

# Potential Impacts of Increasing Supply of Specific Fruits and Vegetables on Nutrient Adequacy

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Aligning the Food System to Meet Dietary Needs: Fruits and Vegetables  
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## **Improving nutrition security through agriculture: an analytical framework based on national food balance sheets to estimate nutritional adequacy of food supplies**

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Food Security 2015

**Describes analytical framework for assessing:**

- **the micronutrient adequacy of national food supplies**
- **the potential for increased crop production to address micronutrient gaps**

# Method to assess micronutrient adequacy gap

1. Calculate micronutrient availability

Food balance sheets  
Daily per capita availability of commodity foods  
*Source: FAO*

Food composition tables  
Micronutrient content of foods  
*Source: USDA Standard Reference*

**USDA** United States Department of Agriculture  
Agricultural Research Service  
National Nutrient Database for Standard Reference Release 28

	NDB No.	Description
SR	11090	Broccoli, raw
SR	11096	Broccoli raab, raw
SR	11739	Broccoli, leaves, raw
SR	11741	Broccoli, stalks, raw
SR	11994	Broccoli, chinese, raw
SR	11740	Broccoli, flower clusters, raw

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**2. Calculate mean population micronutrient requirements**

**Population data**  
**# of individuals in age and sex groups**  
*Source: UN Department of Economic and Social Affairs*

**Nutrient adequacy**  
**Estimated average requirements (EAR)**  
*Source: IOM, IZiNCG*

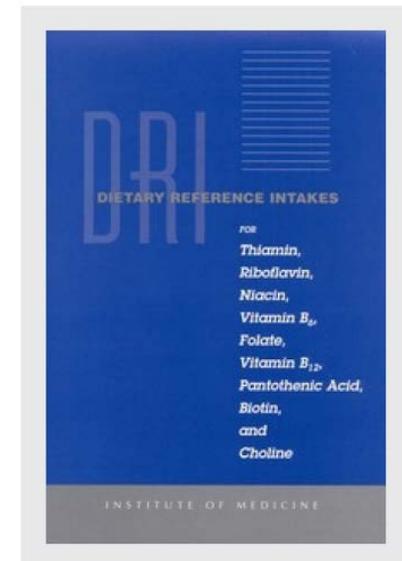
United Nations • Department of Economic and Social Affairs  
**Population Division**  
*World Population Prospects, the 2015 Revision*

Download Files

File type: Indicators (Standard), Indicators (Probabilistic Projections), Indicators (Special Aggregates), Other Files

Major topic / Special groupings: Population indicators, Fertility indicators, Mortality indicators, Migration indicators, Interpolated indicators, Errata, Database (CSV) format

Sub Group	Files (click to download)	Description
Overall	Total Population - Both Sexes (XLS, 3.74 MB)	Total Population - Both Sexes. De facto population in a country, area or region as of 1 July of the year indicated. Figures are presented in thousands.



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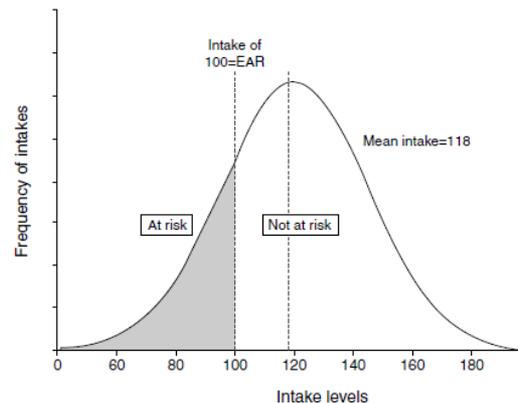
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3. Estimate % of population with adequate micronutrient intakes

EAR cut-point method  
*Source: IOM*



IOM (2000) Dietary Reference Intakes.  
Applications in Dietary Assessment.

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4. Calculate micronutrient gap

=

Micronutrient availability

*minus*

Target nutrient availability to achieve 80% prevalence of adequate intakes

# Method to assess crop amount to meet gap

1. Compile list of  
nutrient-dense  
crops

Food composition data  
Micronutrient content of foods

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2. Calculate amount of crop and land needed to meet gap for each food

Crop amount  
Convert daily per capita amount needed to annual amount for entire population

% of crop land  
Land needed to grow crop amount/total crop land in country  
*Source: FAO*

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3. Calculate crop mix to meet multiple nutrient gaps

Linear programming using Microsoft Excel Solver

- Minimize land
- Meet nutrient gaps
- Portion size limits

# Results: Micronutrient adequacy - Bangladesh

Nutrient	Population adjusted mean EAR	Availability per capita/day	Prevalence of adequate intakes	Target availability per capita/day (80% adequacy)	Gap
Vitamin A (mcg RAE)	485	121	<1%	696	- 575

# Results: Micronutrient adequacy - Bangladesh

Nutrient	Population adjusted mean EAR	Availability per capita/day	Prevalence of adequate intakes	Target availability per capita/day (80% adequacy)	Gap
Vitamin A (mcg RAE)	485	121	<1%	696	- 575
Vitamin C (mg)	54	31	8%	75	- 44
Riboflavin (mg)	0.87	0.68	18%	1.16	- 0.48
Niacin (mg)	9.9	13.6	86%	-	-
Vitamin B-6 (mg)	0.96	3.98	99%	-	-
Folate (mcg DFE)	280	132	<1%	374	- 242
Calcium (mg)	839	256	<1%	1122	- 866
Zinc (mg)	9.0	8.7	44%	11.4	- 2.7

# Amounts of single crops and land needed to meet Vitamin A gap - Bangladesh

Nutrient	Gap	Crop	Nutrient content per serving	Portion size (edible)	Daily portions per capita to meet the gap	% of crop land
Vitamin A	575 mcg	Carrots	319 mcg	1 carrot	1.5	2.6
Vitamin A	575 mcg	Mustard greens	433 mcg	½ cup	1.3	4.0
Vitamin A	575 mcg	Spinach	472 mcg	½ cup	1.2	13.6
Vitamin A	575 mcg	Pumpkin	360 mcg	½ cup	1.6	14.9

## Single crops that meet gap for each nutrient with the smallest amount of land - Bangladesh

Nutrient	Gap	Crop	Nutrient content per serving	Portion size (edible)	Daily portions per capita to meet the gap	% of crop land
Vitamin A	575 mcg	Carrots	319 mcg	1 carrot	1.5	2.6
Vitamin C	44 mg	Guava	125 mg	1 fruit	0.4	1.7
Riboflavin	0.48 mg	Spinach	0.22 mg	½ cup	2.2	24.8
Folate	242 mcg	Broccoli	84 mcg	½ cup	2.9	15.6
Calcium	866 mg	Okra	31 mg	½ cup	14.1	55.7
Zinc	2.7 mg	Okra	0.4 mg	½ cup	7.9	31.1

# Crops to meet gap for multiple nutrients, with minimal land use and portion limits - Bangladesh

Constrain to achieve 80% adequacy for vitamins A and C, 50% for folate (no constraints for riboflavin, calcium and zinc)

	portions	grams	Vitamin A (mcg)	Vitamin C (mg)	Ribo (mg)	Folate (mcg)	Calcium (mg)	Zinc (mg)	% land
Broccoli	0.25	20	15	13	0.02	21	8	0.1	1.4
Carrots	0.50	23	196	0.8	0.01	3	7	0.1	0.9
Guava	0.15	8	3	19	0	4	2	0	0.7
Lentils	0.28	27	0	0	0.02	49	5	0.3	4.3
Mustard greens	0.25	18	108	4	0.01	2	21	0	0.7
Mustard spinach	0.05	4	18	3	0	3	7	0	0.6
Spinach	0.50	45	236	4	0.11	66	61	0.3	5.6
<b>TOTAL</b>	<b>1.97</b>	<b>145</b>	<b>575</b>	<b>44</b>	<b>0.18</b>	<b>148</b>	<b>110</b>	<b>0.9</b>	<b>14.2</b>
<b>% adequacy</b>	-	-	<b>80%</b>	<b>80%</b>	48%	<b>50%</b>	<1%	59%	-

# Micronutrient adequacy - Cameroon

Nutrient	Prevalence of adequate intakes	Gap
Vitamin A (mcg RAE)	52%	- 190
Vitamin C (mg)	99%	-
Riboflavin (mg)	87%	-
Niacin (mg)	97%	-
Vitamin B-6 (mg)	99%	-
Folate (mcg DFE)	91%	-
Calcium (mg)	<1%	- 733
Zinc (mg)	62%	- 1.5

# Crops to meet gap for multiple nutrients, with minimal land use and portion limits - Cameroon

Constrain to achieve 80% adequacy for vitamins A and C (no constraint for calcium)

	portions	grams	Vitamin A (mcg)	Vitamin C (mg)	Ribo (mg)	Folate (mcg)	Calcium (mg)	Zinc (mg)	% land
Barley	0.25	12	0	0	0.03	2	4	0.3	2.2
Broccoli	0.50	39	30	25	0.05	42	16	0.2	0.5
Cashew nuts	0.50	14	0	0	0.01	4	5	0.8	4.0
Collard greens	0.12	11	42	2	0.01	2	16	<0.1	0.2
Spinach	0.25	23	118	2	0.05	33	31	0.2	0.4
<b>TOTAL</b>	<b>1.62</b>	<b>98</b>	<b>190</b>	<b>30</b>	<b>0.15</b>	<b>82</b>	<b>71</b>	<b>1.5</b>	<b>7.3</b>
% adequacy	-	-	80%	99%	91%	95%	<1%	80%	-

# Summary

- **Fruit and vegetable availability is a contributor to some nutrient gaps (vitamins A, C, and folate)**
- **Per capita availability of fruits and vegetables (non-starchy) was 122 g/d in Bangladesh and 385g/d in Cameroon**
  - **WHO recommendation at least 400 g/d<sup>1</sup>**
  - **Analysis by Seigel et al. (PLOS ONE 2014) estimated low income countries supply 42% of need**
- **Seasonality of fruits and vegetables was not directly addressed in these analyses, but processing could extend the period of consumption**

Thank you

