

**THE POTENTIAL FOR FOOD SYSTEMS
APPROACHES TO INCREASE FRUIT &
VEGETABLE CONSUMPTION IN LMICs**

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“Aligning the Food System to Meet Dietary Needs: Fruits and Vegetables”
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OUTLINE

- Nutritional landscape in low- and middle-income countries (LMICs)
- Evidence for the health benefits of consuming fruits and vegetables (F&V)
- Overview of our understanding of F&V consumption in LMICs
- Approaches and challenges to increasing F&V consumption in LMICs
- Policy, investment & research priorities

NUTRITIONAL LANDSCAPE IN LMICs

THE MANY FORMS OF MALNUTRITION

OUT OF A WORLD POPULATION OF
7 BILLION



About **2 billion** people suffer from micronutrient malnutrition



Nearly **300 million** people suffer from calorie deficiency

OUT OF **5 BILLION**
ADULTS WORLDWIDE



Nearly **2 billion** are overweight or obese



One in 12 has type 2 diabetes

OUT OF **667 MILLION** CHILDREN UNDER AGE 5 WORLDWIDE



159 million under age 5 are too short for their age (stunted)



50 million do not weigh enough for their height (wasted)

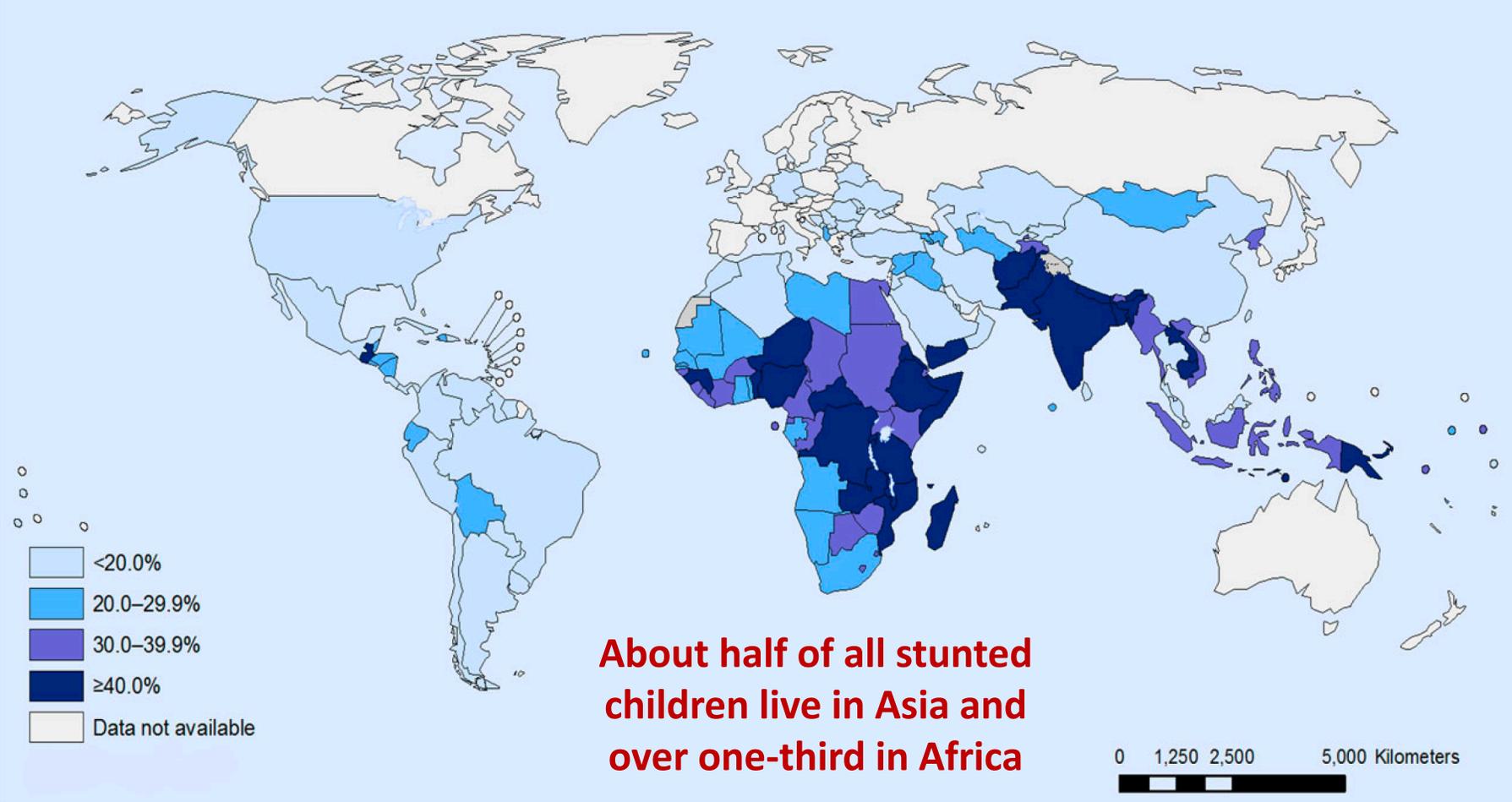


41 million are overweight

OUT OF 129 COUNTRIES WITH DATA, **57 COUNTRIES**

have serious levels of both undernutrition and adult overweight (including obesity)

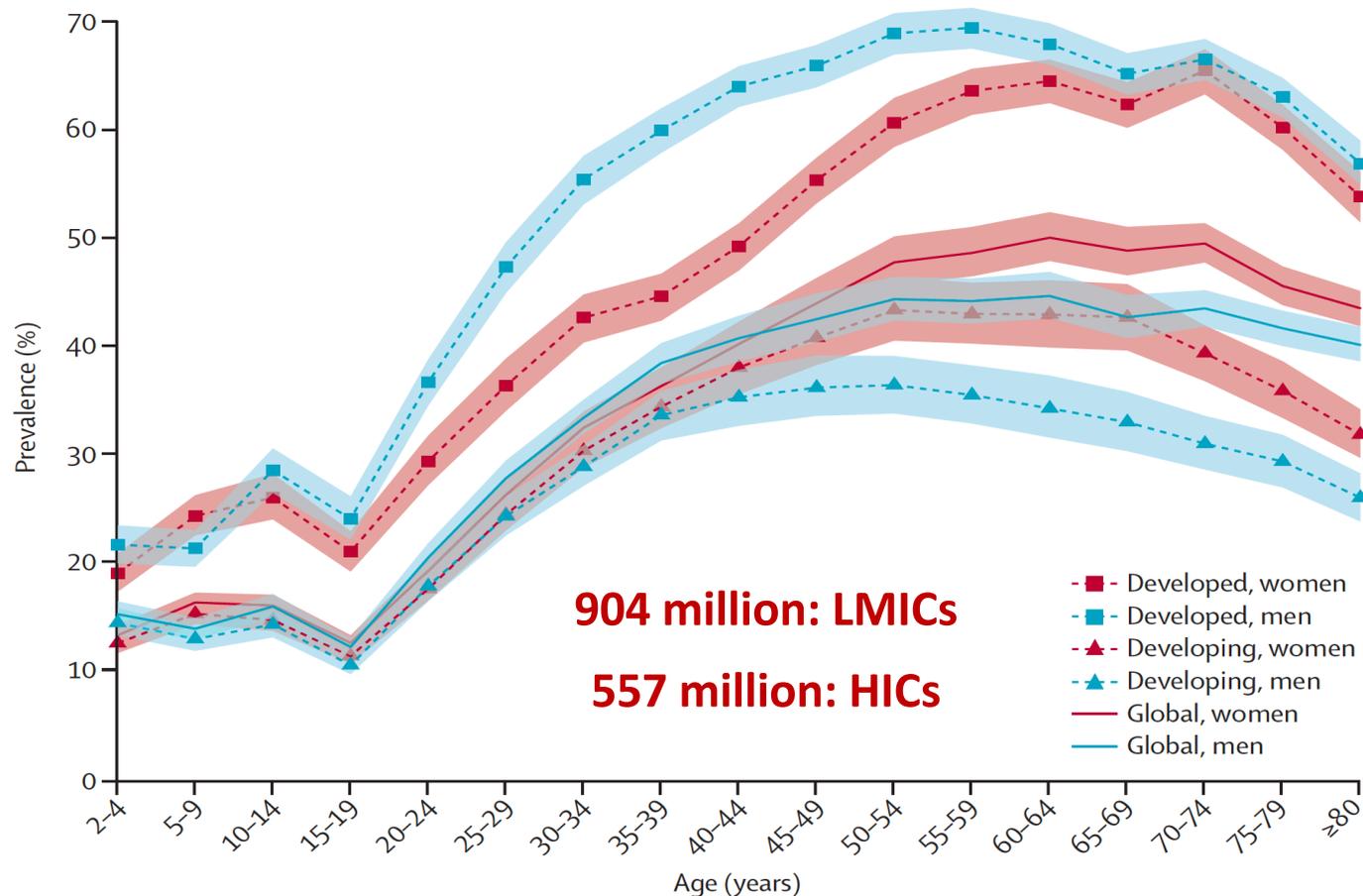
NATIONAL PREVALENCE OF STUNTING AMONG CHILDREN < 5 YEARS



Source: de Onis and Branca (2016). Childhood stunting: a global perspective. *Maternal & Child Nutrition*

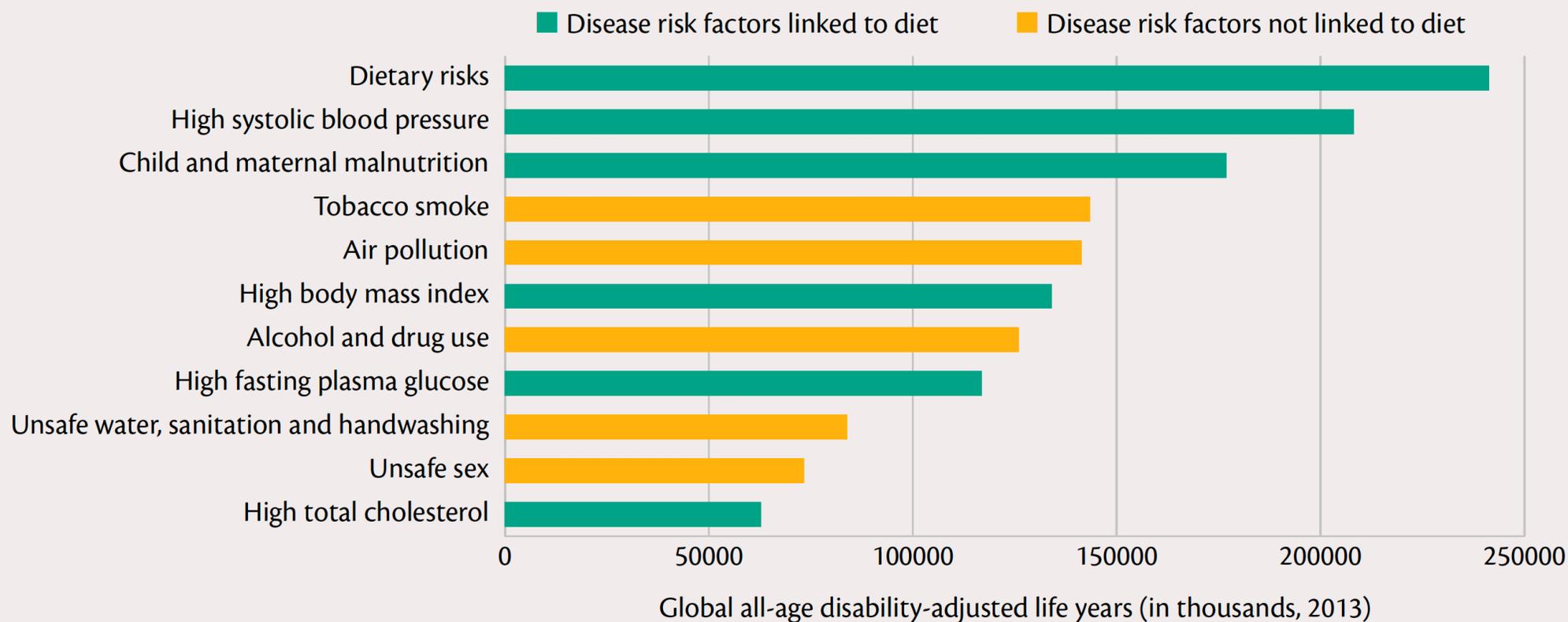
PREVALENCE OF OVERWEIGHT BY AGE AND SEX, 2013

- In developed countries, increases in obesity that began in the 1980s have attenuated in the past 8 years
- In developing countries, where almost 2 in 3 of the world's obese people live, future increases are likely



Source: Ng et al. (2014). Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*

TOP RISK FACTORS DRIVING THE GLOBAL BURDEN OF DISEASE (DALYs)



Source: Global Panel on Agriculture and Food Systems for Nutrition. (2016). Food systems and diets: Facing the challenges of the 21st century. London, UK.

HEALTH BENEFITS OF FRUIT & VEGETABLE CONSUMPTION

RESULTS ON WEIGHT LOSS OF EXPERIMENTAL STUDIES REPORTING INCREASED F&V INTAKE AMONG ADULTS

Study	Change in FV ^a	Change in EI ^b	Wt ^c change	Duration of intervention
Detected expected relationship				
de Oliveira <i>et al.</i> 2008 (4)	↑ 3 servings per day	↓ 104.88 kJ d ^{-1d} ↓ 82.31 kJ d ^{-1f}	↓ 0.93 kg ^{d,e} ↓ 0.84 kg ^f	10 weeks
Sartorelli <i>et al.</i> 2008 (29)	↑ 123 g d ⁻¹	↓ 1331 kJ d ^{-1g}	↓ 1.4 kg	6 months
Ello-Martin <i>et al.</i> 2007 (26)	↑ 52.3 g d ⁻¹	↓ 2090 kJ d ⁻¹	↓ 7.9 kg	1 year
Svendson <i>et al.</i> 2007 (28)	↑ 500 g d ⁻¹	↓ 1463 kJ d ⁻¹	↓ 3.4 kg	3 months
Howard <i>et al.</i> 2006 (30)	↑ 1.4 servings per day	↓ 1509 kJ d ⁻¹	↓ 2.2 kg ↓ 0.8 kg	1 year 7 years
Ortega <i>et al.</i> 2006 (27)	↑ 4.69 servings per day	↓ 2117 kJ d ⁻¹	↓ 2 kg	6 weeks
Stamler and Dolecek 1997 (31)	↑2.2–4.4% EI from F ↑1.0–2.0% EI from V	↓2135–2736 kJ d ⁻¹	↓ 3.0 lb	6 years
Did not detect expected relationship				
Ely <i>et al.</i> 2008 (35)	NS ^h change	Not reported.	↓ 9.4 lb	6 months
Whybrow <i>et al.</i> 2006 (34)	↑229 g d ⁻¹ ↑395 g d ⁻¹	↑400 kJ d ⁻¹ ↑ 659 kJ d ⁻¹	NS ^h change.	8 weeks
John <i>et al.</i> 2002 (33)	↑1.5 servings per day	Not reported.	0.6 kg(ns) ^h	6 months

- Most studies show inverse relationship of F&V consumption with weight loss, though unclear if multiple behavior changes are responsible
- When consumed as part of healthy diet, F&V can help prevent weight gain

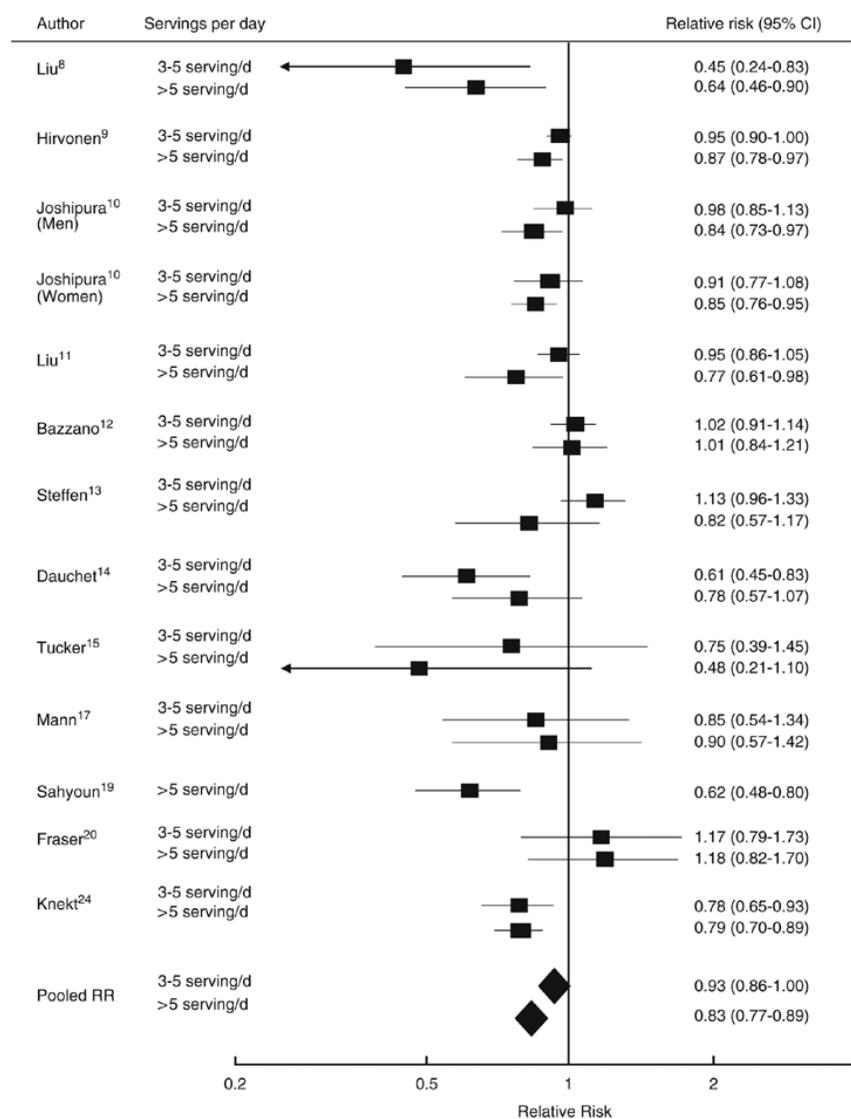
Source: Ledoux et al. (2011). Relationship of fruit and vegetable intake with adiposity: a systematic review. *Obesity Reviews*

RR (95% CI) OF CORONARY HEART DISEASE FOR FRUIT AND VEGETABLE INTAKE

- Increased consumption of F&V from <3 to >5 servings/day led to 17% reduction in CHD risk
- Increased intake to 3–5 servings/day associated with small reduction in CHD risk

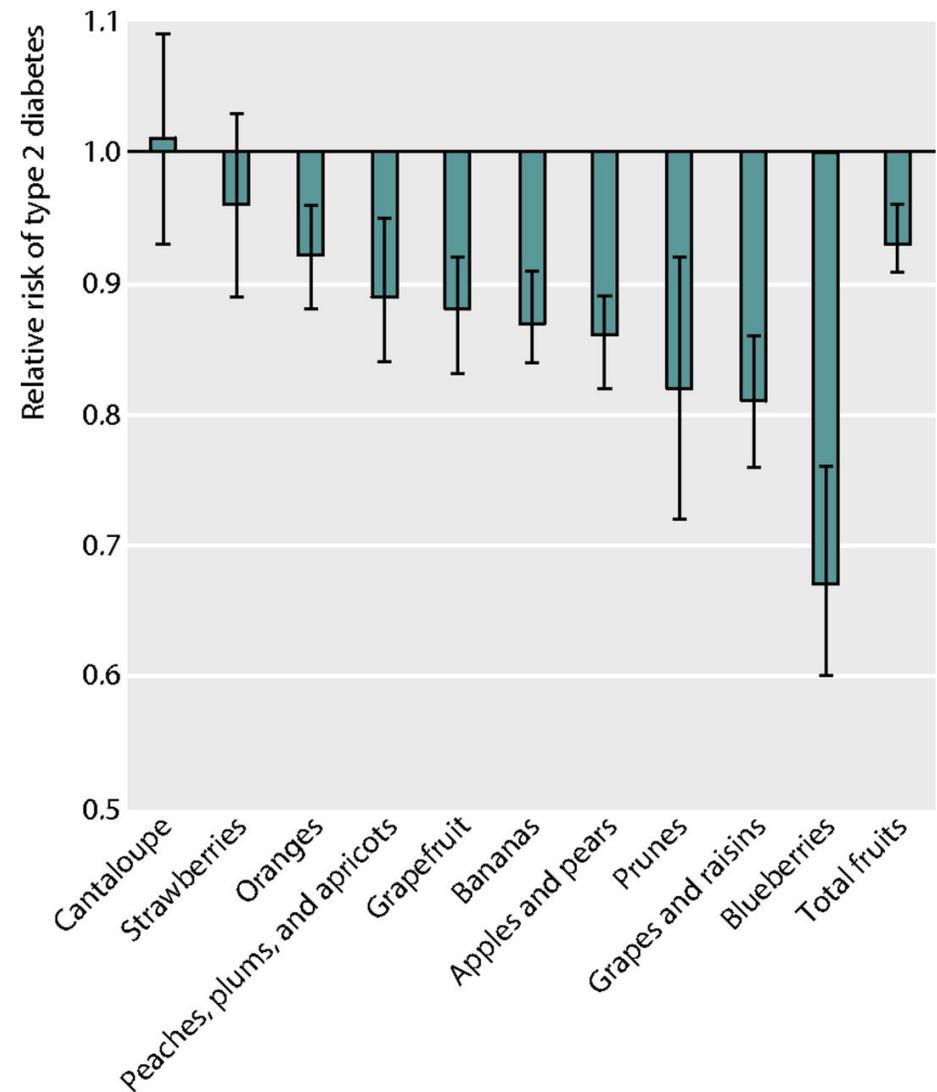
Data from meta-analysis of prospective cohort studies (12 in total)

Source: He et al. (2007). Increased consumption of fruit and vegetables is related to a reduced risk of coronary heart disease: meta-analysis of cohort studies. *Journal of Human Hypertension*



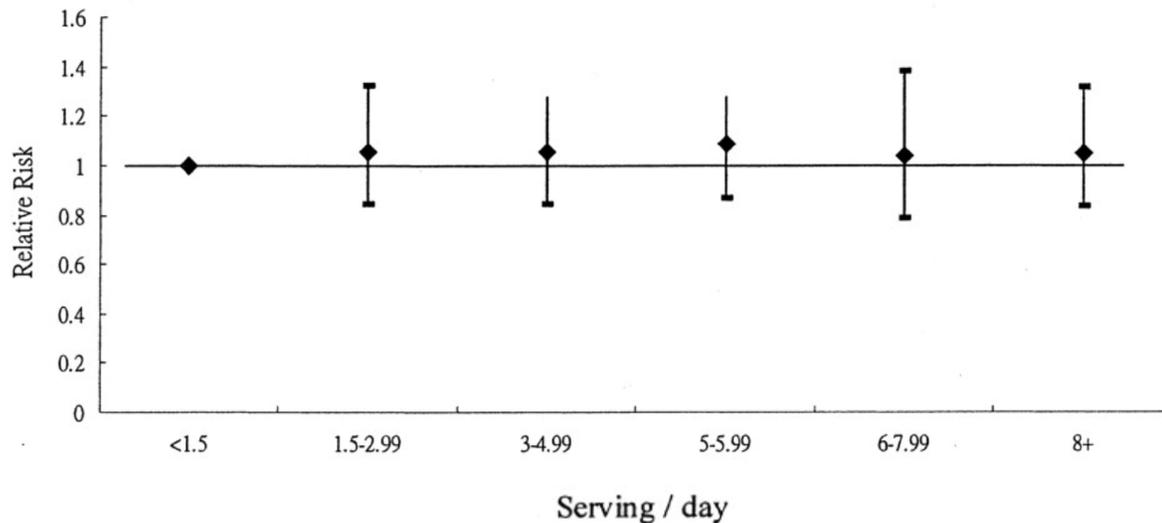
HAZARD RATIOS (95% CI) OF T2D FOR SUBSTITUTING FRUIT FOR FRUIT JUICE

- Greater consumption of specific whole fruits (i.e., blueberries, grapes, apples) associated with lower risk of T2D
- Greater fruit juice consumption was associated with higher risk
- Replacing each 3 servings/week of fruit juice with whole fruits, 7% lower risk of T2D (33% for blueberries)



Source: Muraki I. et al. (2013). Fruit consumption and risk of type 2 diabetes: results from three prospective longitudinal cohort studies. *BMJ*

RR (95% CI) OF CANCER FOR FRUIT AND VEGETABLE INTAKE



Data from Nurses' Health Study and the Health Professionals Follow-up Study (14-year period)

Source: Hung HC, et al. (2004). Fruit and vegetable intake and risk of major chronic disease. *J Natl Cancer Inst*

- Total F&V consumption not associated with cancer incidence (RR (95% CI) for ≥ 8 vs. <1.5 servings/day = 1.05 (0.83, 1.31))
- Some types of F&V may protect against certain cancers
 - Green leafy vegetables may protect against mouth, throat, esophagus, stomach cancer (Wiseman 2008)
 - Tomatoes may offer protection against prostate cancer in men (Giovannucci et al. 2007; Kavanaugh et al. 2007)

POSSIBLE MECHANISMS LINKING F&V TO IMPROVED HEALTH OUTCOMES

- Increased availability of multiple micronutrients that modulate potential risk factors of undernutrition
- Potassium provided by F&V lowers blood pressure (elevated blood pressure and cholesterol are risk factors for CHD and stroke)
- Dietary fiber may lower blood pressure; together with phytochemicals (e.g., plant sterols, flavonoids and other antioxidants) may modulate cholesterol that could reduce the risk of atherosclerosis
- Dietary folate is a determinant of homocysteine levels in the blood; homocysteine linked to CHD
- Dietary fiber may help to regulate insulin, which may impact the risk of T2D
- Dietary fiber and high water content of F&V may help to reduce the risk of overweight by promoting satiety and reducing hunger
- Antioxidants may reduce risk of cancer by preventing oxidative damage to cells of the body

Source: World Health Organization (2014). Increasing fruit and vegetable consumption to reduce the risk of noncommunicable diseases: Biological, behavioural and contextual rationale. Geneva, Switzerland

FRUITS & VEGETABLES CONTRIBUTE STRONGLY TO DIETARY DIVERSITY

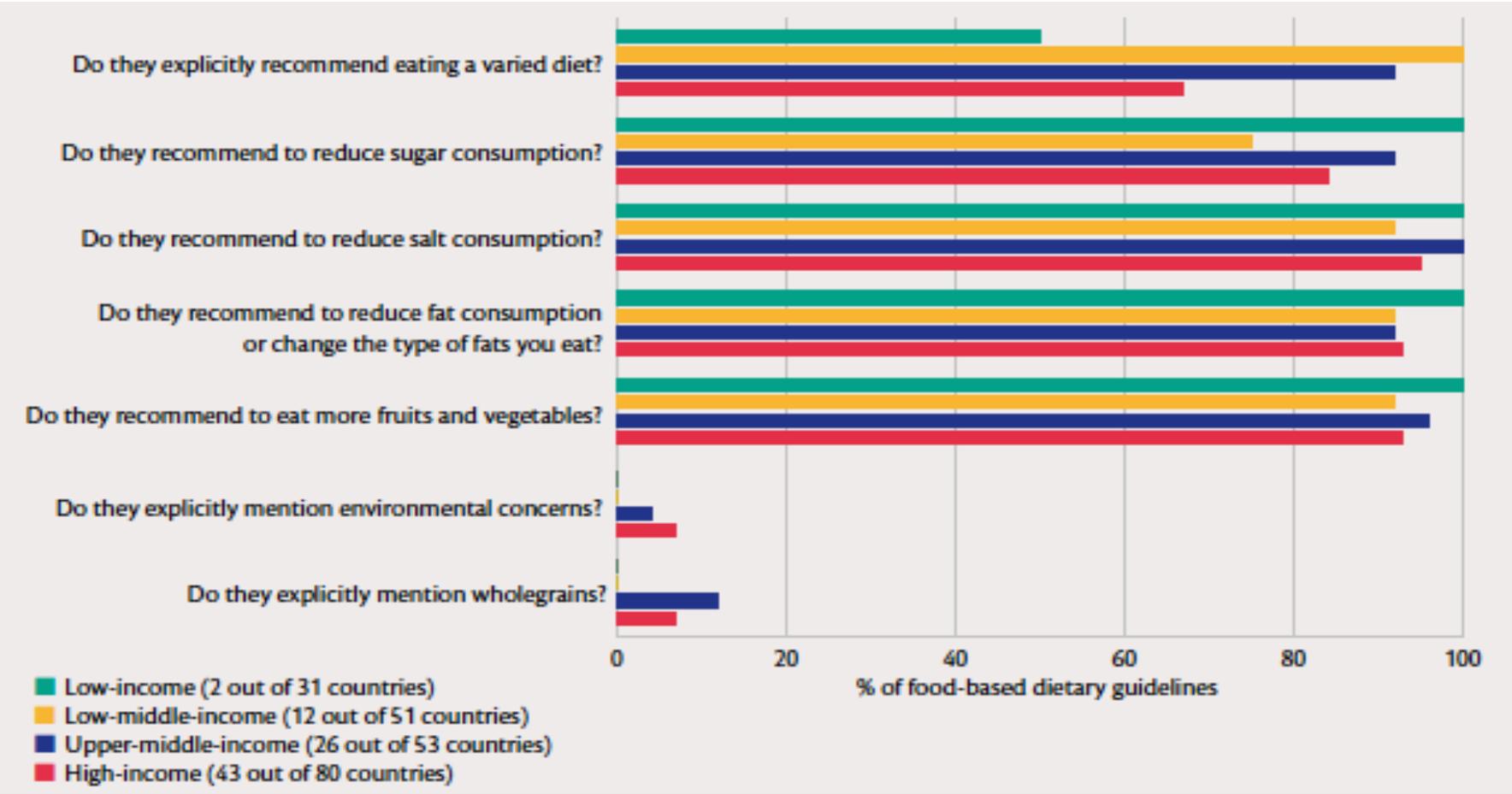
Minimum Dietary Diversity for Children

- Grains, roots and tubers
- Legumes and nuts
- Dairy products (milk, yogurt, cheese)
- Flesh foods (meat, fish, poultry and liver/organ meats)
- Eggs
- **Vitamin-A rich fruits and vegetables**
- **Other fruits and vegetables**

Minimum Dietary Diversity for Women

- Grains, white roots and tubers, and plantains
- Pulses (beans, peas and lentils)
- Nuts and seeds
- Dairy
- Meat, poultry and fish
- Eggs
- **Dark green leafy vegetables**
- **Other vitamin A-rich fruits and vegetables**
- **Other vegetables**
- **Other fruits**

RECOMMENDATIONS FROM 83 NATIONAL FOOD-BASED DIETARY GUIDELINES



Source: Global Panel on Agriculture and Food Systems for Nutrition. (2016). Food systems and diets: Facing the challenges of the 21st century. London, UK.

IMPORTANCE OF DIETARY DIVERSITY

- Findings from multiple contexts consistently confirm the importance for health and nutrition of including a diverse selection of foods in diets
 - energy intakes
 - nutrient intakes
 - nutritional status
 - birth weight
 - cognitive function
 - anemia
 - incidence of cancer
 - mortality

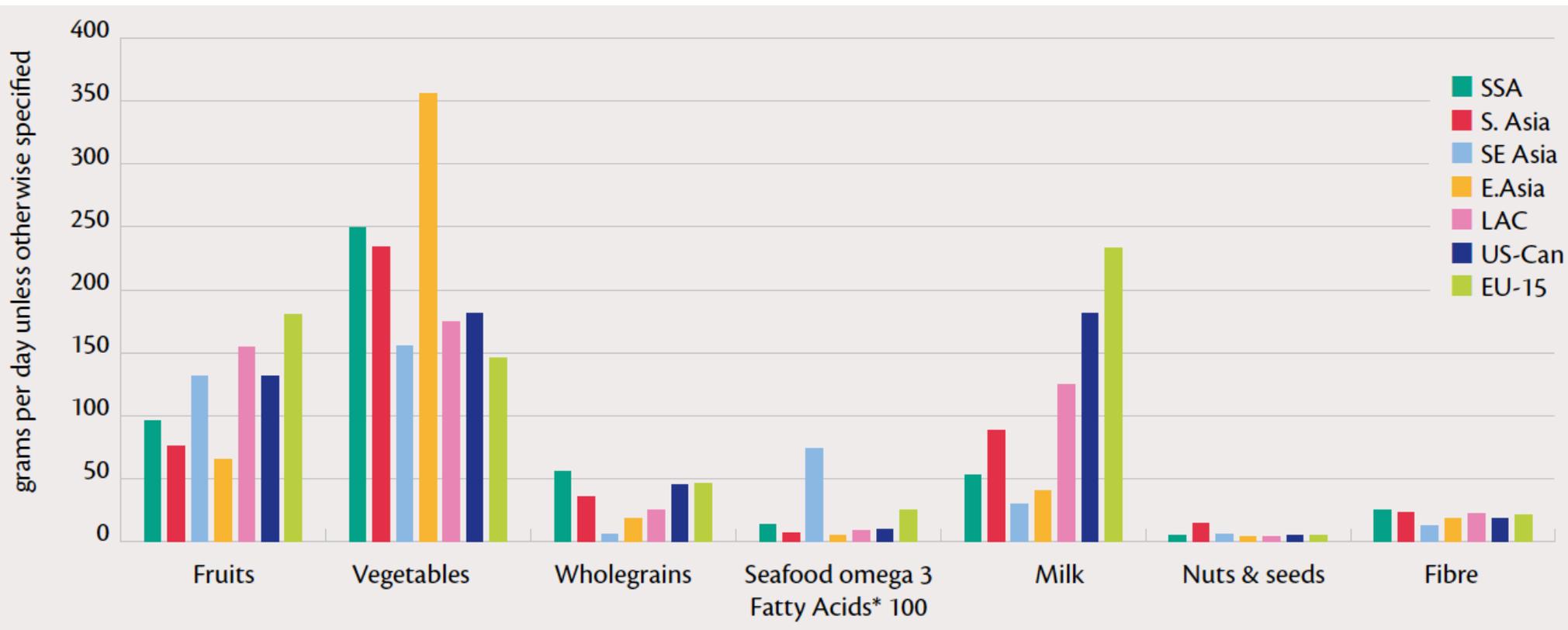
ASSOCIATIONS OF WHO IYCF INDICATORS WITH CHILD STUNTING

Country	Stunting									
	Early initiation of breastfeeding (0–24 months)		Exclusive breastfeeding under 6 months (0–5 months)		Continued breastfeeding at 1 year (12–15 months)		Introduction of solid, semi-solid, or soft foods (6–8 months)		Minimum dietary diversity (6–23 months)	
	OR (95% CI)	<i>n</i>	OR (95% CI)	<i>n</i>	OR (95% CI)	<i>n</i>	OR (95% CI)	<i>n</i>	OR (95% CI)	<i>n</i>
Bangladesh	1.23 (–, –)	2 096	1.05 (–, –)	–	3.29 (–, –)	–	0.26** (–, –)	–	0.88 (–, –)	–
Cambodia	–	–	1.00 (0.49, 2.02)	1104	–	–	–	–	0.75 (0.56, 1.02)	–
Haiti	0.83 (0.57, 1.20)	996	1.50 (0.64, 3.48)	253	0.98	211	3.84	121	0.79 (0.47, 1.32)	–
India	1.10 (0.98, 1.25)	14 257	1.08 (0.84, 1.40)	3740	1.05 (0.77, 1.45)	3151	0.78 (0.58, 1.06)	2064	0.76*** (0.65, 0.89)	–
Kenya	1.13 (0.80, 1.60)	1 944	1.67 (0.54, 5.13)	433	0.76 (0.28, 2.09)	319	1.23 (0.46, 3.27)	300	0.94	–
Uganda	0.76 (0.57, 1.02)	1 011	0.55 (0.26, 1.15)	235	0.42 (0.14, 1.28)	202	1.89 (0.44, 8.03)	139	0.88 (0.60, 1.29)	–
Zimbabwe	1.06 (0.83, 1.35)	1 980	1.17 (0.51, 2.68)	544	2.13 (0.79, 5.75)	376	1.18 (0.30, 4.57)	289	0.78 (0.57, 1.06)	–

Source: Jones et al. (2013). World Health Organization infant and young child feeding indicators and their associations with child anthropometry: a synthesis of recent findings. *Maternal & Child Nutrition*

FRUIT & VEGETABLE CONSUMPTION IN LMICs

INTAKE OF SELECT FOODS AND DIET COMPONENTS, BY WORLD REGION, 2013



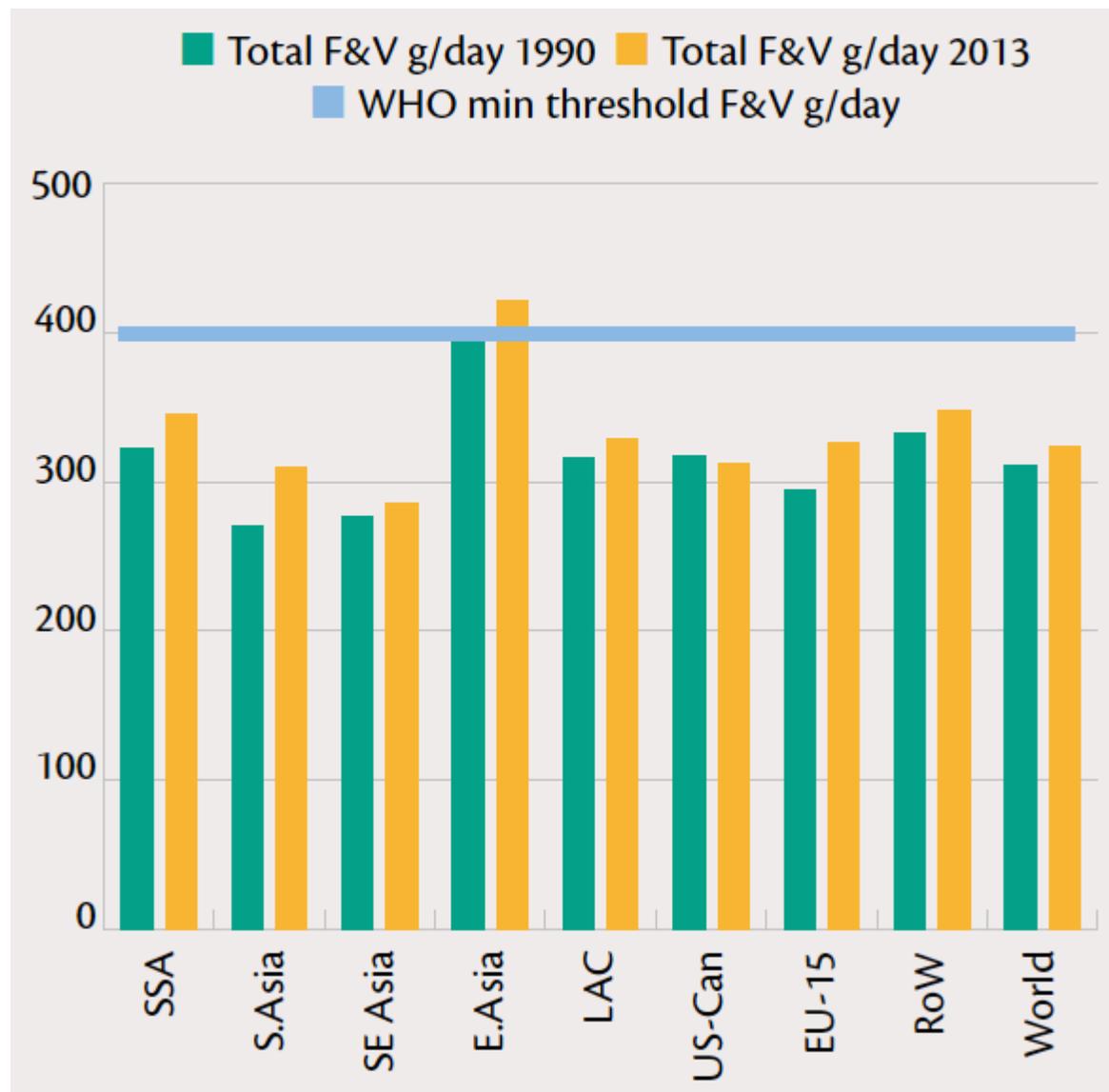
Data from Global Dietary Database

Source: Global Panel on Agriculture and Food Systems for Nutrition. (2016). Food systems and diets: Facing the challenges of the 21st century. London, UK.

FRUIT & VEGETABLE CONSUMPTION (g/day), BY WORLD REGION, 1990-2013

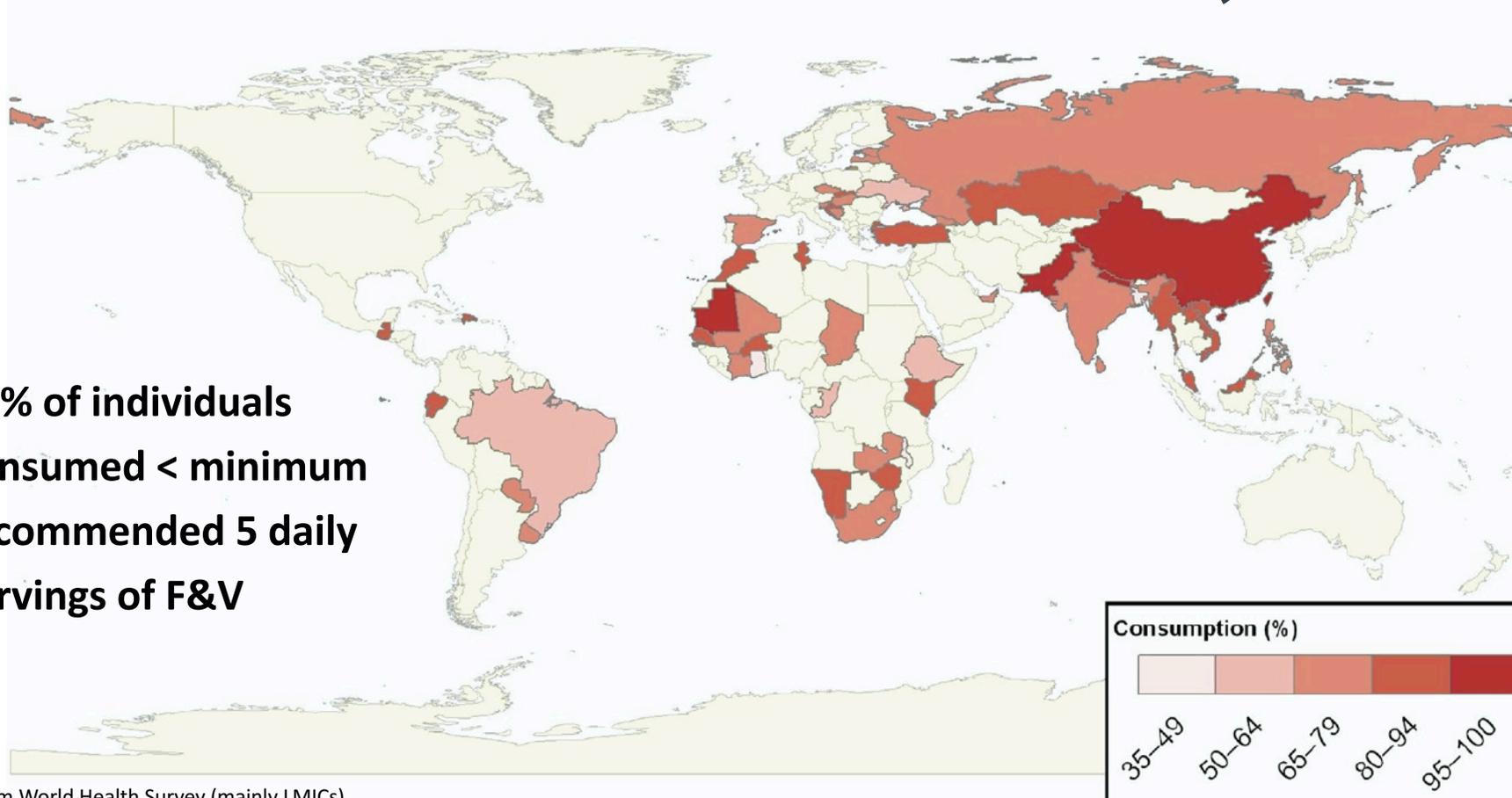
- WHO recommends minimum of 400 g of F&V per day (excluding potatoes) for prevention of chronic disease and MN deficiencies

Source: Global Panel on Agriculture and Food Systems for Nutrition. (2016). Food systems and diets: Facing the challenges of the 21st century. London, UK.



PREVALENCE OF LOW FRUIT AND VEGETABLE CONSUMPTION FOR WOMEN IN 52 COUNTRIES, 2002-2003

78% of individuals consumed < minimum recommended 5 daily servings of F&V

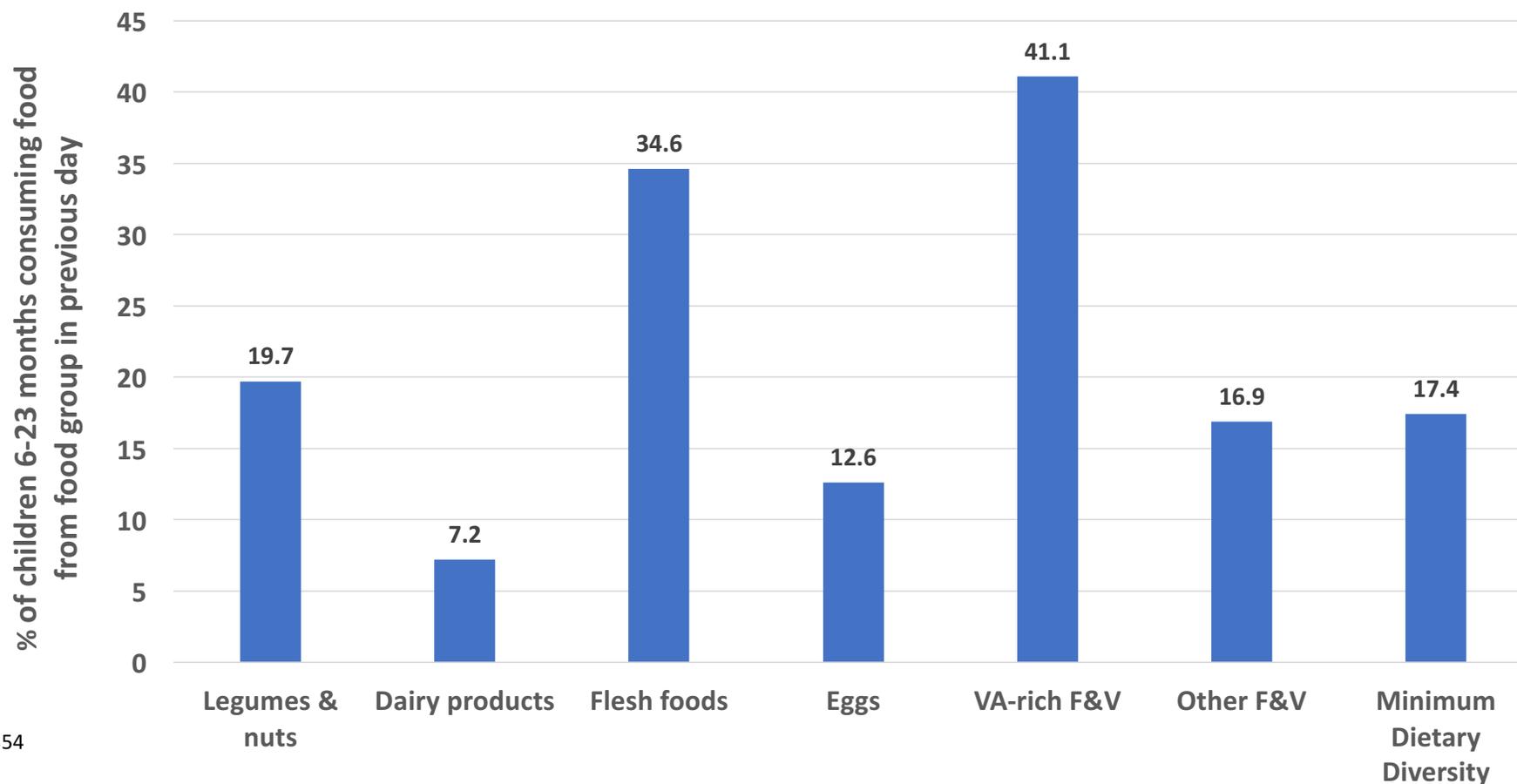


Data from World Health Survey (mainly LMICs)

Source: Hall et al. (2009). Global variability in fruit and vegetable consumption. *American Journal of Preventive Medicine*

n = 196,373

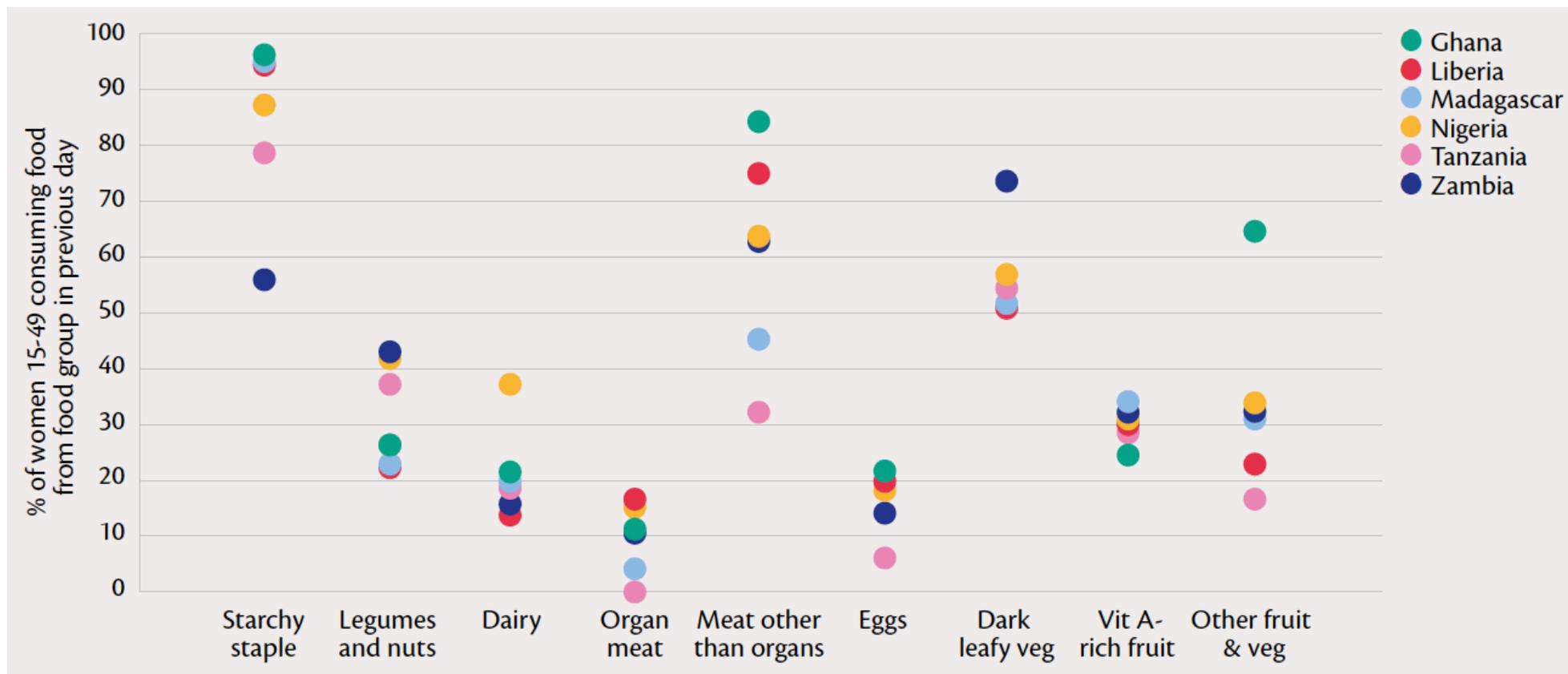
RECENT CONSUMPTION OF VARIOUS FOOD GROUPS AMONG CHILDREN AGED 6-23 MONTHS, 15 SSA COUNTRIES (2011-2015)



n = 28,354

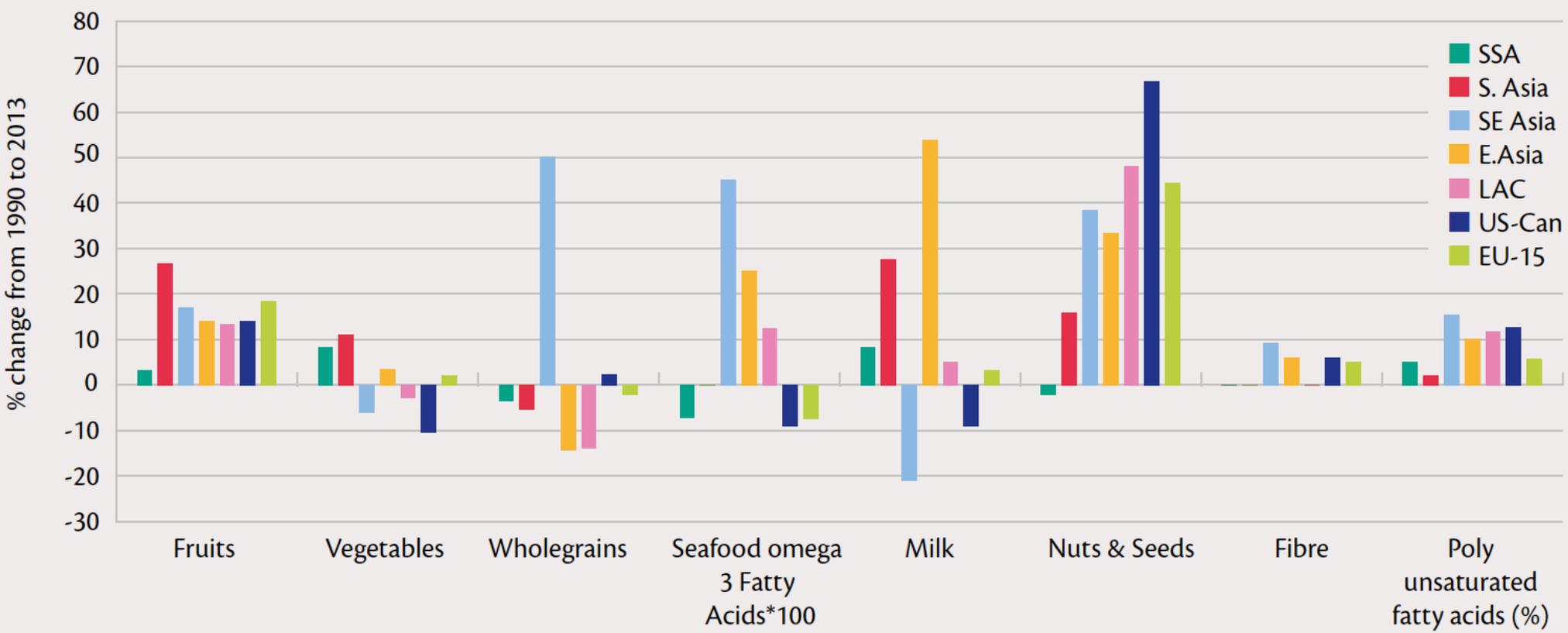
Source: Jones AD et al. Deforestation and child diet diversity: a geospatial analysis of 15 sub-Saharan African countries. *Lancet* 2017;389:S11.

RECENT CONSUMPTION OF VARIOUS FOOD GROUPS AMONG WOMEN AGED 15-49 YEARS, 2007-2010 DHS SURVEYS



Source: Global Panel on Agriculture and Food Systems for Nutrition. (2016). Food systems and diets: Facing the challenges of the 21st century. London, UK.

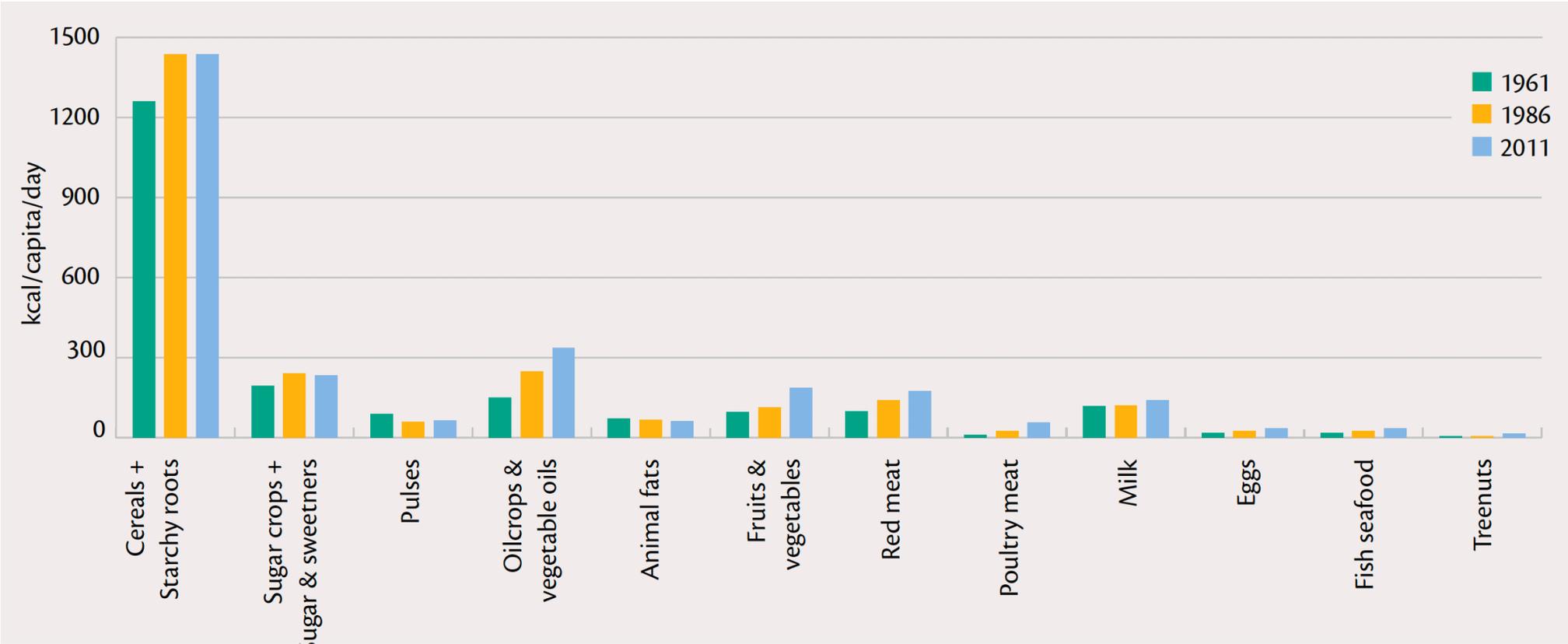
CHANGES IN INTAKE OF SELECT FOODS AND DIET COMPONENTS, BY WORLD REGION, 1990-2013 (%)



Source: Global Panel on Agriculture and Food Systems for Nutrition. (2016). Food systems and diets: Facing the challenges of the 21st century. London, UK.

**APPROACHES AND CHALLENGES TO
INCREASING FRUIT & VEGETABLE
CONSUMPTION IN LMICs**

GLOBAL PER CAPITA AVAILABILITY PER DAY (KCAL) FROM DIFFERENT FOODS: 1961, 1986, 2011



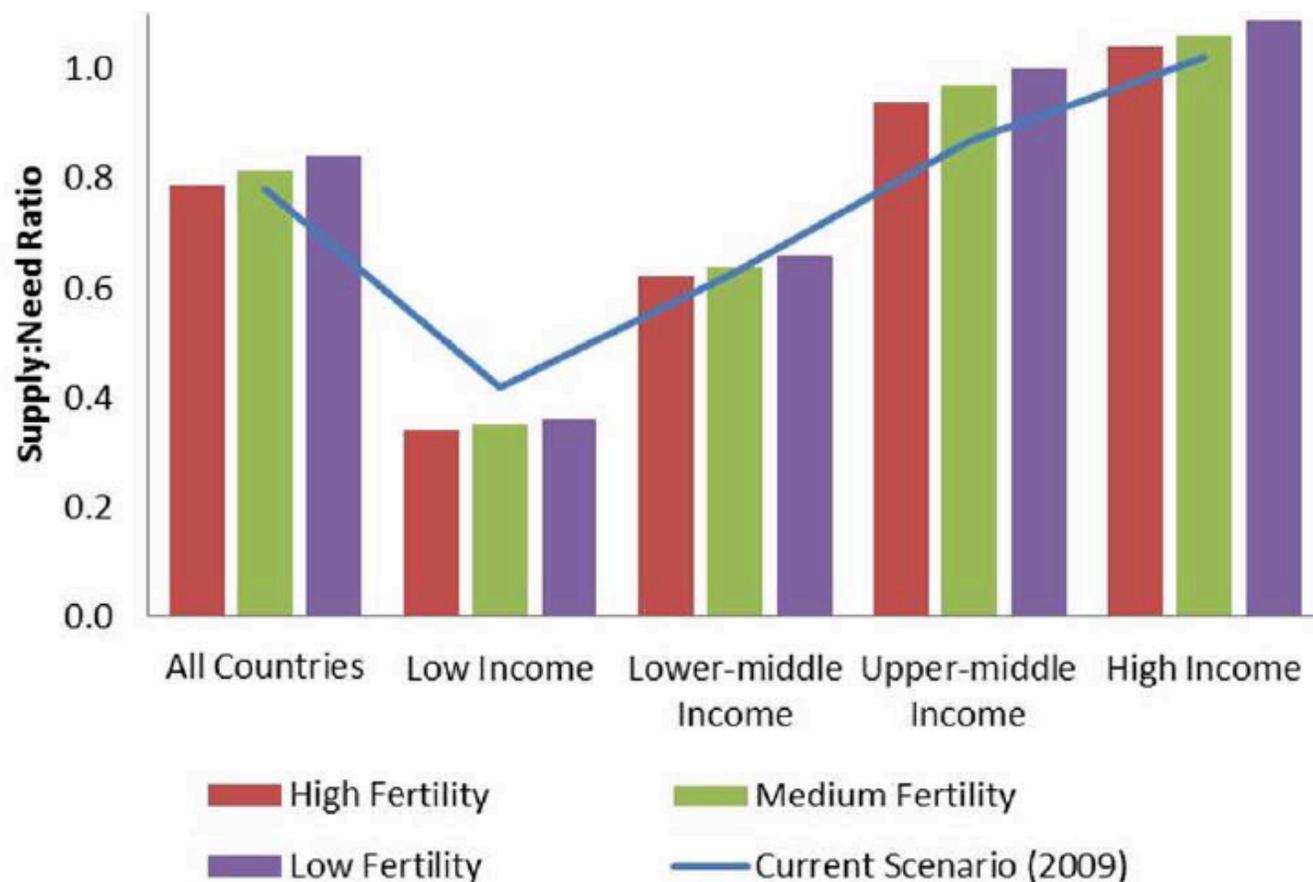
Source: Global Panel on Agriculture and Food Systems for Nutrition. (2016). Food systems and diets: Facing the challenges of the 21st century. London, UK.

HOMOGENIZATION OF GLOBAL FOOD SUPPLIES

- From 1961-2009, national food supplies worldwide have become more similar in composition (16.7% mean change in similarity)
- East and Southeast Asia, and Sub-Saharan Africa display greatest homogenization
- Oil commodities show greatest average increase in relative abundance; millets, rye, sorghum, yams, cassava, and sweet potatoes showed the largest declines
- Little change in geographic spread of F&V; slope of the change in relative abundance of most F&V in contribution to calories has increased somewhat

PROJECTED SUPPLY:NEED RATIO OF FRUIT AND VEGETABLE PRODUCTION, 2025

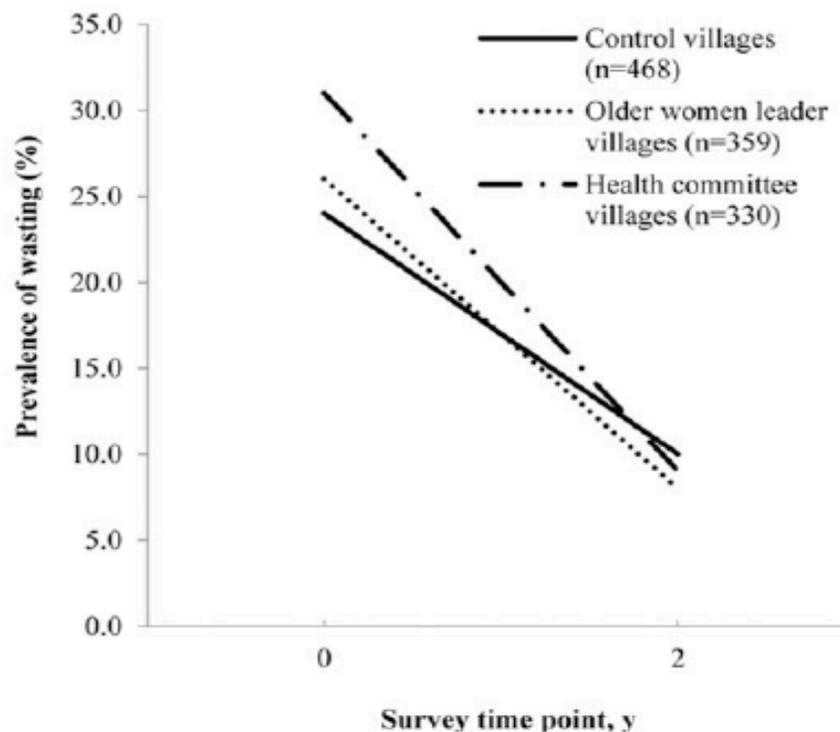
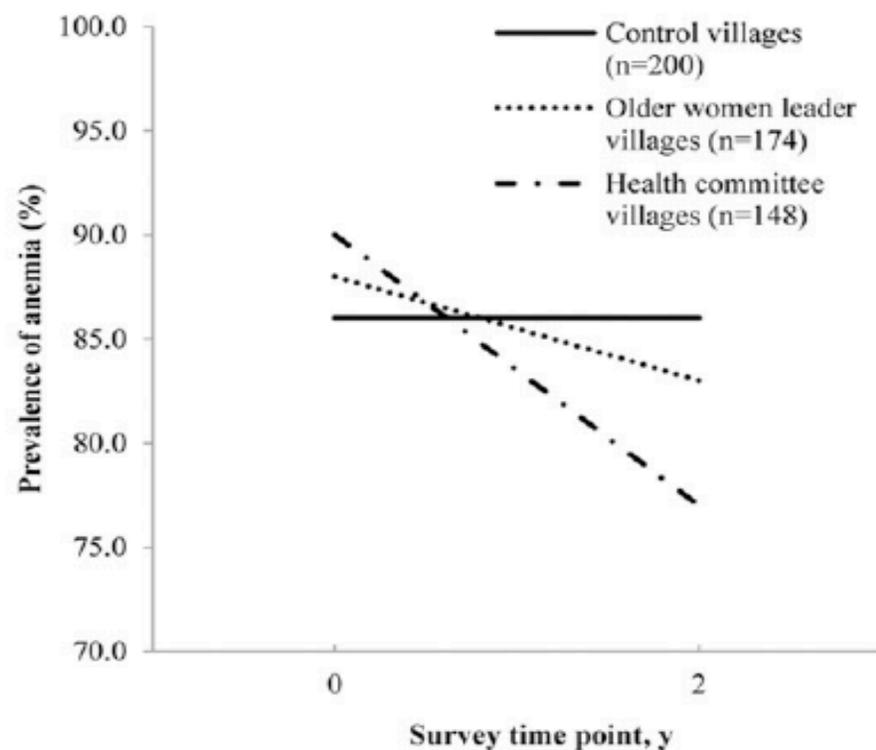
- Global supply of F&V is 22% below population need (supply:need ratio: 0.78 (range: 0.05–2.01))
- Median supply:need ratio of 0.42 and 1.02 in LICs and HICs, respectively



CHARACTERISTICS OF HOME GARDENS

- Small scale
- High species density
- F&V, medicinal plants
- For consumption and income
- Labor: women, elderly, children
- Part-time labor
- Daily, seasonal harvests
- Horizontal and vertical space utilization
- Near dwelling
- Irregular and row cropping pattern
- Simple hand tools
- Low input cost
- Rural and urban areas
- Technical assistance needs can be low

NUTRITIONAL IMPACTS OF HOMESTEAD FOOD PRODUCTION, BURKINA FASO



Source: Olney et al. (2015), A 2-Year Integrated Agriculture and Nutrition and Health Behavior Change Communication Program Targeted to Women in Burkina Faso Reduces Anemia, Wasting, and Diarrhea in Children 3–12.9 Months of Age at Baseline: A Cluster-Randomized Controlled Trial. *J Nutr*



Photo source: Bioversity International.
Nutrition-sensitive landscapes

AGRICULTURAL BIODIVERSITY AND DIET DIVERSITY

	Author (Year)	Country	Sample size
1	Dewey (1981)	Mexico	149 children
2	Torheim et al. (2004)	Mali	319
3	Ekesa et al. (2008)	Kenya	144
4	Herforth (2010)	Kenya, Tanzania	376
5	Gonder (2011)	Philippines	261
6	Remans et al. (2011)	Kenya, Malawi, Uganda	170
7	Ecker et al. (2012)	Ghana	3,976
8	Keding et al. (2012)	Tanzania	252 women
9	Oyarzun et al. (2013)	Ecuador	51
10	Walingo and Ekesa (2013)	Kenya	164
11	Jones (2014)	Bolivia	251
12	Jones et al. (2014)	Malawi	6,623
13	Pellegrini et al. (2014)	8 countries	33,119
14	Dillon et al. (2015)	Nigeria	2,154
15	Kumar et al. (2015)	Zambia	3,040
16	Malapit et al. (2015)	Nepal	3,332
17	Shively and Sununtnasuk (2015)	Nepal	1,769 children
18	Sibhatu et al. (2015)	Indonesia, Kenya, Ethiopia, Malawi	8,230
19	Snapp & Fisher (2015)	Malawi	9,189
20	Bellon et al. (2016)	Benin	652
21	Jones (2016)	Malawi	3,000
22	M'Kaibi et al. (2016)	Kenya	525

Sample sizes are in households unless otherwise specified

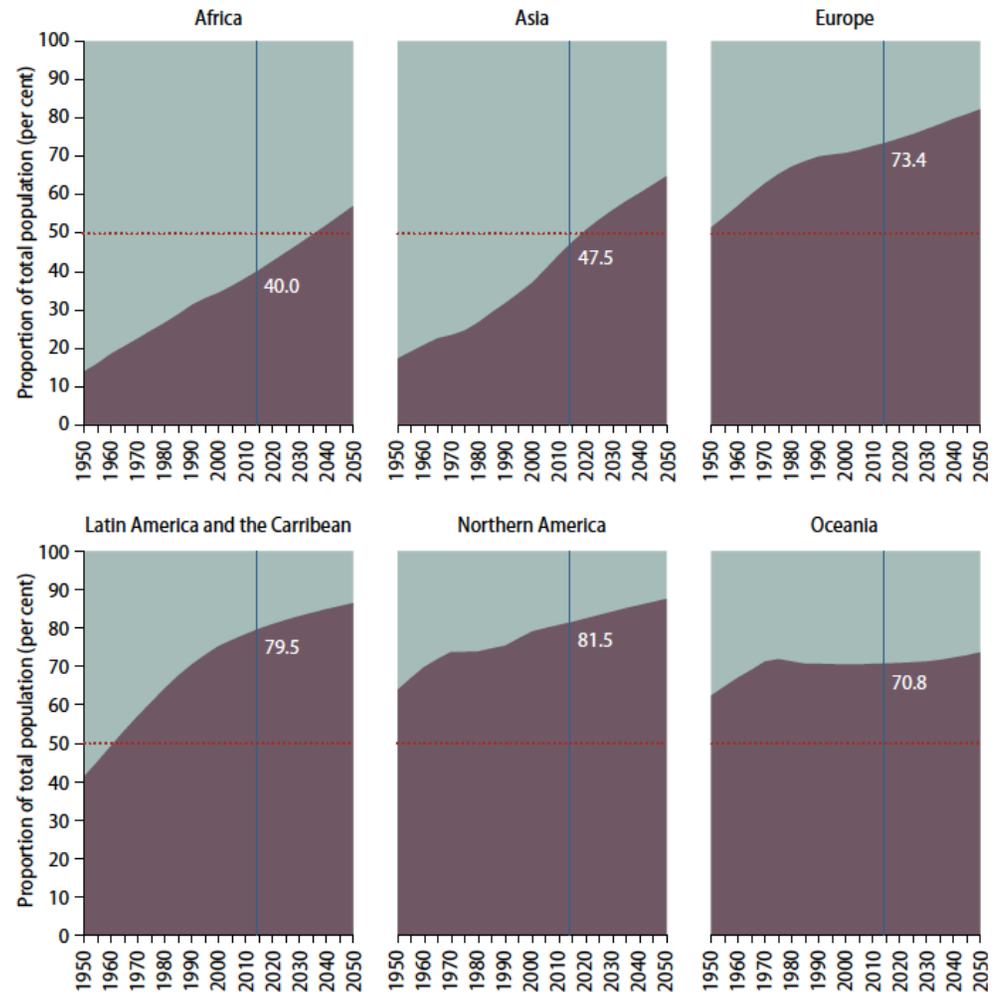
Source: Jones AD. (in press). Agricultural biodiversity, diet diversity, and nutritional status in low- and middle-income countries: a critical review of the emerging research evidence. *Nutrition Reviews*

AGRICULTURAL BIODIVERSITY AND DIET DIVERSITY

- Small, positive association between agricultural biodiversity and diet diversity in 18 of 20 studies (1-unit increase in CSR associated with 0.01 - 0.25 unit increase in the number of food groups consumed by households)
- Association between agricultural biodiversity and dietary diversity often follows an “inverted U” shape
- Both subsistence- and market-mediated mechanisms appear to be driving these associations

URBAN AND RURAL POPULATION AS PROPORTION OF TOTAL POPULATION, BY MAJOR AREAS, 1950-2050

- Virtually all population growth over the next 30 years will be concentrated in urban areas of LMICs



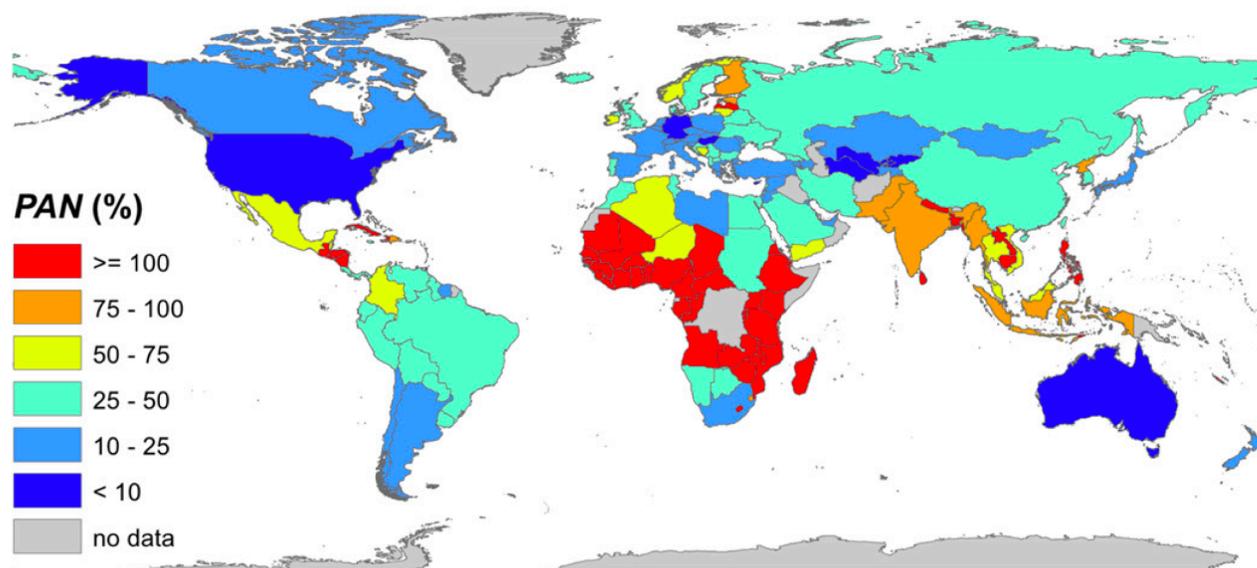
Source: United Nations (2014). World Urbanization Prospects. New York NY: UN



Urban agriculture proposed as solution to feed an urbanizing world by: 1) producing food where population density is highest, 2) reducing transportation costs, 3) connecting people to food systems, and 4) using urban areas efficiently

Photo source: http://www.fao.org/uploads/media/urban_agriculture_530.jpg.

% OF URBAN AREA NEEDED TO MEET RECOMMENDED CONSUMPTION OF VEGETABLES BY URBAN DWELLERS THROUGH URBAN AGRICULTURE

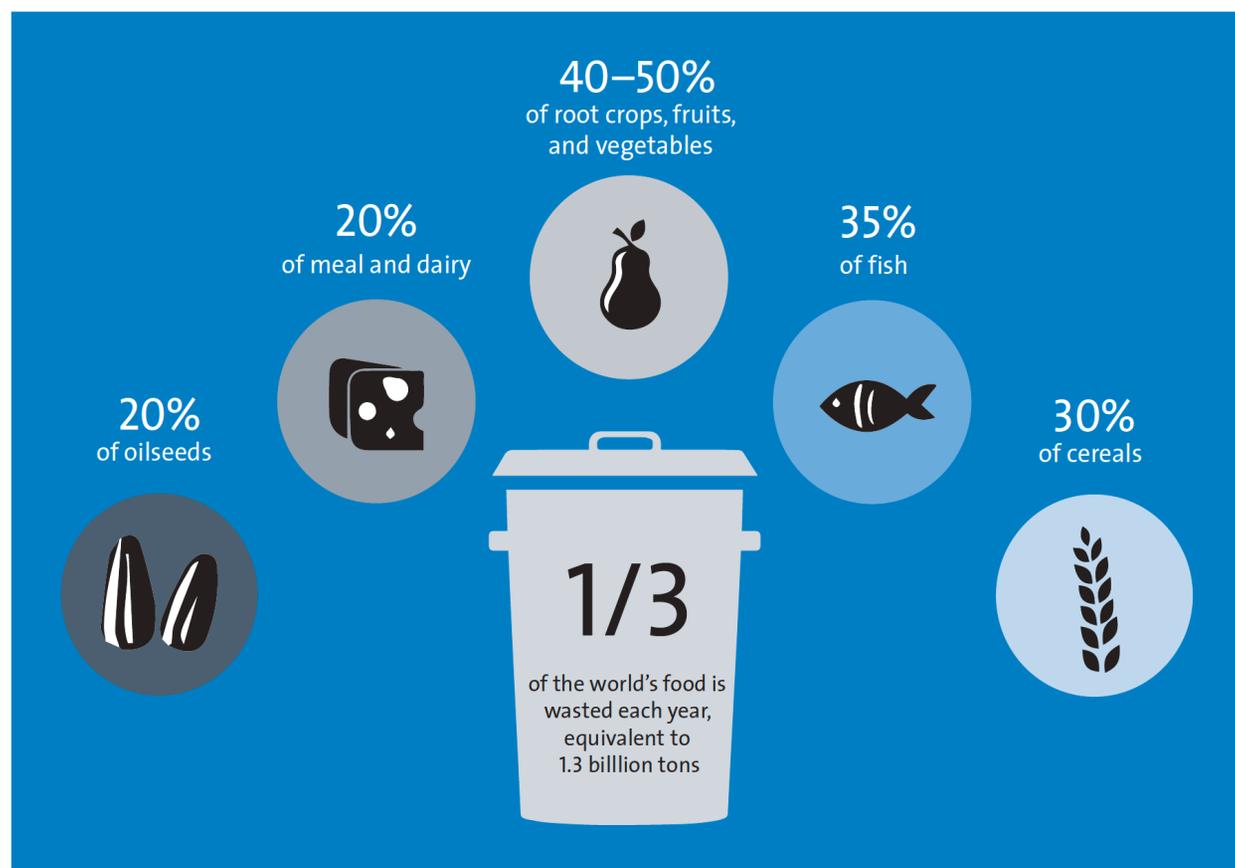


- 9 countries require <10% of urban area; 51 have insufficient area to meet recommendations
- Urban population density has the highest impact on area needed
- Space severely limits UA's potential to meet recommendations in LICs
- Small- and medium-sized urban areas can contribute substantially to UA production

Source: Martellozzo et al. (2014). Urban agriculture: a global analysis of the space constraint to meet urban vegetable demand. *Environ. Res. Lett.*

ANNUAL GLOBAL FOOD LOSS AND WASTE

- F&V susceptible to temperature extremes, are highly perishable
- Market linkages require unbroken cold chain or rapid processing (e.g., drying, canning, pickling)
- In LMICs, lack of adequate storage and distributions systems, warm climate, seasonal fluctuations



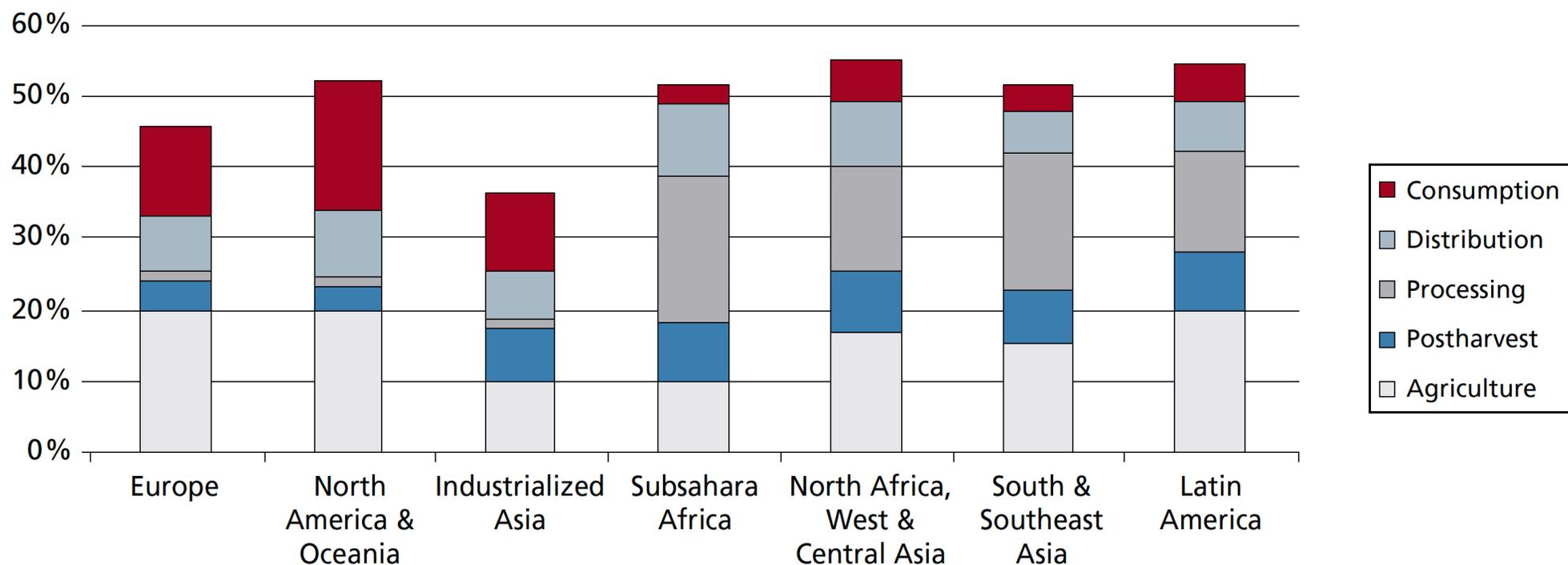
Source: FAO (2014). Global Initiative on Food Loss and Waste Reduction. Rome: FAO; Chicago Council on Global Affairs. (2015). Healthy Food for a Healthy World.

FOOD LOSS AND WASTE ALONG THE VALUE CHAIN

Production	Handling and storage	Processing and packaging	Distribution and market	Consumption
Definition				
During or immediately after harvesting on the farm	After produce leaves the farm for handling, storage, and transport	During industrial or domestic processing and/or packaging	During distribution to markets, including losses at wholesale and retail markets	Losses in the home or business of the consumer, including restaurants/caterers
Includes				
Fruits bruised during picking or threshing	Edible food eaten by pests	Milk spilled during pasteurization and processing (e.g., cheese)	Edible produce sorted out due to quality vegetables	Edible products sorted out due to quality
Crops sorted out at post harvest for not meeting quality standards	Edible produce degraded by fungus or disease	Edible fruit or grains sorted out as not suitable for processing	Edible products expired before being purchased and seeds	Food purchased but not eaten
Crops left behind in fields due to poor mechanical harvesting or sharp drops in prices	Livestock death during transport to slaughter or not accepted for slaughter	Livestock trimming during slaughtering and industrial processing	Edible products spilled or damaged in market	Food cooked but not eaten
Fish discarded during fishing operations	Fish that are spilled or degraded after landing	Fish spilled or damaged during/smoking		

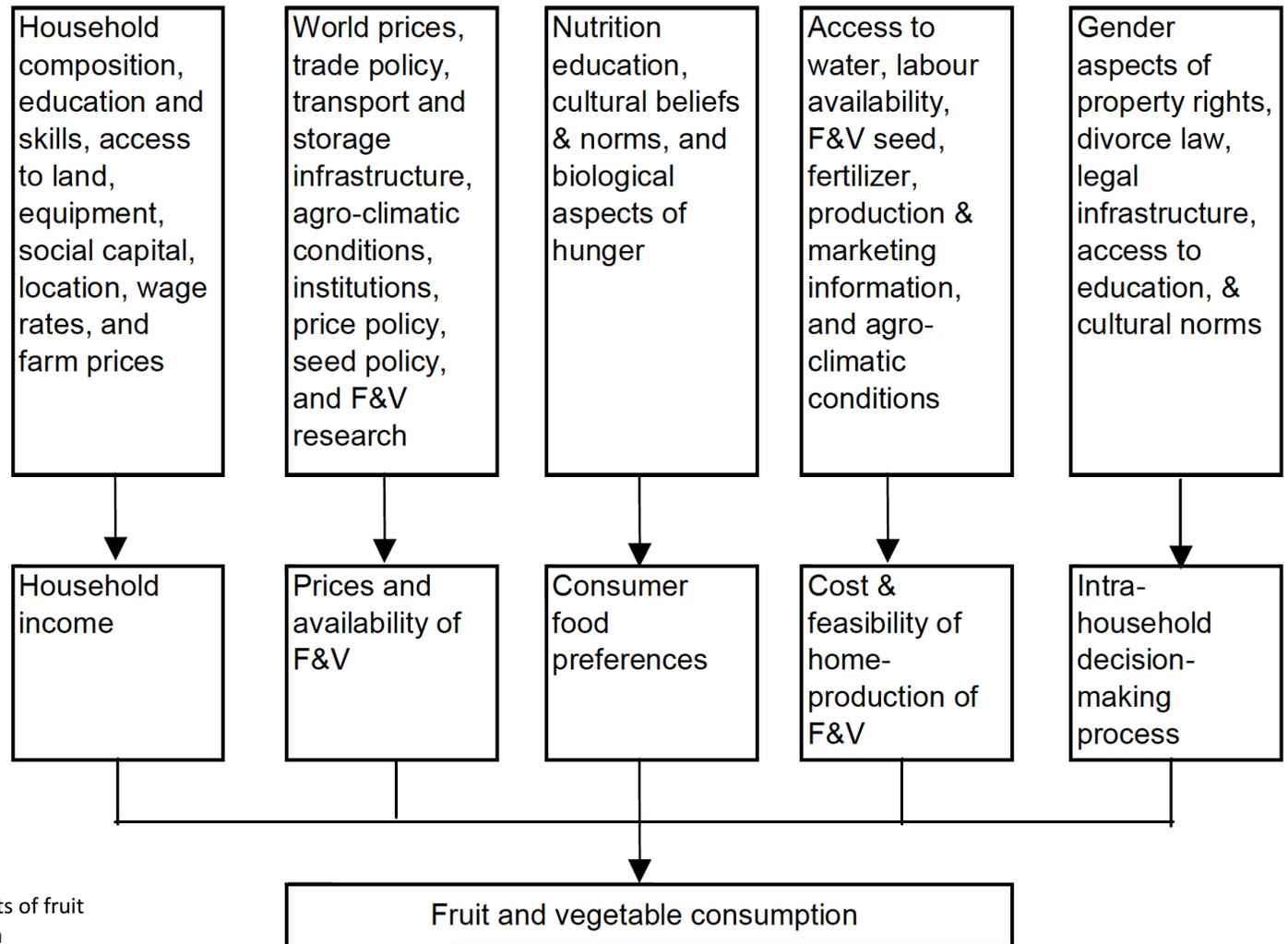
Source: Global Panel on Agriculture and Food Systems for Nutrition. (2016). Food systems and diets: Facing the challenges of the 21st century. London, UK.

PROPORTION OF INITIAL F&V PRODUCTION LOST OR WASTED AT DIFFERENT STAGES OF THE FOOD SUPPLY CHAIN



Source: Gustavsson et al. (2011). Global food losses and food waste: Extent, causes and prevention. Rome: FAO

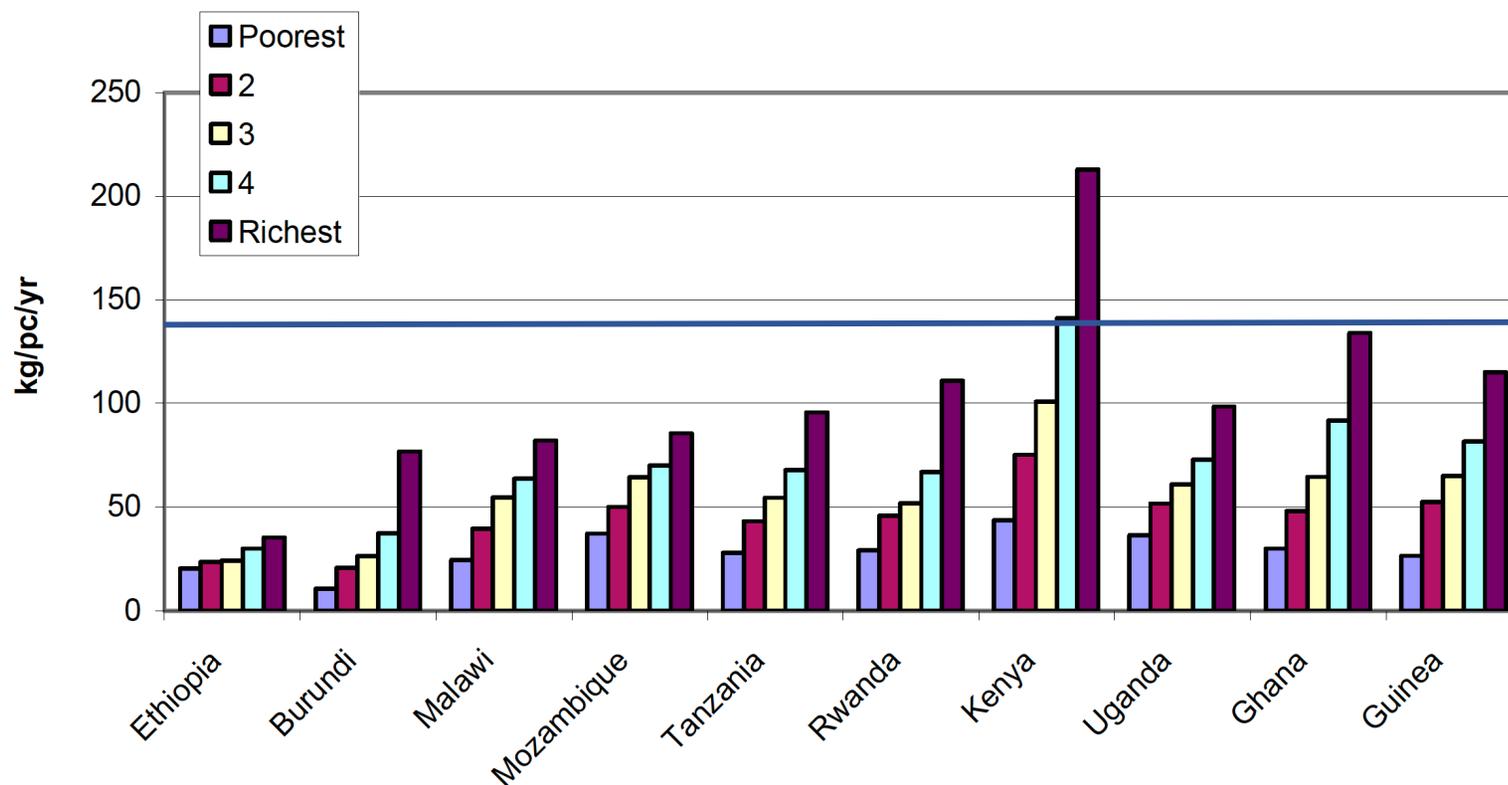
CONCEPTUAL FRAMEWORK OF DETERMINANTS OF F&V CONSUMPTION



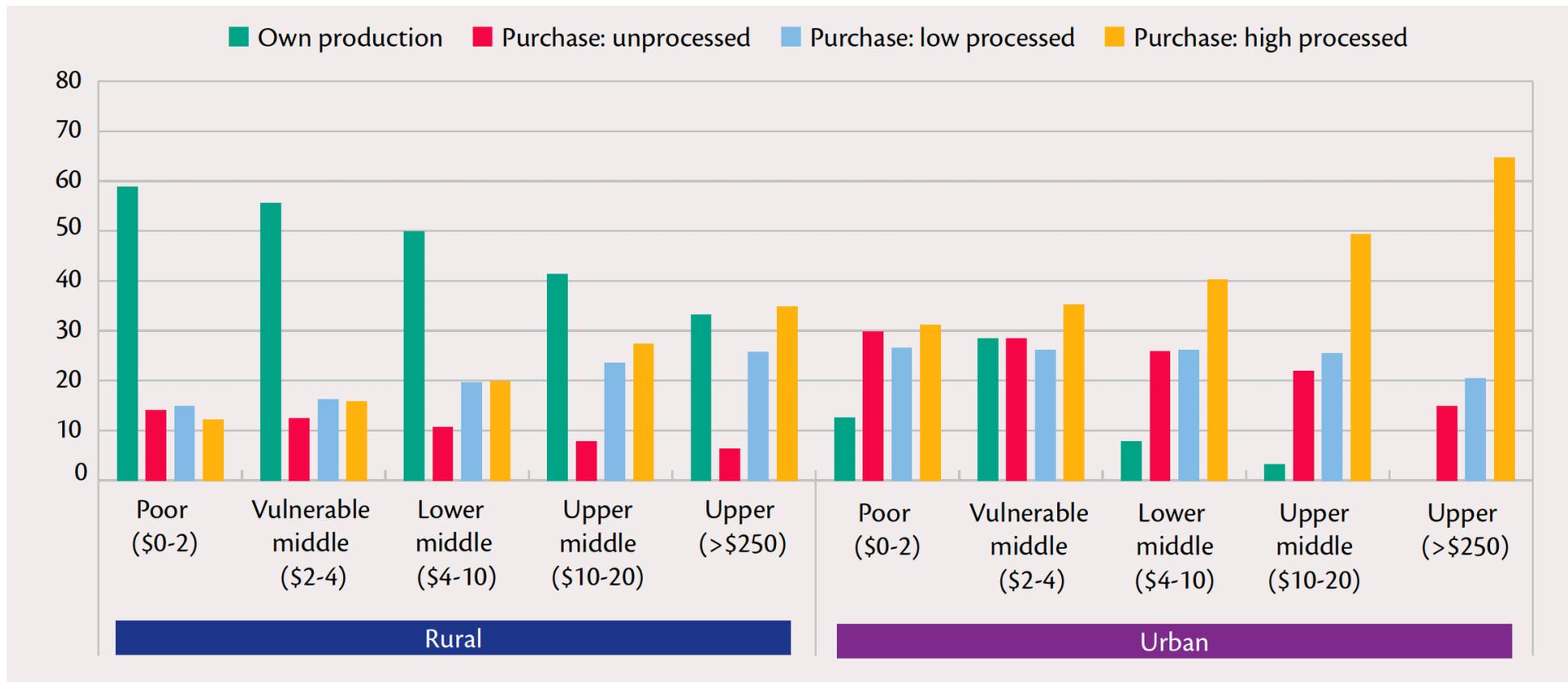
Source: Ruel et al. (2005). Patterns and determinants of fruit and vegetable consumption in sub-Saharan Africa: a multicountry comparison. Washington, DC: IFPRI

FRUIT AND VEGETABLE CONSUMPTION BY EXPENDITURE QUINTILE, 10 SSA COUNTRIES

- SES gradients for vegetables are larger than for fruits; thus, rising incomes may result in larger increases in vegetable consumption



PERCENTAGE OF MONETARY VALUE OF FOOD CONSUMED FROM DIFFERENT CATEGORIES



Countries: Ethiopia 2004/2005, Uganda 2009/2010, Tanzania 2010/2011, Mozambique 2008/2009, Malawi 2001/2011, South Africa 2010

Source: Global Panel on Agriculture and Food Systems for Nutrition. (2016). Food systems and diets: Facing the challenges of the 21st century. London, UK.

BEHAVIORAL INTERVENTIONS TO INCREASE F&V CONSUMPTION

- Small to moderate increase in F&V intake (0.1–1.4 serving/d) among healthy adults in a diversity of settings (i.e., communities, markets, work places, healthcare settings), using a diversity of approaches
- Larger effects observed in individuals with pre-existing health disorders
- Little evidence of effectiveness of specific components of interventions and of interventions in LMICs
- Small-scale interventions may not be cost-effective; larger-scale policies and programs that influence price/availability of F&V should be prioritized

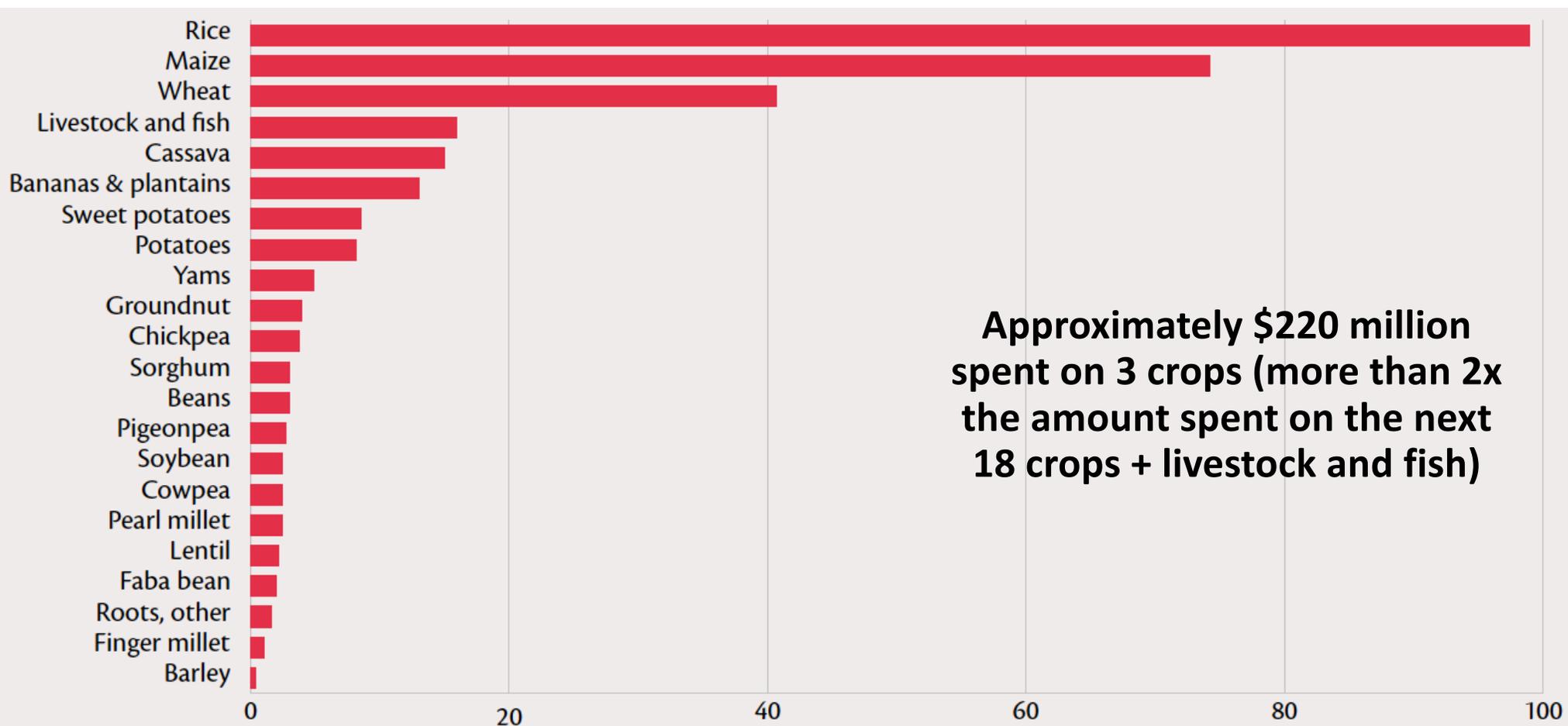
Source: Pomerleau et al. (2005). Interventions Designed to Increase Adult Fruit and Vegetable Intake Can Be Effective: A Systematic Review of the Literature. *Journal of Nutrition*; Cobiac et al. (2010). Cost-effectiveness of interventions to promote fruit and vegetable consumption. *PLoS One*

POLICY, INVESTMENT & RESEARCH PRIORITIES

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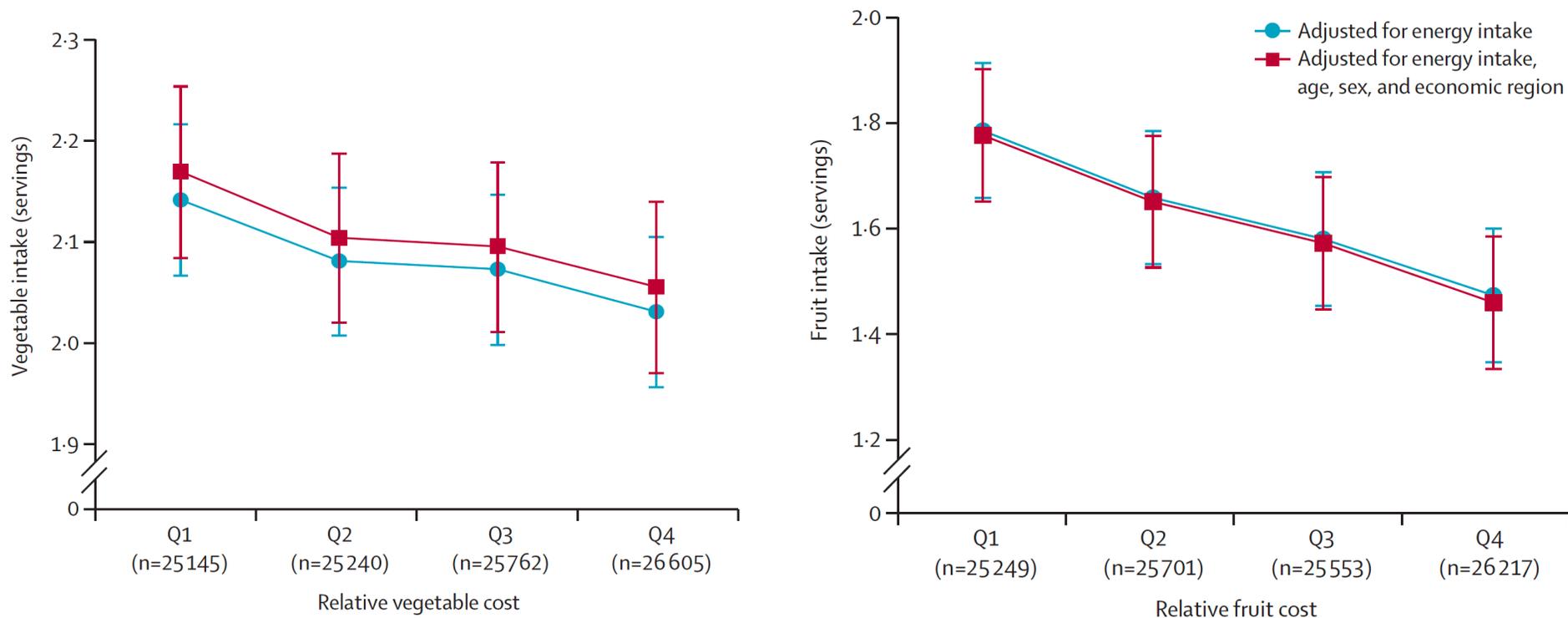
- Increased funding for research aimed at reducing unit costs of production of F&V

CGIAR RESEARCH FUNDING ALLOCATED TO SPECIFIC CROPS, 2012 (IN US\$ MILLION)



Source: Global Panel on Agriculture and Food Systems for Nutrition. (2016). Food systems and diets: Facing the challenges of the 21st century. London, UK.

MEAN INTAKE OF VEGETABLES AND FRUITS PER PERSON ADJUSTED FOR COVARIATES, BY RELATIVE COST



FFQ data from 18 countries (mix of high- and low-income) (2003-2013); cost of F&V relative to income per household member

Source: Miller et al. (2016). Availability, affordability, and consumption of fruits and vegetables in 18 countries across income levels: findings from the Prospective Urban Rural Epidemiology (PURE) study. *Lancet Global Health*

POLICY, INVESTMENT & RESEARCH PRIORITIES

- Increased funding for research aimed at reducing unit costs of production of F&V
- Shaping consumer demand

INFLUENCING CONSUMER DEMAND

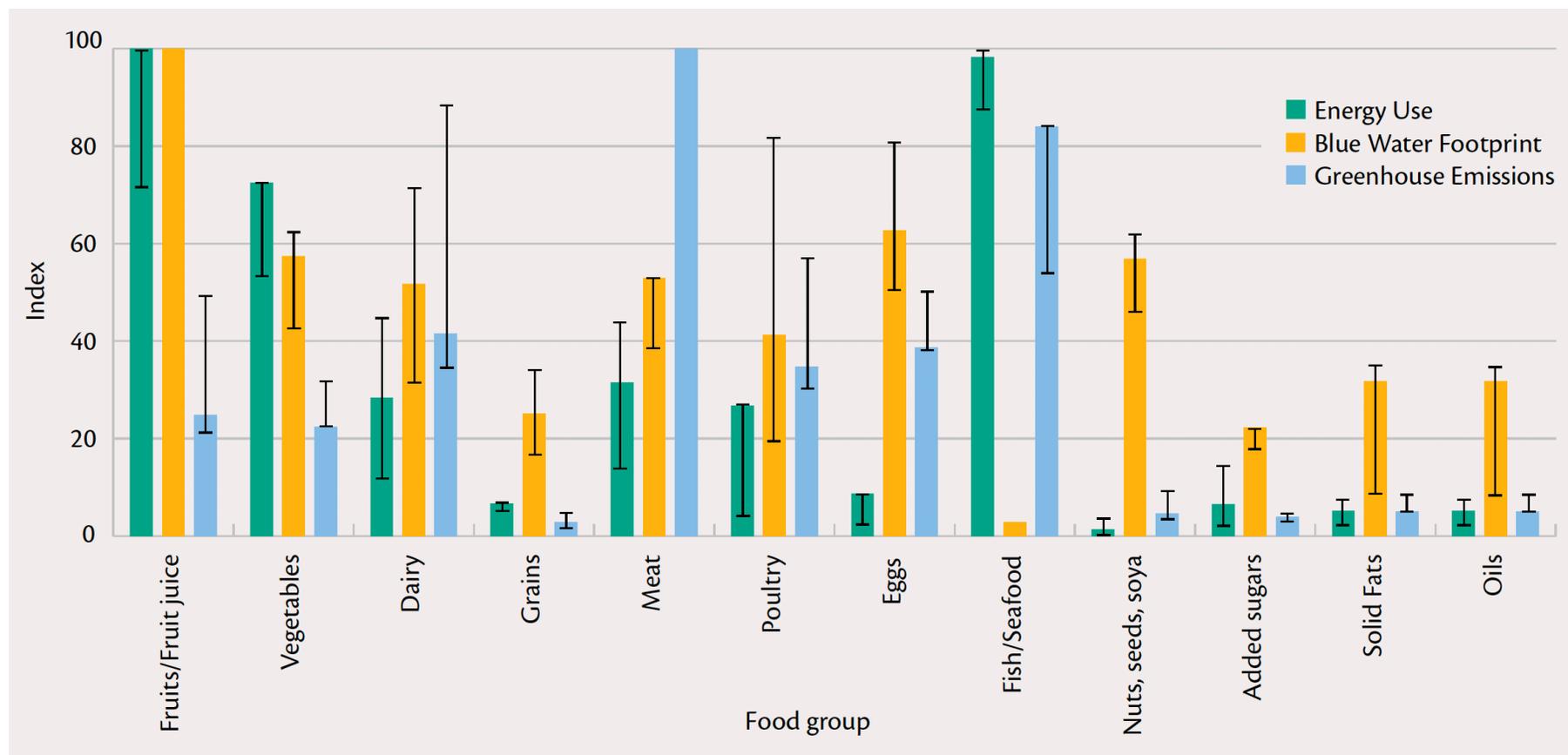
- From 1980 to 2004, global advertising expenditure rose from US\$216 billion to US\$512 billion
- Foods promoted to children and adolescents are predominantly high in sugar and fat with no reference to F&V

Sources: Story and French (2004). Food Advertising and Marketing Directed at Children and Adolescents in the US. *Int J Behav Nutr Phys Act*; Gamble and Cotunga (1999). A quarter century of TV food advertising targeted at children. *American Journal of Health Behavior*; Taras and Gage (1995). Advertised foods on children's television. *Arch Pediatr Adolesc Med*

POLICY, INVESTMENT & RESEARCH PRIORITIES

- Increased funding for research aimed at reducing unit costs of production of F&V
- Shaping consumer demand
- Reduce food waste and loss
 - Good manufacturing practices; storage and conservation solutions; technical solutions for transport, processing, packaging; infrastructure and cold chain investments; valorize surplus foods, by-products, side streams and non-used food; efficient, low-cost greenhouses
- Diversifying production systems at various scales and locations
- Better and more data are needed characterizing global diets, including integrated data sets; some ongoing efforts: Global Dietary Database, FAO/WHO Global Individual Food consumption data Tool

INDICES OF AVERAGE ENERGY USE, BLUE-WATER FOOTPRINT, AND GHGEs PER CALORIE OF FOOD, US DATA



Source: Global Panel on Agriculture and Food Systems for Nutrition. (2016). Food systems and diets: Facing the challenges of the 21st century. London, UK.

KEY TAKE-AWAYS

- Poor diets are the key driver of malnutrition in LMICs and F&V are central to improving diets and related health outcomes
- Consumption of F&V is lower than recommendations in most LMICs though there are increasing trends, and gaps are not insurmountable
- An “all-of-the-above” approach is needed to increase availability of F&V; increased research for improved technology is central
- Enhancing affordability and shaping consumer demand are equally important priorities

THANK YOU

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