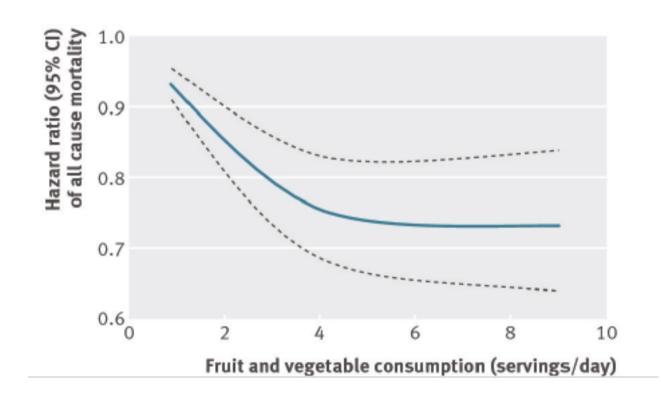


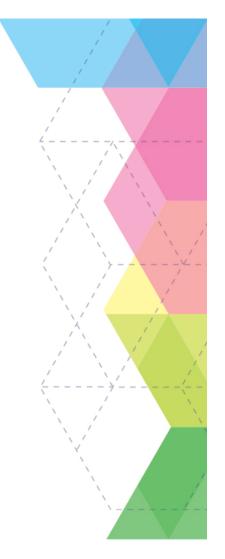
## Phytonutrients Challenges & Opportunities: Where Do We Stand?

Keith Randolph, PhD Fellow & Nutrition Technology strategist Amway global discovery R&D



# Fruit & vegetable consumption and all cause mortality from chronic disease





BMJ 2014;349:g4490 doi: 10.1136/bmj.g4490 (Published 29 July 2014)

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# Fruit & vegetable consumption and chronic disease risk

Table 3 Summary of the strength of evidence on the association between the consumption of vegetables and fruit and the risk of chronic diseases

	Evidence judgement (strength of the evidence)			
	Convincing	Probable	Possible	Insufficient
Obesity		o <sup>a</sup>	$\downarrow^{b}$	
Type 2 diabetes mellitus		o		
Hypertension	1			
Coronary heart disease (CHD)	1			
Stroke	1			
Cancer		1		
Chronic inflammatory bowel diseases				~
Rheumatoid arthritis (RA)			1	
Chronic obstructive pulmonary disease (COPD)			1	
Asthma			1	
Osteoporosis			1	
Eye diseases				
Macular degeneration			1	
Cataract			1	
Glaucoma				~
Diabetic retinopathy				~
Dementia			1	

↓ Risk reduction by increased vegetable and fruit consumption, o no association, ~ insufficient evidence

Eur J Nutr (2012) 51:637-663

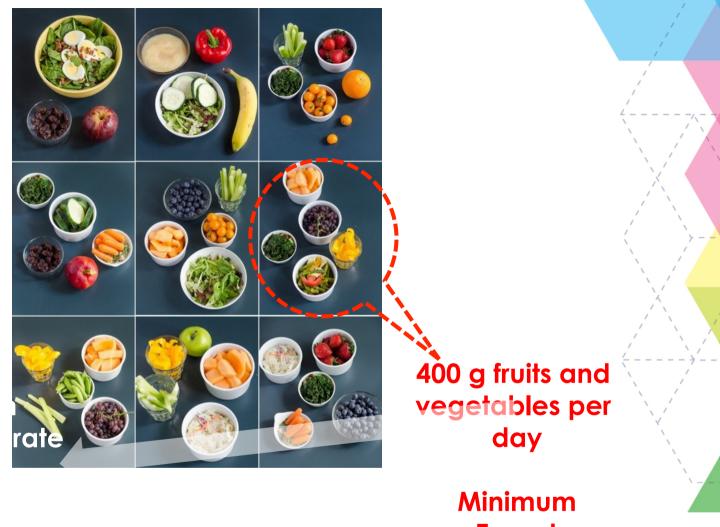


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<sup>&</sup>lt;sup>a</sup> Weight loss

b Weight increase



**Phytonutrients** 





Target commendatio

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British Journal of Nutrition, page 1 of 15

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## Global assessment of select phytonutrient intakes by level of fruit and vegetable consumption

Mary M. Murphy<sup>1\*</sup>, Leila M. Barraj<sup>1</sup>, Judith H. Spungen<sup>1</sup>†, Dena R. Herman<sup>2</sup> and R. Keith Randolph<sup>3</sup>



<sup>&</sup>lt;sup>1</sup>Exponent, Inc., 1150 Connecticut Avenue, Northwest, Suite 1100, Washington, DC 20036, USA

<sup>&</sup>lt;sup>2</sup>Department of Family and Consumer Sciences, California State University, Northridge, CA 91330, USA

<sup>&</sup>lt;sup>3</sup>Nutrilite Health Institute, Buena Park, CA 90621, USA

## **3 Objectives**



1. F & V Quantity

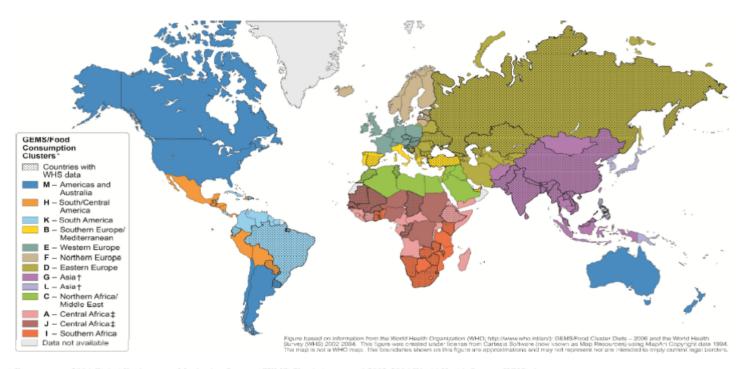
2. F & V Variety

## 3. Phytonutrient Intake

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## Scope

Figure S1. Thirteen Geographic Diet Clusters Corresponding to the 2006 GEMS/Food Consumption Clusters



<sup>\*</sup> Data sources: 2006 Global Environment Monitoring System (GEMS)/Food clusters and 2002-2004 World Health Survey (WHS) data.

## Data from 196,925 people in 52 countries clustered in 13 regions

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<sup>†</sup> Asia was separated by GEMS into two clusters; both diets were high in rice and wheat. Cluster G was characterized by higher availability of fruiting vegetables, milk & milk products, potatoes, and fish/seafood & fish/seafood products, while cluster L was characterized by higher availability of fish/seafood & fish/seafood products, maize, milk & milk products, and brassica vegetables.

<sup>‡</sup> Central Africa was separated by GEMS into two clusters. Cluster A was characterized by higher availability of plantains, cassava, rice, wheat, maize, and milk & milk products. Cluster J was characterized by higher availability of cassava, sorghum, milk & milk products, millet, rice, and maize.

#### **Methods**

#### Quantity

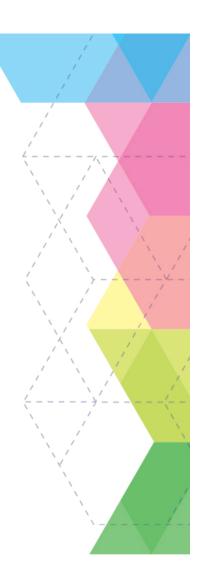
F&V intake data from World Health Survey, 2004

### Variety

Estimated from FAO Food Supply Utilization data, 2012

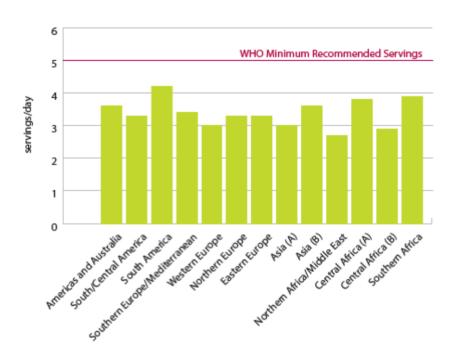
### Phytonutrient Intakes

 Estimated from published literature, USDA National Nutrient Database for Standard Reference, and USDA Flavonoid database



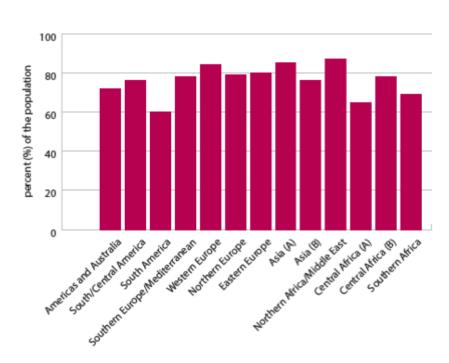
## **F&V Intake Quantity**

Figure 1A. Average Number of Fruit and Vegetable Servings Consumed Per Day



Based on 2006 GEMS/Food cluster and FAO supply utilization accounts data.2

Figure 1B. Percent Consuming Less than 5 Servings of Fruits and Vegetables/Day



Based on 2006 GEMS/Food cluster and FAO supply utilization accounts data.2



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# F&V Intake of "meeters" and "non-meeters"

Figure 2A. Average Number of Fruit and Vegetable Servings/
Day Consumed by People Meeting
the WHO Recommendations

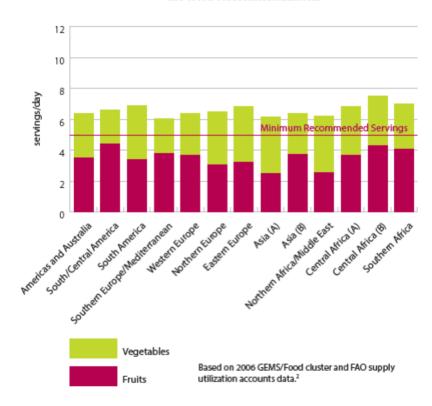
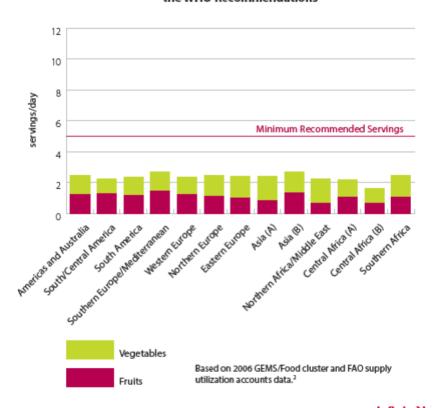


Figure 2B. Average Number of Fruit and Vegetable Servings/
Day Consumed by People <u>Not</u> Meeting
the WHO Recommendations





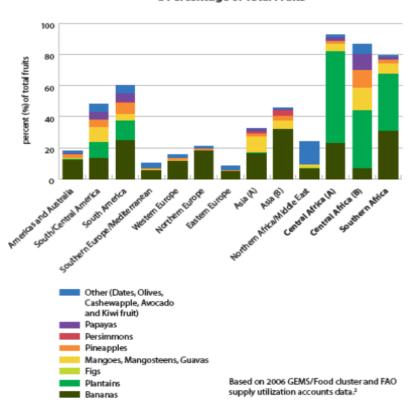
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## **Fruit Abundance and Variety**

#### **Tropical Fruits and Citrus**

Figure 3. Variety of Tropical/Subtropical Fruits as a Percentage of Total Fruits



## Figure 4. Variety of Citrus Fruits as a Percentage of Total Fruits 35 percent (%) of total fruits 30 25 15 10 5 Tangerines, Mandarins, Clementines Grapefruit (inc. Pomelos) Lemons and Limes Based on 2006 GEMS/Food cluster and FAO supply utilization accounts data.2 Oranges

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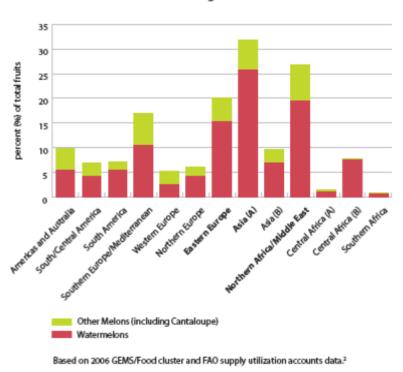
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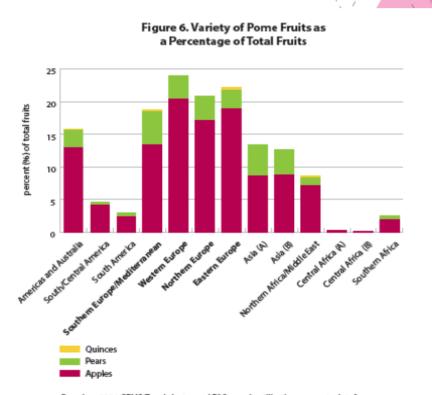
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## **Fruit Abundance and Variety**

#### **Melons and Pomes**

Figure 5. Variety of Watermelons/Other Melons as a Percentage of Total Fruits





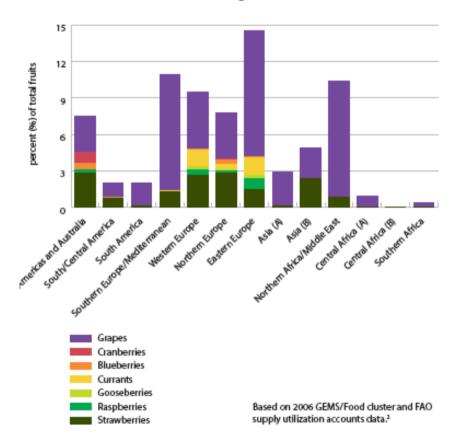
Based on 2006 GEMS/Food cluster and FAO supply utilization accounts data.2

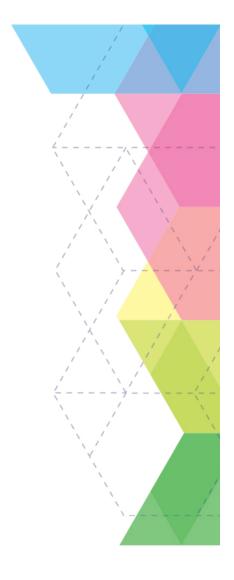


## **Fruit Abundance and Variety**

#### **Berries**

Figure 7. Variety of Berries as a Percentage of Total Fruits





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## **Vegetable Abundance and Variety**

#### Fruiting vegetables and curcubits

Figure 8. Variety of Fruiting Vegetables as a Percentage of Total Vegetables

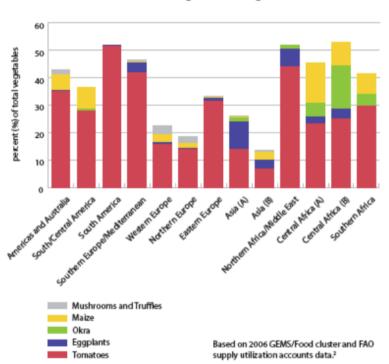
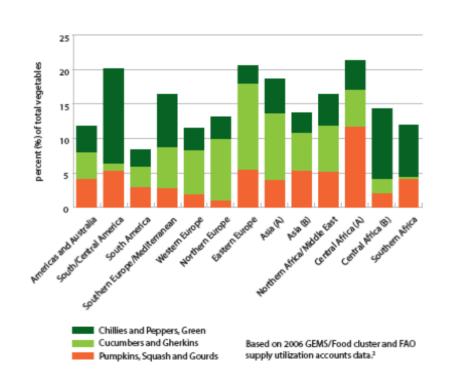


Figure 10. Variety of Fruiting Vegetables Including Cucurbits as a Percentage of Total Vegetables





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## **Vegetable Abundance and Variety**

#### Brassica and leafy vegetables

Figure 9. Variety of Brassica Vegetables as a Percentage of Total Vegetables

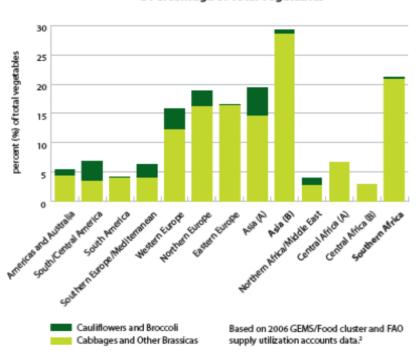
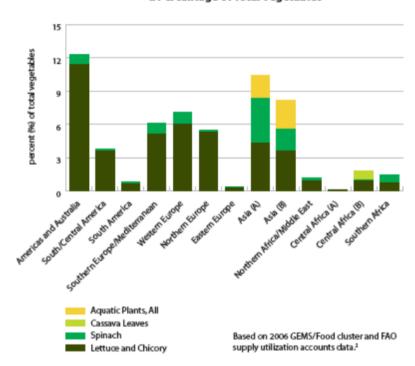


Figure 11. Variety of Leafy Vegetables as a Percentage of Total Vegetables





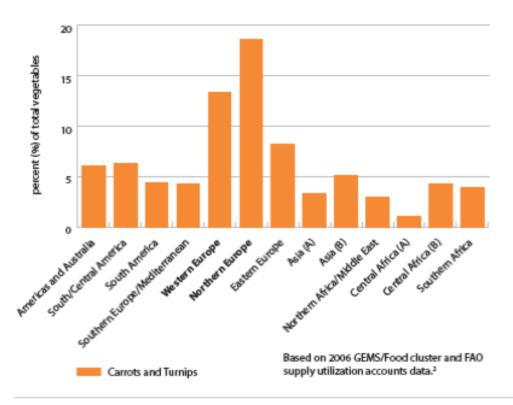
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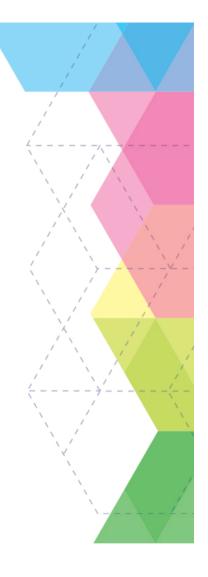


## **Vegetable Abundance and Variety**

#### **Root vegetables**

Figure 12. Variety of Root Vegetables as a Percentage of Total Vegetables

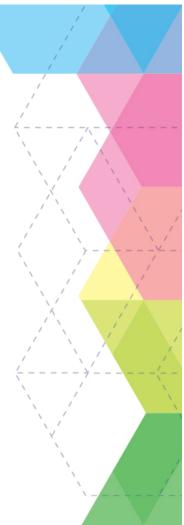




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## **Primary Phytonutrients & Sources**

- Carrots and turnips were top sources of alpha- and betacarotene in 9/13 clusters
- Lettuces and brassica were top sources of lutein& zeaxanthin globally
- Tomatoes were a top source of lycopene globally
- Onions were a top source of quercetin globally
- Oranges were the top source of hesperetin in 12/13 clusters



### **Summary**

#### Quantity

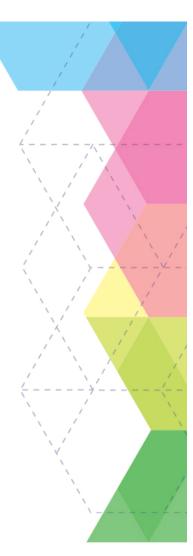
- ~75% of people globally fall short of WHO F&V recommendation
- Most individuals need to double F&V intake

#### **Variety**

- The most common F&V globally are tropical/subtropical fruits, and fruiting vegetables
- F&V intake variety varies widely globally, and is relatively narrow within different regions

#### **Phytonutrients**

- Phytonutrient intakes by adults consuming >400 g/d of F&V were ~2- to 6-fold higher than intakes by adults consuming <400 g/d</li>
- Of all the color categories, blue/purple appears to be the least abundant and least consumed globally



#### **Recommendations**

- Recurring (~every ten years) global dietary assessments are warranted
- Methodology for assessment is preferably based upon consumption vs availability
- Sustained shortfalls in fruit and vegetable consumption into the future relative to WHO recommendations are likely without better education, improved global supply chains, and expansion of sustainable farming practices
- Health/wellness outcomes should be included alongside morbidity and mortality in global dietary assessments
- Research supporting supplementation as an approach to fill the fruit and vegetable consumption shortfall is needed
- Dietary and supplementation research needs to consider nutritional complexity of plant foods rather than individual components

