



Consumption patterns and diet gaps across regional Myanmar



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Consumption patterns and diet gaps across regional Myanmar

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1. Executive summary

Transformation of Rural Landscapes for Sustainable and Nutritious Food Systems is a project that attempts to understand the geographic disparities in both diets and agricultural production systems in Myanmar. Its aim is to devise plausible approaches for environmentally sustainable nutrition-sensitive agriculture under existing conditions as well as possible climate-altered conditions in the future. The project analyzes secondary data at the state and regional level across Myanmar.

This technical report presents the findings of a diet analysis based on the Integrated Household Living Conditions Assessment Survey (IHLCA) 2010. The aim of the nutrition component of the study is to understand current diet patterns in Myanmar to determine what makes up the typical local diet and identify what the diet gap is in each location.

In the absence of quantifiable national dietary surveys for Myanmar, we use household expenditure surveys as a proxy for apparent consumption from the IHLCA 2010 across all states and regions in Myanmar. Further comparison of mean consumption to food based dietary guidelines (FBDGs) from Bangladesh, the EAT–Lancet Planetary Health Diet and World Health Organization (WHO) recommendations was made to quantify diet gaps across the states and regions.

Current dietary patterns are inadequate with respect to consumption of diverse nutritious food groups across all areas studied. The Myanmar diet largely consists of white rice. Increasing the consumption of all nutritious food groups would improve upon this staple food. Regional differences were observed for each of the other food groups, besides rice, across all study areas.

Reducing the consumption of animal-source foods (ASFs) in line with the EAT diet should not be a blanket approach for Myanmar. The consumption of ASFs by vulnerable groups should be prioritized through nutrition-sensitive interventions. ASFs here within include all meats, fish and aquatic animals, milk and eggs. Compared to all other meat, eggs and milk, the predominant ASF consumed in Myanmar is fish, defined as aquatic animals from fresh, brackish and marine environments. The portion range within the EAT diet recommendations would need to be modified to reflect consumption preferences of ASFs, such as the dominance of fish, in Myanmar. Because of this, sustaining capture fisheries and optimizing aquaculture are key interventions to maintain and increase the fish supply for local consumption. In addition, biodiversity aspects need to be monitored to ensure that wild-caught species are considered least-concern species according to the Red List of Threatened Species by the International Union for Conservation of Nature.

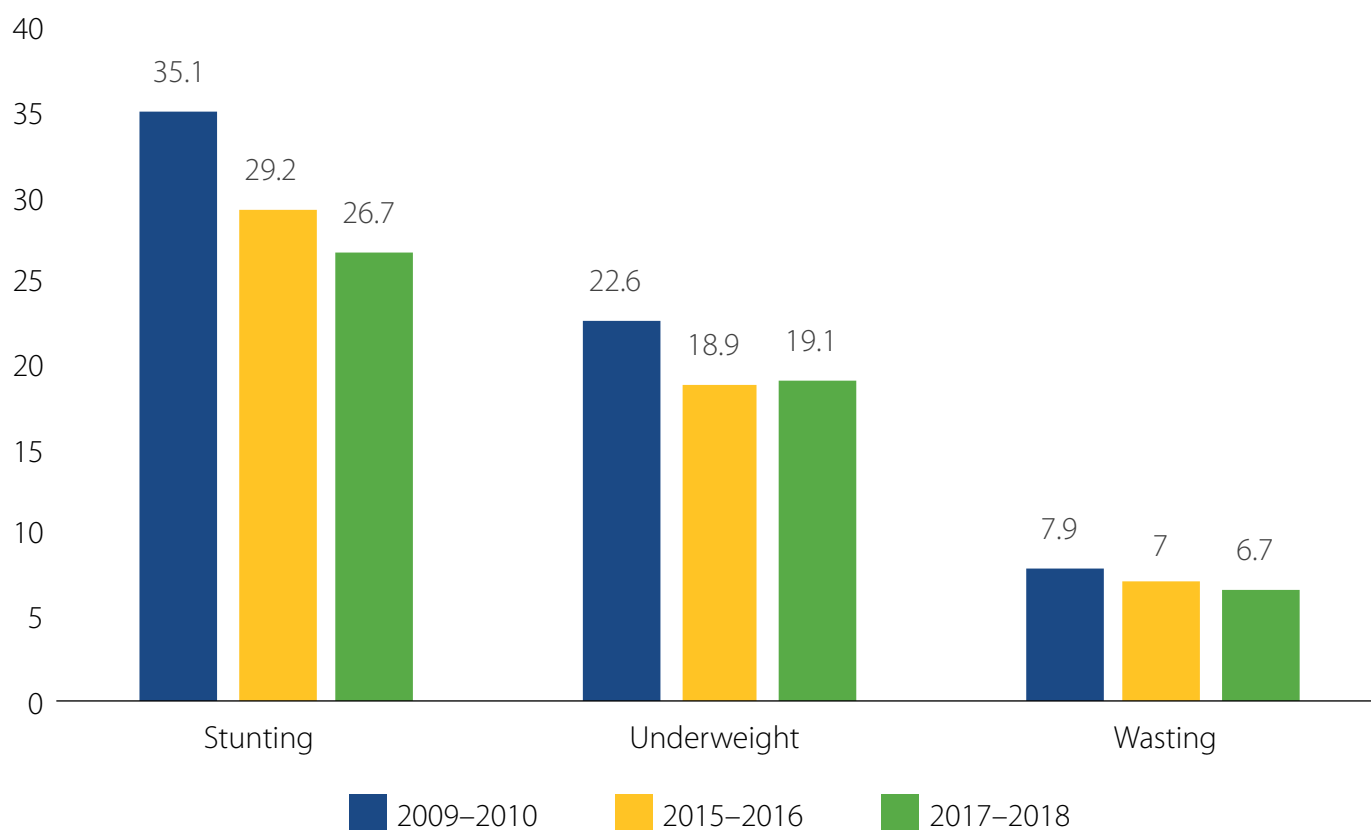
Total fruit and vegetable consumption is inadequate across all regions studied, when compared with the FBDGs and EAT diet as well as World Health Organization (WHO) recommendations for the prevention of chronic disease and micronutrient deficiencies. Recommendations to drastically increase the consumption of plant-based foods, such as vegetables, fruits and legumes, are in line with the EAT diet recommendations for planetary health. These should be prioritized in all regions of Myanmar for improved health and nutrition of the whole population.

Nutrition-sensitive fish agri-food systems should prioritize nutrient-rich foods and dietary diversity in agriculture development to combat malnutrition. Diversifying agrarian production systems, which are driven by smallholders, is an underlying principle for achieving the objectives of Myanmar's Multi-Sectoral National Plan of Action on Nutrition (MS-NPAN) and the Agriculture Development Strategy (ADS). As part of transforming the food system, changes in agriculture production are justified and necessary to fill the diet gaps identified across Myanmar. Increasing the consumption of diverse nutritious foods is imperative for combating malnutrition in all forms, and multisectoral approaches are key to this success.

2. Introduction

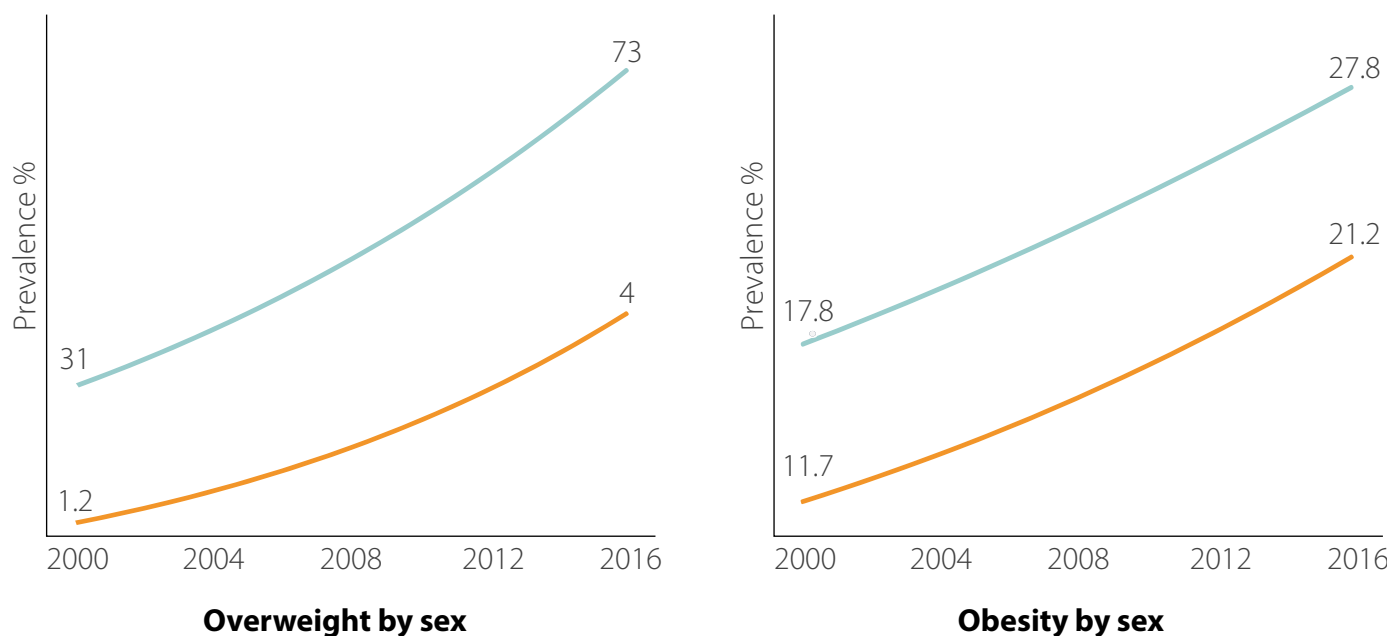
Global malnutrition in multiple forms persists at unacceptably high rates across populations and throughout the lifespan of individuals (HLPE 2020). The coexistence of overnutrition (overweight and obesity) alongside undernutrition (stunting and wasting) is referred to as the double burden of malnutrition (Popkin et al. 2020; Wells et al. 2020). Furthermore, micronutrient deficiency can occur in an individual who is either undernourished or overnourished. Throughout a person's life, an individual could be undernourished (for example, stunted or wasted) as a child and then progress to overweight in adulthood, while also suffering from multiple micronutrient deficiencies, such as iron, vitamin A, iodine and zinc, to name a few (Bailey et al. 2015). Increasingly, all three forms of malnutrition (undernutrition, overnutrition and micronutrient deficiency) are coinciding within populations and households, and this is described as the triple burden of malnutrition (UNICEF 2019).

Seventy percent of Myanmar's 55 million population live in rural areas, but this trend is gradually changing. The country is in a state of transformation and urbanization with promising progress made to reduce undernutrition in the country. Stunting among children declined from just over 40% in 1990 to 29.2% in 2016 and then to 26.7% in 2017–2018 (Hlaing et al. 2019). As Figure 1 shows, the persisting prevalence of micronutrient deficiencies is a pressing public health concern (MOHS 2017). Simultaneously, and in line with global trends, rates of overweight and obese individuals are increasing, as shown in Figure 2 (Hong et al. 2018). In addition, nutrition associated diseases, such as diabetes, cardiovascular disease and some cancers, are also on the rise (MOH 2014; GNR 2020). The triple burden of malnutrition is apparent and cause for concern in Myanmar. Diets are both the cause and the solution toward a nutrition transition that improves rather than hinders public health outcomes.



Source: MOHS 2017.

Figure 1. Myanmar Micronutrient and Food Consumption survey.



Source: Global nutrition¹- country profile.

Figure 2. Global statistics showing trends in overweight and obesity by sex.

In Myanmar, there are currently no national consumption surveys and food composition tables to quantify nutrient intake at either the population or individual level. Yet the lack of diversity in the rice-dominated diet is apparent, and consumption of saturated fat and processed foods is increasing (San-San-Myint and MOHS 2018). Natural disasters, civil unrest and seasonal factors, such as drought and floods, effect local food availability and access. On top of all this, the COVID-19 pandemic has reduced the availability of fish due to movement restrictions that health authorities have imposed to reduce infection rates (Middleton et al. 2020) Furthermore, over half of the country's population is unable to afford a nutritious diet because of poverty and high food costs (Mahrt et al. 2019)

The ways food is produced has gained momentum in the global discourse. While agriculture production is at risk from water scarcity, climate change and natural disasters, it is also a major driver of environmental degradation. "Food is the single strongest lever to optimize human health and environmental sustainability on Earth," according to Willett et al. (2018). This premise is central to the EAT–Lancet Commission on Healthy Diets from Sustainable Food Systems. The commission provides excellent recommendations to increase sustainable, nutrient-dense, mostly plant-based foods. However, although well intentioned in addressing global nutrition, the cost of the EAT diet is not affordable for the world's poor (Hirvonen et al. 2019). It has also been criticized for not taking into consideration existing malnutrition (Adesogan et al. 2019) such as the high prevalence of micronutrient deficiencies, as is the case in Myanmar. Furthermore, diet and food production recommendations at the national level do not capture intra-country differences in localized food systems and interventions.

Food systems need to address planetary health and the triple burden of malnutrition for all populations. This requires cross-sectoral nutrition strategies at all levels (HLPE 2017). Myanmar is progressing toward improved food systems for nutrition and health through the MS-NPAN (San-San-Myint and MOHS 2018). The MS-NPAN aims to broaden the rice-dominated agriculture sector as a strategy to address malnutrition. Smallholder-driven diversification of agrarian production systems is the key principle for achieving two of the three MS-NPAN agriculture outcomes as well as realizing the overall objective of the Myanmar Agriculture Development Strategy (MOALI 2018).

Transformation of Rural Landscapes for Sustainable and Nutritious Food Systems is a project that can further contribute to addressing evidence gaps in current consumption patterns and sustainable food production in Myanmar through interdisciplinary assessments and recommendations.

2.1. Overall approach

The project attempts to understand geographic disparities in both diets and agricultural production systems. It does so in order to devise plausible approaches for environmentally sustainable nutrition-sensitive agriculture under existing conditions, as well as possible climate-altered conditions in the future. The project analyzed data from the seven states and seven regions across Myanmar (Figure 3).

This technical report focuses on the diet component of the study. This will be used in conjunction with the environmental impacts of the agricultural production systems, specifically water footprints and greenhouse gas emissions, to provide assessments of healthy diets in relation to environmental impacts.

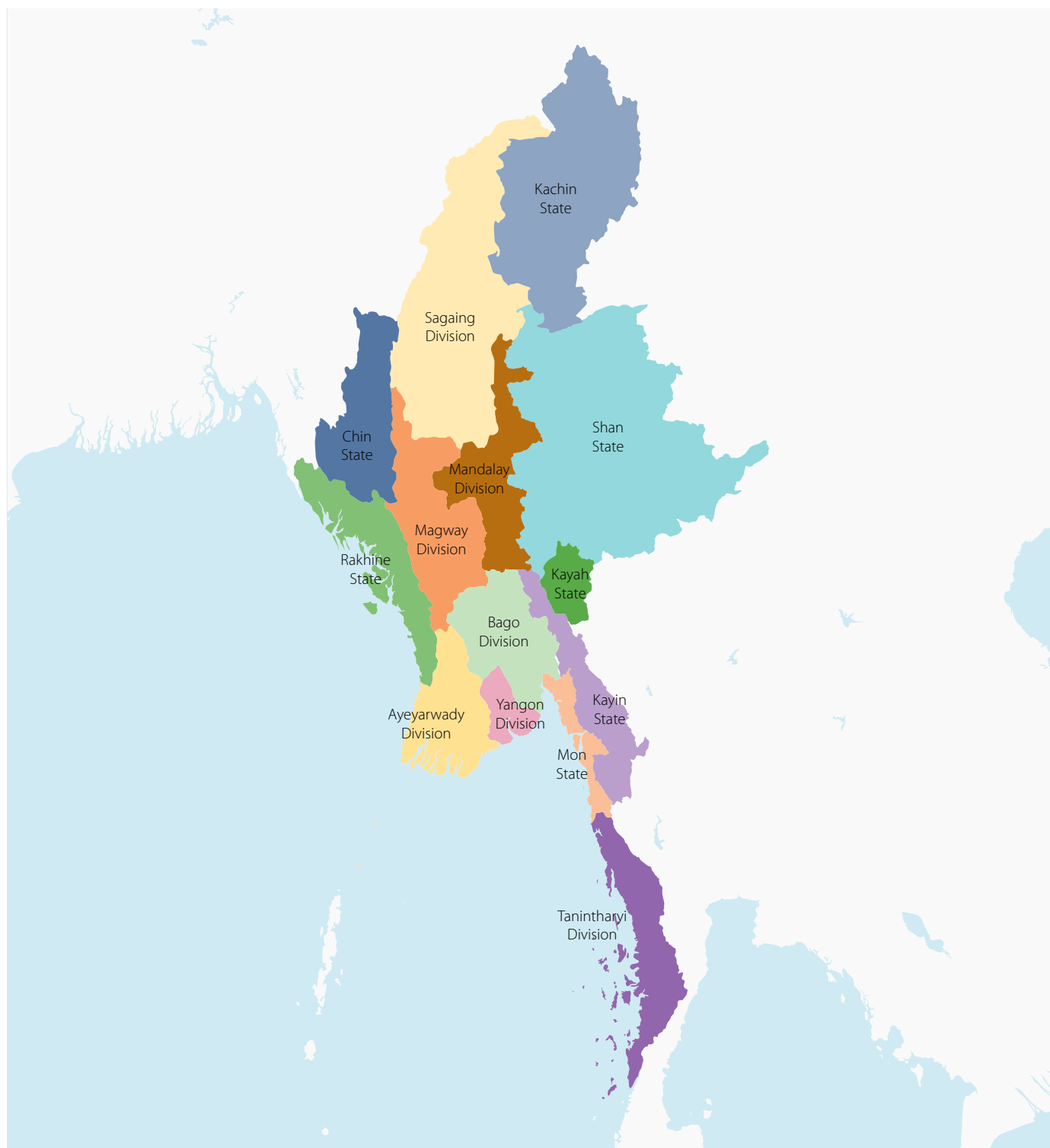


Figure 3. States and regions of Myanmar.

3. Dietary gap assessment and derivation of healthy diets

The aim of the nutrition component of the study is to understand current diet patterns in Myanmar. It focuses on two questions:

- (1) What makes up the typical local diet?
- (2) What is the diet gap in this location?

3.1. Hypothesis

There is considerable variation in food production among different locations. But broadly, diets across Myanmar are dominated by one starchy staple food (rice), with small amounts of nutrient-dense foods. This results in a quantifiable diet “gap,” which is the difference between actual food consumption and a healthy diet.



Photo credit: AZ Photography

Fried fish on a plate.

4. Method

There are no quantifiable national dietary surveys for Myanmar, so we use household expenditure surveys as proxy for apparent consumption. Analysis was based on the Integrated Household Living Conditions Assessment (IHLCA) from 2009–2010 (MNPED 2011a and 2011b). We use the IHLCA study because it is representative at the state and regional levels. More recent expenditure surveys are not refined to this level, as required for such a localized analysis.

The main purpose of the IHLCA was to monitor and assess changes in living conditions in Myanmar. The IHLCA conducted two visits to a total of 18,660 households in December 2009/January 2010 and May 2010. The first visit was during the cool season, a few months after the monsoon season. The second was during the hot dry season and the end of the pre-monsoon period. Households were treated separately in each round. The survey was representative at national, urban/rural and state/region levels.

We assigned waste factors for most food items based on the United States Department of Agriculture food composition table (USDA 2016). For fish items, we used wastage factors reported in a recent database that WorldFish developed (Scott 2019). Wastage factors allowed “as purchased” food quantities to be converted into edible portions. Quantities used throughout this report are presented in edible grams per adult equivalent (AE).

To determine adult equivalents from household data, we used the existing method applied to the Myanmar IHLCA from the Cost of the Recommended Diet (CoRD) analysis (Mahrt et al. 2019). Mahrt et al. (2019) provide details of the full method and conversions from the national surveys in the CoRD. The Food and Agriculture Organization (FAO) details an analysis based on dietary energy recommendations for a moderately active population whereas Waid et al. (2017) describes the methodology.

The IHLCA collected consumption data at the household level from 228 individual food items.

To assess dietary patterns, these items were aggregated into food groups. This method was informed by the minimum dietary diversity food groups (FAO and FHI 360 2016; FAO 2018), though they were adapted to Myanmar and expanded to disaggregate food groups that were relevant to this study. For example, fish and fish-based products were separated from the animal meats group and the vegetable and fruit groups. As such, IHLCA food items were grouped into 26 food groups, as detailed in Table 1.

To understand how Myanmar’s consumption patterns stack up against the EAT diet, we compared average national consumption with the standard quantified portions of the diet (Willett et al. 2019). We also compared them to the WHO’s recommendation of a minimum of 400 g of fruits and vegetables daily for the prevention of chronic disease and micronutrient deficiencies. For comparisons with more localized diet recommendations, the National Nutrition Centre (MOH) and the Nutrition Technical Task Force, which includes UN agencies, have started planning to develop quantified FBDGs for Myanmar, though quantified food groups and portions have yet to be determined. In the interim, we reviewed the existing Myanmar qualitative guide (MOHS 2007) compared with Bangladesh’s quantitative FBDG’s (Nahar et al. 2013) for the purpose of quantifying regional diet gaps. In the absence of quantified country specific guidelines, this is justified because Myanmar and Bangladesh are neighboring countries that share some similarities in agricultural production and diets.

A limitation to this analysis, using household derived apparent consumption, is that we cannot account for differences in the actual consumption of individual household members. Food intakes presented are the mean for a region and do not take in consideration factors such as gender or age. It is important that socioeconomic factors in relation to food access, affordability and availability be considered in any recommendations. To provide a reference point, the results for grams of consumption are given per adult equivalent, but this does

not reflect an actual individual person's intake. The assessment and findings in this report are relevant for describing overall population patterns.

Individual intakes and nutrition status can only be determined through individual diet recall and body measurement assessment (Caballero 2012).

Minimum Dietary Diversity for Women of Reproductive Age (MDD-W) groups	Modified MDD-W groups	Food group description
Grains, white roots and tubers, and plantains	Rice Other grains and grain products Tubers * and roots	<ul style="list-style-type: none"> This has been adapted from the Food and Nutrition Technical Assistance III project (FANTA), FHI. 2012 FANTA MDD-W guide (specific to Myanmar). These foods, which may also be referred to as “starchy staples,” provide energy and carbohydrates as well as varying amounts of micronutrients. In Myanmar, this group is dominated by <i>tamin</i> (white rice). White rice has been milled to remove the germ and bran, which unfortunately reduces the micronutrients in white rice. *All sweet potato in this analysis is grouped with tubers; the survey does not distinguish sweet potatoes by color. Ideally, orange sweet potatoes would be grouped with vitamin-A rich vegetables.
Pulses, legumes (beans, peas and lentils)	Pulses (beans, peas and lentils)	<ul style="list-style-type: none"> This group includes members of the plant family <i>Fabaceae</i>. It is high in plant-based protein and B vitamins. Examples: gram (chickpea), penilay (peyaza), butter bean, pegyi (lablab beans), boiled pea, soybean.
Nuts and seeds	Nuts and seeds	<ul style="list-style-type: none"> These are high in fat (mostly “good” fat) and protein and have varied micronutrient contents. Tree nuts, specifically, have positive health associations. Examples: peanuts/ground nuts, coconuts, sesame, sunflower seeds, cashew nuts.
Dairy	Milk and yogurt	<ul style="list-style-type: none"> Most commonly known for being high in calcium, dairy is also a quality protein and rich in several micronutrients. It includes fresh milk and milk powder, not “creamer,” which is non-dairy. The survey does not specifically ask about yogurt consumption.
Meat, poultry and fish	Small fish (calcium-rich) Large fish (inland and marine, capture and aquaculture species), dried fish, shellfish, other seafood and molluscs Fish products (fermented fish paste, dried fish and shrimp) Large or small wild or domesticated mammals, reptiles and amphibians Wild or domesticated birds	<ul style="list-style-type: none"> “Flesh foods,” along with milk and eggs, make up ASFs, which are associated with reduced stunting in young children. This group is rich in animal protein and micronutrients of high bioavailability, meaning the body can easily use them. These include iron and zinc as well as B12, which is only found in ASFs. High intakes of red and processed meats are positively associated with some cancers. It is made up of large fish, such as rohu, mrigal and tilapia. Small indigenous fish species, such as mola, barbs and sardines, can be eaten whole with bones and are especially rich in calcium, iron, zinc and B12 compared to other fish species. Many small fish are also a good source of high-quality vitamin A. Extra amounts are consumed with the head on. In the survey they have been categorized as “small inland fish” or “small marine fish.” Marine fish (e.g. anchovy, mackerel) and other marine aquatic foods (e.g. shrimp, shellfish) are good sources of iodine, though this is not the same for freshwater fish. Examples: Fish includes all types, such as dried and fermented fish and shrimp. As well as pork, chicken, goat, mutton (not sheep) and beef.

Minimum Dietary Diversity for Women of Reproductive Age (MDD-W) groups	Modified MDD-W groups	Food group description
Eggs	Eggs	<ul style="list-style-type: none"> This has been adapted from the Food and Nutrition Technical Assistance III project (FANTA), FHI. 2012 FANTA MDD-W guide (specific to Myanmar). Like other ASFs, eggs are rich in protein and nutrients and a good source of vitamin A. They are also convenient for complementary feeding of infants older than 6 months of age. Examples: chicken eggs, duck eggs, quail eggs.
Dark green leafy vegetables	Vitamin A-rich dark green leafy vegetables	<ul style="list-style-type: none"> These are rich in vitamin A, folate and other micronutrients. Examples: waterleaf/cress, roselle leaf, subok, mustard leaf, gourd leaf. This would also include local wild foraged leaves, though it is unclear if they are captured in the survey.
Other vitamin A-rich fruits and vegetables	Vitamin A-rich vegetables (orange-fleshed)	<ul style="list-style-type: none"> These fruits and vegetables are rich in vitamin A, as well as vitamin C, folate and other micronutrients.
	Vitamin A-rich fruits	<ul style="list-style-type: none"> Fruits need to be consumed ripe with 'orange flesh' to be counted within this group per the MDD-W tool; however the survey tool did not always distinguish between ripe or unripe fruits. Examples: pumpkins, carrots, red peppers/capsicum, mangoes.* *All mango in this analysis is grouped here; the survey does not separate orange and green flesh.
Other vegetables	Vitamin C-rich vegetables	<ul style="list-style-type: none"> Diets rich in fruits and vegetables are associated with positive health outcomes. In addition to multiple micronutrients and fiber, they contain protective bioactive compounds and antioxidants. Examples: tomatoes, long beans, cabbage.
	All other vegetables	<ul style="list-style-type: none"> Examples: gourds, onions, eggplants, cucumbers.
Other fruits	Vitamin C-rich fruits	<ul style="list-style-type: none"> Examples: limes, oranges, papayas,* pineapples. *All papaya in this analysis is grouped here as the survey does not separate between orange and green flesh.
	All other fruits	<ul style="list-style-type: none"> These are fruits that do not fall under the category of vitamin C-rich fruits. They contain a range micronutrients and health benefits. Examples: bananas, watermelons, apples, grapes.
Other fats and oils	Other fats and oils	<ul style="list-style-type: none"> These can be high in saturated fats, which have associations with negative health outcomes. Examples: palm oil, groundnut/peanut oil, sesame oil, sunflower oil, butter, ghee.
Non-nutritionally essential food items	Sweets and added sugars	<ul style="list-style-type: none"> Examples: cake, sugar, palm jaggery.
	Alcohol/betel	<ul style="list-style-type: none"> Examples: local liquor, toddy, betel leaf/nut.
	Tea/coffee (unsweetened)	<ul style="list-style-type: none"> Examples: coffee, green tea, picked tea.
	Spices and condiments	<ul style="list-style-type: none"> Examples: alt, seasoning, dried chilli.
	Other	<ul style="list-style-type: none"> Items not classified in other food groups, such as non-dairy creamer, potato crisp and infant formula.
	Food away from home	<ul style="list-style-type: none"> Mohinga, fried snacks, Shan noodles, coffee/tea.

Table 1. Food group descriptors and application to IHFLCA survey data.

5. Results

5.1. Dietary patterns across states and regions in Myanmar

White rice is the dominant staple food in the Myanmar diet, with a large national mean consumption of 460 g/AE/day. More rice is

consumed in rural than in urban areas. As shown in Figure 4, consumption of rice is lowest in Yangon (356 g/AE/day) and highest in Bago (550 g/AE/day) as well as Rakhine (553 g/AE/day). The type of white rice consumed varies regionally and is made up of several varieties, such as Ngasein, Emata and Nga kywe.

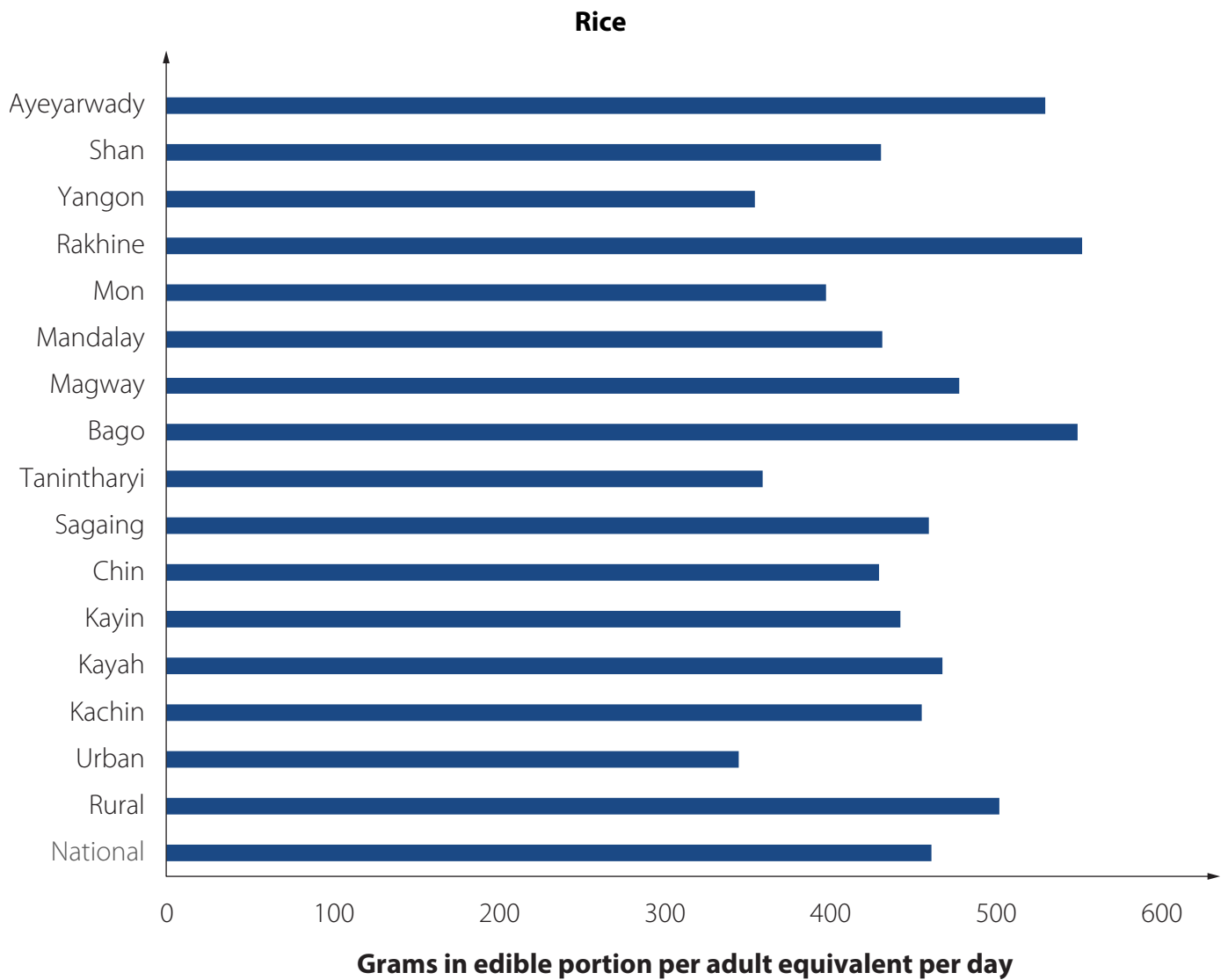


Figure 4. Regional mean of apparent consumption of rice per adult equivalent per day. Authors' calculations based on the 2010 IHLCA.

The consumption of the remaining staple foods (besides rice), such as other grains, tubers and roots, combined contributes to a national average of only 40 g/day to the diet. Regional differences are seen across each of the food groups. As shown in Figure 5, consumption of other grains is highest in Kayah (81 g/day), tubers in Chin (43 g/day), pulses in Sagaing (43 g/day), and nuts and seeds in Magway (15 g/day).

Fish (all types, including products) is the predominantly consumed ASF, with a national mean of 62 g/AE/day, compared to 45 g/AE/day of eggs, meats and dairy combined. This pattern is seen in all lower and coastal areas, though lower fish consumption is seen in the northern and mountainous areas of Chin, Kachin and Shan. Furthermore, Chin, Shan and Kachin have the lowest total ASF consumption. Dairy (limited to fresh and powdered milk in the survey) consumption is minimal across the country, with the highest being in urban Yangon (8 g/AE/day), as shown in Figure 6.

Total fruit and vegetable consumption is inadequate across all regions. The national average (230 g) is barely half of the WHO's

recommendation of a minimum 400 g of fruits and vegetables daily for preventing chronic disease and micronutrient deficiencies. The lowest combined fruit and vegetable intake is in Tanintharyi at only 150 g/AE/day, whereas double this amount is consumed in Sagaing (301 g/AE/day). While sweet potato is consumed in Myanmar, the orange-flesh type is less common and therefore sweet potatoes are grouped with tubers for this analysis. Other vitamin A-rich vegetables such as pumpkin and carrot are consumed in small amounts. Other dark leafy green vegetables, such as watercress, roselle and mustard leaves, as well as vitamin C-rich tomato, chili, green bean and cabbage, are more commonly consumed. This pattern of inadequate intake also continues across all of types of fruit. Vitamin A-rich fruit intake was made up of mango only. The ILHCA survey did not differentiate the intake of ripe papaya, which is also rich in vitamin A, so within this analysis all papaya is included in the vitamin C-rich fruit group. Oranges and limes are in this group as well with small amounts of pineapple, durian and jackfruit also included. Bananas were the most consumed of the remaining "all other fruits" group, along with apples, watermelons and lesser amounts of grapes and mangosteens. As Figure

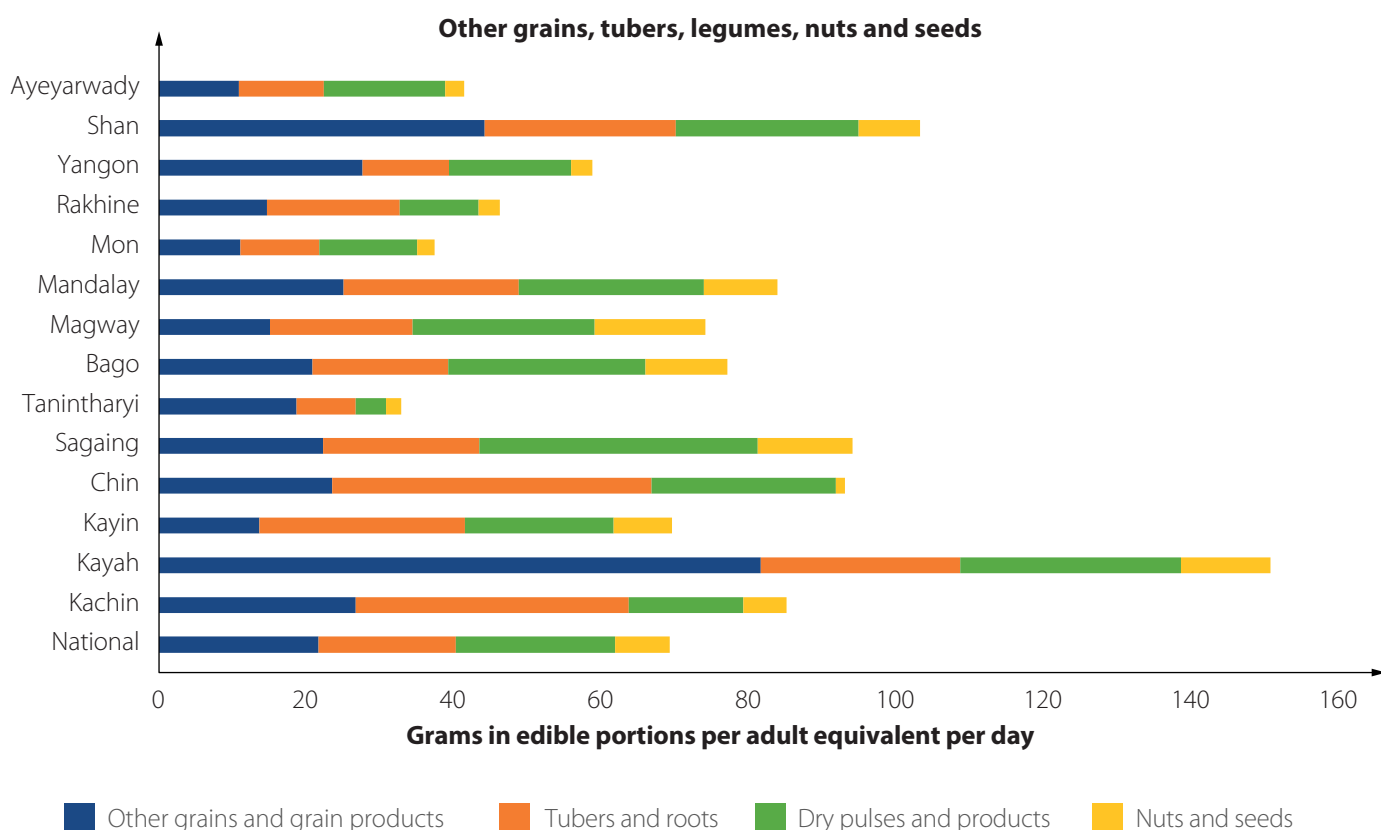


Figure 5. Regional mean of apparent consumption of grains (other than rice), tubers, legumes, nuts and seeds per adult equivalent per day. Authors' calculations based on the 2010 IHLCA.

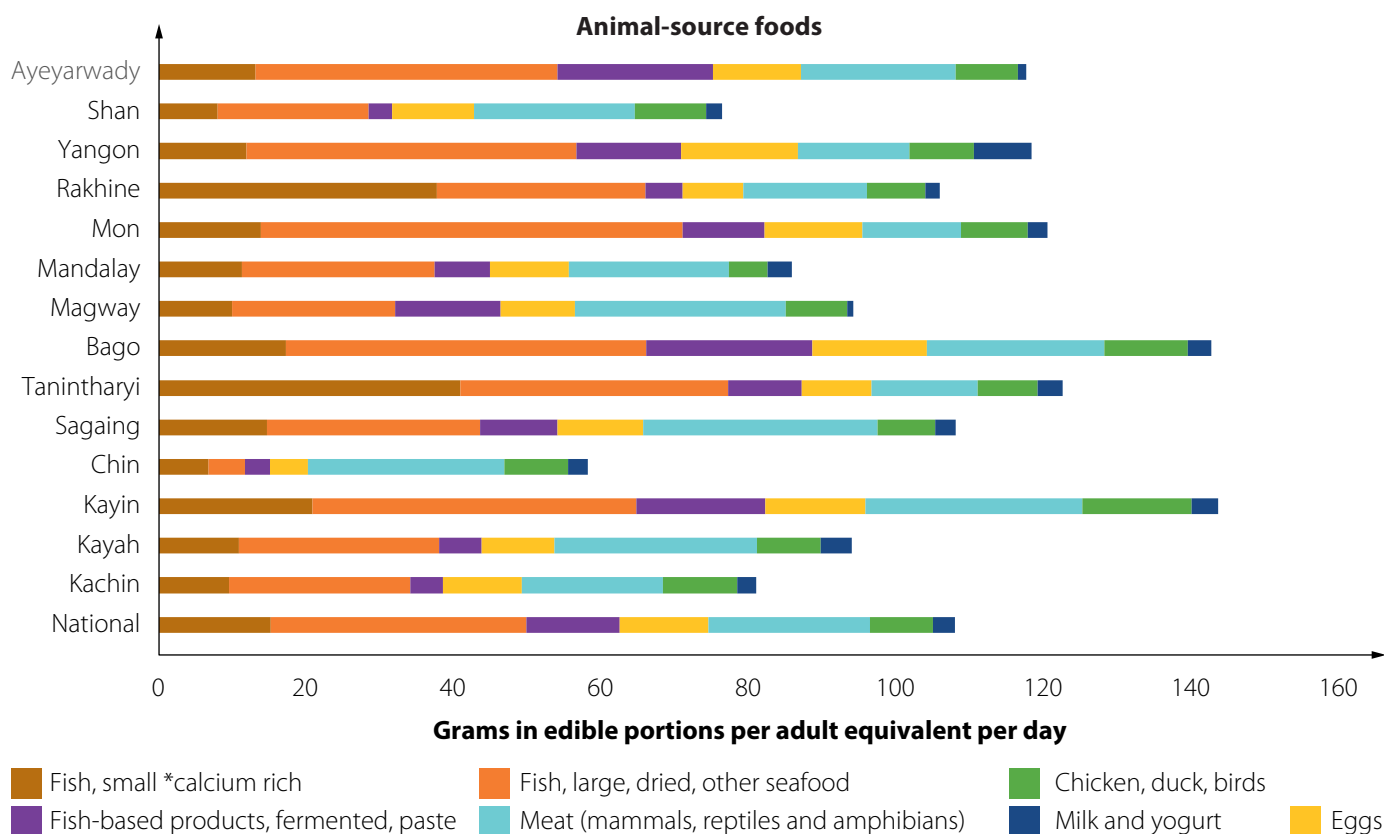


Figure 6. Regional mean of apparent consumption of ASFs per adult equivalent per day. Authors' calculations based on the 2010 IHLCA.

7 shows, increasing the amounts of vegetables and fruits consumed across all regions is required to improve dietary diversity and overall health.

Foods consumed away from home, such as from street vendors and in tea shops, are popular across Myanmar, as shown in Figure 8. However, these foods are often high in fat (many are fried) and also high in sugar, such as sweetened tea and drinks. The total fat, oil and sugar from foods consumed away from home and processed food consumption are likely underestimated in the total diet. Public health messaging and education are required to limit consumption of foods that are low in nutrients and high in saturated fat, sugar and/or salt.

For each of the food groups presented in Figures 4–8, we determined the top three contributing food items per region. (This is available in the supporting Excel document to the report.) This information can be used to further model commonly consumed individual food items in the regions. Some of the food groups comprise the same items across all regions but consumed in varying amounts. For example, bananas and apples made up most of the “other fruits” category

across the regions, though watermelons, grapes and mangosteen also comprised the top three items in differing areas. Onion is common in the “other vegetables” category across all regions.

5.2. Diet gaps

The EAT diet inspired the assessment of sustainable diets for regional Myanmar in this study (Willett et al. 2019). However, the dietary patterns in the country differ considerably from the recommended EAT diet (Table 2). Adapting the diet's possible range per food group could be further modified to suit Myanmar, though current consumption would still largely differ from an adjusted EAT diet. The reason for this is twofold: current dietary intakes overall are not “healthy” and thus the gap between apparent consumption and the EAT recommendations is large. This is demonstrated in Table 2 through inadequate consumption of plant-based foods (legumes, vegetable and fruits). Secondly, they differ in cultural dietary preferences, such as the Myanmar staple-based diet of white rice being more than double the EAT diet portion for the whole grains group.

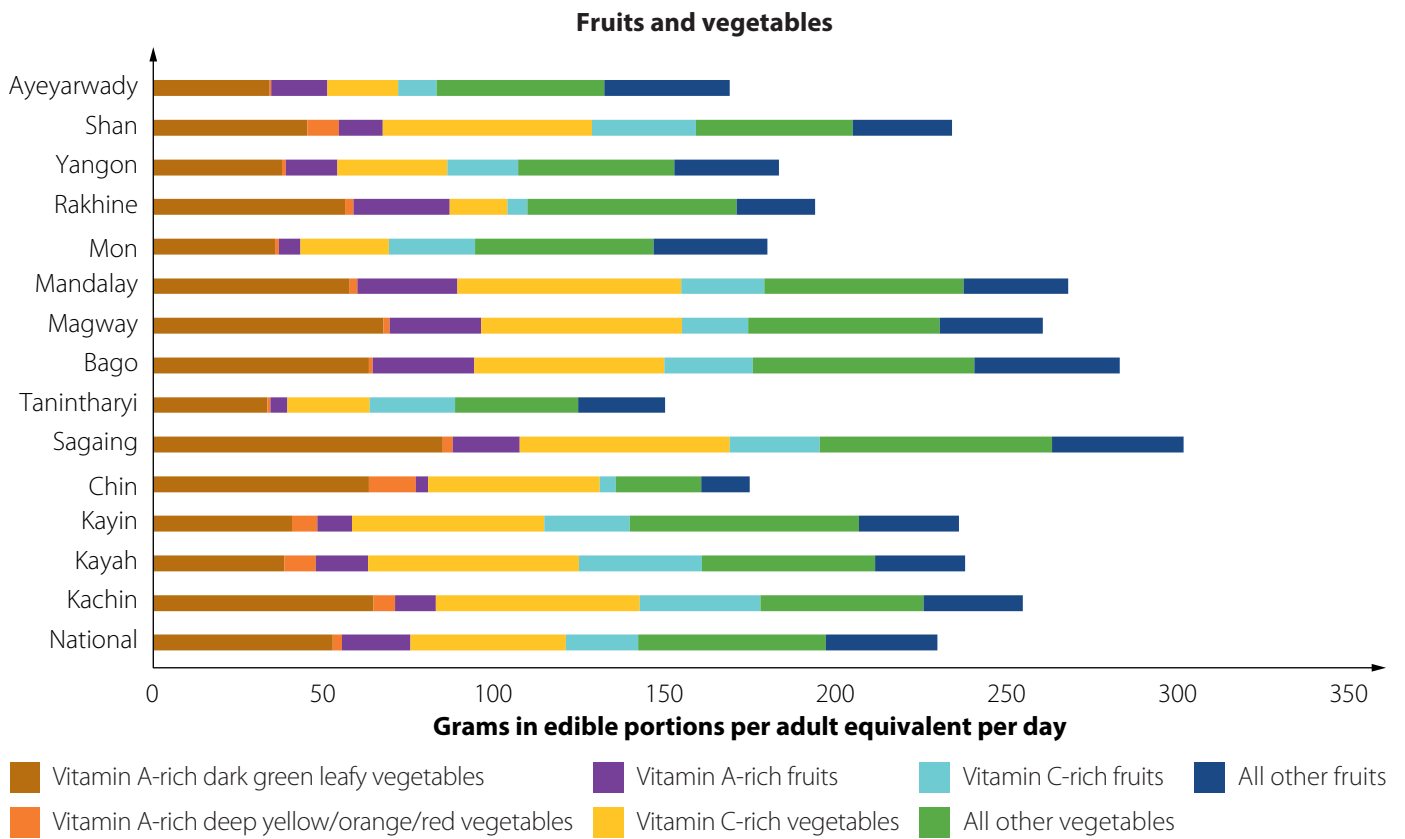


Figure 7. Regional mean of apparent consumption of fruits and vegetables per adult equivalent per day. Authors' calculations based on the 2010 IHLCA.

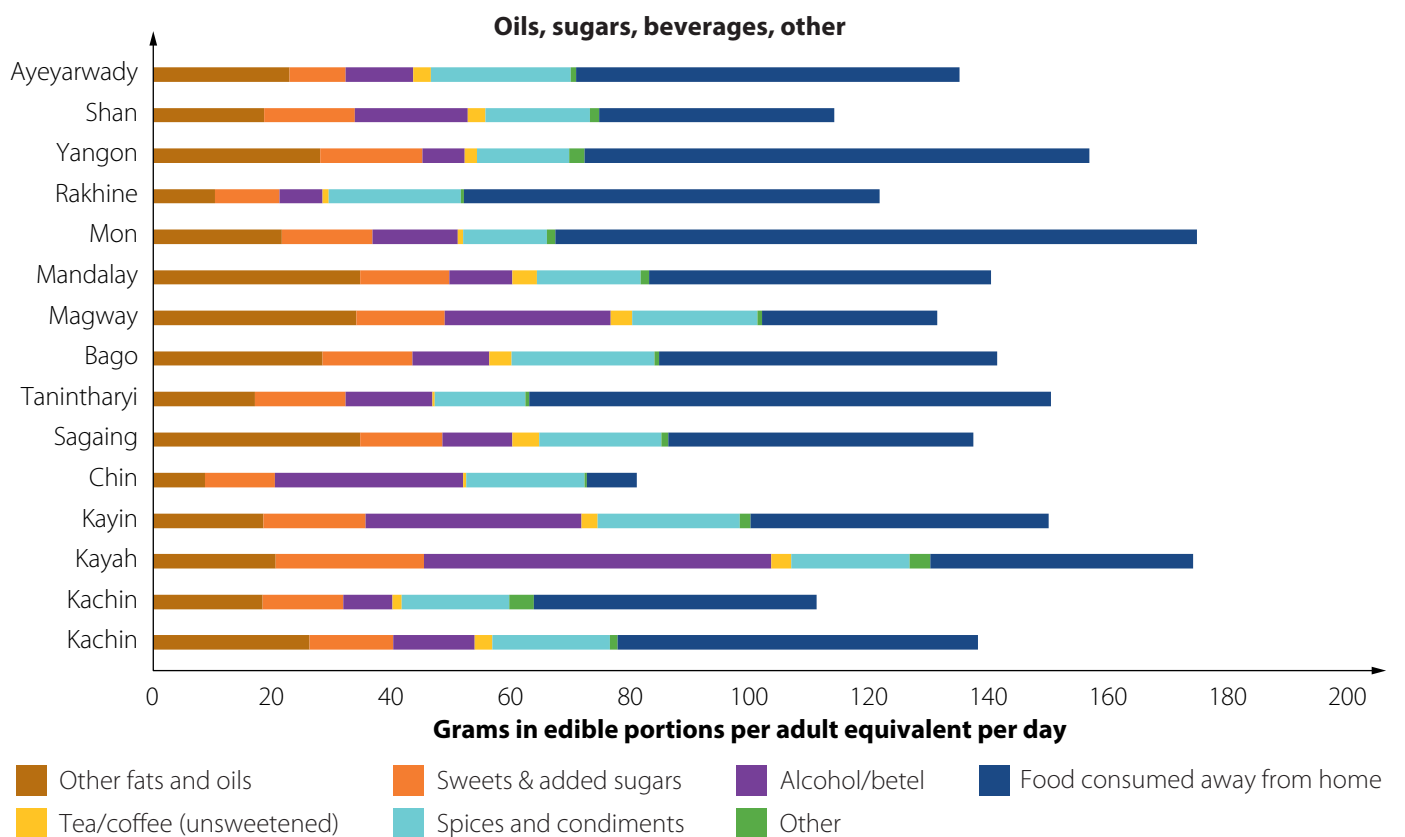


Figure 8. Regional mean of apparent consumption of oil, sugars, beverages, spices and condiments and food consumed away from home, per adult equivalent per day. Authors' calculations based on the 2010 IHLCA.

Myanmar consumption exceeds the EAT diet for the fish group, and the beef and pork group. The intake of eggs is also comparatively high (93%), though chicken consumption only meets 29% of the EAT diet. It is important to note that since the 2010 ILHCA survey, chicken and egg production has increased (Belton et al. 2020) and further analysis by the authors (in progress) demonstrates increased chicken and egg consumption in 2015, though this work is currently being prepared for publication. Dairy intake is minimal, and future recommendations will need to balance increasing milk production, access and availability with suitable non-dairy alternatives, such as calcium-fortified tofu and milk alternatives, as well as small fish consumed with bones.

Blanket messages to reduce fish or animal meat consumption in line with the EAT diet should be avoided in Myanmar. ASFs are important sources of iron, zinc, B vitamins, vitamin A, calcium, iodine and essential fatty acids of high bioavailability that are critical for growth and development in the first 1000 days of life. Plant-based diets can have positive benefits both environmentally and for human health. However, plant-based sources can be limiting in meeting the micronutrient requirements of vulnerable groups in low- and middle-income countries (GAIN 2020). The portions of ASFs would require remodeling to address the variation between Myanmar consumption and the current EAT diet recommended portions. For example, they would have to account for the

Food group	EAT diet g/day ²	EAT possible range g/day	Myanmar national consumption (2010) g/day	% meets or exceeds the EAT diet
Whole grains	232		484	208
Tubers	50	(0–100)	19	37
Legumes	75	(0–100)	22	29
Nuts	50	(0–75)	7	15
Dairy	250	(0–500)	3	1
Eggs	13	(0–25)	12	93**
Fish	28	(0–100)	62	223
Beef, pork	14	(0–28)	22	156
Chicken	29	(0–58)	9	29**
All vegetables	300	(200–600)	121	40
All fruits	200	(100–300)	109	55
Added fats (unsaturated 40 g + saturated 11.8 g)	52	(20–80 + 0–11.8)	26	50*
Added sugars	31	(0–31)	14	45*

Note: A comparison made with the scientific targets of the EAT diet for an intake of 2500 kcal/day. The possible ranges are provided and could be adjusted in future remodeling of the Myanmar diet based on the EAT–Lancet Commission's guidelines.

* Food away from home, beverages excluded, so added fats and sugars are likely higher in the Myanmar diet in real terms.

** National consumption of chicken and eggs has increased since 2010 (analysis in progress), which is in line with increased production (Belton et al. 2020).

Table 2. Comparison of the EAT diet with current national apparent consumption patterns per adult equivalent per day. Authors' consumption calculations based on the 2010 IHLCA.

preference for high fish intakes and ensure that the nutritional requirements of vulnerable groups with a high prevalence of existing micronutrient deficiencies are met.

In addition to the EAT diet comparison, to further understand dietary gaps we assessed regional consumption compared to Bangladesh's FBDGs (in the absence of a quantified Myanmar guideline).

We use the Bangladesh FBDGs as some of the groups are more closely aligned to current consumption patterns. The Bangladesh FBDGs apply a larger starchy staple portion (360 g/day) and increased consumption of fish, meats and eggs of a combined 125 g average portion, as opposed to the 84 g per day guideline of EAT. With the knowledge that the population in Myanmar consumes minimal amounts of dairy, and that milk is expensive and not always locally available, we modified the dairy group to include calcium-rich small fish as a culturally acceptable and available calcium food source. Small fish consumed with bones have been shown to provide the equivalent

absorption of calcium to that sourced from milk (Hansen et al. 1998), making it a suitable local source in addition to dairy in Myanmar.

In the Myanmar diet, across all regions, the consumption of starchy staples is greater than the recommended intake, as shown in Figure 9. This is attributed to the high quantity of rice consumed. For this reason, this food group is separated from the others to visualize the diet gaps.

With the exception of the surplus intake of rice (within the starchy staples/grains group) and oils, consumption of all other food groups, across all regions, falls short of recommended amounts in the Bangladesh FBDGs. Although rice is the staple food in the diet and is important for meeting the population's energy needs, it is poor in micronutrients. Poor quality diets lack diversity, particularly of nutrient-dense and protective foods. As a result, they contribute to micronutrient deficiencies and increase the risk of noncommunicable diseases, such as heart disease and diabetes, in the population.

Recommended food group servings per day	Minimum number of servings	Maximum number of servings	Average number of servings	Serving size (g)	Average recommended amount (g) ³
Starchy staples	9	15	12	30	360
Pulses	1	2	1.5	25	37.5
Fish/meat/eggs	1	4	2.5	50	125
Dairy and small fish	1	2	1.5	150	225
Dark green leafy vegetables	1	2	1.5	100	150
Other vegetables	2	4	3	100	300
Fruit	1	3	2	100	200
Fats and oils	3	6	4.5	7	31.5

Note: Recommendation to eat one citrus fruit and one vitamin A-rich fruit per day excluded due to data limitations. Modified to include small fish in the dairy recommendation. Portion sizes estimated based on conflicting information in the Bangladesh FBDGs portion guide.

Table 3. Adaptation of dietary recommendations from Bangladesh's FBDGs.

Food group	Average recommended quantity (Bangladesh FBDGs g/day)	Myanmar consumption (2010) g/AE/EP/day
Starchy staples	360	489
Pulses	45	22
Fish/meat/eggs	125	90
Small fish and dairy	225	95
Dark green leafy vegetables	150	53
Other vegetables	300	103
Fruit	200	74
Fats and oils	45	30

Table 4. Quantity of recommended portions in the Bangladesh FBDGs compared with (apparent) national average consumption in Myanmar per adult equivalent per day. Authors' calculations based on the 2010 IHLCA.

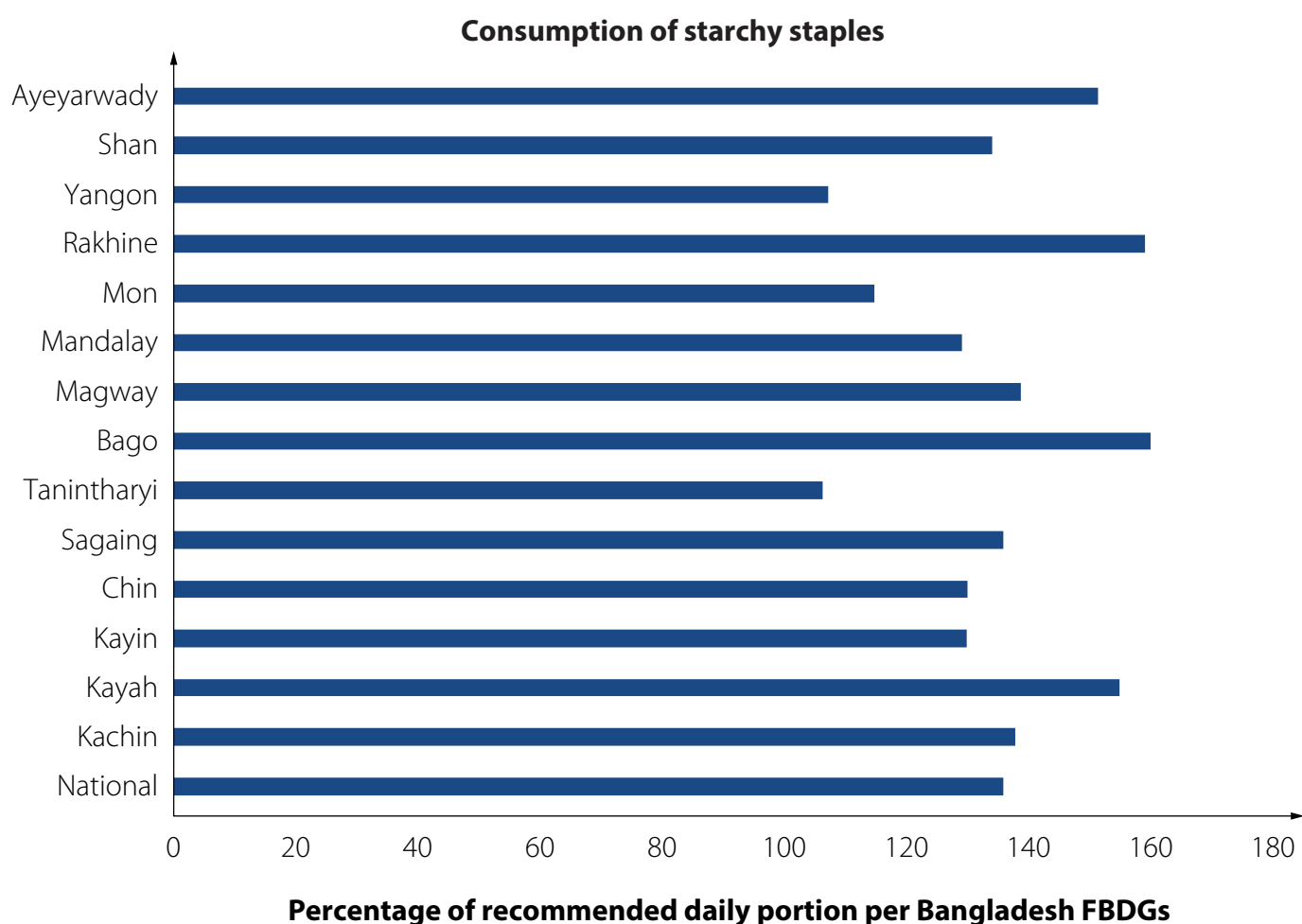


Figure 9. Comparison of regional mean apparent consumption with the recommended dietary intake for starchy staples. Authors' calculations based on the 2010 IHLCA.

The national average consumption of pulses meets just over half (58%) of the recommended portion. In Sagaing and Kayah, consumption of pulses met 100% and 80% of the recommended amounts, respectively. This is in contrast to consumption of pulses in Tanintharyi, which only met 11% of the recommended portion in the Bangladesh FBDGs.

Bago and Kayin have the highest consumption of the fish, meat and eggs group, at more than 95% of the recommended portions. Mon and Ayeyarwady closely follow, with 83%, whereas only 39% of this group is met in Chin State. Fish is the largest contributor to this group across the country. The consumption of pork, chicken and eggs varied widely across the regions (further itemized in Table S1 in the supplementary Excel file). It is important to note that since the IHLCA survey, which was conducted in 2010, the consumption of meats and eggs has increased in line with increased production (Belton et al. 2020). Because of this, strong conclusions are not made on consumption of itemized meats, eggs and fish in this report. The consumption of dairy in the form of milk was very low across Myanmar, as shown in Figure 3, so we modified this food group to include an alternative calcium-rich food (small fish) for dietary assessment and consideration in Table 3. The supplementary Table S1 further distinguishes the top three food items in this group by region. The highest consumption of calcium-rich fish was seen along the coast of Rakhine (fresh and dried marine small fish) and from rivers in inland Kayin (dried small fish) (Figure 10). Overall ASF (fish, meats, eggs and dairy) consumption across all states and regions indicates that fish is the most important contributor and that ASFs should be increased for vulnerable groups.

Groundnuts and palm oil contribute the most to the consumption of fats and oils. Though the IHLCA survey specifies types and quantities of foods consumed away from home, it is beyond the scope of this analysis to disaggregate these dishes into each of the eight FBDG food groups. If disaggregated by food group, consumption in each food group would likely increase. However, the authors expect that foods consumed away from home disproportionately increase quantities consumed of staples and added fats.

Our results throughout show vegetable intake is inadequate, and this holds against the Bangladesh recommendations to consume 150 g of dark green leafy vegetables (DGLVs) as well as 300 g of other vegetables (which is higher than the WHO and EAT diet minimum). National consumption meets only 35% and 34% of each vegetable group respectively. Tanintharyi has the lowest vegetable consumption of both types (20% other vegetables and 22% DGLVs), as do both Ayeyarwady and Mon (23%–26%). The highest intake of DGLV was seen in Sagaing, though still only 56% of the recommended portion.

Similar patterns continue for regional fruit intake, the national mean consumption meeting only 37% of the recommended 200 g per day. Consumption in Chin State is the lowest and met only 11%, as well and it is also low in the coastal areas of Tanintharyi, Ayeyarwady, Mon and Rakhine, as well as Yangon (33%). Bago has the highest fruit consumption (49%), though only half of the recommended amount. Regional consumption patterns clearly demonstrate a severely inadequate intake of vegetables and fruit across all regions compared with Bangladesh's FBDGs. Increasing the consumption of vegetables and fruits across all regions should be a priority.

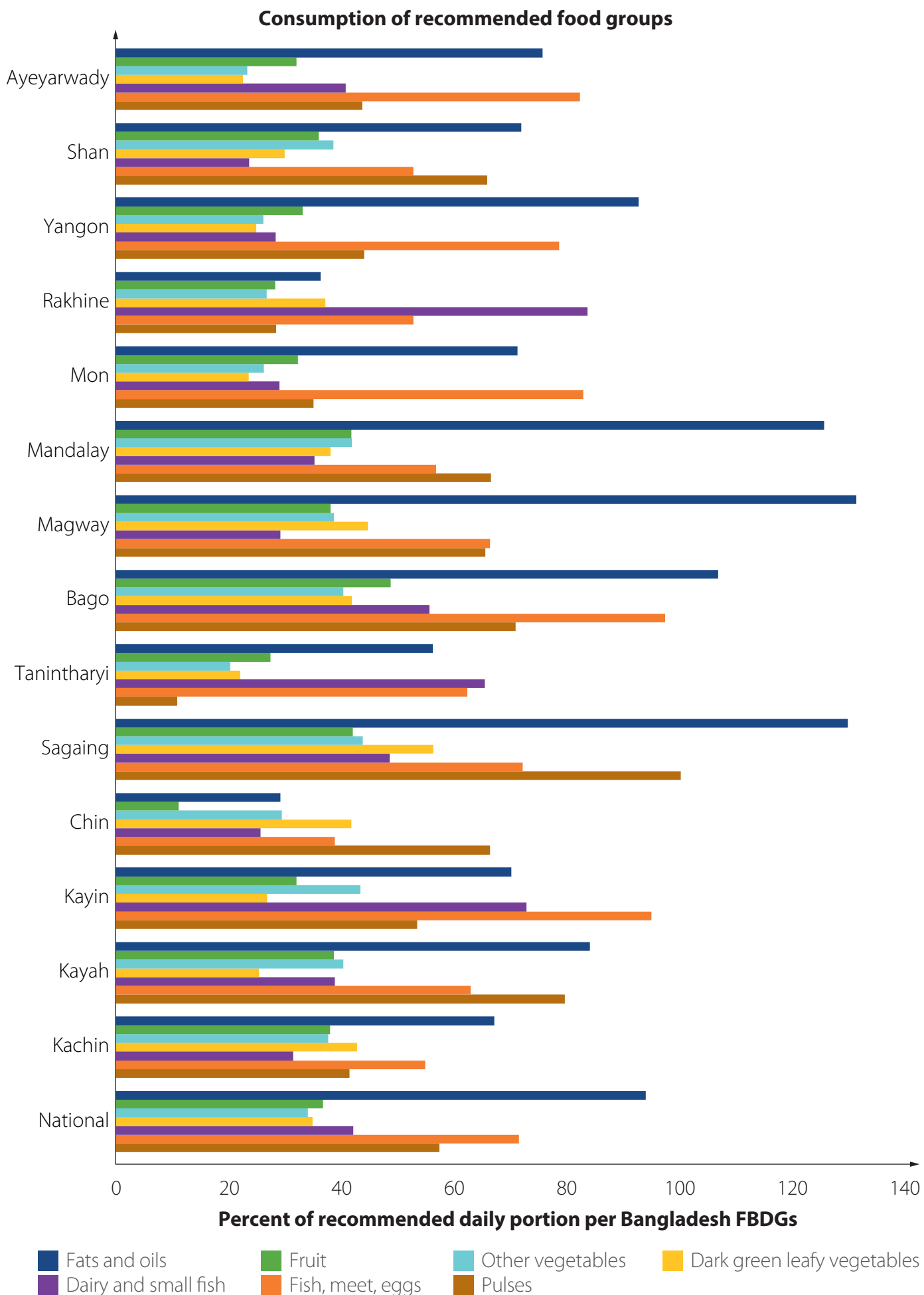


Figure 10. Comparison of regional mean apparent consumption with the recommended dietary intakes in the Bangladesh FBDGs. Authors' calculations based on the 2010 IHLCA.

6. Discussion

Current dietary patterns are inadequate with respect to consumption of diverse nutritious food groups across all regions. The Myanmar diet comprises mainly white rice, so increasing the amounts of all nutritious food groups could improve upon it. The dominance of white rice as the main staple food likely meets the energy needs of most people, but it is inadequate in providing micronutrients, essential fatty acids and protein. Recommendations to drastically increase the consumption of plant-based foods, such as vegetables, fruits and legumes, are in line with the EAT diet recommendations and should be prioritized in all regions for improved health and nutrition of the country's population. The etiology of the different forms of malnutrition are unique and complex. However, per the WHO's "double duty actions," these increases can simultaneously address both undernutrition and overnutrition (Dietz 2017). This could be achieved by increasing and diversifying the types of food out on the plate. Doing so would improve dietary diversity, micronutrient intake and associated protective benefits with respect to overweight, obesity and noncommunicable diseases.

Reducing the consumption of ASFs in line with the EAT diet should not be a blanket approach for Myanmar. The consumption of ASFs by vulnerable groups should be prioritized through nutrition-sensitive interventions. These foods should be targeted to improve the intake of micronutrients as well as essential fatty acids and protein among malnourished populations and those with increased nutrient requirements, such as pregnant and lactating women as well as infants and young children. Nutrients obtained from ASFs are highly bioavailable, whereby the body can absorb them more readily as compared to nutrients obtained from plant-source foods. Furthermore, ASFs enhance the absorption of micronutrients from plant-source foods when consumed together in a meal. Fish is the dominant and most relied upon ASF in the Myanmar diet. Because of this, sustaining capture fisheries and optimizing aquaculture are key interventions to maintain and increase the supply of fish for local consumption.

Localized healthy food systems should be optimized. Local food sources from both production and natural sources, such as small fish from marine and freshwater as well as pulses from dry zones, must be sustained and increased to provide essential limiting nutrients. Localized food systems should continue to build on indigenous foods and local preferences. This analysis is limited to food items identified in the national survey and secondary nutrient composition tables, so greater focus in future studies should be given to local and indigenous foods (foraged or cultivated) for improved nutrition.

Nutrition-sensitive fish agri-food systems should prioritize nutrient-rich foods and dietary diversity in food systems development to combat malnutrition. Diversifying agrarian production systems, driven by smallholders, is an underlying principle for achieving MS-NPAN and ADS objectives. The nutrient composition of different food items within a food group must be leveraged, for example in the vitamin A-rich (orange flesh varieties) and DGLVs. As well as nutrient-dense post-harvest products, such as dried fish and fish powder. Integrated agriculture-aquaculture production systems, including homestead vegetables and ponds, through to rice-fish systems can further diversify smallholder and large-scale food production. To fill dietary gaps, it is critical that interdisciplinary planning between agronomists, fisheries, aquaculturists and nutritionists prioritizes culturally acceptable and desirable nutrient-dense species and varieties.

7. Conclusion

The rich diversity of agricultural landscapes throughout Myanmar is reflected in the differences in localized diets, such as high fish consumption in Ayeyarwady and the coastal areas, and more pulses, nuts and sesame oil in inland areas. But broadly, diets across Myanmar are dominated by one starchy staple food (rice), with small amounts of nutrient-dense foods. This analysis has demonstrated clear diet gaps, yet it is possible to directly fill the diet gaps across all regions in Myanmar. Changes in agriculture production are justified and necessary. This can be done by increasing local production and productivity, reducing food loss and improving the availability, access and affordability of diverse nutrient-rich foods for both household and regional consumption. Transitioning from a rice-dominated to a diverse diet increases the cost. Factoring the cost of the diet is critical, with over half of the population in Myanmar unable to afford the cost of a nutritious diet (estimated before the current COVID-19 disruptions). Increasing consumption of nutritious foods for the poorest households will require multilayered approaches that address affordability.

This analysis of consumption patterns and diet gaps across regional Myanmar serves to inform subsequent interdisciplinary analysis and recommendations in the next stages of the Transformation of Rural Landscapes for Sustainable and Nutritious Food Systems project in Myanmar. A food systems approach including all aspects from field to fork through market systems, education and behavior change should be considered in improving healthy sustainable diets for Myanmar. Increasing the consumption of diverse nutritious foods is imperative for combating malnutrition in all forms, and multisectoral approaches will be the key to success.



Photo credit: Hay, Su Hainy/BPAC

Mixing food with pestle and mortar.

Notes

- ¹ For further details on the nutrition status and progress in Myanmar please see <https://globalnutritionreport.org/resources/nutrition-profiles/asia/south-eastern-asia/myanmar/> <https://scalingupnutrition.org/sun-countries/myanmar/> (last updated November 2017).
- ² EAT–Lancet Commission: Although the Planetary Health Diet, which is based on health considerations, is consistent with many traditional eating patterns, it does not imply that the global population should eat exactly the same food, nor does it prescribe an exact diet. Instead, the Planetary Health Diet outlines empirical food groups and ranges of food intakes, which, combined in a diet, would optimize human health. Local interpretation and adaptation of the universally applicable Planetary Health Diet is necessary and should reflect the culture, geography and demography of the population and individuals.
- ³ Population dietary guidelines provide a range of daily servings, which must be tailored to life stage and sex to meet an individual’s energy and nutrient requirements.

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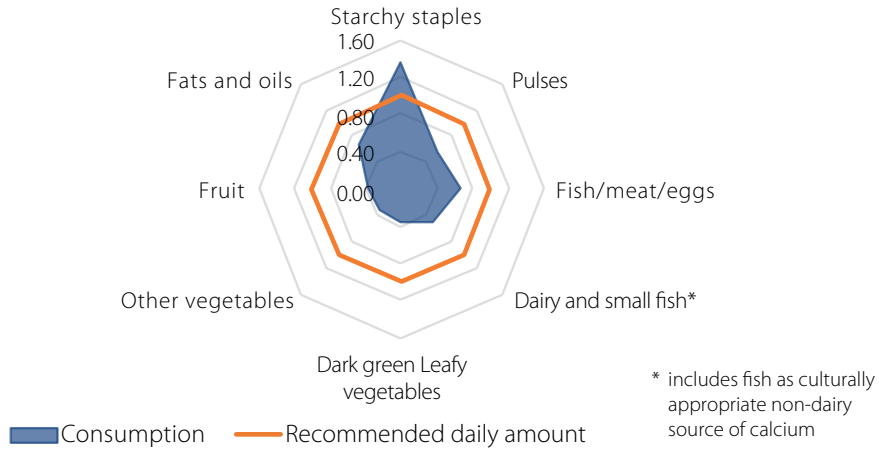
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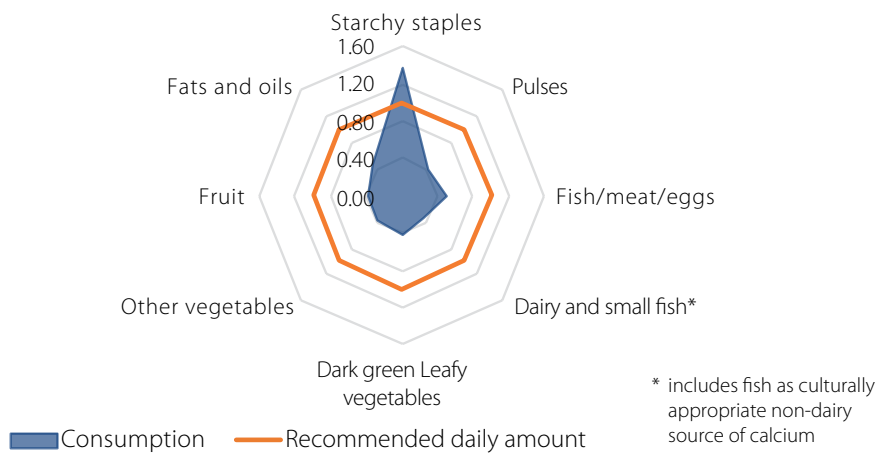
Appendix and supplementary

Radar graphs (by region) showing actual consumption of each food group as a proportion of that recommended.

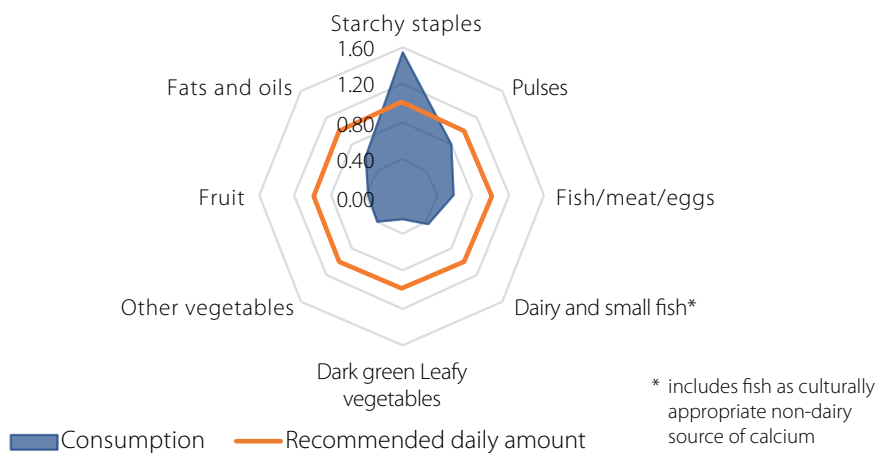
Myanmar: National food consumption



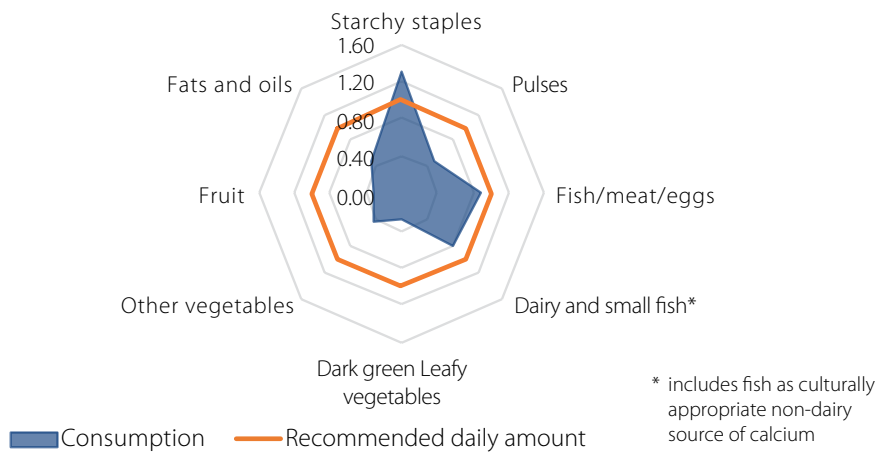
Kachin: Food consumption



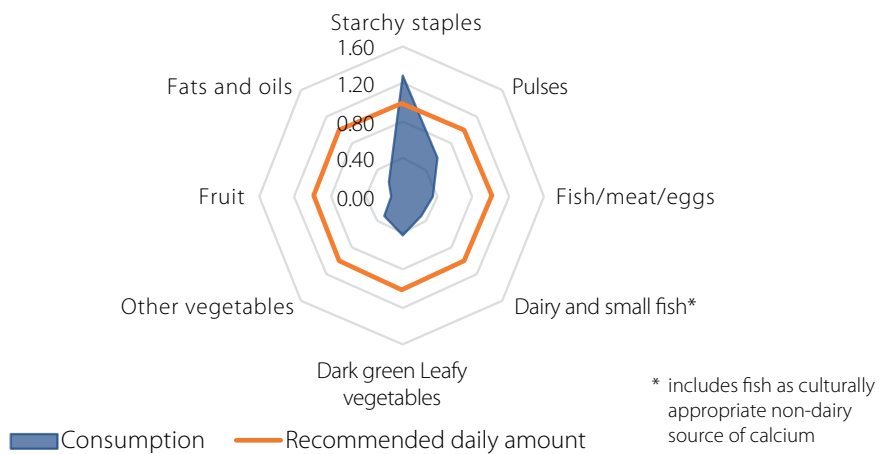
Kayah: Food consumption



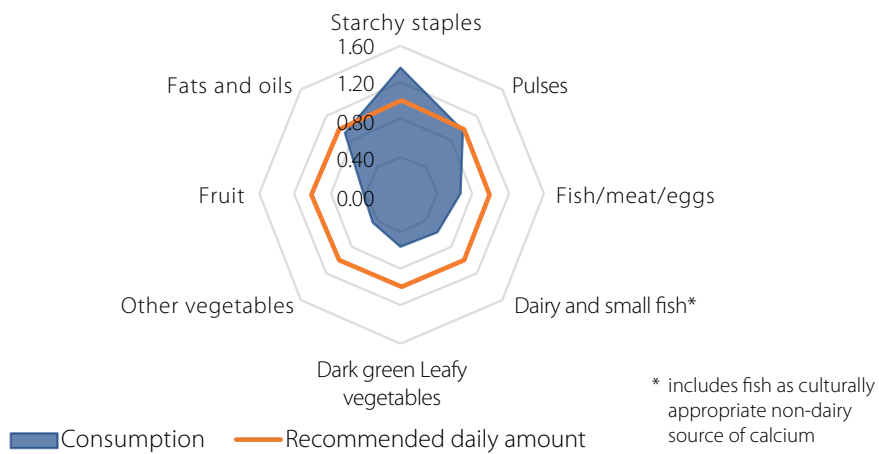
Kayin: Food consumption



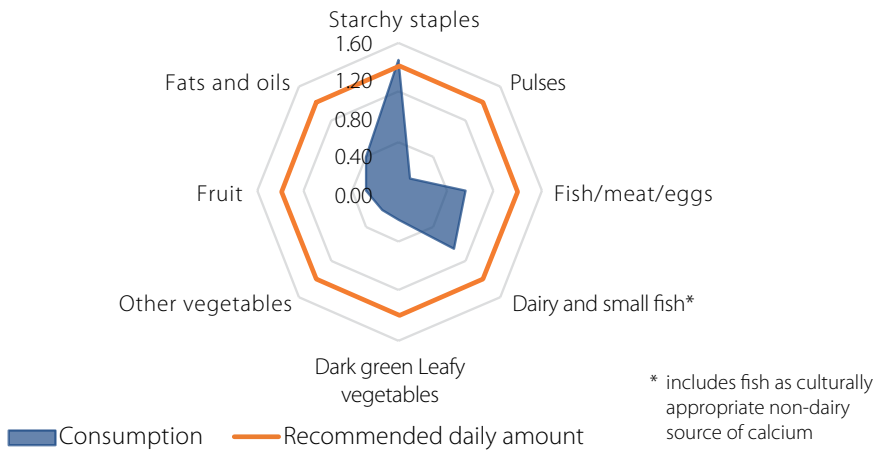
Chin: Food consumption



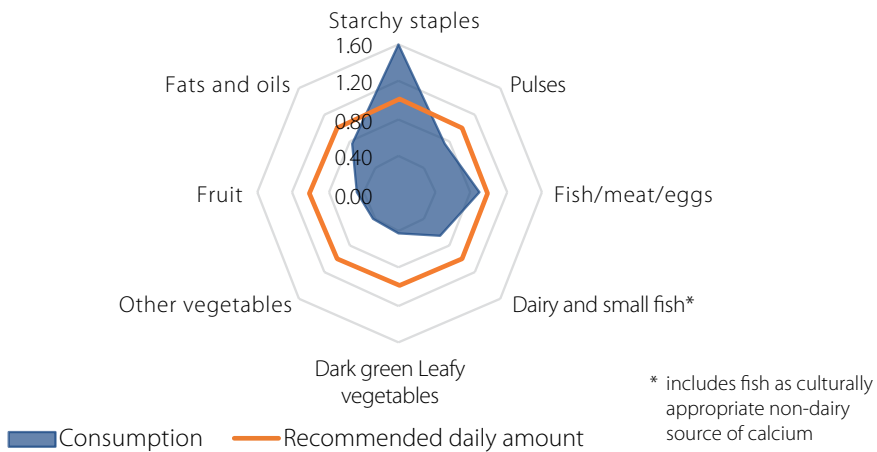
Sagaing: Food consumption



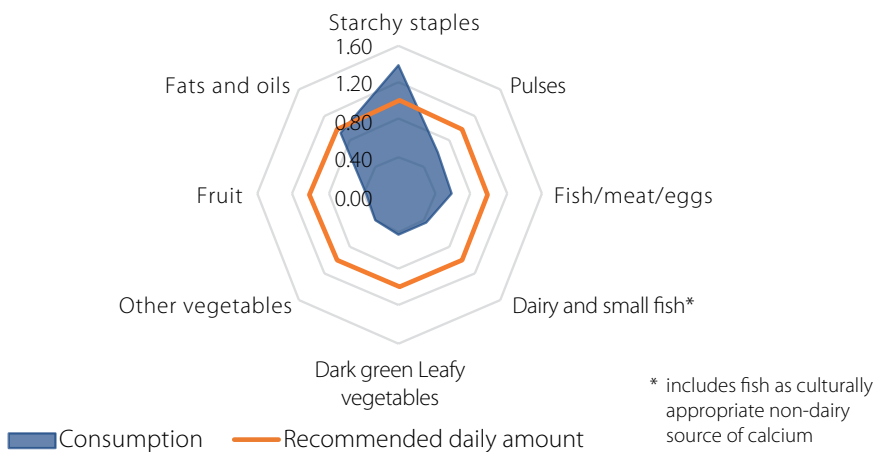
Tanintharyi: Food consumption



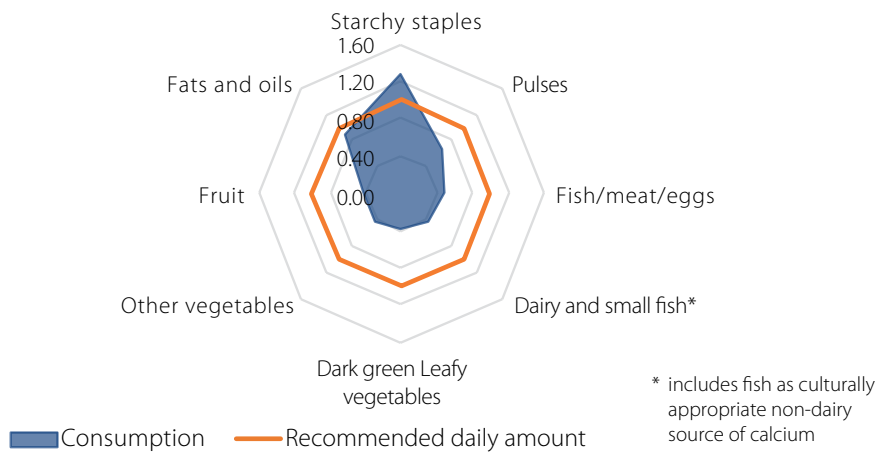
Bago: Food consumption



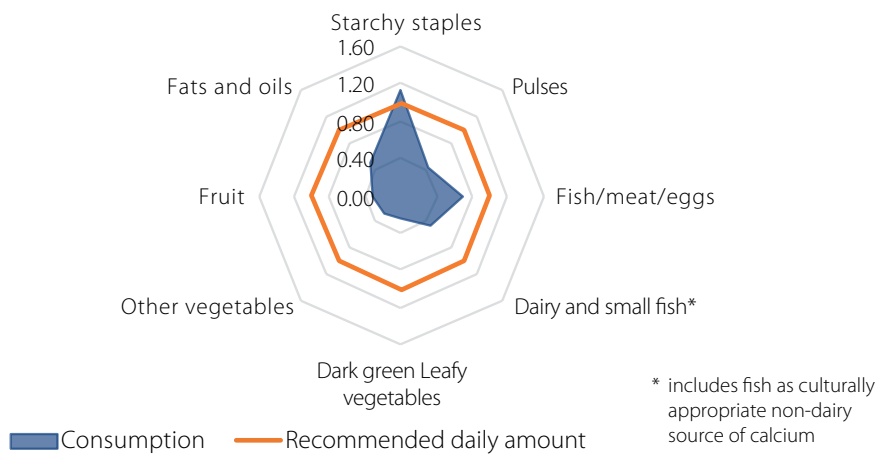
Magway: Food consumption



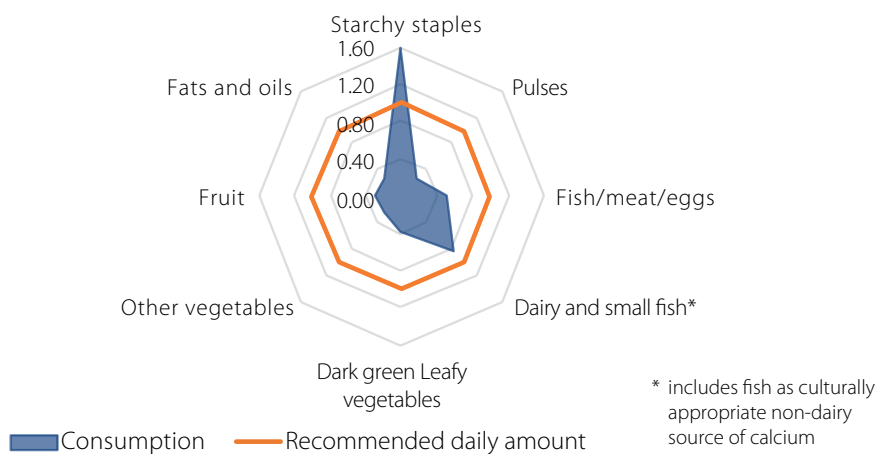
Mandalay: Food consumption



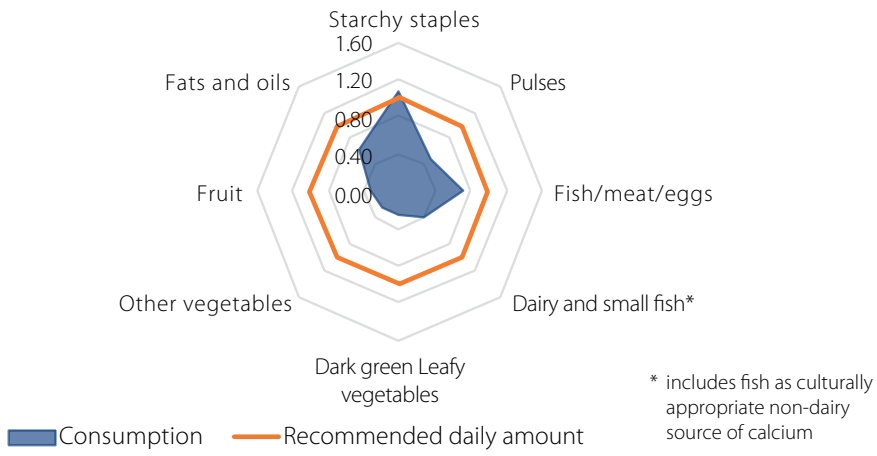
Mon: Food consumption



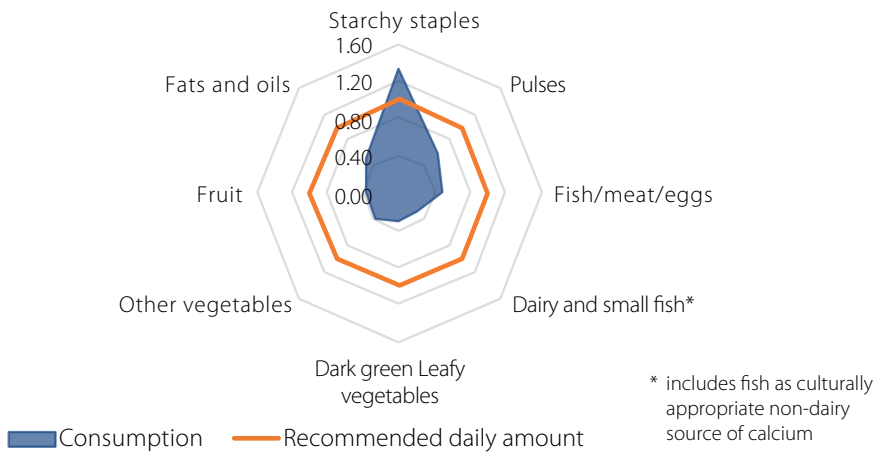
Rakhine: Food consumption



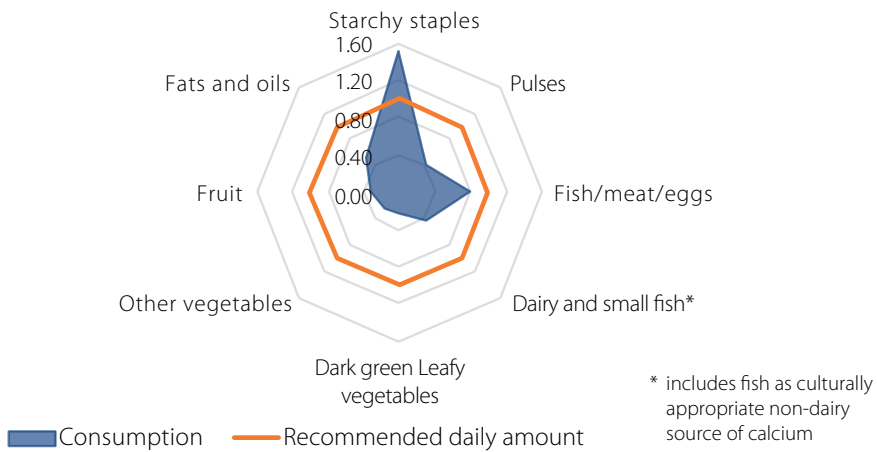
Yangon: Food consumption



Shan: Food consumption



Ayeyarwady: Food consumption



	National	Kachin	Kayah	Kayin	Chin	Sagaing	Tanintharyi	Bago	Magway	Mandalay	Mon	Rakhine	Yangon	Shan	Ayeyarwady
	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items
Food Group		Rice (Ngasein)	Rice (Ngasein)	Rice (Ngasein)	Rice (Ngasein)	Rice (Ngasein)	Rice (Ngasein)	Rice (Ngasein)	Rice (Ngasein)	Rice (Ngasein)	Rice (Emata)	Rice (Ngasein)	Rice (Ngasein)	Rice (Emata)	Rice (Ngasein)
	Rice (Emata)	Rice (Emata)	Rice (Emata)	Rice (Emata)	Rice (Emata)	Rice (Emata)	Rice (Emata)	Rice (Emata)	Rice (Emata)	Rice (Emata)	Rice (Medone)	Rice (Emata)	Rice (Emata)	Rice (Emata)	Rice (Nga kywe)
	Rice (Nga kywe)	Other rice (local variety)	Other rice (local variety)	Other rice (local variety)	Other rice (local variety)	Other rice (local variety)	Other rice (local variety)	Other rice (local variety)	Other rice (local variety)	Other rice (local variety)	Rice (Nga kywe)	Rice (Nga kywe)	Other rice (local variety)	Rice (Nga kywe)	Other rice (local variety)
Other grains and grain products	Dried wheat noodle	Dried rice noodle	Bread	Dried wheat noodle	Bread	Dried wheat noodle	Dried rice noodle		Rice vermicelli	Dried wheat noodle	Dried wheat noodle	Dried wheat noodle	Rice vermicelli	Rice vermicelli	Dried rice noodle
	Bread	Bread	Vermicilli (bean)	Bread	Maize seeds (dry)	Bread	Dried wheat noodle		Bread	Bread	Bread	Bread	Bread	Bread	Dried wheat noodle
	Fritters with pea	Fritters with pea	Fritters with pea	Fritters with pea	Millet	Fritters with pea	Bread		Fritters with pea	Fritters with pea	Fritters with pea	Fritters with pea	Fritters with pea	Fritters with pea	Bread
Tubers and roots	Sweet potatoes	Sweet potatoes	Sweet potatoes	Potatoes	Sweet potatoes	Sweet potatoes	Sweet potatoes		Sweet potatoes	Sweet potatoes	Sweet potatoes	Sweet potatoes	Sweet potatoes	Sweet potatoes	Sweet potatoes
	Potatoes	Potatoes	Potatoes	Yams	Potatoes	Potatoes	Potatoes		Potatoes	Potatoes	Potatoes	Potatoes	Potatoes	Potatoes	Potatoes
	Taro	Taro	Taro	Taro	Taro	Palm shoot	Palawpenan		Palm shoot	Palm shoot	Pemyit	Taro	Taro	Taro	Taro
Dry pulses and products	Gram (Chick pea)	Pe poke	Pegya	Pegyi (Lablab beans)	Pe poke	Pegya	Sadawpe (green peas)		Gram (Chick pea)	Pegyi (Lablab beans)	Gram (Chick pea)	Pegyi (Lablab beans)	Sadawpe (green peas)	Gram (Chick pea)	Pegya
	Penilay (Peyaza)	Sadawpe (green peas)	Pe poke	Pegya	Gram (Chick pea)	Gram (Chick pea)	Gram (Chick pea)		Butter bean	Sadawpe (green peas)	Butter bean	Gram (Chick pea)	Gram (Chick pea)	Penilay (Peyaza)	Pe poke
	Boiled pea (any kind of peas)	Gram (Chick pea)	Gram (Chick pea)	Gram (Chick pea)	Other pulses/beans/nuts/seeds	Butter bean	Boiled pea (any kind of peas)		Boiled pea (any kind of peas)	Gram (Chick pea)	Boiled pea (any kind of peas)	Boiled pea (any kind of peas)	Boiled pea (any kind of peas)	Boiled pea (any kind of peas)	Gram (Chick pea)
Nuts and seeds	Sesame	Sesame	Sesame	Sesame	Sesame	Sesame	Sesame		Sesame	Sesame	Sesame	Sesame	Sesame	Sesame	Sesame
	Groundnut without shell	Groundnut without shell	Groundnut without shell	Groundnut without shell	Groundnut without shell	Groundnut without shell	Groundnut without shell		Groundnut without shell	Groundnut without shell	Groundnut without shell	Groundnut without shell	Groundnut without shell	Groundnut without shell	Groundnut without shell
	Coconut	Coconut	Coconut	Coconut	Coconut	Coconut	Coconut		Coconut	Coconut	Coconut	Coconut	Coconut	Coconut	Coconut
Milk and yoghurt	Fresh milk	Fresh milk	Fresh milk	Fresh milk	Fresh milk	Fresh milk	Fresh milk		Fresh milk	Fresh milk	Fresh milk	Fresh milk	Fresh milk	Fresh milk	Fresh milk
	Milk powder	Milk powder	Milk powder	Milk powder	Milk powder	Milk powder	Milk powder		Milk powder	Milk powder	Milk powder	Milk powder	Milk powder	Milk powder	Milk powder
Eggs	Chicken eggs	Chicken eggs	Chicken eggs	Chicken eggs	Chicken eggs	Chicken eggs	Chicken eggs		Chicken eggs	Chicken eggs	Chicken eggs	Chicken eggs	Chicken eggs	Chicken eggs	Chicken eggs
	Duck eggs	Duck eggs	Duck eggs	Duck eggs	Duck eggs	Duck eggs	Duck eggs		Duck eggs	Duck eggs	Duck eggs	Duck eggs	Duck eggs	Duck eggs	Duck eggs
	Quail eggs	Quail eggs	Quail eggs	Quail eggs	Quail eggs	Quail eggs	Quail eggs		Quail eggs	Quail eggs	Quail eggs	Quail eggs	Quail eggs	Quail eggs	Quail eggs

	National	Kachin	Kayah	Kayin	Chin	Sagaing	Tanintharyi	Bago	Magway	Mandalay	Mon	Rakhine	Yangon	Shan	Ayeyarwady
	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items
Small fish eaten whole with bones	Other small river fish	Other small river fish	Other small river fish	Other small river fish	Other small river fish	Other small river fish	Other small sea water fish	Other small river fish	Other small river fish	Other small river fish	Other small river fish	Other small sea water fish	Other small river fish	Other small river fish	Other small river fish
	Other dried small river fish	Other dried small river fish	Other dried small river fish	Other dried small river fish	Other dried small river fish	Other dried small river fish	Other dried small sea water fish	Other dried small river fish	Other dried small river fish	Other dried small river fish	Other dried small river fish	Other dried small river fish	Dried prawns	Other dried small river fish	Other dried small sea water fish
Small fish eaten whole with bones	Dried prawns	Dried prawns	Dried prawns	Dried prawns	Dried prawns	Dried prawns	Dried prawns	Dried prawns	Dried prawns	Dried prawns	Dried prawns	Other dried small sea water fish	Dried prawn powder	Dried prawns	Dried prawns
Large whole fish, dried fish, shellfish, other seafood and molluscs	Ngagyin	Ngagyin	Ngagyin	Ngagyin	Ngagyin	Ngagyin	Pazun Kyawt	Ngamyitchin	Ngagyin	Ngagyin	Ngayant	Ngapokethin	Ngamyitchin	Ngagyin	Ngamyitchin
	Ngayant	Ngayant	Ngayant	Ngayant	Other medium river fish	Ngayant	Other medium sea water fish	Ngagyin	Ngayant	Ngapokethin	Ngathalauk	Pazun Kyawt	Ngagyin	Ngayant	Ngayant
	Ar Bye Gyauk	Ar Bye Gyauk	Other medium river fish	Ngakhu	Ar Bye Gyauk	Ar Bye Gyauk	Other dried medium and above sea water fish	Ngayant	Ar Bye Gyauk	Ar Bye Gyauk	Ar Bye Gyauk	Other medium sea water fish	Ar Bye Gyauk	Nga Yantchawk	Pazun Kyawt
Post harvest fish products	Shrimp paste	Shrimp paste	Shrimp paste	Shrimp paste	Shrimp paste	Shrimp paste	Shrimp paste	Shrimp paste	Shrimp paste	Shrimp paste	Shrimp paste	Shrimp paste	Shrimp paste	Shrimp paste	Shrimp paste
	Fish/shrimp sauce	Fish/shrimp sauce	Ngapiyae	Fish/shrimp sauce	Fish/shrimp sauce	Fish/shrimp sauce	Fish/shrimp sauce	Fish/shrimp sauce	Fish/shrimp sauce	Fish/shrimp sauce	Fish/shrimp sauce	Fish/shrimp sauce	Fish/shrimp sauce	Fish/shrimp sauce	Fish/shrimp sauce
	Ngapiyae	Nagpikaung/Salted fish	Nagpikaung/Salted fish	Ngapiyae	Nagpikaung/Salted fish	Nagpikaung/Salted fish	Ngapiyae	Ngapiyae	Nagpikaung/Salted fish	Ngapiyae	Ngapiyae	Ngapiyae	Ngapiyae	Nagpikaung/Salted fish	Ngapiyae
Large or small wild or domesticated mammals, reptiles and amphibians	Beef	Beef	Beef	Beef	Beef	Beef	Beef	Beef	Beef	Beef	Beef	Beef	Beef	Beef	Beef
	Pork	Pork	Pork	Pork	Pork	Pork	Pork	Pork	Pork	Pork	Pork	Pork	Pork	Pork	Pork
	Mutton	Dried meat	Dried meat	Mutton	Dried meat	Mutton	Mutton	Mutton	Mutton	Mutton	Mutton	Mutton	Mutton	Dried meat	Mutton
Wild or domesticated birds	Chicken	Chicken	Chicken	Chicken	Chicken	Chicken	Chicken	Chicken	Chicken	Chicken	Chicken	Chicken	Chicken	Chicken	Chicken
	Duck	Duck	Duck	Duck	Duck	Duck	Duck	Duck	Duck	Duck	Duck	Duck	Duck	Duck	Duck
Vitamin A-rich dark green leafy vegetables	Water leaf	Roselle leaf	Water leaf	Water leaf	Roselle leaf	Water leaf	Water leaf	Water leaf	Water leaf	Water leaf	Water leaf	Water leaf	Water leaf	Water leaf	Water leaf
	Roselle leaf	Mustard leaf	Roselle leaf	Roselle leaf	Mustard leaf	Roselle leaf	Roselle leaf	Roselle leaf	Roselle leaf	Roselle leaf	Roselle leaf	Roselle leaf	Roselle leaf	Mustard leaf	Roselle leaf
	Mustard leaf	Subok	Mustard leaf	Kinmoon	Subok	Mustard leaf	Kinmoon	Kinmoon	Gourd leaf	Mustard leaf	Kinmoon	Gourd leaf	Mustard leaf	Subok	Gourd leaf

	National	Kachin	Kayah	Kayin	Chin	Sagaing	Tanintharyi	Bago	Magway	Mandalay	Mon	Rakhine	Yangon	Shan	Ayeyarwady
	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items	Top items
Vitamin A-rich deep yellow/orange/red vegetables	Pumpkin	Pumpkin	Pumpkin	Pumpkin	Pumpkin	Pumpkin	Pumpkin	Pumpkin	Pumpkin	Pumpkin	Pumpkin	Pumpkin	Pumpkin	Pumpkin	Pumpkin
	Carrots	Carrots	Carrots	Carrots	Carrots	Carrots	Carrots	Carrots	Carrots	Carrots	Carrots	Carrots	Carrots	Carrots	Carrots
	Fresh pepper/sweet pepper	Fresh pepper/sweet pepper	Fresh pepper/sweet pepper	Fresh pepper/sweet pepper	Fresh pepper/sweet pepper	Fresh pepper/sweet pepper	Fresh pepper/sweet pepper	Fresh pepper/sweet pepper	Fresh pepper/sweet pepper	Fresh pepper/sweet pepper	Fresh pepper/sweet pepper	Fresh pepper/sweet pepper	Fresh pepper/sweet pepper	Fresh pepper/sweet pepper	Fresh pepper/sweet pepper
Vitamin A-rich fruits	Mangoes	Mangoes	Mangoes	Mangoes	Mangoes	Mangoes	Mangoes	Mangoes	Mangoes	Mangoes	Mangoes	Mangoes	Mangoes	Mangoes	Mangoes
Vitamin C-rich vegetables	Tomato	Tomato	Tomato	Ash pumpkin	Tomato	Tomato	Tomato	Tomato	Tomato	Tomato	Tomato	Cabbage	Tomato	Tomato	Tomato
	Bean/long bean	Cabbage	Cabbage	Tomato	Cabbage	Cabbage	Cabbage	Bean/long bean	Bean/long bean	Cabbage	Horseradish	Bean/long bean	Cabbage	Cabbage	Cabbage
Vitamin C-rich vegetables	Chillie/pepper/sweet pepper	Bean/long bean	Bean/long bean	Bean/long bean	Chayote	Bean/long bean	Chillie/pepper/sweet pepper	Bean sprouts	Bean sprouts	Bean/long bean	Bean/long bean	Chillie/pepper/sweet pepper	Bean sprouts	Bean/long bean	Chillie/pepper/sweet pepper
Vitamin C-rich fruits	Lime	Papaya	Papaya	Lime	Lime	Lime	Papaya	Lime	Lime	Lime	Papaya	Lime	Lime	Papaya	Lime
	Papaya	Grapefruit	Oranges	Papaya	Papaya	Papaya	Pineapples	Papaya	Papaya	Papaya	Pineapples	Papaya	Papaya	Oranges	Papaya
	Oranges	Oranges	Jackfruit	Oranges	Oranges	Oranges	Durian	Oranges	Oranges	Oranges	Oranges	Jackfruit	Oranges	Jackfruit	Oranges
All other vegetables	Gourd	Gourd	Cucumber	Gourd	Brinjal/eggplant	Gourd	Brinjal/eggplant	Gourd	Gourd	Brinjal/eggplant	Brinjal/eggplant	Gourd	Gourd	Brinjal/eggplant	Gourd
	Brinjal/eggplant	Onions	Onions	Cucumber	Onions	Brinjal/eggplant	Onions	Brinjal/eggplant	Brinjal/eggplant	Onions	Cucumber	Brinjal/eggplant	Onions	Onions	Cucumber
	Onions	Garlic	Garlic	Onions	Garlic	Onions	Garlic	Onions	Onions	Garlic	Onions	Onions	Garlic	Garlic	Onions
All other fruits	Banana	Banana	Banana	Banana	Banana	Banana	Banana	Banana	Banana	Banana	Banana	Banana	Banana	Banana	Banana
	Watermelon	Watermelon	Watermelon	Watermelon	Apple	Watermelon	Mangosteens	Watermelon	Apple	Apple	Mangosteens	Watermelon	Watermelon	Watermelon	Apple
	Apple	Apple	Apple	Apple	Grapes	Apple	Apple	Apple	Grapes	Grapes	Apple	Apple	Apple	Apple	Grapes
Other fats and oils	Groundnut oil	Groundnut oil	Groundnut oil	Groundnut oil	Groundnut oil	Groundnut oil	Groundnut oil	Groundnut oil	Groundnut oil	Groundnut oil	Groundnut oil	Groundnut oil	Groundnut oil	Groundnut oil	Groundnut oil
	Sesamum oil	Mustard oil	Sesamum oil	Sesamum oil	Sesamum oil	Sesamum oil	Palm oil	Sesamum oil	Sesamum oil	Sesamum oil	Sesamum oil	Palm oil	Palm oil	Sesamum oil	Sesamum oil
	Palm oil	Pork fat	Palm oil	Palm oil	Sunflower oil	Sunflower oil	Other cooking oil and fat	Palm oil	Palm oil	Palm oil	Palm oil	Mustard oil	Other cooking oil and fat	Palm oil	Palm oil

Table 5. Top three food items per food group (provides specific item detail of each regional diets).

About WorldFish

WorldFish is a nonprofit research and innovation institution that creates, advances and translates scientific research on aquatic food systems into scalable solutions with transformational impact on human well-being and the environment. Our research data, evidence and insights shape better practices, policies and investment decisions for sustainable development in low- and middle-income countries.

We have a global presence across 20 countries in Asia, Africa and the Pacific with 460 staff of 30 nationalities deployed where the greatest sustainable development challenges can be addressed through holistic aquatic food systems solutions.

Our research and innovation work spans climate change, food security and nutrition, sustainable fisheries and aquaculture, the blue economy and ocean governance, One Health, genetics and AgriTech, and it integrates evidence and perspectives on gender, youth and social inclusion. Our approach empowers people for change over the long term: research excellence and engagement with national and international partners are at the heart of our efforts to set new agendas, build capacities and support better decision-making on the critical issues of our times.

WorldFish is part of One CGIAR, the world's largest agricultural innovation network.