Seasonality of food availability influences dietary patterns in two farming districts of Malawi

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1.0 Introduction

In most rural areas Africa, farm households rely on their own food production or local open markets for food. Seasonal variations in food availability are characteristic in such areas due to poor food distribution/system infrastructure. Such variability in food availability sometimes results in a food and health crisis that ruins and kills Africans every year, but its severity and duration vary across households and over time [1]. The situation is exacerbated by the rain-fed farming systems, where smallholder farmers depend on a single rainy season for most of their staple food needs. Rain-fed agriculture is dependent on the unpredictable behavior of the weather conditions in the context of climate change [1]. Poor rain performance, directly affects household food and livelihood security, because it affects yield, which in turn is linked to household food consumption and household cash income [2].

In Malawi, food shortages tend to be seasonal, mainly because the vast majority (>84%) of the smallholder farmers depend on rain-fed agriculture and have small land holding sizes (average of < 1.12 hectare) [3]. Seasonal variations in food prices characterized by lowest grain prices around harvest time and steady rise through the dry season until the next harvest also creates vulnerability for the 42% and 82% rural and urban poor Malawians respectively who rely on buying their food from markets [4]. Rural poor farmers are the most vulnerable to seasonal variations in food availability [5]. Many of these famers depend on agriculture for subsistence and income and have limited access to land, financial resources, and farm inputs [1].

Food availability and accessibility have been reported to affect diet pattern. A study in Texas explored social and environmental influences on children's diets using focus group discussions and they found that availability, accessibility, television, peer and parent influences influenced

consumption of fruits, juices, vegetables and low fat foods [6]. Another study which aimed to evaluate the relationship between the home food environment and Hispanic children's diet quality, found that home food availability, parental diet and family eating habits were associated with the diet quality of Hispanic children [7].

Seasonal food shortages are a common cause of malnutrition among infants [8]. Anecdote evidence showed that the admission pattern of undernourished children to nutrition rehabilitation units in Malawi followed the trend of food scarcity. Most admissions of severely undernourished children to nutrition rehabilitation units in Malawi occurs during the months of January to February, and similarly the highest number of children are admitted to the supplementary feeding or outpatient therapeutic programs during these months [9].

Adequate nutrition is critical for optimal growth, health and cognitive development of infants. Complementary feeding which starts when breast milk alone is no longer sufficient to meet the nutritional requirements of infants is essential from 6 to 23 months of age. However, complementary feeding in rural areas is highly affected by seasonality of food supplies. Seasonal availability and access to different foods were identified among constraints to successful infant and young child feeding (IYCF) interventions by WHO/UNICEF [8]. To address malnutrition, household guidance on recipes based on seasonal food availability has proved to be essential [10].

In Malawi, there is limited dietary diversification due to lack of understanding of food values, poor choices and feeding practices [11]. High incidence of nutrition-related diseases in infants occur during the critical weaning period between 6 months and one year of age in rural areas of Malawi, attributed to inappropriate infant weaning practices [12].

Child undernutrition is one of the big challenges in Malawi and 37% of the under-five children are stunted [13]. The high stunting levels for under-five children in Malawi led to the Malawi government to put in place a number of strategies to combat child malnutrition. One of such strategies is improving women's nutrition and care before, during and after pregnancy and ensure the consumption of a diversified diet made with foods from the six food groups. This study aimed to determine the seasonal food availability patterns in Dedza and Balaka for the development of seasonal food availability calendar (SFAC) as one of the nutrition interventions to reduce stunting in Malawi. SFAC is one of the tools that can be used to raise awareness to recurring food shortages and helps in developing seasonal complementary food recipes [8].

The study also aimed to determine seasonal variation in the dietary patterns of pregnant women, lactating women and children aged between 12 and 23 months. The first 1000 days of human life, from conception to the age of 2 years, are a critical stage when vital organs such as the brain and its interconnections with the rest of the body are formed and there is rapid growth and development [14]. Extended periods of insufficient nutrient intake for a child during this period can result in permanent damage through stunting [15]. Therefore, the study drew associations between seasonal food availability and dietary patterns of pregnant women, lactating women and children aged between 12 and 23 months.

2.0 Materials and Methods

2.1 Study area and seasons

The study was conducted in Dedza and Balaka districts, Central and Southern Malawi respectively (Figure 1) during March to December 2015. Dedza has 10 Extension Planning Areas (EPAs) with

169 sections and 197, 492 farming families and Balaka has 6 EPAs consisting of 83 sections with 125, 444 farming families (Ministry of Agriculture and Food Security, 2013). Data were collected in four quarters (March, June, September and December). The seasons in this study were divided into three following Malawi meteorology department description i.e. Warm wet season (November to April), cool dry winter season (May to August) and hot dry season (September to October) [16].

2.2 Study design and study population

The study was cross sectional employing both qualitative and quantitative data collection methods. The population comprised of pregnant or lactating women and children aged between 12 and 23 months living in 10 EPAs of Dedza and 6 EPAs of Balaka during March to December 2015. The study protocol was reviewed and approved by the Faculty of Food and Human Sciences at LUANAR. Permission to conduct the study was sought from Dedza and Balaka District Commissioner and from Dedza and Balaka District Agricultural Development Officers. Written and thumb-printed informed consent was also obtained from the participants.

2.3 Sampling of participants and data collection methods

Household survey

The study population was separated into mutually exclusive, homogeneous Extension Planning Areas (EPAs), thus 10 EPAs in Dedza and 6 EPAs in Balaka. A two stage stratified sampling technique was used. First proportional probability sampling was used to randomly sample five EPAs from the two districts that is; three EPAs (Kabwazi, Linthipe and Bembeke) in Dedza and two (Mpilisi and Bazale) EPAs in Balaka (Figure 1). Then purposive sampling technique was

used to sample households. Sample size of 160 households with pregnant or lactating women and or children aged between 12 and 23 months was used targeting 32 households in each of the 5 EPAs.

Household survey was used to collected information on dietary patterns and household seasonal food availability. The interviewees included pregnant or, lactating women and mothers of children aged between 12 and 23 months. Due to limited number of children who were eligible throughout the study, all children who were at least within the eligible age group were recruited. A participant was replaced if a household had moved from the area or if the child was no longer within the eligible age range. In the case where a registered pregnant woman gave birth, they were moved to the lactating group. A Semi-structured questionnaire was used to collect data on seasonal availability of foods and a 179 item Food frequency questionnaire validated by a food record was used to determine the dietary patterns. The reference time period for the FFQ was a month and the response categories included; daily, weekly or monthly consumption of food items.

Focus group discussions

The participants were selected purposively by targeting 6 to 15 women who were either pregnant, lactating or had children aged between 12 and 23 months from different villages within an EPA in all the 16 EPAs. Focus group discussion participants were not involved in the household survey and data was collected from the same participants in all the four quarters. The discussions were guided by a checklist to collect information on available food with the aid of audio voice recorders.

2.4 Data analysis

Principal component analysis (PCA) was used to identify the diet patterns captured using a 179 item FFQ and the data was analyzed using SPSS Version 20. Applicability of factor analysis was

verified by Kaiser-Meyer-Olkin (KMO) measurement of adequacy. The presence of correlations between food groups was tested using the Bartlett test of sphericity and was accepted when it was significant at $p<0.05$. Varimax rotation was used to extract the factors, Eigen value of >1.0 was used to decide the number of components to return and total variance explained indicated how much of the variability in the data was modeled by the extracted factors.

The audio data captured by an audio recorder was transcribed verbatim into written words manually, using Microsoft word. The typed interview transcripts were laid out on left half of the page while keeping the right half margin for writing the codes and notes. The transcript was made anonymous by tagging each voice (e.g. voice A, voice B) to distinguish multiple voices. Coding was done by making notes in the right margin adjacent to each line paragraph. Apart from that, significant participant's quotes worthy of attention were highlighted. The codes from all the transcripts were drawn together to come up with themes.

Association between food availability and diet pattern were derived by dividing total number of all foods in the diet with total number of food which were shown to be adequate or scarce and multiplying that number with one hundred. Associations then were drawn by looking at the percentage level of availability of the foods that were in the diet.

3.0 Results and Discussions

Most of the participants were young married mothers, who had dropped out of primary school and earned their income through farming (Table 1). Only 31% of girls in Malawi complete primary school and 11% graduate from secondary school, such that one in three of the Malawian girls marry and/or experience at least one pregnancy before her 20th birthday [18]. Maternal education has often been associated with positive child health and nutritional outcomes. In Haiti, maternal

150 education was associated with greater dietary diversity in young children's diets [19]. Considering
151 that 64.5% of the participants in this study did not finish primary school, this may likely affect the
152 way they accept and adhere to nutrition messages.

153

154 **Table 1: Demographic characteristics of household survey respondents**

Characteristics	**Balaka (n=62)**	**Dedza (n=96)**
Age*	25.9±7.7	24.9±5.0
Household size*	4.6±1.7	4.2±1.3
Number of <5 children in the household*	1.3±0.7	1.3±0.7
Marital status (%)		
Single	8 (12.9%)	11 (11.5%)
Married	53 (85.5%)	85 (88.5%)
Widowed	1 (1.6%)	0
Pregnancy		
First trimester	0	2 (2.1%)
Second trimester	5 (8%)	11 (11.5%)
Third trimester	7 (11.2%)	2 (2%)
Not pregnant	50 (80.6%)	81 (84.3%)
Lactation		
Still lactating	48 (77.4%)	81 (84.4%)
Not lactating	3 (4.8%)	2 (2%)
Not applicable	10 (16.1%)	13 (13.5%)
Women with Children aged between 1 & 2	23 (37%)	24 (25%)
Education level (%)		
None	3 (4.9%)	10 (10.5%)
<PSLCE	40 (64.5%)	71 (74%)

PSLCE	11 (17.7%)	9 (9.4%)
JCE	7 (11.3%)	3 (3%)
MSCE	1(1.6%)	3 (3.1%)
Source of income		
Formal employment	4 (6.5%)	3 (3.1%)
Farming	44 (71%)	80 (83.3%)
Business	9 (14.5%)	6 (6.3%)
Peace work	5 (8%)	5 (5.2%)

*Values are mean with standard deviation

The cool dry winter season had more variety of foods available as compared to the other seasons. This is because the cool dry winter season coincides with the crop harvest period, and food is readily available through own farms production. However, when the stocks run dry, the households become dependent on purchase [4]. On the other hand, daily meal frequency reduced in cool dry winter season from 3 to 2 meals per day in the hot dry season and 1 meal per day in warm wet season respectively. Similar meal frequencies were reported in Lilongwe district of Malawi, where meal frequency was higher (3 meals per day) immediately after harvest than during pre-harvest period (1 meal per day) [20]. Similarly in Mwense district of Zambia, meal frequency for infants reduced from four to one or two meal per day with change in season [8].

In both districts, maize was the main staple food and it was adequately available all year round (Table 2). This is because maize is a dominant staple food for Malawi supplying more than 54% of the food calories [21]. Common beans were the most common legume in both districts, and were mostly grown in Dedza, while Balaka was a net importer. Legumes grown in Dedza and Balaka were for subsistence and cash crop, however priority was for cash. Economic necessities

171 rather than own consumption preference influence cultivation and sale of food crops. Households
172 sale portions of their harvest in order to buy chemical fertilizers and to meet costs for clothing,
173 schooling, medical services, transport and maize milling" [22]. Vegetables were least available
174 during the hot dry season. In a trials of improved practice (TIPs) study, Malawian mothers raised
175 a general concern that lack of vegetables in the dry season was one of the reasons that made it
176 difficult to adhere to counseling messages for child feeding [8]. In order to improve year-round
177 availability of vegetables, most of the households preserved leafy vegetables through direct sun
178 drying. In times of plenty, vegetables are made in part imperishable by blanching and drying and
179 are stored in traditional storage bags called "*zikwatu*" for future use [22] [24]. Unfortunately, sun
180 drying exposes the food directly to the sun, compromising nutrient retention and hygiene as
181 opposed to solar drying [23]. On the other hand indigenous vegetables were more adequately
182 available in the warm wet season. Another study supports, that indigenous vegetables are abundant
183 during the rainy season, where they grow around family homesteads [24].

184

185 **Table 2: Foods available in Balaka and Dedza districts at different seasons**

Name of food	District	Seasons											
		Warm wet						Cool dry winter				Hot dry	
		N	D	J	F	M	A	M	J	J	A	S	O
STAPLES													
Maize (*Zea mays*)	Balaka	M	M	M	FM	FM	FM	FM	FM	FM	FM	M	M
	Dedza	FM	FM	M	M	FM	FM	FM	FM	FM	FM	FM	FM
Irish potatoes (*Solanum tuberosum*)	Balaka	M	M	M	M	M	M	M	M	M	M	M	M
	Dedza	M	M	M	M	M	FM	FM	FM	FM	FM	FM	FM

Name of food	District	Seasons											
		Warm wet						Cool dry winter				Hot dry	
		N	D	J	F	M	A	M	J	J	A	S	O
Sweet potatoes (*Ipomoea batatas*)	Balaka	M	M			FM	FM	FM	FM	FM	FM	M	M
	Dedza					FM	FM	FM	FM	FM	FM	FM	
Cassava (*Manihot esculenta*)	Balaka	M	M	M	M	M	FM	FM	FM	FM	FM	M	M
	Dedza	FM	FM	FM	FM	FM					FM		
Rice (*Oryza sativa*)	Balaka	M	M	M	M	M	M	M	M	M	M	M	M
	Dedza	M	M	M	M	M	M	M	M	M	M	M	M
LEGUMES													
Soya beans (*Glycine max*)	Balaka					FM	FM	FM	FM	FM	FM		
	Dedza	M	M	M	M	M	F	F	F	FM	FM	FM	M
Dry pigeon peas (*Cajanus cajan*)	Balaka	FM	FM	FM	FM	FM	F	F	FM	FM	FM	FM	FM
	Dedza												
Dry common bean (*Phaseolus spp*)	Balaka	M	M	M	M	M	M	M	M	M	M	M	M
	Dedza	FM	M	M	M	F	F	FM	FM	FM	FM	FM	FM
VEGETABLES													
Cabbage (*Brassica oleracea var. capitata*)	Balaka	M	M	M	M	M	M	M	M	M	M	M	M
	Dedza	M	M	M	M	M	FM	FM	FM	FM	M	M	M
Rape (*Brassica napus var. oleifera*)	Balaka	M	M	M	M	M	FM	FM	FM	FM	FM	M	M
	Dedza	M	M	M	M	M	FM	FM	FM	FM	FM	M	M
Mustard Indian (*Brassica juncea*)	Balaka	M	M	M	M	M	M	M	M	M	M	M	M
	Dedza	M	M	M	M	M	FM	FM	FM	FM	FM	M	M
Sweet potato leaves (*Ipomoea batatas*)	Balaka	F	F	F	F	F	F	F	F	F	F	F	F
	Dedza	F	F	F	F	F	F	F	F	F	F	F	F
Pumpkin leaves (*Cucurbita species*)	Balaka	M	M	F		F	F	F	FM	FM	FM	M	M
	Dedza	FM	FM	F	F	F	F	F	FM	FM	FM	FM	FM

Name of food	District	Seasons											
		Warm wet						Cool dry winter				Hot dry	
		N	D	J	F	M	A	M	J	J	A	S	O
Cassava leaves (*Manihot esculenta*)	Balaka	F	F	F	F	F	F	F	F	F	F	F	F
	Dedza	F	F	F	F	F	F	F	F	F	F	F	F
Amaranth (*Amaranthus hybridus*)	Balaka	M	F	F	F	F	F	FM	FM	FM	FM		M
	Dedza	F	F	M	F	F	FM	FM	FM	M	M	M	M
Blackjack (*Bidens pilosa*)	Balaka		F	F	F	F	F	F	F	F			
	Dedza	M	M	M	M	M	M	M	M	FM	FM	FM	FM
Ye-be (*Cardeauxia edulis*)	Balaka		F	F	F	F	F	F	F				
	Dedza		F	F	F	F	FM	FM					
Sweet corn (*Zea mays*)	Balaka	M	M		F	F	F	FM	FM	M	M	M	M
	Dedza	M	M		F	F	F	F	FM	FM	FM	M	M
Tomato (*Lycopersican esculentum*)	Balaka	M	M	M	M	M	M	M	M	M	M	M	M
	Dedza	M	M	M	M	M	M	M	M	M	M	M	M
Okra (*Hibiscus esculentus*)	Balaka	M	M		M	FM	F	F	F	FM	FM		M
	Dedza	M	M	M	FM	FM	FM	FM	FM	FM	M	M	M
Onion (*Allium cepa*)	Balaka	M	M	M	M	M	M	M	M	M	M	M	M
	Dedza	M	M	M	M	M	M	M	M	M	M	M	M
ANIMAL PRODUCTS													
Usipa/Bonya fish (*Engraulicypris sardella-Large*)	Balaka	M	M	M	M	M	M	M	M	M	M	M	M
	Dedza	M	M	M	M	M	M	M	M	M	M	M	M
Cat fish-*Mlamba/Anjolinjo* (*Clarias gariepinus*)	Balaka	M	M	M	M	M	M	M	M	M	M	M	M
	Dedza	M	M	M	M	M	M	M	M	M	M	M	M
Utaka (*Copadichromis, Otopharynx*)	Balaka	M	M	M	M	M	M	M	M	M	M	M	M
	Dedza	M	M	M	M	M	M	M	M	M	M	M	M
Micheni	Balaka			M	M	M	M	M	M	M	M	M	M

Name of food	District	Seasons											
		Warm wet						Cool dry winter				Hot dry	
		N	D	J	F	M	A	M	J	J	A	S	O
(*Rhamphochromis sp.)*	Dedza	M	M	M	M	M	M	M	M	M	M	M	M
Matemba (*Barbus paludinosus*)	Balaka	M	M	M	M	M	M	M	M	M	M	M	M
	Dedza	M	M	M	M	M	M	M	M	M	M	M	M
Chicken	Balaka	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM
	Dedza	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM
Eggs	Balaka	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM
	Dedza	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM
Pork	Balaka	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM
	Dedza	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM
Goat Meat	Balaka	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM
	Dedza	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM	FM
Beef	Balaka			M	M	M	M	M	M	M	M		
	Dedza			M	M	M	M	M	M	M	M		
Cow milk	Balaka			M			M	M	M	M	M		
	Dedza	M	M	M	M	M	M	M	M	M	M	M	M
FRUITS													
Jujube (*Ziziphus mauritiana)*	Balaka					FM	FM		FM	FM	FM	FM	
	Dedza						FM	FM	FM	FM	FM		FM
Baobab (*Adansonia digitata*)	Balaka					FM	FM	FM	FM	FM			
	Dedza					FM	FM	FM					
Ripe Bananas (*Musa paradisiaca*)	Balaka	M	M	FM	FM	FM	FM	M	M	M	M	M	
	Dedza	M	M	FM	FM	FM	FM	FM	FM	FM	FM	M	
Mangoes (*Mangifera indica*)	Balaka	F	F	FM	FM						FM	F	
	Dedza	F	F	F		FM					FM		

Name of food	District	Seasons											
		Warm wet						Cool dry winter				Hot dry	
		N	D	J	F	M	A	M	J	J	A	S	O
Guava (*Psidium guajava*)	Balaka				FM	FM	FM	FM	FM				
	Dedza				FM	FM	FM	FM	FM	FM			
OIL FOODS													
Vegetable Cooking oil	Balaka	M	M	M	M	M	M	M	M	M	M	M	M
	Dedza	M	M	M	M	M	M	M	M	M	M	M	M
Soya beans (*Glycine max*)	Balaka					FM	FM	FM	FM	FM	FM		
	Dedza	M	M	M	M	M	F	F	F	FM	FM	FM	M
Dry groundnuts (*Arachis hypogaea*)	Balaka	M	M	M	M	M	FM	FM	FM	FM	FM	M	M
	Dedza	FM	M	M	M	M	F	F	F	FM	FM	FM	FM
Avocado pears (*Persea americana*)	Balaka				M	M	M	M	M	M	M		
	Dedza					M	M	M	M	M	M		

Key: N- November, D- December, J- January, F- February, M-March, A- April, M- May, J-June, J-July, A- August, S- September, O- October

Adequately available Scarcely available Not available

Source of food: (^{F}) individual household farming; (^{M}) purchase from the market; (^{FM}) purchase from the market and individual household farming

Exotic vegetables, animal and oil foods, were predominantly obtained from the market in both districts, therefore consumption of these foods highly depends on financial resources of a household. Fish is the main source of animal protein for poor rural households in Malawi. Forty percent of the total protein supply comes from fish, which provides over 60% of dietary animal protein intake of Malawians [25]. Households involved in animal farming don't usually consume the animals that they farm, because animal farming has a prestigious value attached to it and most of the households would only consume their own animals during ceremonies. Consumption of

198 fruits was lower than that of vegetables and only half of all households in Malawi consume fruits
199 [26]. A participant in Dedza mentioned that "*In Malawi, households do not usually grow fruits,*
200 *most of the fruits that are available are naturally available in the communities*". When it comes to
201 government agricultural programs and extension workers expertise in Malawi, there is also a bias
202 towards staple crops and cereals, with a small focus on horticulture and fruit tree production [27].
203 On the other hand, vegetable-cooking oil was adequately available across all the seasons in both
204 districts. One of the participants in Balaka mentioned that "*unlike some years back, with the*
205 *awareness of the importance of inclusion of oil foods in the diet and the preferred taste of fried*
206 *foods, most of the households now make sure that they cook meals using cooking oil for at least*
207 *once a week*". The participants also explained that most households can now afford cooking oil
208 because vendors provide cooking oil in small sachets with a starting price of K50 (around 0.069$)
209 which is cheaper as compared to commercial packaging which starts from a 500ml bottle at
210 MK750 (around 1$).

211 A Malawian recommended diet comprising of six food groups was not observed among the study
212 participants across all the seasons. A recommended diet for Malawians including pregnant and
213 lactating women as well as children aged between 12 and 23 months, is a diet comprising of food
214 from the six food groups of Malawi; staples, legumes, vegetables, animal products, fruits and oils
215 [17]. Increasing the variety of foods across and within food groups is recommended to ensure
216 adequate intake of essential nutrients that promote good health. However, diets comprising of at
217 least four food groups which is considered acceptable, were observed in the warm wet season and
218 hot dry season; "*vegetable, oil,staple, fish and legume based diet*" observed in Balaka in the warm
219 wet season, "*vegetable, legume, oil, staple and fruit based diet*" observed in Balaka in the hot dry
220 season and "*legume, fish, vegetable and staple based diet*" observed in Dedza in the hot dry season

(Table 3). Other studies in rural Malawi have reported that 33% of rural Malawians consumed food from less than five out of the six food groups [4].

Table 3: Summary of dietary patterns for pregnant and lactating women and children aged between 6 and 23 months for Dedza and Balaka at different seasons

Warm wet Season		Cool dry winter Season		Hot dry Season	
Balaka	**Dedza**	**Balaka**	**Dedza**	**Balaka**	**Dedza**
Vegetable and fish based	Legume, oil and fish based	Vegetable and snack based	Animal, oil and vegetable based	Fish, vegetable and snack based******	Legume, fish, vegetable and staple based
Legume and vegetable based*	Staple, vegetable and snack based	Staple and vegetable based***	Snack based*******	Vegetable, legume, oil, staple and fruit based	fish, snack, animal and oil based
Vegetable, oil, staple, fish, and legume based	Animal, fruit and snack based	Legume and vegetable based*	Staple and vegetable based***	Staple and snack based	Staple and vegetable based***
Legume and snack based**	Vegetable based****	Fish, vegetable and snack based******	Legume and vegetable based*	Animal based	Staple and animal based*****
Staple and fruit based	Legume, vegetable and staple based	Vegetable, oil and snack based	Legume and snack based**	Staple and vegetable based***	Vegetable based****

Staple and animal based*****	Vegetable based****	Staple and oil based
		Snack based*******

Dietary patterns that are reappearing between the districts and across the seasons have the same number of asterisks. Dietary patterns with at least four food groups have been highlighted.

Diets comprising of food made from at least four food groups were observed in the warm wet season and hot dry season, showing that malnutrition cases are more likely to increase in the cool dry winter season. This is contrary to expectation, since the cool dry season coincides with harvest time, when households had access to a variety of foods as indicated by the seasonal food availability calendars (Table 2). In ability to consume a balanced diet in the cool dry winter season may be due to a number of reasons. Inadequate nutrition knowledge among women and men farmers contributes to unbalanced nutrition in Malawi [22]. On the other hand, people's attitude towards health and nutrition advice also affects diet that is followed. In one study, 85.6% of the students were familiar with the concept of balance of nutrients in food, but only 7% of them used it in their diets [28]. Time is also a challenge, this being a harvest season, women are usually busy in the fields harvesting, hence they may not have adequate time to prepare nutritious meals. It should also be noted that food choices are largely driven by taste, cost, and convenience [29]. Dietary guidelines tend to emphasize good nutrition, rarely taking food preferences, food prices, or diet costs into account. The ability to follow a healthy diet depends on having sufficient knowledge, money, and time, which low-income families often lack.

A brief overview shows that the constituents of the diets were food items that were adequately available in homes as compared to those that were adequately available at the market. In the warm wet season, 87% and 82% of the food that comprised the diets of Balaka and Dedza respectively were adequately available in the home, while in the cool dry winter season, 92% of the foods in Balaka diets and 74% of the food in the Dedza diets were adequately available. Likewise in the hot dry season 65% and 67% of the foods in the diets of Balaka and Dedza respectively were adequately available (Table 2 and 3). Several studies indicate existence of positive associations between food consumption and availability of foods in the home [30]. One study found that intakes of fruit and vegetables were positively associated with household availability and that consumption of milk increased when milk was available in the home [31]. Yet in another study, it was found that adolescents consumed less snacks and sweetened beverages when these foods were not available in the home [32].

In conclusion, the findings of the present study supported by other studies, has revealed that nutrition knowledge is essential to achieving adequate food utilization. That home food availability is associated with consumption patterns as opposed to market food availability, which is entangled with issues of accessibility. Enhancing the nutrition attitudes, knowledge and practices of people is important because this would lead to more food-conscious society, which could be predisposing factors for improving eating habits and adopting a healthy diet. Simple messages on behavior change mechanisms on improving dietary pattern and provision of different types of recipes containing locally available foods will help households to make better food choices which could be a component of dietary change intervention.

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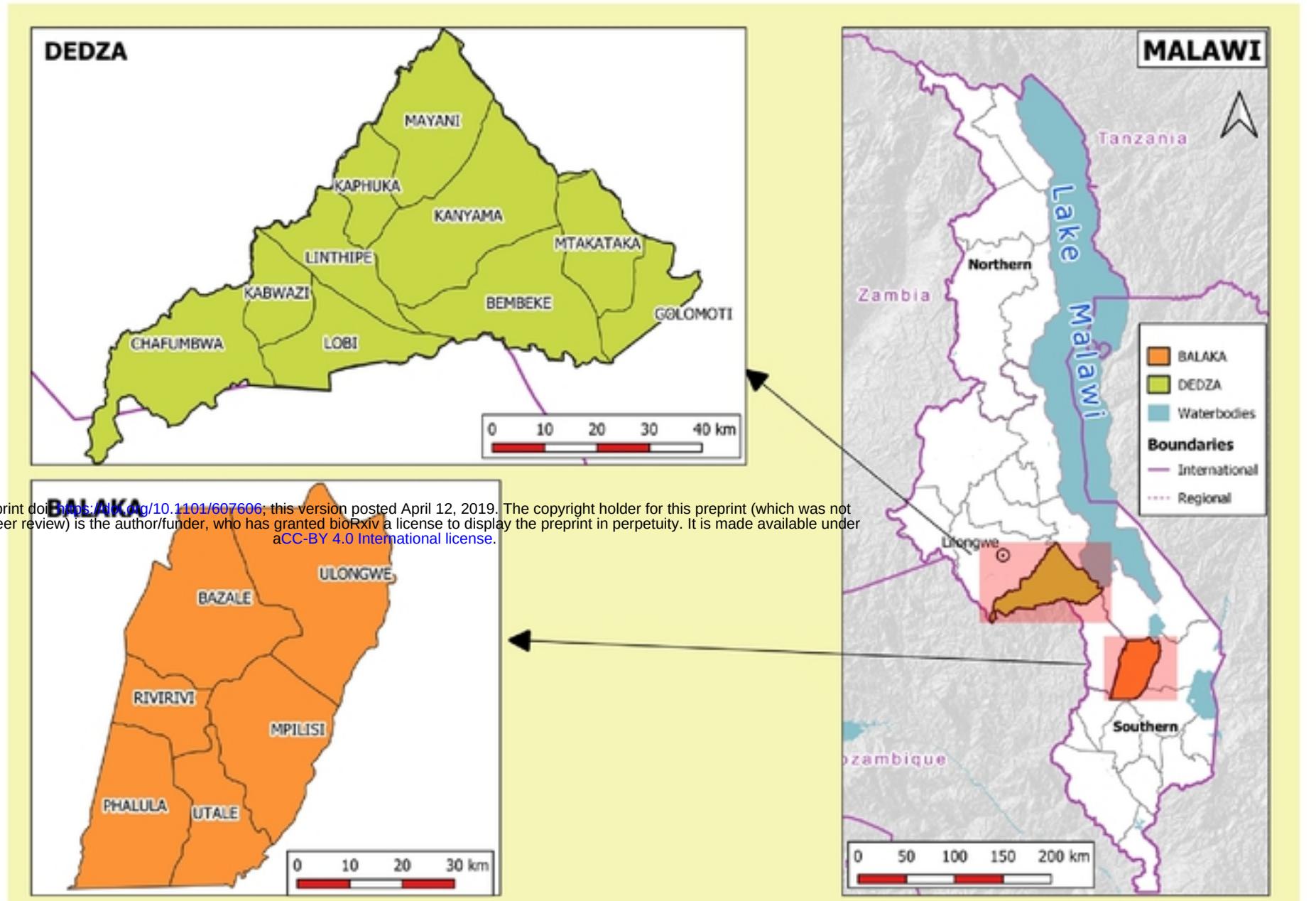

Figure 1: Map of Dedza and Balaka districts showing Extension Planning Areas