increases in food prices and variability in available incomes at the household level all contribute to seasonal variations in the cost of an adequate diet [7].

### Seasonality and Children's Nutrition

In the first systematic study of seasonality for over 20 years, Chambers and co-workers examined how seasonality continues to be neglected despite being a glaringly obvious dimension of poverty, which affects the nutritional status of vulnerable groups [8]. The classical seasonality-nutrition scenario is that at the end of the dry season and during the rainy season food stocks run low, food prices increase and food consumption decreases. The rainy season is also a

\*Address correspondence to this author at the Nutrition Education and Consumer Awareness Group, Nutrition Division, Food and Agriculture Organization of the United Nations, Viale delle Terme di Caracalla, 00153 Rome, Italy; Tel: 0039 06 5705 4113; Fax: 0039 06 5705 4593; E-mail: Ellen.Muehlhoff@fao.org

The views expressed in this information product are those of the authors and do not necessarily reflect the views or policies of FAO.

period of intensive agricultural work with higher energy needs, coupled with greater exposure to infectious diseases due to the wet conditions. Since women are actively involved in agriculture especially during the busy planting season and children are most vulnerable to infections (especially diarrhoea, malaria and upper respiratory infections), the nutritional status particularly of these groups is negatively affected [9]. This pattern is not universal in rural areas of developing countries, but is likely in farmers, who are too poor to buy the food that is needed when own stocks are depleted [9].

Early studies found that children's nutritional status was at its lowest when low food availability coincided with periods of peak labour [10]. A study in Kenya found that the prevalence of low weight-for-age showed a consistent seasonal pattern in children aged 6-23 months [9]. Among agricultural communities seasonal food shortages have been found to be one of the common causes of acute malnutrition or wasting [11]. Golden [12] also ascribed marked fluctuation in the prevalence of malnutrition in children to seasonal shortages and changes in diets. In terms of micronutrients, vitamin A and/or vitamin C status is most affected by seasonal variations in food availability, often linked to availability of fruit/vegetables [13-15].

Women's heavy workload may negatively affect food intake, not only for their children and other members of their families but also for the women themselves. The combination of low food availability and less time for food preparation may result in lower meal frequency and smaller meals that are less varied and less well prepared [10]. Shortage of mother's time could also influence caring capacity [16]. The question of the quality of childcare also arises, with common options often being other family members or other adults [17]. Without childcare, women working as labourers are often forced to take their young children into the fields [18] where it is difficult to provide the desired quantity and quality of complementary food. Studies on women's seasonal work and pregnancy outcomes have suggested that low birth weights are related to women's seasonal workload [10]. Improved birth weight is as an essential first step in reducing stunting at 2 years of age [19]. Other potential consequences of women's increased seasonal workload include lack of time for other tasks such as food gathering, house-cleaning and fuel and water collection [8].

The impact of seasonality on nutritional status varies with factors like socioeconomic status and gender differences [20]. It has been argued that children are most severely affected during periods of food scarcity, since resources may be preferentially allocated to the more "productive" members of the household (HH). Although one study supports this assumption [21], more studies suggest that children are preferentially allocated food and protected from seasonal food shortages [20, 22-23]. Various communities use different means of coping with seasonal food shortages [20, 23-24]. Decrease of mother's personal food intake in order to protect the nutritional status of their children has also been recorded [20, 25].

## **Objectives**

International guidelines on planning CF interventions recommend assessment of the food security situation of the target population, including seasonal food shortages and hunger patterns [1, 5, 26]. This paper looks at data gathered from FAO complementary feeding projects that used the Trials of Improved Practices (TIPs) methodology in Afghanistan, Cambodia, Laos and Zambia. The paper describes how seasonal food data collected as part of these projects can be presented and utilized to inform the design of food and nutrition security programmes to enhance their impact on family nutrition. The paper also shows the extent to which seasonal variations in food availability and caring capacity feature in the educational materials developed by these projects, and documents practical recommendations given for mitigating seasonal effects, when planning CF interventions. (This paper is not intended to present an evaluation of the process or outcomes of TIPs.)

## **MATERIALS AND METHODS**

### **Data Analysis**

We reviewed FAO grey literature from four FAO food and nutrition security projects which included a complementary feeding component. Two of the authors were directly involved in these projects. Common features of the projects were examined and it became apparent that a common underlying theme in this literature was seasonal food availability. This initial finding supported observational evidence that suggested that a major constraint facing families is seasonal food availability and affordable sources of

micronutrient-rich foods. Related FAO project documents were then searched for key words such as “season”, “food availability”, “constraints” and “workload”, in order to identify literature that had specifically mentioned issues in these areas. The findings were organized into various predominant themes (household seasonal food availability and women’s time constraints; creation and use of seasonal food availability calendars; development and testing of season-specific dishes and recipes; and proposed mechanisms to buffer negative seasonal effects on family and child food intake). The data obtained from the four case study sites was organized into a standardized format for analyzing and discussing commonalities across the countries.

### **Brief Description of Grey Literature Used**

Sources included data presented at regional workshops and project reports of FAO officers and consultants from FAO food security projects in Afghanistan, Cambodia, Laos and Zambia. The information in the documents on the TIPs process was originally obtained using descriptive research methodology, with pre-tested data collection forms and recording guides/checklists developed by FAO and used during the TIPs’ home visits. Community-level TIPs facilitators were trained on using the questionnaires and forms for recording observations. CF manuals or recipe books that were produced containing recipes that were successfully field-tested during the TIPs trials were also consulted. These are available for Afghanistan [27], Zambia [28] and Cambodia [29-30].

### **Development of Seasonal Food Availability Calendars**

A Seasonal Food Availability calendar (SFAC) is a visual expression of year round food availability expressed in months and/or seasons in a year. SFACs show periods of the year in which different foods are available and also highlight periods in which households have difficulty in making balanced meals. The SFAC can be a useful tool for identifying corrective actions to overcome food shortages, such as modifying food production and engaging in processing activities during periods of surplus or favourable weather conditions. In the FAO-supported TIPs studies, SFACs were developed using a community based approach tailored to the local situation. Using this approach, the community is gathered, and issues relating to the

problem of seasonal food availability are discussed. The discussion is facilitated along the following themes:

- a) Listing of foods commonly grown and consumed
- b) Categorizing foods according to availability by month, ranging from abundant to not available at all.
- c) Depicting the findings in a calendar format. The format is selected based on community characteristics such as literacy.

### **TIPs Methodology Used for Collecting Household Food Availability Data and for Field Testing Recipes**

The projects used a consistent methodology based on TIPs [31] in all four countries to develop child feeding recommendations (6-23 months) and assess the acceptability and feasibility of adopting nutritionally improved CF recipes using locally available and affordable foods in different seasons, and local processing and cooking equipment/utensils. During TIPs a combination of exploratory research methods such as in-depth interviews and household observations were conducted. Households were purposively selected according to TIPs guidelines. The participants lived in rural areas with poor market integration, where seasonal differences in food availability are pronounced. TIPs trainers and facilitators generally involved multi-sectoral teams from the Ministries of Health, Agriculture, Education and Women’s Affairs and Department of Community Development, depending on the country. Round one of the TIPs field work consisted of four home visits: during the first visit the family food security (FS) situation, feeding behaviours and dietary intake were evaluated. Subsequent home visits assessed families’ ability to engage in selected improved practices, such as preparing thicker complementary foods, and/or increasing the diversity and quantity of food fed, as well as increasing feeding frequency and practicing active feeding. Round two of TIPs consisted of three home visits with the family FS situation and child feeding behaviours being reassessed in the first visit and the families’ ability to engage in selected improved practices assessed in subsequent visits.

One round of visits was designed to capture complementary feeding improvements which HHs could do during the pre-harvest lean season (late dry season) and the other round was designed to capture improvements feasible during the harvest season (late

**Afghanistan:** Winter grains are wheat and barley

Staple Crop	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Maize					Brown	Green	Green	Yellow				
Rice					Brown	Brown	Green	Green	Green	Yellow	Yellow	
Spring wheat*			Brown	Brown	Green	Green	Green	Yellow	Yellow			
Winter grains	Green	Green	Green	Green	Yellow	Yellow				Brown	Brown	Green
TIPs											Diagonal	Diagonal
Seasons	winter		spring			summer			autumn			

**Cambodia**

Staple Crop	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Maize					Brown	Brown	Green	Green	Yellow	Yellow		
Rice (dry s.)	Brown	Green	Yellow	Yellow								
Rice (main wet)							Brown	Brown	Brown	Brown	Green	Green
TIPs	Diagonal							Diagonal	Diagonal	Diagonal		Diagonal
Seasons					wet					dry		

**Laos**

Staple Crop	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	
Rice (dry s.)	Brown	Green	Green	Yellow									
Rice (wet s.)					Brown	Brown	Brown	Green	Green	Green	Yellow	Yellow	
TIPs	Diagonal	Diagonal			Diagonal	Diagonal	Diagonal	Diagonal				Diagonal	
Seasons					wet							dry	

**Zambia**

Staple Crop	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	
Maize	Green	Green	Green	Green	Yellow	Yellow					Brown	Brown	
Millet	Green	Green	Green	Green	Green	Green	Yellow					Brown	
Sorghum	Brown	Green	Green	Green	Yellow	Yellow						Brown	
Wheat					Brown	Brown	Green	Green	Green	Yellow	Yellow		
TIPs		Diagonal	Diagonal							Diagonal	Diagonal	Diagonal	
Seasons					dry							wet	

**Figure 1:** Crop cycle for main crops in Afghanistan, Cambodia, Laos and Zambia [43], with seasons and months where TIPs were carried out indicated. Brown: sowing (peak labour); green: growing; yellow: harvesting (peak labour).

wet season), when HHs have access to a wider variety of foods. Some countries started with the harvest season, while others started with lean season trials for reasons including duration of the food seasons and project timeline. Hence visits were not necessarily scheduled to allow pre-post intervention, but overall outcomes of the trials gave a basis for developing food security interventions, some of which were season specific.

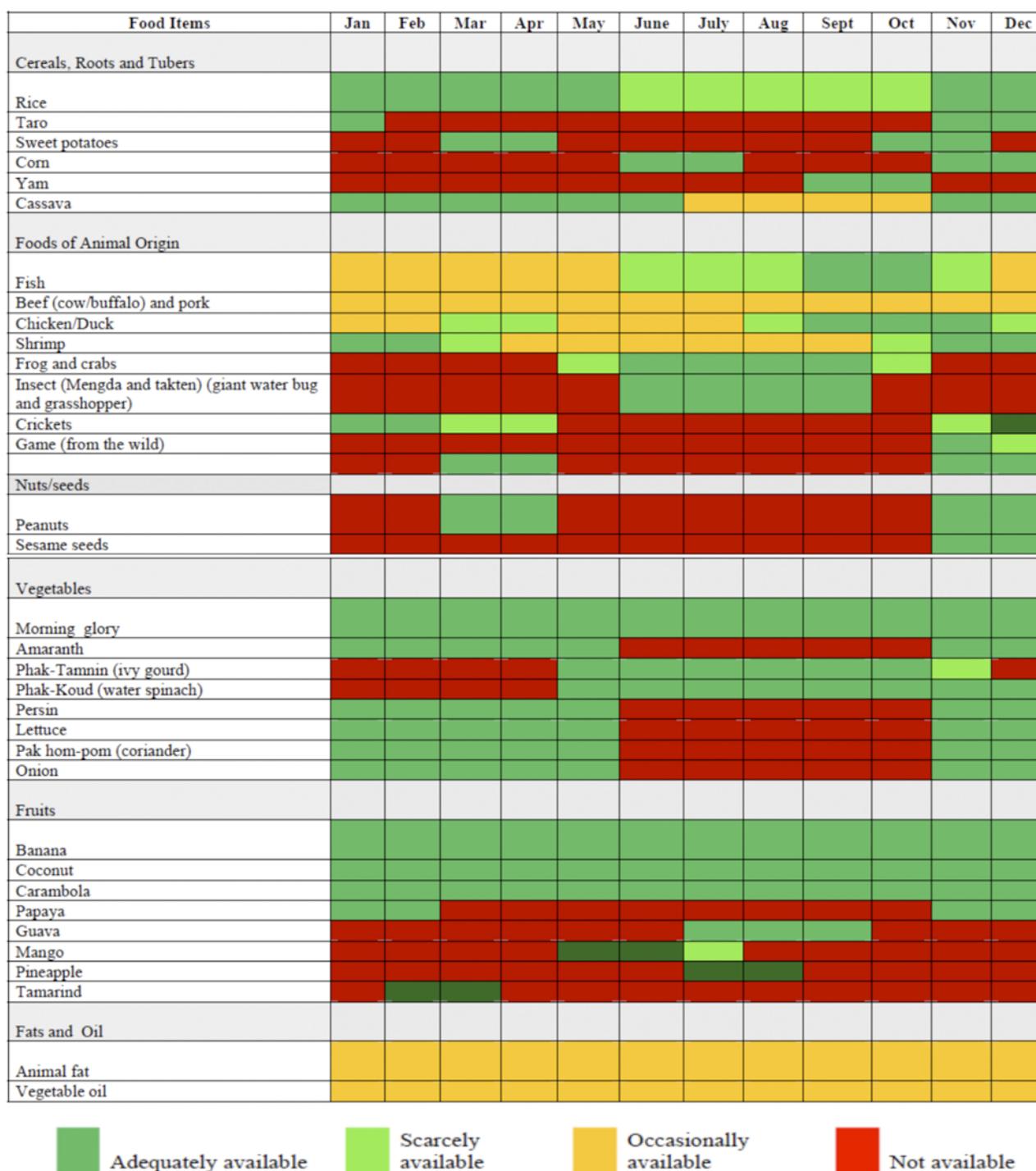
## Study Settings

### Afghanistan

The country has four distinct seasons: winter, spring, summer and autumn (see Figure 1)<sup>1</sup>. TIPs were

<sup>1</sup>Please note, the four countries are not in the same climatic region, hence types of season differ. Afghanistan has a continental climate, and thus seasons differ from those in the other countries, which have dry and wet (rainy) seasons.





**Figure 3:** Seasonal Food Availability Calendar for Laos: Ban Hat Pho and Ban Non Somboon Communities.

information from the initial assessment stage was not available. The rainy season (wet season) trials were conducted from February-March 2004 in four districts Chieng, Nchelenge, Kawambwa and Mwense, covering 188 HHs, 64 of which had been covered during the dry season TIPs.

Figure 1 shows the crop cycles for the four countries included in this study.

## RESULTS

### Collecting and Presenting Seasonality Data:

#### a. Community Food Availability: Seasonal Effects

During the TIPs preparatory phase, communities either prepared or provided information for the preparation of seasonal food availability calendars (SFACs), which

Seasonal Food Calendar: Qala-e-Mirgol Village, Gozerah Distric, Herat Province, Afghanistan

	Hamal (March)	Sour (April)	Jawza (May)	Saratan (June)	Asad (July)	Sunbulah (Aug)	Mizan (Sept)	Agrab (Oct)	Qaus (Nov)	Jadi (Dec)	Dalwa (Jan)	Haut (Feb)
Cereals	Orange	Orange	Orange	Orange	Green	Green	Green	Yellow	Yellow	Yellow	Yellow	Orange
Pulses & nuts	Orange	Orange	Orange	Yellow	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Orange
Roots	Orange	Orange	Orange	Green	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Orange
Vegetables	Red	Red	Red	Green	Green	Green	Yellow	Yellow	Yellow	Red	Red	Orange
Fruits	Orange	Orange	Orange	Green	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Red
Dairy products	Yellow	Yellow	Green	Green	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Orange
Meat/eggs/fish	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Orange	Orange	Orange	Orange	Orange	Orange
Fats	Orange	Orange	Yellow	Yellow	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Orange
Sugars	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange
Wild foods	Yellow	Green	Yellow	Yellow	Red	Red	Red	Red	Red	Red	Red	Red

Seasonal Food Calendar: Deh-Shar Village, Shughnan Distric, Badakhshan Province, Afghanistan

Food Type	Hamal (March)	Sour (April)	Jawza (May)	Saratan (June)	Asad (July)	Sunbulah (Aug)	Mizan (Sept)	Agrab (Oct)	Qaus (Nov)	Jadi (Dec)	Dalwa (Jan)	Haut (Feb)
Cereals	Orange	Orange	Orange	Orange	Orange	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Orange
Pulses & nuts	Red	Red	Red	Red	Red	Orange	Orange	Red	Red	Red	Red	Red
Roots	Red	Red	Red	Red	Red	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Orange
Vegetables	Red	Red	Red	Red	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Orange
Fruits	Red	Red	Red	Red	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Orange
Dairy products	Red	Yellow	Yellow	Yellow	Yellow	Yellow	Red	Red	Red	Red	Red	Red
Meat/eggs/fish	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange
Fats	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange
Sugars	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange
Wild foods	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red

Colour code: Red: not available; Orange: available in small quantities; Yellow: available in good quantities; Green: abundant

Figure 4: Seasonal food availability calendar for Afghanistan.

mapped food variety and availability throughout the year. Data collected during the initial home visits confirmed these food availability patterns.

Some examples of SFACs prepared in the FAO projects are given in Figures 2-4. Food availability was assessed by food group in Afghanistan but was disaggregated by food items within groups in Laos and Cambodia. SFACs can have different formats, such as colour coding to show times of plenty and times of scarcity (e.g. Afghanistan); thickness of bar reflecting periods of plenty (thick bars) and times of scarcity (thin bars) or using small pieces of actual foods to construct the calendar (e.g. Cambodia). The use of colours, symbols, drawings and food models is particularly useful in semi-literate communities.

Figure 4 shows the SFACs from Afghanistan for a village in Herat province and one in Badakhshan province. The contrast in seasonal food availability between these two villages is obvious. In Herat, cereals, potatoes, legumes and dairy products are available all year round; cultivated vegetable supplies

diminish from December-June, but the gap is filled by fruits and wild vegetables. In contrast, in Badakhshan, none of the food groups are abundant at any time. Pulses and nuts are only available (albeit in small quantities) only for 2 months of the year. Roots, fruit/vegetables and dairy products are available for 2-5 months of the year.

**b. Household Food Availability and Women’s Time Constraints: Seasonal Effects**

Checklists used during the first TIPs home visit included questions on year round availability of specific food groups and any specific times of the year when shortages are experienced. A question on types of foods collected from the wild (e.g. insects, vegetables) was also asked together with periods when these foods are normally collected. Records of food availability, consumption and CF practices at HH level obtained in this manner for Laos and Zambia and are shown in Tables 1 and 2.

The information given in column 2 of Table 1 (Laos) is similar to information previously seen in the SFAC for

**Table 1: Summary of village level discussions on food production, availability and utilization in Laos. Rainy season: May-October; dry season: November-April. Lean season refers to the pre-harvest months, which are the last months of the rainy season (August-October)**

Issue	Bolikhambxai Province		Sekong Province		Luang Namtha Province	
	Bolikhhan District		Laman District		Namtha District	Vieng Phoukho District
	Ban Hat Pho + Ban Non Sombonn	Ban Phaday	Ban Pak Thon	Ban Beng	Nam Lu-Lenten Ethnics	Ban Kampone
Staples produced	Sticky rice and ordinary rice	Sticky and ordinary rice	Sticky rice	Stick rice	Sticky and ordinary rice	Sticky rice
Roots and tubers produced	Sweet potatoes and cassava	Sweet potatoes and cassava	Sweet potatoes and cassava	Sweet potatoes and cassava	Sweet potatoes, taro and cassava	Sweet potatoes, taro and cassava
Cash crops and source of income	Tobacco, chillies and surplus rice	Chillies and surplus rise	Not mentioned	Groundnuts and surplus rice	Rubber, chillies & woven cloth	Groundnuts, yellow corn and sunflower
Availability of Staple food	Rice is available all year round for most households. Surplus is sold. Some households have shortage from July-August.	Most households produce enough with surplus. Poor households experience shortages.	Rice is available all year for most households. Some experience shortages during March-May.	Rice is available all year round. Households have two harvests, the second crop is produced under irrigation.	Rice is available all year round for most households. Households with not much land experience rice shortage.	Own produce is low because of poor soils and shift cultivation, rice shortages are experienced.
Coping strategy during periods of rice shortage	Collect food from forest and work as day labourers to get income to purchase food.	Work as day labourers to get income to purchase food and/or collect food from forest.	Not discussed	Most households produce enough with surplus.	Work as day labourers to get income to purchase food and/or collect food from forest.	Purchase additional rice with cash from selling corn, sunflower and groundnuts.
Availability of vegetables	Cultivated and wild vegetables abundant during the rains (June-October) Not enough during dry season (April-June)	Cultivated and wild vegetables abundant during rains, but shortage during dry season. No knowledge to preserve surplus.	Cultivated and wild vegetables abundant during rains, but shortage during dry season. No knowledge to preserve surplus.	Cultivated and wild vegetables abundant all year round because all have gardens.	Cultivated and wild vegetables abundant during the rains (June-October). Vegetables are consumed daily.	Cultivated and wild vegetables abundant during the rains, but inadequate during the dry season.
Availability of fish	Readily available from the river.	Good availability from the river, especially in August. Fish preservation techniques include drying, fermentation and salting.	Readily available from the river.	Not readily available. Consumption is therefore low.	Little available from river, but sometimes bought from market. Consume 1-2 times per month	Fish, crabs, snails and shrimps are available and are consumed 1-2 times per week.
Availability of legumes	Mostly eaten as green beans.	Mostly eaten as green beans Some dry seed and use for snacks.	Mostly eaten as green beans.	Mostly eaten as green beans.	Mostly eaten as green beans. Dried beans are eaten with rice.	Mostly eaten as green beans.
Availability of groundnuts and seeds	Produce for home consumption as snack, also grow sesame seeds.	Produce for home consumption as snack.	Produce for home consumption as snack.	Produce as cash crop and home consumption as snack. Groundnuts are eaten with rice	Produce for sale and home consumption. Sesame is grown and added to vegetables.	Produce for sale and home consumption. Eat as snack and added to vegetables. Sesame is grown and added to vegetables.

(Table 1). Continued.

Issue	Bolikhamxai Province		Sekong Province		Luang Namtha Province	
	Bolikhon District		Laman District		Namtha District	Vieng Phoukho District
	Ban Hat Pho + Ban Non Sombonn	Ban Phaday	Ban Pak Thon	Ban Beng	Nam Lu-Lenten Ethnics	Ban Kampone
Availability of meat and eggs	Meat is occasionally available, but expensive. Eggs consumed by some as omelette.	Meat is occasionally available, but expensive.	Meat is occasionally available, but expensive. Eggs consumed by some.	Meat is occasionally available, but expensive. Eggs consumed by some.	Meat is occasionally available and eaten 1-2 times per week. Eggs consumed by some.	Meat and/or eggs consumed once a week.
Availability of insects and worms	Collect from the forest	Collect from the forest	Not discussed	Not discussed	Collect from the forest	Collect from the forest
Availability of fats and oils	Not discussed	Not discussed	Rarely used	Rarely used	Fry foods (vegetables) using pork fat	Fry using pork fat or purchased vegetable oil
Daily meal frequency and main determinant	3 meals/day all year round Meal quality changes in lean season	3 meals/day all year round Meal quality changes in lean season	For most, 3 meals/day all year round For a few, 2 daily meals in lean season	For most, 3 meals/day all year round For a few, 2 meals in lean season	3 meals/day all year round Meal quality changes in lean season.	3 meals/day all year round Lean season meals are poor
Main family dish (s)	Mainly sticky rice with vegetable, fish or meat dish/sauce	Mainly sticky rice with vegetable, fish or meat dish/sauce	Mainly sticky rice with vegetable, fish or meat dish/sauce	Mainly sticky rice with vegetable, fish or meat dish/sauce	Sticky and ordinary rice with a sauce Local noodles	Mainly sticky rice with a sauce Cassava with pork

these two communities in the Bolikhamxai Province, although, the information provided in the SFAC was more in-depth. However, Table 1 allows us to make a comparison in seasonal food availability between provinces. Most villages in Laos have one rice harvest, and harvesting is done from October to November. Poor households, especially those with smaller pieces of land experience rice shortages during March to May in some areas. To purchase rice, these households work as day labourers, or eat food collected from the forest. Cultivated and wild vegetables are abundant during the rainy season (June-October). Most communities experience a shortage of vegetables from April-June. During this period, fewer vegetable dishes are consumed and fewer vegetables added to soups. Fish was readily available in 3 villages, seasonally available (in August) in one village, and not available in two villages. In most villages meat was only occasionally available, due to high cost. Four villages collected edible insects and worms from the forest (Table 1).

Most communities in Laos consume sticky rice with a vegetable, fish or meat dish and daily meal frequency

was 3 meals/day in all communities visited. During the lean season (the pre-harvest months, which are the last months of the rainy season, i.e. August-October) meal diversity decreases, and some households in Sekong Province also reported reduced daily meal frequency. Complementary foods consisted primarily of sticky rice, with children fed 3 times a day, although one village reported rice soup enriched with vegetables and meat when available, 3-4 times a day.

In Zambia cassava was available all year round but all districts reported lower quantities during December-March due to problems with sun-drying sufficient quantities during the rains (Table 2). Also, women could only carry limited quantities from the field because of heavy rains and difficulty in transporting the tubers. Maize was available for up to six months of the year (April-October) from household stocks in three districts and from March-May in the fourth district. Seasonal availability of vegetables was recorded, with some villages consuming dried vegetables or exotic fresh vegetables during periods of local shortage. Villages in Chieng district reported limited fish availability between April and July, while in Nchelenge

**Table 2: Summary of Village Level Discussions on Food Production, Availability and Utilization in Zambia. Dry season: April-October; Wet (rainy) season: November-March**

Issue/ Characteristics	Chiengwe District	Nchelenge District	Kawambwa District	Mwense District
Availability of cassava	Available all year round, with less available December-March because of processing problems during rains	Available all year, with less available December -March because of processing problems during rains	Available all year, with less available December -March	Available all year, with less available December -March
Availability of maize	Available April-October	Available April-October	Available April -October	Available March-May
Availability of groundnut	Available April to December	Groundnuts available April-October	Groundnuts available April-October	Groundnuts available April-October
Availability of other legumes	Legumes are available March-October	Beans and bambara groundnuts are available April-October	Beans and cowpeas are available April-October	Beans and cowpeas are available April-October
Availability of fish	Fish stocks are limited between April to July.	Fish is available all year, despite fish ban.	Fish is expensive in December-March.	Fish is expensive December to March.
Availability of vegetables	Reduced stocks June-October.	Reduced stocks June-October.	Cassava, beans, pumpkin leaves, mushroom, sweet potato leaves, mangoes and avocados are available November to April. Exotic fresh vegetables and dried vegetables April-October.	Cassava, beans, pumpkin leaves, mushroom, sweet potato leaves and mangoes are available December-May. Exotic fresh vegetables and dried vegetables are available June-November.
Daily meal frequency, seasonal variations and reasons	Late rainy into early dry season: Three meals per day during the late rainy and early dry seasons, when food is plentiful after the harvest and during the early dry season when food stocks are good. Dry to early rainy season: Two meals per day during the dry to early rainy season. Families cope with reduced food stocks by consuming only two meals per day and also reduce meal frequency during periods of heavy workload during planting.	Late rainy season: Three meals per day during the late rainy season, when food is plentiful and there is an increased variety of food. Late dry season: Two meals per day during the late dry season when household food stocks are low.	Early dry season: 2-3 meals per day are consumed during the early dry season due to better food availability just after the harvest. There is an increased variety of legumes. Early rainy season: Meal frequency falls to one to two meals per day during the early rainy season because of low cereal, however, there are more vegetables and fruits; fish is available.	Late rainy season: Two major meals + snacks between meals - food is abundant during the late rainy season up to June Dry season: 2-3 meals per day. Early rainy season: 1-2 meals per day
Composition of main dishes and seasonal variation	Dry season: Cassava nshima with fish, beans, cabbage, rape and preserved traditional vegetables Rainy season: Cassava nshima with fish, bean leaves, pumpkin leaves, sweet potato leaves and mushroom Early dry season: Maize/cassava nshima with rape, African egg plant, fish, preserved traditional vegetable	Dry season: Beans, fish, meat, chicken, cassava leaves with cassava/maize meal Rainy season: Cassava with pumpkin leaves, kalembule, beans or fish	Dry season: Nshima (cassava/maize) with beans, chicken, fish, goat, vegetables and groundnuts which are readily available Rainy season: Nshima (cassava) with mushroom, okra, cassava leaves, sweet potato leaves, pumpkin leaves, fish, chicken which are readily available at that time	Dry season: October-March: Cassava meals April-September: Maize meals served with vegetables and groundnuts and sometimes fish during August-November Rainy season: Cassava nshima with fish, bean leaves, pumpkin leaves, sweet potato leaves and mushroom
Daily frequency complementary feeding	0-5 months: porridge given two times per day 6-11 months: porridge and nshima given 2-3 times per day 12-17 months: porridge and nshima given 3 times per day 18-24 months: nshima given 2-3 times per day	Daily frequency is 2 times a day for other foods	Four meals per day when food is available, 1-2 times per day during food shortages * cassava not considered a meal by this discussion group	Information not available

**Table 3: Season-Specific Recipes in Zambia**

For the early Dry Season (April-August)	For the late Dry and Early Rainy Season (September-December)	For the Late Rainy Season (February-March)
Foods that are readily available during the early dry season include cassava, maize, rice (in some areas), pumpkins, sweet potatoes, beans, groundnuts, fish, a few indigenous vegetables and some exotic vegetables where dry season gardening is practiced.	Food reserves are relatively low in most households during the late dry and early rainy seasons and the range of available foods is limited. Households generally have cassava, fish and some exotic vegetables where dry season gardening is practiced. Availability of indigenous vegetables improves gradually one month after the onset of rains.	Food reserves start improving during the late rainy season as households start harvesting green maize, fresh beans, groundnuts, pumpkins and gourds. Indigenous vegetables are also readily available.
Recommended complementary feeding recipes include:	Recommended complementary feeding recipes include:	Recommended complementary feeding recipes include:
Cassava and groundnut porridge Cassava and bean porridge Maize and groundnut porridge Maize and beans porridge Sweet potatoes and groundnut porridge Rice and groundnut porridge	Cassava and fish porridge Rice and fish porridge Fish soup and nshima	Fresh maize and fresh groundnut porridge Cassava and fresh groundnut porridge
Mother's Tip: If fish is available, the groundnut or beans flour can be replaced with fish flour. This way the child will eat a wider range of diverse foods and this is good for his/her health.	Mother's Tip: Mothers and caregivers are encouraged to keep aside some groundnuts for use after the November planting season. This special stock can be used to improve the diversity of food fed to small children during this season.	Mother's Tip: Fresh maize can be replaced with fresh beans with palm or vegetable oil added. The pumpkin/gourd recipes can also be prepared if the household is experiencing food shortage of other staple foods.

district fish was reported to be available year-round despite fishing restrictions being active in some months. Two other districts reported that fish was expensive from December-March. A ban on fishing in Zambian lakes from December to February results in lower availability of fish and higher prices of available fish. The composition of meals also changes with season (Table 2), e.g. in the Mwense district, the main staple changed from cassava from October-March to maize from April-September. Meal frequency was 3 times a day in the late rainy season in most districts, due to higher availability after the harvest. Meal frequency sometimes reduced to 1-2 times/day in the early rainy season in the Kawambwa and Mwense districts. Among the reasons given for lower meal frequencies were low food availability (especially the staple and legumes), heavy workload during planting and reduced/limited food stocks during the dry season. The lower food availability also affects complementary feeding. In Kawambwa district, meal frequency for infants was 4 meals/day when food was available, but 1-2 times/day when not available. In all 4 districts, mothers mentioned that attempts to improve CF recipes using legumes such as groundnuts depended on adequate households stocks being available.

Regarding seasonal effects on women's workload and time allocation, far less data were available, even though this is one of the problems highlighted in the TIPs Assessment and Counseling Guide used by the

facilitators, with respect to feeding children 12months-2yrs of age. The Guide includes recommendations on how to address this.

In Cambodia, many mothers reported time constraints for preparing enriched complementary foods daily, especially during periods with a high workload such as the rice transplanting season. In Afghanistan the key problem recorded for the 12 months to 2 yrs age group was that children are fed less than 3 meals per day because of the mother's heavy workload, especially during the busy agricultural summer months [27]. In the Chieng District in Zambia, one of the reasons cited for reduced meal frequency during the dry to early rainy season was heavy workload during planting.

### How Seasonality Data are Utilized

#### *a. Developing Season-Specific Dishes and Recipes*

Community and household seasonal food availability data (see preceding sections) are used to develop recipes using the TIPs process, where the recipes are tried out by families in a real home environment. After TIPs, the recipes are further refined for wider community use.

Nutrients targeted in the recipe development were energy, fat, vitamin A, iron and zinc, while maintaining recommended age-specific volumes of complementary

food per meal as stipulated in the WHO Guiding Principles [1]. In addition to the cooked complementary food, caregivers were encouraged to give mashed fresh fruits, a good source of Vitamin C.

Table 3 shows season specific dishes which were developed into a booklet and used during the wider dissemination phase of TIPs in Zambia. A unique feature of the booklet is that recipes take into account the seasonal availability of different foods during the dry and the rainy seasons. This is intended to help mothers make the best food choices for variety, nutritional value and cost at different times of the year [28].

**b. Proposing/Testing Mechanisms to Buffer Negative Seasonal Effects**

The FAO projects proposed various strategies to close the gap in year round access to certain foods and time constraints due to seasonal labour. In Afghanistan women were organized into groups to learn how to

pickle fruits/vegetables and to make tomato sauces. FAO helped to establish market-linkages with the local area to generate income for the women.

In Cambodia, the high cost of animal source foods and fruit, and lack of time for preparing special CF daily were constraints for improved CF practises; possible solutions identified included the promotion of home gardens and small-scale animal raising and planting of early maturing papaya trees. Improved post-harvest technology and storage of rice to prevent post-harvest losses and processing and preservation of vegetables and fruit were also indicated as urgent measures. Additionally, fuel efficient cooking stoves were promoted to reduce women's time spent on fuel collection and meal preparation.

In Laos, women were trained in home-based food processing and preservation of locally available foods, with an emphasis on ready-to-cook and ready-to-eat complementary foods. Income generation was an additional aim. The processes demonstrated included

Dishes/Actions To Recommend	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b>A. Recommended Dishes:</b>												
Fish-based porridges	←-----→											
Green leafy vegetable-based dishes	←-----→											
Fresh maize/fresh groundnuts porridge			←-----→									
Fresh maize/fresh beans porridge			←-----→									
Gourd/avocado-based dishes			←-----→									
Fresh and dried sweet potato-based dishes			←-----→									
Pumpkin/avocado-based dishes			←-----→									
Legumes-based (dry) dishes		←-----→								←-----→		
Groundnuts (dried)				←-----→						←-----→		
<b>B. Actions to Recommend:</b>												
Drying sweet potatoes				←-----→								
Drying of vegetables	←-----→											
Keeping sufficient dried groundnuts for feeding small children					←-----→							

Key:

←-----→ Abundant supply of ingredients, appropriate period for recommending dishes and actions indicated in Column 1

----- Scarce supplies of ingredients, not the appropriate time to expect effective implementation of proposed action(s). Promote practical actions aimed at improving access to the required ingredients. Some of the actions to promote access of the ingredients may have to be undertaken before that period.

Figure 5: Season-specific dishes and actions to be recommended at specific times of the year (Zambia).

processing of rice, mung bean and peanut for preparing complementary food with additional strategies for income generation.

Information on seasonal availability can be used to develop and test season-specific strategies for using and preserving seasonally available foods, as demonstrated below for Zambia (Figure 5). Figure 5 indicates the months in which action can be taken to preserve surplus foods for later use, e.g. drying sweet potatoes and vegetables, and storing larger quantities of dried groundnuts for home consumption. Other actions proposed in Zambia are shown in Box 1. Communities often expressed eagerness to learn preservation techniques to preserve foods during the period of abundance for later use.

The counselling guidelines used during TIPs process also addressed the problem of reduced meal frequency for children aged 12months-2yrs owing to mothers' heavy workload, especially during the rains.

The advantage of bulk processing at household level (e.g. cassava/maize flour and pounded groundnuts in Zambia, and flours from groundnuts, pumpkin seed and dried fish in Laos, in pre-mixed in stocks that last 1-2 weeks), coupled with proper storage, were stressed as a means of reducing the caregivers' workload. The recipes developed for Zambia included options for bulk processing ingredients such as bean flour and sweet potato flour, to be considered if the mother had a heavy workload.

### **c. Highlighting Seasonality-Related Issues in Complementary Feeding Manuals**

CF manuals/recipe booklets have been developed for Afghanistan, Cambodia and Zambia, which highlight the seasonality-related issues that need to be considered. Some examples are given below.

The manual prepared for Afghanistan (FAO 2008a) highlights the considerable seasonal and regional variations in food availability in the country, which

- Community sensitisation on importance of:
  - continuous or year round supply/production of vegetables;
  - dry season vegetable production and consumption;
- Promotion of home gardening for income generation (high value crops) and nutrition improvement (vegetables and legumes in particular); through, among others:
  - Establishment of demonstration gardens as part of the nutrition promotional activities promoted by Community-Based Growth Monitoring and Promotion centres in close collaboration/with technical support with camp officers;
  - Early initiation of gardening activities in areas where water is a problem so as to use residual moisture;
  - Protection of home garden plots from animal destruction through fencing (group fencing where possible and acceptable);
  - Improved irrigation and water conservation techniques during the dry season;
- Improving access to and promotion of early maturing varieties of protein-rich foods:
  - at the onset of the rainy season, e.g. groundnuts (*solontoni* or Natal common) and beans (*pembela* variety) which can be harvested as fresh groundnuts and beans from the end of January to reduce the gap in the supply of protein-rich foods during the period December-March;
  - during dry season wet land cultivation; and
  - staggering the planting of certain crops so as to ensure a steady supply of vegetables and legumes.
  - Promoting preservation and storage of vegetables and legumes during the period of plenty, particularly appropriate ways of storing bean, which is currently problematic

**Box 1:** Actions proposed in Zambia to close the gap in year-round access to certain foods critical to dietary improvement.

affects households' ability to prepare nutritious meals during the course of the year. The manual shows how information on seasonality can be incorporated into decision making, and advises extension/health workers, in consultation with local communities, to prepare SFACs that will help identify ingredients for preparing nutritious recipes at different times of the year, making optimal use of seasonally available food combinations.

This manual for Afghanistan also gives possible solutions to the low meal frequencies for young children due to mothers' seasonal workload. These include encouraging mothers to bulk process ingredients for making complementary foods e.g. processing quantities that will feed the child for up to 2 weeks, provide different snacks between the 3 meals; and if working in the field, preparing one of the meals at home and taking the food to the field. The manual notes that particular communities "require additional food security interventions in addition to nutrition education before they can make significant improvements to their diet. These interventions can include kitchen gardening, introduction of greenhouses, poultry and animal health projects, and food processing activities."

Another manual for field workers and trainers on home-based fruit/vegetable processing in Afghanistan [32] includes details of how to decrease post harvest losses through improved handling and storage and how to preserve fruit/vegetables for consumption later in the season. The manual for Cambodia recommends that foods that are in season and are readily available in most homes should be selected for use in cooking demonstrations [30]. The recipe booklet for Zambia for use by community service providers [28] has been written specifically taking seasonal availability of foods into account, as discussed previously in this paper.

## DISCUSSION

Nonadherence to counseling messages for child feeding is commonly associated with lack of resources and incompatibility with demands on mothers' time [33]. Our experiences from Afghanistan, Cambodia, Laos and Zambia show that both low food availability and time constraints for food preparation owing to labour demands are strongly seasonal. New data we have from conducting TIPs in Malawi support these conclusions, as a general concern raised by mothers has been the lack of vegetables in the dry season.

The FAO CF interventions included the preparation of SFACs. In addition to helping to develop balanced CF and family meals, SFA calendars can also help towards making a community more food secure. For example, a study of the consumption pattern of carotene rich foods by households in Coimbatore, India, resulted in a "year calendar" from which low-cost, high carotene foods could be selected and used in intervention programmes and in the community [34].

Our study highlights some practical implications when planning CF interventions, such as the importance of carefully considering the season in which to conduct TIPs. For example, in a study in rural Malawi using fortified spreads for infants, the authors record that in order to maximize the power of the trial it was carried out during the rainy season when nonintervention infants were expected to grow most slowly, as during this season FS in the area and weight and length gain of children are at their lowest (Kuusipalo *et al.* 2006). We found that in Zambia progress in implementing rainy season TIPs was slow because it coincided with the heavy on-farm workload, and facilitators could only find the caregivers in the afternoons, thus taking more time to complete the household assessment forms than anticipated. When formative research is used to compare the outcome between two different sets of message, it is important to ensure that the interventions are carried out in the same season in order to be able to evaluate them correctly. For example, a study testing the outcome of two different TIPs messages reported that the time gap between the two rounds resulted in different seasonal foods being available, which prevented some feeding recommendations from being carried out in the 2<sup>nd</sup> round [35].

It is important to combine dietary advice on improved infant feeding with targeted and responsive FS actions aimed at increasing locally available, nutrient dense foods. Mechanisms to buffer negative seasonal effects can include alternative strategies in both production and availability [36]. Strategies include horticultural interventions such as early-maturing varieties (e.g. papaya varieties in Cambodia, groundnut varieties in Zambia); staggered planting; use of multi-purpose crops; crops that may need minimum land preparation, weeding and irrigation; and agricultural diversification. Appropriate price support may be needed to encourage farmers. Other factors that could be considered are underutilized food sources, such as insects or wild plants; the use of crops that can serve as subsistence as well as cash crops; and the

establishment of community cash funds/food stocks. A recent systematic review looking at the effects of agricultural interventions to increase household food production on the nutrition and health outcomes of women and young children also stressed the need for an integrated approach that includes supplements and fortified foods while increasing household food production [37]. Short-term provision of food supplements, including lipid-based nutrient supplements are particularly relevant during a lean season [26].

Promotion of better preservation and storage techniques are also fundamental elements for increasing year-round food availability. Time-saving technologies, which range from better cooking facilities, to village-level milling facilities, to piped water, to technology in other areas of women's work, such as in agricultural labour, are measures that can feasibly be incorporated within food and nutrition security programmes [16]. Women's access to food processing technology at the HH level has been shown to have positive dietary benefits during the pre-harvest lean season [38]. Some of these approaches serve the dual purpose of saving time plus preserving food for lean periods. Other practices recommended in FAO programmes have been to encourage kitchen gardening, introduction of greenhouses, poultry and animal health projects, food processing activities, encouraging households to reconsider the ways in which they utilized produce, e.g. Zambia, to keep some groundnuts for children to eat rather than selling all the produce, and introducing fuel-efficient cooking stoves. One of the project recommendations arising from the food preservation and processing component in Laos was to set up small-scale food processing centres at community level by self-help groups or women entrepreneurs, to produce nutritious complementary foods and nutritious fast food that could be used for income generation.

Gender has been argued to be the key dimension which links agricultural programs to improved nutrition and health (especially when combined with nutrition education), with women's relative bargaining power within the household and control over assets influencing whether gains in income translate into nutritional improvements, particularly for children [18]. Providing optimal seasonal childcare is one way of taking gender into consideration when planning CF interventions. Collective childcare, which can also double as a location for seasonal child feeding, has been successfully reported in the past, e.g. harvest

season day-care centres in Punjab, India (Chambers, 1982, cited in ACC/SCN, 1991). Community childcare *via* family day-care homes, where a "community mother" who receives training, a small stipend and credit to upgrade her home to hygiene and safety standards, was popular in the 1980s in Columbia; the programme covered 500, 000 children by 1989 [16]. Such a scheme in urban areas of Guatemala has been reported more recently [39]. Revisiting such ideas and other innovative approaches to childcare, such as mobile crèches, may be appropriate, particularly in seasons where labour demand is high.

### Strengths and Weakness of Study

The data available for the four countries were not uniform, with more documentation available for Zambia than for the other countries. Although the Zambian data are the oldest (from 2002-2004), we do not think the age of the data are relevant to the type of analysis presented in our study. As none of the original TIPs trials were conducted with the sole aim of testing coping mechanisms for seasonality, it is not possible to present data that show which of the recommendations for preserving foods, processing food, seasonal recipes etc. were subsequently more widely adopted at community level or if these led to improved dietary intakes and nutritional status of the children. However, the related educational materials were developed as a consequence of the TIPs, and included those recipes and recommendations that had been field-tested and found to be acceptable/practical during the TIPs [27-28, 30].

Although two of the authors were directly involved in the projects, the data have been obtained from FAO grey literature related to these projects. We do not see this as a limitation. Grey literature is as important a source of information as conventional literature and differs not in terms of scientific value but in content and purpose as well as in methods of production and diffusion [40]. Such literature is by its nature, often more inclusive than standard, peer-reviewed and commercially published work, and is thought to play an important role in the evidence-based movement [41].

### CONCLUSION

Country-specific social and behavior change communication activities generally include formative assessments to understand current maternal dietary and IYCF practices and identify gaps in information that need to be further explored [42]. Season-specific

information should always be included in formative assessments especially in rural areas, in order to capitalize on locally available foods in different seasons. This information can also be used to plan targeted and responsive food security actions to increase nutrient dense foods and food processing/storage techniques, which can all be part of nutrition sensitive agriculture program design. Finally, programs aimed at promoting women's participation in income generation should also consider women's reproductive role, which is often ignored. Attention should be paid to seasonal time-constraints of mothers/caregivers and potential impact on child feeding and care. Seasonality, as a key element of food availability and access in developing countries, has recently returned to the research focus, perhaps due to the renewed interest in the linkages between nutrition and agriculture. A multisectoral approach, which links nutrition-sensitive agricultural production (integrated with fortification and supplementation when needed), nutrition education, and addresses seasonal constraints to improving CF within the context of family feeding, can have a positive impact on food and nutrition security.

#### ACKNOWLEDGEMENTS

We would like to acknowledge the funding received from the Government of Germany for the GCP/AFG/050/GER project in Afghanistan; from the European Union for the GCP/CMB/033/EC project in Cambodia; from the Government of Italy to the GCP/LAO/016/ITA project in Laos; and from the Government of Belgium to the GCP/ZAM/ 059/BEL in Zambia. We are very grateful to Koung Ry Ly for answering all our questions on TIPs in Cambodia and Irela Mazar for providing additional information on the FAO project in Laos. Our thanks to Theresa Jeremias for useful comments on an early version of this paper. Finally, we wish to acknowledge all the people who wrote the FAO project reports/workshops, from which data were obtained. We regret that we are unable to acknowledge you individually by name.

#### CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

#### DISCLAIMER

The views expressed in this information product are those of the author(s) and do not necessarily reflect the views or policies of FAO.

#### SOURCE OF FUNDING

The TIPs interventions received funding as part of the following projects: Government of Germany for the GCP/AFG/050/GER project in Afghanistan; from the European Union for the GCP/CMB/033/EC project in Cambodia; from the Government of Italy to the GCP/LAO/016/ITA project in Laos; and from the Government of Belgium to the GCP/ZAM/ 059/BEL in Zambia.

#### REFERENCES

- [1] PAHO/WHO. Guiding Principles for Complementary Feeding of the Breastfed Child. (Pan American Health Organization/World Health Organization) Division of Health Promotion and Protection Food and Nutrition Program: Washington, DC. 2003. Available from <http://whqlibdoc.who.int/paho/2003/a85622.pdf>
- [2] Dewey KG, Adu-Afarwah S. Systematic review of the efficacy and effectiveness of complementary feeding interventions in developing countries. *Matern Child Nutr* 2008; 4(Suppl.1): 24-85. <http://dx.doi.org/10.1111/j.1740-8709.2007.00124.x>
- [3] Dewey KG, Adu-Afarwah S. Systematic review of the efficacy and effectiveness of complementary feeding interventions in developing countries. *Matern Child Nutr* 2008; 4(Suppl.1): 24-85. <http://dx.doi.org/10.1111/j.1740-8709.2007.00124.x>
- [4] Soofi S, Cousens S, Iqbal SP, Akhund T, Khan J, Ahmed I, et al. Effect of provision of daily zinc and iron with several micronutrients on growth and morbidity among young children in Pakistan: a cluster-randomised trial. *Lancet* 2013; 382(9886): 29-40.
- [5] Daelmans B, Mangasaryan N, Martines J, Saadeh R, Casanovas C, Arabi M. Strengthening actions to improve feeding of infants and young children 6 to 23 months of age: Summary of a recent World Health Organization/UN ICEF technical meeting, Geneva, 6-9 October 2008. *Food Nutr Bull* 2009; 30(2): S236-S8.
- [6] UN. 2012. Zero Hunger Challenge. Available from [http://un-foodsecurity.org/sites/default/files/EN\\_ZeroHungerChallenge.pdf](http://un-foodsecurity.org/sites/default/files/EN_ZeroHungerChallenge.pdf)
- [7] Save the Children. The Minimum Cost of a Healthy Diet: Findings from piloting a new methodology in four study locations. Available from [http://www.savethechildren.org.uk/sites/default/files/docs/The\\_Minimum\\_Cost\\_of\\_a\\_Healthy\\_Diet\\_corrected09\\_1.pdf](http://www.savethechildren.org.uk/sites/default/files/docs/The_Minimum_Cost_of_a_Healthy_Diet_corrected09_1.pdf)
- [8] Chambers R, editor. Foreword and Seasonal poverty: Integrated, overlooked and therefore opportunity. In: *Seasonality, Rural Livelihoods and Development* (eds S. Devereux, R. Sabates-Wheeler, R. Longhurst), pp. xv-xviii; pp. 76-92. Earthscan from Routledge, London and New York 2012.
- [9] Hoorweg J, Foeken D, Klaver W. Seasons and Nutrition at the Kenya Coast. African Studies Centre Research Series 7/1995. Avebury. Available at <https://openaccess.leidenuniv.nl/bitstream/handle/1887/4664/ASC-1241504-011.pdf?sequence=1>
- [10] ACC/SCN. 1989. UN Administrative Committee on Coordination/Subcommittee on Nutrition. Women's Role in Food Chain Activities and the Implications for Nutrition - Nutrition Policy Discussion Paper No. 4. Available from [http://www.unscn.org/layout/modules/resources/files/Policy\\_paper\\_No\\_4.pdf](http://www.unscn.org/layout/modules/resources/files/Policy_paper_No_4.pdf)

- [11] Huybregts L, Houngré F, Salpeteur C, Brown R, Roberfroid D. The Effect of Adding Ready-to-Use Supplementary Food to a General Food Distribution on Child Nutritional Status and Morbidity: A Cluster-Randomized Controlled Trial. *PLoS Med* 2012; 9(9): e1001313.
- [12] Golden MH. Proposed Recommended Nutrient densities for moderately malnourished children. *Food Nutr Bull* 2009; 30(3 Suppl. 1): S267-S342.
- [13] Zou XN, Taylor PR, Mark SD, Chao A, Wang W, Dawsey SM, *et al.* Seasonal variation of food consumption and selected nutrient intake in Linxian, a high risk area for esophageal cancer in China. *Int J Vitam Nutr Res* 2002; 72(6): 375-82.  
<http://dx.doi.org/10.1024/0300-9831.72.6.375>
- [14] He L, Zhao W, Zhang X, You Y, Chen J. Trend of seasonal change on intake of nutrients in a year of the residents in both northern and southern China. *Wei Sheng Yan Jiu* (= Journal of hygiene research) 2004; 33(6): 694-7.
- [15] Faber M, Laubscher R. Seasonal availability and dietary intake of  $\beta$ -carotene-rich vegetables and fruit of 2-year-old to 5-year-old children in a rural South African setting growing these crops at household level. *Int J Food Sci Nutr* 2008; 59(1): 46-60.  
<http://dx.doi.org/10.1080/09637480701664852>
- [16] ACC/SCN. ACC/SCN State-of-the-art series (SOA) Nutrition policy discussion papers. Nutrition-Relevant Actions - Some Experiences from the Eighties and Lessons for the Nineties by S. Gillespie and J. Mason, October 1991. (SOA No. 10) 1991.
- [17] Sriram R, Ganapathy H. The Unresolved Dilemma-Child Care Options in Agricultural Contexts. *Econ Polit Weekly*, October 25, WS-64-WS72 1997.
- [18] Meinzen-Dick R, Behrman J, Menon P, Qisumbing A. Gender: A key dimension linking agricultural programs to improved nutrition and health. International Food Policy Research Institute (IFPRI). 2011. Available from <http://www.ifpri.org/sites/default/files/publications/2020anhcnfbr09.pdf>
- [19] UNSCN. United Nations System Standing Committee on Nutrition. Sixth report on the world nutrition situation. Chapter 3 Maternal nutrition and the intergenerational cycle of growth failure. 2010. Available from [http://www.unscn.org/files/Publications/RWNS6/report/SCN\\_report.pdf](http://www.unscn.org/files/Publications/RWNS6/report/SCN_report.pdf)
- [20] Leonard WR. Household-level strategies for protecting children from seasonal food scarcity. *Soc Sci Med* 1991; 33(10): 1127-33.  
[http://dx.doi.org/10.1016/0277-9536\(91\)90228-5](http://dx.doi.org/10.1016/0277-9536(91)90228-5)
- [21] Abdullah M, Wheeler E. Seasonal variations and the intra-household distribution of food in a Bangladeshi village. *Am J Clin Nutr* 1985; 41: 1305-13.
- [22] Kaiser LL, Dewey KG. Household economic strategies, food resource allocation and intra-household patterns of dietary intake in rural Mexico. *Ecol Food Nutr* 1991; 25: 123-45.  
<http://dx.doi.org/10.1080/03670244.1991.9991162>
- [23] Savy M, Martin-Prével Y, Traissac P, Eymard-Duvernay S, Delpeuch F. Dietary diversity scores and nutritional status of women change during the seasonal food shortage in rural Burkina Faso. *J Nutr* 2006; 136(10): 2625-32.
- [24] Valverde V, Delgado H, Martorell R. Seasonality and nutritional status. A review of findings from developed and developing countries. *Arch Latinoam Nutr* 1982; 32(3): 521-40.
- [25] Goudet SM, Griffiths PL, Bogin BA, Selim N. Impact of flooding on feeding practices of infants and young children in Dhaka, Bangladesh Slums: What are the coping strategies? *Matern Child Nutr* 2011; 7(2): 198-14.  
<http://dx.doi.org/10.1111/j.1740-8709.2010.00250.x>
- [26] UNICEF. Programming Guide: Infant and Young Child Feeding. United Nations Children's Fund. Available at [http://www.unicef.org/nutrition/files/Final\\_IYCF\\_programming\\_guide\\_2011.pdf](http://www.unicef.org/nutrition/files/Final_IYCF_programming_guide_2011.pdf)
- [27] FAO. Healthy Food, Happy Baby, Lively Family. Improved Feeding Practices and Recipes For Afghan Children and Mothers. Published by arrangement with the Food and Agriculture Organization of the United Nations by the Ministry of Agriculture, Irrigation and Livestock, and Ministry of Public Health Government of Afghanistan. Written by Dirorimwe, C. Available from <http://www.fao.org/ag/humannutrition/15403-0397cd6b1f6ca0073374b4c8c9f642644.pdf>. 2008.
- [28] Government of the Republic of Zambia/FAO. Improved Complementary Foods Recipe Booklet: family foods for breastfed children in Zambia. Lusaka; National Food and Nutrition Commission, Government of the Republic of Zambia and The Food and Agriculture Organization of the United Nations. Available from <ftp://ftp.fao.org/docrep/fao/010/ai208e/ai208e.pdf> 2007.
- [29] FAO. Promoting Improved Complementary Feeding (with recipes): A Manual for Community Nutrition Promoters. Manual produced by the Food and Agriculture Organization of the United Nations (FAO) in collaboration with the Ministry of Agriculture, Forestry and Fisheries, the Ministry of Women's Affairs and the Ministry of Health in Cambodia. 2011. Available from <http://www.fao.org/docrep/014/am867e/am867e00.pdf>
- [30] FAO. Complementary feeding for children aged 6-23 months: A recipe book for mothers and caregivers. Produced by FAO in collaboration with the Cambodian Ministry of Agriculture, Forestry and Fisheries, the Ministry of Women's Affairs and the Ministry of Health. FAO, June 2011. Available from <http://www.fao.org/docrep/014/am866e/am866e00.pdf> 2011.
- [31] Dickin KM, Griffiths M, Piwoz E. Designing by Dialogue: A programme planners' guide to consultative research for improving young child feeding. The Manoff Group and Academy for Educational Development for the Health and Human Resources Analysis (HHRAA) Project, Washington, D.C. 1997. Available from <http://childhealthandnutrition.care2share.wikispaces.net/file/view/Designing%2520by%2520Dialogue.pdf>
- [32] FAO. Home-based fruit and vegetable processing: A Manual for Field Workers and Trainers. Written by Susan Azam Ali, Edited by Charlotte Dufour. Published by arrangement with the Food and Agriculture Organization of the United Nations by the Ministry of Agriculture, Irrigation and Livestock, Government of Afghanistan. Available at <http://www.fao.org/docrep/011/a1549e/a1549e00.HTM> 2008.
- [33] Ashworth A, Ferguson E. Dietary counseling in the management of moderate malnourishment in children. *Food Nutr Bull* 2009; 30(3 Suppl. 1): S405-S33.
- [34] Devadas Rajammal P, Chandrasekhar U, Premakumari S, Saishree R. Consumption Pattern of Carotene Rich Foods and Development of a Year Calendar. *Biomed Environ Sci* 1996; 9(2-3): 213-22.
- [35] Paul KH, Muti M, Chasekwa B, Mbuya MNN, Madzima RC, Humphrey JH, *et al.* Complementary feeding messages that target cultural barriers enhance both the use of lipid-based nutrient supplements and underlying feeding practices to improve infant diets in rural Zimbabwe. *Matern Child Nutr* 2012; 8(2): 225-38.  
<http://dx.doi.org/10.1111/j.1740-8709.2010.00265.x>
- [36] Hassan N, Huda N, Ahmad K. Seasonal patterns of food intake in rural Bangladesh: Its impact on nutritional status. *Ecol Food Nutr* 1985; 17(2): 175-86.  
<http://dx.doi.org/10.1080/03670244.1985.9990891>
- [37] Girard AW, Self JL, McAuliffe C, Olude O. The effects of household food production strategies on the health and nutrition outcomes of women and young children: a systematic review. *Paediatr Perinat Epidemiol* 2012; 26(Suppl 1): 205-22.

- [38] Silva-Barbeau I, Hull SG, Prehm MS, Barbeau WE. Women's access to food-processing technology at the household level is associated with improved diets at the pre-harvest lean season in The Gambia. *Food Nutr Bull* 2005; 26(3): 297-308.
- [39] Ruel MT, Quisumbing AR, Hallman K, de la Brière B, de Salazar NC. The Guatemala Community Day Care Program: An example of effective urban programming. Research Report of the International Food Policy Research Institute. 2006; (144): 1-64.
- [40] Di Cesare R, Ruggieri R. The evaluation of grey literature using bibliometric indicators: A methodological proposal. In Anderson KL, Thiery C, editors *Information for Responsible Fisheries: Libraries as Mediators: proceedings of the 31st Annual Conference: Rome, Italy, October 10 – 14, 2005* Fort Pierce, FL: International Association of Aquatic and Marine Science Libraries and Information Centers 2006 Available from <https://darchive.mblwhoilibrary.org/bitstream/handle/1912/1322/proc06057.pdf?sequence=1>
- [41] Jones K. Mission Drift in Qualitative Research, or Moving Toward a Systematic Review of Qualitative Studies, Moving Back to a More Systematic Narrative Review. *The Qualitative Report* Volume 9 Number 1 March 2004 95-112 [http://eprints.bournemouth.ac.uk/1181/1/Jones\\_Output\\_4.pdf](http://eprints.bournemouth.ac.uk/1181/1/Jones_Output_4.pdf) 2004.
- [42] USAID. USAID's infant and young child nutrition project: IYCN social and behavior change communication approach. Available from [http://iycn.wpengine.netdna-cdn.com/files/IYCN\\_sbcc\\_approach\\_071511.pdf](http://iycn.wpengine.netdna-cdn.com/files/IYCN_sbcc_approach_071511.pdf) 2011.
- [43] FAO. FAO-GIEWS (global information and early warning system on food and agriculture) country briefs. Available from <http://www.fao.org/giews/countrybrief/index.jsp>. 2013.

---

Received on 01-10-2013

Accepted on 22-10-2013

Published on 28-11-2013

<http://dx.doi.org/10.6000/1929-4247.2013.02.04.7>© 2013 Wijesinha-Bettoni *et al.*; Licensee Lifescience Global.

This is an open access article licensed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0/>) which permits unrestricted, non-commercial use, distribution and reproduction in any medium, provided the work is properly cited.