



# GLOBAL PHYTONUTRIENT REPORT

A GLOBAL SNAPSHOT OF FRUIT AND VEGETABLE INTAKE AND AVAILABILITY,  
AND IMPLICATIONS FOR PHYTONUTRIENT INTAKES





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A Global Snapshot of Fruit and Vegetable Intake and Availability, and Implications for Phytonutrient Intakes

## CONTENTS

- Executive Summary ..... 2
- What are Phytonutrients? ..... 3
- Importance of Quantity and Variety ..... 4
- Research Overview ..... 5
- Global Fruit and Vegetable Intake Falls Short of Recommendations ..... 6–7
- Global Availability of Fruits and Vegetables ..... 8
  - Fruit Availability ..... 9
    - Tropical/Subtropical Fruits ..... 9
    - Citrus Fruits ..... 9
    - Melons ..... 10
    - Pome Fruits ..... 10
    - Berries ..... 11
  - Vegetable Availability ..... 12
    - Fruiting Vegetables (excluding Cucurbits) /Mushrooms ..... 12
    - Brassica Vegetables ..... 12
    - Fruiting Vegetables (including Cucurbits) ..... 13
    - Leafy Vegetables ..... 13
    - Root Vegetables ..... 14
- Conclusion ..... 15
- References ..... 16
- Appendix ..... 17–19

# EXECUTIVE SUMMARY

**ABOUT THIS REPORT** *The Global Phytonutrient Report* summarizes total fruit and vegetable intake in servings per day and the primary types of fruits and vegetables available in various global regions. Inferences about phytonutrient intake are then made by Nutrilite from this information. The report aims to raise awareness worldwide about the importance of fruit, vegetable and ultimately, the quantity and variety of phytonutrient consumption, and their impact on optimal health.

## THE PHYTONUTRIENT LANDSCAPE

Nutrition and health experts around the world recognize fruits and vegetables are key components of a healthy diet. In addition to being sources of many vitamins, minerals and fiber, they also are sources of **phytonutrients – the natural, protective substances found in plants that often give them their vibrant colors**. Emerging research suggests that phytonutrients may also provide a range of health benefits.

Recent research reveals that approximately 1 in 4 men and women meet the minimum recommendation of five servings (or 400 grams) of fruits and vegetables per day.<sup>1</sup> In comparison to the available data about fruit and vegetable intake, there is significantly less data available at the global level about the amount and variety of specific fruit and vegetable intake, which influences total phytonutrient intakes. Research in this area generally supports the idea that amount and variety are desirable and important for overall health.

## DATA SOURCES\*

*The Global Phytonutrient Report: A Global Snapshot of Fruit and Vegetable Intake and Availability, and Implications for Phytonutrient Intakes* was developed by Nutrilite using results from an analysis of fruit and vegetable intakes conducted for Nutrilite by Exponent, Inc.<sup>2</sup> The analysis of fruit and vegetable intakes was conducted using data from several sources:<sup>2</sup>

- World Health Organization's (WHO) World Health Survey (WHS)
- The Global Environment Monitoring System - Food Contamination Monitoring and Assessment Programme (GEMS/Food)
- The Food and Agriculture Organization's (FAO) Supply Utilization Accounts (SUA) and Food Balance Sheets

\*All implications and inferences presented in this report were prepared by Nutrilite and represent the opinions of Nutrilite.

## KEY FINDINGS

### AMOUNT OF FRUIT AND VEGETABLE CONSUMPTION

The vast majority of adults (60-87%) worldwide reported consuming less than the minimum of five servings of fruits and vegetables per day recommended by the World Health Organization.

**The majority of adults worldwide would have to at least double their current intake of fruits and vegetables to meet the WHO recommendation.**

### VARIETY OF AVAILABLE FRUITS AND VEGETABLES

The most commonly available global fruits and vegetables and examples of their associated phytonutrients are:



**Tropical and subtropical fruits**, for example, plantains (alpha-carotene and beta-carotene), mangos (beta-carotene), papayas (beta-cryptoxanthin) and guavas (lycopene).



**Fruiting vegetables**, for example, tomatoes (alpha-carotene, beta-carotene and lycopene), corn (lutein/zeaxanthin), and eggplants (anthocyanidin).

In addition to providing a better understanding of the amount and variety of fruit and vegetable consumption around the world, these insights point to the need for future research about intake of fruits and vegetables and their associated phytonutrients. This will allow for a better understanding of the role that these healthful foods play in the maintenance of optimal health.

To learn more about the phytonutrient research led by Nutrilite Health Institute, please contact Lindsay Pott at [lindsay.pott@amway.com](mailto:lindsay.pott@amway.com) or Clare Wade at [clare.wade@amway.com](mailto:clare.wade@amway.com).



WHAT ARE PHYTONUTRIENTS?

WHAT ARE PHYTONUTRIENTS?

Phytonutrients are organic components found in plants that are thought to promote human health. The term “phyto” originates from a Greek word meaning plant. Fruits, vegetables, grains, legumes, nuts and teas are all rich sources of phytonutrients. Many plant-based foods including fruits and vegetables contain a number of different phytonutrients, even if they have been studied primarily for just one or two. That is why there is not only a need to increase consumption of fruits and vegetables in general, but also to increase variety to ensure the best possible benefits.<sup>3-4</sup>

Phytonutrients that will be highlighted in this report are included in Table 1 along with their associated beneficial functions.

**KEY INSIGHT** Both quantity and **variety** of fruits and vegetables are necessary to obtain the maximum benefit from what we eat.

Table 1: Select Phytonutrients and Associated Health Benefits

COLOR CATEGORY	PHYTONUTRIENT	EXAMPLES OF ASSOCIATED HEALTH BENEFITS	EXAMPLES OF FRUITS/VEGETABLES <sup>38,39</sup>
Green	Lutein/ Zeaxanthin	Vision health <sup>5-7</sup>	Spinach, lettuce, kale, broccoli
	Glucosinolates	Cellular health <sup>43</sup>	Broccoli, bok-choy, cabbage, mustard greens
Red	Lycopene	Prostate health, <sup>8</sup> lung, <sup>9</sup> stomach health, <sup>10,11</sup> heart health <sup>44</sup>	Tomatoes, watermelon, red grapefruit
	Ellagic Acid	Cell health <sup>12,13</sup>	Raspberries, strawberries
White	Quercetin	Blood vessel and heart health, <sup>14,15</sup> bone and joint health <sup>45,46</sup>	Onions, apples, radicchio
Purple/Blue	Anthocyanidins	Heart health, <sup>16</sup> cell health, <sup>17,18</sup> skin health, <sup>19</sup> digestive health, <sup>20</sup> brain health <sup>47,48</sup>	Grapes, blueberries, eggplants
Yellow/Orange	Alpha-carotene	Vision health, <sup>21</sup> healthy growth and development, <sup>22</sup> heart health <sup>23</sup>	Carrots, plantains, pumpkin
	Beta-carotene	Vision health, <sup>24</sup> healthy immune function, <sup>25</sup> healthy growth and development, <sup>22</sup> heart health, <sup>23</sup> bone health <sup>26</sup>	Carrots, Chinese cabbages, plantains, cantaloupe
	Hesperidin	Heart health <sup>27</sup>	Oranges, lemons, limes
	Beta-cryptoxanthin	Heart health, <sup>23</sup> bone health, <sup>26</sup> joint health <sup>28</sup>	Oranges, tangerines, papayas

IMPORTANCE OF QUANTITY AND VARIETY

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**KEY INSIGHT** Recent research in the United States and Korea as seen in Table 2<sup>30-31</sup> suggests it is likely that populations consuming low amounts and **variety** of fruits and vegetables are also consuming low quantities and varieties of phytonutrients.

While specific recommendations for phytonutrient intake amounts needed to support optimal health have not yet been established, it is clear that consumption of fruits and vegetables is linked to phytonutrient intake.

Dietary Guidelines for Americans and the 5-a-Day program in the U.K. emphasize consuming a larger quantity and variety of fruits and vegetables.<sup>32-33</sup> This is because different fruits and vegetables appear to support a range of biological functions. Consuming a variety of plant-based foods helps to ensure that individuals receive the optimum benefits from fruits and vegetables.<sup>34-35</sup>

Globally, a number of factors likely influence intake of fruits and vegetables—and ultimately phytonutrients. Examples may include, but are not limited to:<sup>36-37</sup>

- Cost
- Convenience
- Quality
- Perceptions of the nutritional value
- Seasonal and geographic availability
- Limited access to transportation
- Limited access to cooking facilities
- Limited access to safe food storage options

In comparison to the available data about the amount of fruit and vegetable intake as a group of foods, there are less data available at the global level about the amount and variety of specific fruit and vegetable intake. **This data shortfall makes it challenging to assess the role of intake variety on health, as well as to make robust estimates of phytonutrient intakes.**

**Table 2: Phytonutrient Research Findings in United States and South Korea**

	UNITED STATES <sup>30</sup>	KOREA <sup>31</sup>
Falling Short on Fruit & Vegetable Intake	5% of men and 7% of women met MyPyramid recommendations for consumption of fruit and vegetables.	4% of men and 6% of women satisfied the recommended fruit and vegetable intake.
Phytonutrient Intake Higher for Individuals Meeting Fruit & Vegetable Recommendations	Intakes of all phytonutrients (other than ellagic acid) were considerably higher among men and women meeting dietary recommendations for fruit and vegetable intakes compared to those not meeting the recommendations.	Intakes of major carotenoids, flavonoids and one phenolic compound were significantly higher among subjects who met the recommendations for fruit and vegetable consumption compared with those who did not.
Lack of Variety in Fruit & Vegetable Intake	For five of the nine phytonutrients, a single food accounted for 64% or more of the total intake of the phytonutrient.  Tomatoes, carrots, oranges and orange juice, and strawberries accounted for approximately two-thirds or more of the average intake of five of the nine phytonutrients.	One or two food items contributed to nearly all intake of each phytonutrient.  Carrots and squash are major sources of carotenoids, with the exception of lycopene. Watermelon and tomatoes largely contributed to lycopene intake. Major sources of flavonoids were fruits, onions, soybeans and nuts.

RESEARCH OVERVIEW

RESEARCH OVERVIEW

An analysis of the number of servings of fruits and vegetables consumed in 13 regions around the globe and the major types of specific fruits and vegetables available in each region was conducted for Nutrilite.<sup>2</sup> From these data and other information in the published literature, general inferences about phytonutrient intakes were made by Nutrilite. For the remainder of this report, the term “variety” refers to the major types of fruits and vegetables available in each region.

WORLD HEALTH SURVEY (WHS) DATA

In the analysis of fruit and vegetable intakes by region, or geographic diet cluster, consumption data were based on responses to a World Health Organization (WHO) questionnaire on fruit and vegetable intake provided to a group of individuals participating in the World Health Survey (WHS) from 2002-2004.<sup>2</sup> Information on fruit and vegetable intake was collected from a total of 196,925 adults from 52 primarily low and middle income countries around the globe.<sup>2</sup> The WHS data therefore were available from a subset of countries within each geographic diet cluster. The data provided information addressing two questions:<sup>2</sup>

- 1) How many servings of fruit do you eat on a typical day?
- 2) How many servings of vegetables do you eat on a typical day?

In general, one serving of vegetables was considered to be one cup (80g) of raw green leafy vegetables such as spinach or salad; one-half cup (80g) of other vegetables cooked or chopped raw, such as tomatoes, carrots, pumpkin, corn, Chinese cabbage, fresh beans or onions; or one-half cup (80g) vegetable juice.<sup>2</sup> Likewise, one serving of fruit was considered to be one medium size piece of fruit, such as an apple, banana or orange; one-half cup (80g) chopped, cooked or canned fruit; or one-half cup (80g) fruit juice.<sup>2</sup>

ONE SERVING



1 cup (80g)

or



½ cup (80g)

or



½ cup (80g)



1 piece

or



½ cup (80g)

or



½ cup (80g)

FOOD AND AGRICULTURE ORGANIZATION (FAO) DATA

Since the WHS did not collect information on the specific types of fruits and vegetables consumed by each participant, data from the WHO and Food and Agriculture Organization (FAO), which provided information on the quantity of major types of fruits and vegetables available by country, were analyzed.<sup>2</sup> These data were used to estimate the proportion of fruits and vegetables available by type in each of the thirteen geographic clusters.<sup>2</sup> It is important to note that the fruit and vegetable proportion data are therefore not a record of what people actually ate; rather, the data are a proxy for actual consumption.<sup>2</sup>

THE GLOBAL ENVIRONMENTAL MONITORING SYSTEM (GEMS) CLUSTERS

The analysis of fruit and vegetable intake in servings per day and the primary types of fruits and vegetables available was completed for 13 geographic regions, which are based on the 2006 GEMS/food clusters\*:

- Americas and Australia, e.g., United States
- South/Central America, e.g., Mexico
- South America, e.g., Brazil
- Southern Europe, e.g., Italy
- Western Europe, e.g., Germany
- Northern Europe, e.g., Sweden
- Eastern Europe, e.g., Russia
- Asia (A), e.g., China and India
- Asia (B), e.g., Japan and Korea
- Northern Africa/Middle East, e.g., Morocco
- Central Africa (A), e.g., Cameroon
- Central Africa (B), e.g., Nigeria
- Southern Africa, e.g., South Africa

The 13 regions in the analysis correspond to the 2006 diet clusters identified by the WHO Global Environmental Monitoring System (GEMS) – Food Contamination Monitoring and Assessment Programme (GEMS/Food Program).<sup>2</sup> The clusters will be used for the remainder of this report and serve as the key to describe the data in the tables and figures within.

\*A list of countries in each cluster can be found in the Appendix. Asia was separated by GEMS into two clusters, with both diets being high in rice and wheat. Cluster Asia (A) was characterized by higher availability of fruiting vegetables, milk and milk products, potatoes and fish/seafood and fish/seafood products, while cluster Asia (B) was characterized by higher availability of fish/seafood and fish/seafood products, maize, milk and milk products and brassica vegetables. Central Africa was separated by GEMS into two clusters. Cluster Central Africa (A) was characterized by higher availability of plantains, cassava, rice, wheat, maize, milk and milk products. Cluster Africa (B) was characterized by higher availability of cassava, sorghum, milk and milk products, millet, rice and maize.

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A Global Snapshot of Fruit and Vegetable Intake and Availability, and Implications for Phytonutrient Intakes

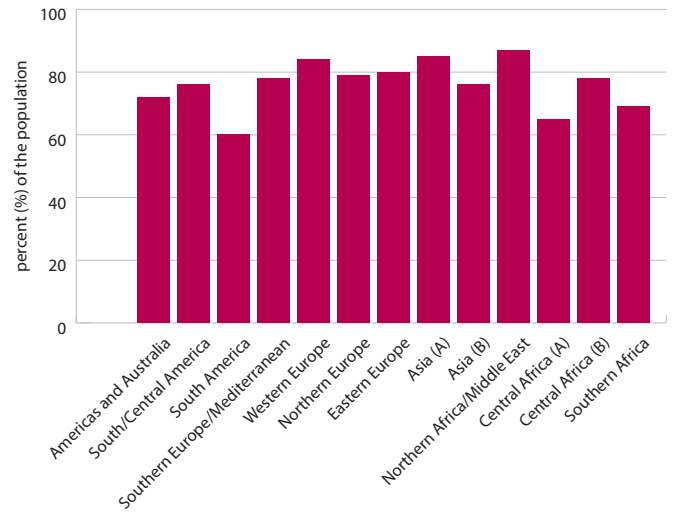
## GLOBAL FRUIT AND VEGETABLE INTAKE

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



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

**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.<sup>2</sup>

### KEY FINDINGS: GLOBAL FRUIT AND VEGETABLE INTAKE FALLS SHORT OF RECOMMENDATIONS

Adults in all regions around the world have average intakes of fruit and vegetable servings that are below the recommended minimum of at least five servings daily. Average intakes ranged from 2.7 servings per day in Northern Africa/Middle East to 4.2 servings per day in South America. The majority of adults (60-87%) worldwide reported consuming fewer than five servings of fruits and vegetables per day.



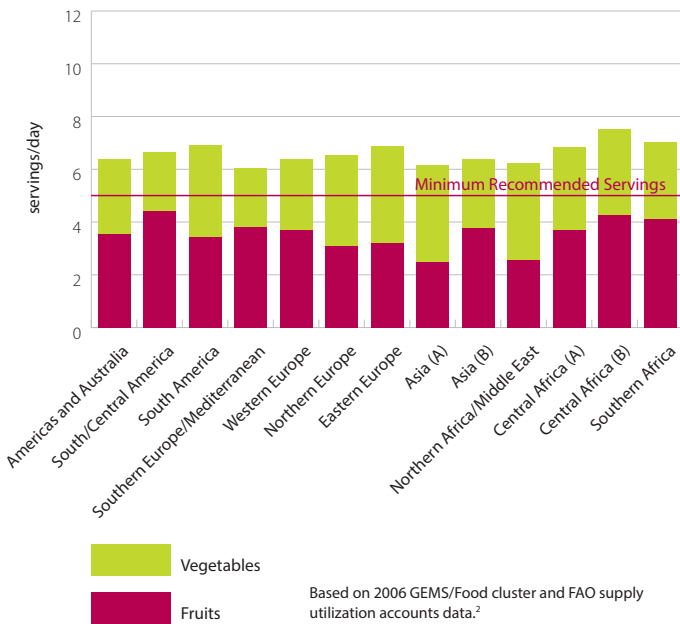


## GLOBAL PHYTONUTRIENT REPORT

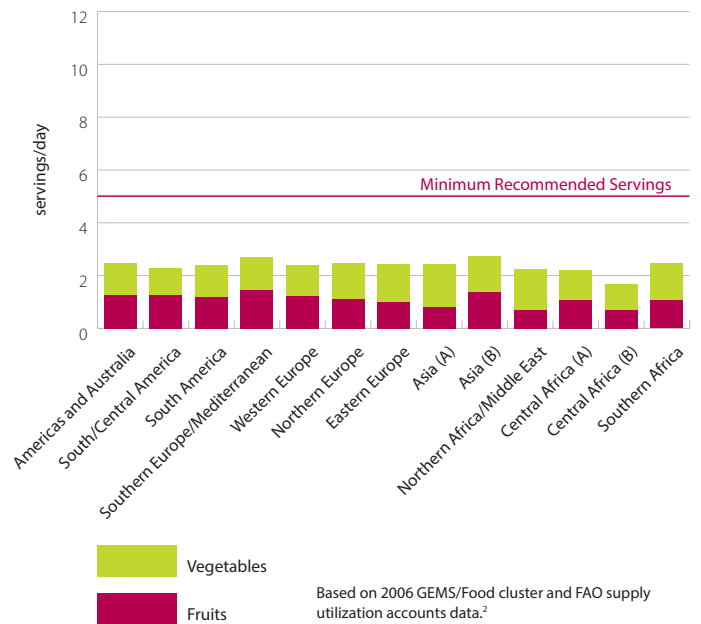
A Global Snapshot of Fruit and Vegetable Intake and Availability, and Implications for Phytonutrient Intakes

### GLOBAL FRUIT AND VEGETABLE INTAKE

**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 Not Meeting the WHO Recommendations**



## KEY FINDINGS

A small percent of the adults within various regions consumed five or more servings per day with typical intakes between six to seven and a half servings per day, or approximately three times what the low-intake consumers reported. Among the adults with low fruit and vegetable intakes, the combined intake ranged from 1.7 to 2.7 servings per day, or roughly one-third to one-half the minimum recommended level.

These data indicate that a majority of adults worldwide would need to at least double their current intake of fruit and vegetable servings to meet minimum WHO recommendations.

# GLOBAL PHYTONUTRIENT REPORT

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## GLOBAL AVAILABILITY OF FRUITS AND VEGETABLES

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Based on the system FAO uses to group fruits and vegetables, a total of nine fruit categories and ten vegetable categories were examined in the analysis. Below are select fruit and vegetable categories from the analysis:

#### FRUITS



**Tropical/Subtropical fruits:** bananas, plantains, figs, mangos, mangosteens, avocados, guavas, pineapples and papaya.



**Citrus fruits:** oranges, lemons, limes, grapefruit, tangerines, mandarins, and clementines.



**Melons:** watermelons, cantaloupes, and other melons.



**Pome fruits:** apples, pears, and quinces.



**Berries:** strawberries, raspberries, gooseberries, currants, blueberries, cranberries, and grapes.

#### VEGETABLES



**Fruiting vegetables (excluding cucurbits)/Mushrooms:** tomatoes, okra eggplants, maize, mushrooms, and truffles.



**Brassica vegetables:** cabbages, broccoli, cauliflower and other brassicas.



**Fruiting vegetables (including cucurbits):** pumpkins, squash, gourds, cucumbers and gherkins, chilies, and peppers (e.g., green peppers).



**Leafy vegetables:** lettuce, chicory, spinach and other leafy vegetables.



**Root vegetables:** carrots and turnips.



## GLOBAL PHYTONUTRIENT REPORT

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### FRUIT AVAILABILITY

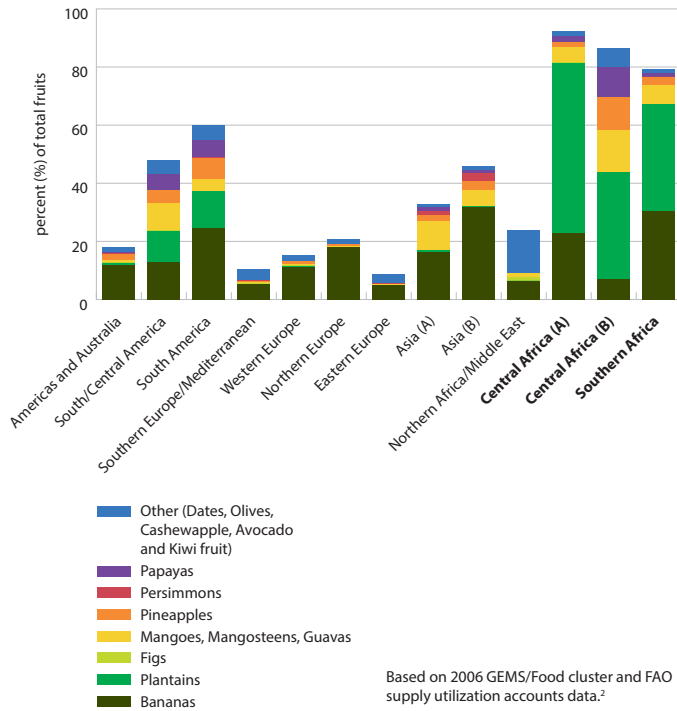
## FRUIT AVAILABILITY

### TROPICAL/SUBTROPICAL FRUITS

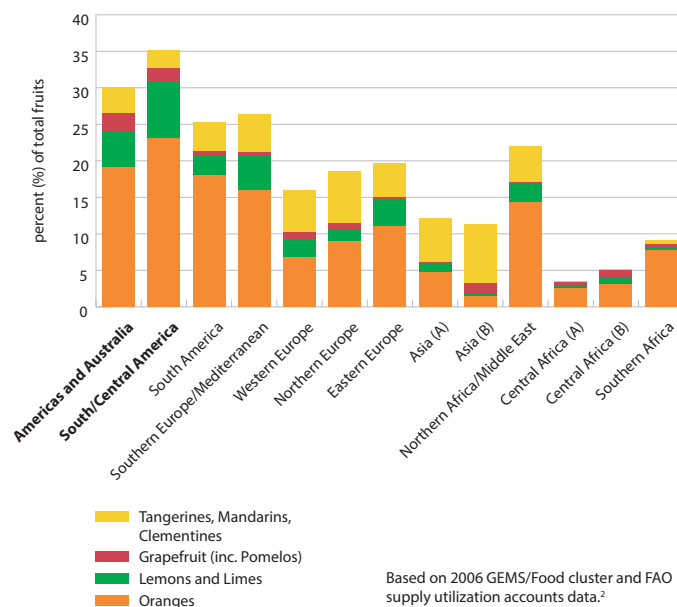
Tropical/subtropical fruits are widely available globally and accounted for the vast majority of total fruit available in Central Africa (A and B) and Southern Africa, representing 79-93% of total fruits. While bananas and plantains are the most available tropical fruits across most regions, mangoes, mangosteens and guavas also make a contribution to the available fruits across all regions, and are most available in Central Africa (B), Asia (A) and South/Central America.

Tropical/subtropical fruit types are good sources of vitamins A, C and E, as well as phytonutrients, such as alpha-carotene and beta-carotene (e.g., plantains), beta-cryptoxanthin (e.g., papayas) and lycopene (e.g., guavas).<sup>38</sup> Alpha-carotene and beta-carotene have been shown to be important for maintaining eye health,<sup>21,24</sup> while beta-carotene and beta-cryptoxanthin play a protective role in bone health by minimizing bone loss with aging.<sup>26</sup>

**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**



### CITRUS FRUITS

Citrus fruits are frequently available and accounted for 30-35% of total fruits in the Americas and Australia and South/Central America, and 20-26% in Eastern Europe, Northern Africa/Middle East, South America and Southern Europe/Mediterranean, respectively. In the remaining regions, citrus fruits accounted for less than 20% of total fruits. Oranges were the predominant citrus fruit available across most regions but Asia (A and B) had higher availability of tangerines, mandarins and clementines. The Americas, Australia and South/Central America had higher availability of lemons, limes and grapefruits compared to other regions.

Citrus fruits are rich sources of vitamin C, as well as phytonutrients, such as hesperidin (e.g., lemons, limes, and oranges), beta-cryptoxanthin (e.g., tangerines and oranges) and lycopene (e.g., red or pink grapefruit).<sup>38,39</sup> Lycopene has been shown to support prostate health,<sup>8</sup> as well as promote lung<sup>9</sup> and stomach health.<sup>10-11</sup> Hesperidin has been shown to have effects on heart health in part because of its lipid-lowering properties.<sup>27</sup>

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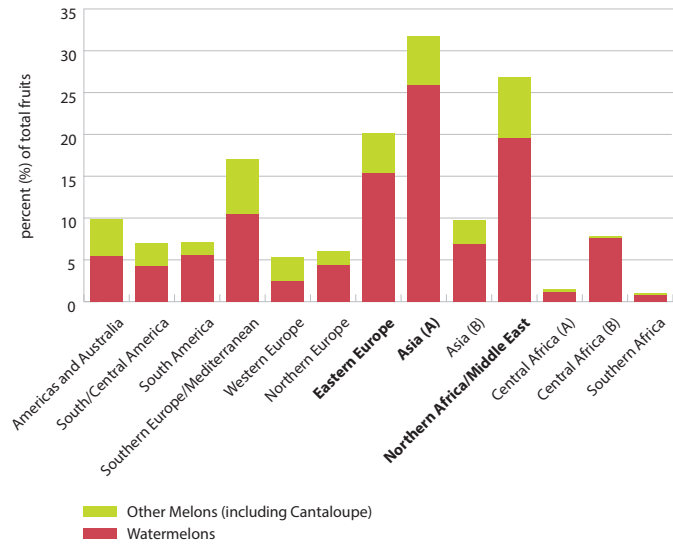
## FRUIT AVAILABILITY

### MELONS

Watermelons and other melons, including cantaloupes, were also among the top contributors to fruit availability in Eastern Europe, Northern Africa/Middle East and Asia (A), accounting for 20%-32%. Watermelons made the predominant contribution to melon availability across all regions but other melons, such as cantaloupes, contributed to availability in Southern Europe/Mediterranean, Northern Africa/Middle East and Asia (A).

Melons deliver phytonutrients, such as lycopene (e.g., watermelon) and beta-carotene (e.g., cantaloupe).<sup>38,39</sup> In addition to supporting healthy immune function,<sup>25</sup> beta-carotene also supports healthy growth and development.<sup>22</sup>

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



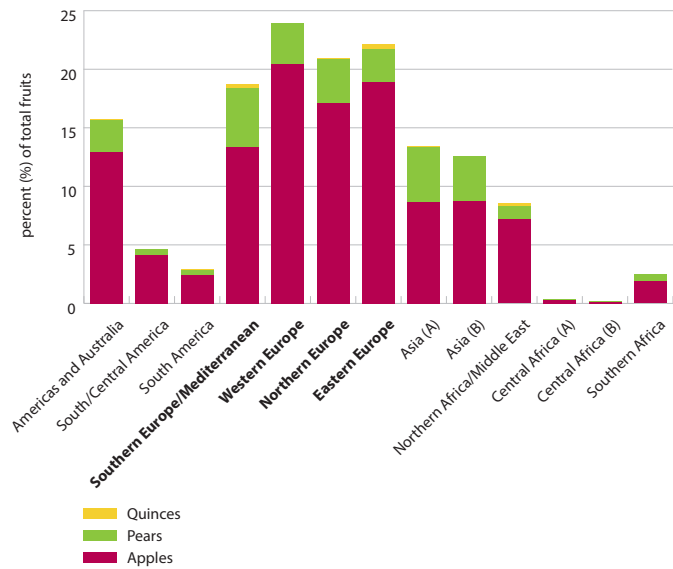
Based on 2006 GEMS/Food cluster and FAO supply utilization accounts data.<sup>2</sup>

### POME FRUITS

In the European regions, pome fruits make up 19-24% of available fruits, although pome accounted for no more than 16% of total fruit available in other regions. Apples were the predominant pome fruit across all regions, with pears making larger contributions in Southern Europe/Mediterranean and Asia (A and B). Quinces were only available in a few regions.

Quercetin is the phytonutrient that is most prevalent in pome fruits.<sup>38,39</sup> Quercetin is important for maintaining blood vessel health and heart health.<sup>14,15</sup>

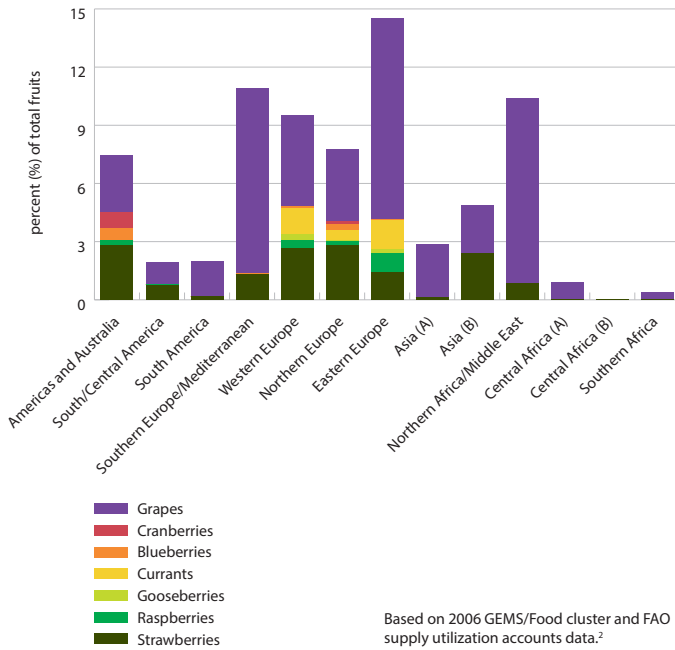
**Figure 6. Variety of Pome Fruits as a Percentage of Total Fruits**



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

FRUIT AVAILABILITY

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



BERRIES

Berries and other small fruits (e.g., strawberries, raspberries, gooseberries, currants, blueberries, cranberries and grapes), accounted for a small proportion of fruits available in Southern Europe/Mediterranean, Eastern Europe and Northern Africa/Middle East regions and were low (no more than 10%) or virtually nonexistent in the other regions. Berries are an excellent source of anthocyanidin (e.g., blueberries, currants, cranberries, raspberries, red grapes, and strawberries).<sup>38,39</sup> Anthocyanidin is important for cell health,<sup>17,18</sup> skin health<sup>19</sup> and supporting digestive health.<sup>20</sup>

KEY FINDINGS

The fruit availability data presented in this section highlight the variations in fruit availability across the globe. These differences suggest that both quantity and variety of phytonutrient consumption may vary widely in different regions of the world.

## GLOBAL PHYTONUTRIENT REPORT

A Global Snapshot of Fruit and Vegetable Intake and Availability, and Implications for Phytonutrient Intakes

### VEGETABLE AVAILABILITY

## VEGETABLE AVAILABILITY

### FRUITING VEGETABLES (EXCLUDING CUCURBITS)/MUSHROOMS

Fruiting vegetables, excluding cucurbits, accounted for the greatest proportion of total available vegetables in most regions. This category accounted for 23%-53% of vegetables available in all regions except Northern regions of Europe and parts of Asia (B). Tomatoes were the most common fruiting vegetable across all regions, and corn accounted for a portion of fruiting vegetables, particularly in Central Africa (A and B) and South/Central America. In Asia (A) and Northern Africa/Middle East, eggplants were more commonly available.

Tomatoes are rich sources of the carotenoid lycopene and a source of alpha-carotene and beta-carotene.<sup>38, 39</sup> Corn is a good source of lutein/zeaxanthin, which have been found to be protective for eye health especially in aging populations,<sup>5-7</sup> and eggplants contain anthocyanidin and other phenolic compounds, which have been shown to support cell health.<sup>17, 18, 38, 39</sup>

### BRASSICA VEGETABLES

Brassica vegetables represented 29% of available vegetables in Asia (B), 21% in Southern Africa and 16%-19% in Western, Northern and Eastern European regions and Asia (A). Cabbages and other brassicas were the predominant vegetables available in this category. Cauliflower and broccoli also made contributions to brassica availability in Asia (A), Western Europe and South/Central America but were almost completely absent in Central Africa (A and B).

Brassica vegetables are good sources of phytonutrients, such as anthocyanidin (e.g., red cabbages), beta-carotene (e.g., Chinese cabbages) lutein/zeaxanthin and glucosinolate (e.g., brussel sprouts and broccoli).<sup>38-41</sup> Beta-carotene is important for heart health<sup>23</sup> and healthy immune function.<sup>25</sup> Lutein/zeaxanthin<sup>5-7</sup> and beta-carotene<sup>24</sup> both support vision health. Glucosinolates have been shown to have strong antioxidant effects<sup>40, 41</sup> and provide cell protection against outdoor pollutants.<sup>42</sup>

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

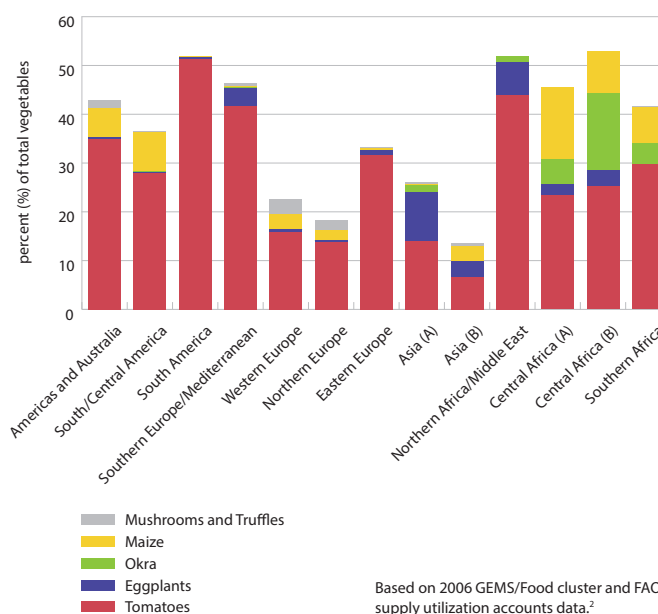
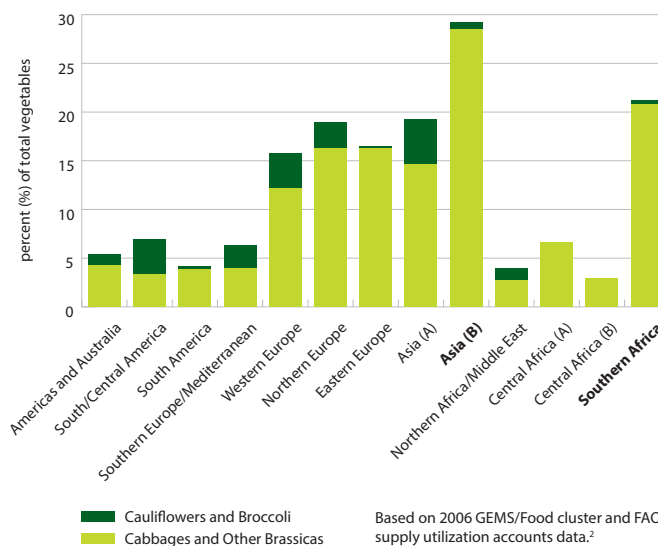
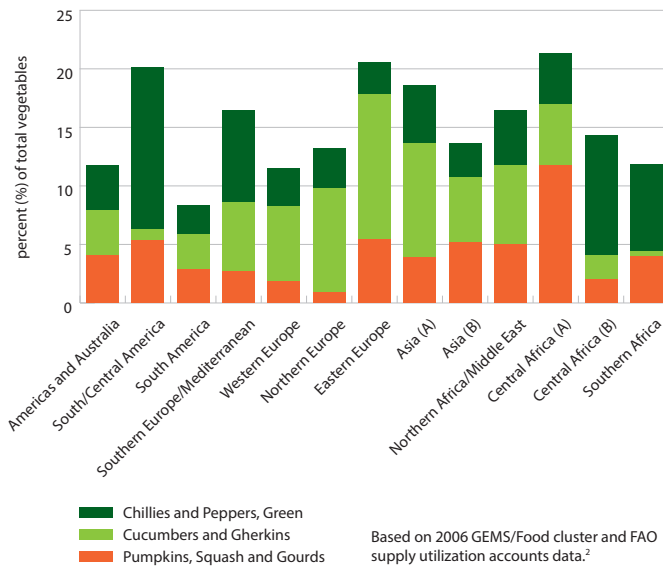


Figure 9. Variety of Brassica Vegetables as a Percentage of Total Vegetables



VEGETABLE AVAILABILITY

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

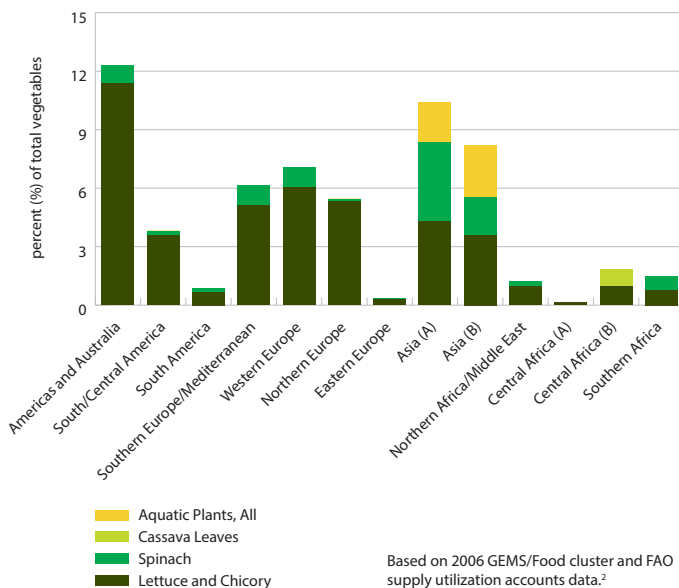


FRUITING VEGETABLES (INCLUDING CUCURBITS)

Fruiting vegetables, including cucurbits, accounted for 12-21% of available vegetables in all regions, except for South America. The vegetable type that predominated in this category differed considerably across the regions. In Central Africa (A), pumpkins, squash and gourds were the most commonly available fruiting vegetables, while in Northern Europe, Eastern Europe and Asia (A), cucumbers and gherkins were more available. In South/Central America and Central Africa (B), chillies and peppers were more available.

Pumpkins and butternut squash are sources of alpha-carotene. Butternut squash also contains beta-carotene and beta-cryptoxanthin. Red peppers are sources of beta-cryptoxanthin and other peppers contain quercetin.<sup>38, 39</sup> Alpha-carotene, beta-carotene and beta-cryptoxanthin all support heart health.<sup>23</sup> Beta-carotene and beta-cryptoxanthin are also important for bone health.<sup>26, 28</sup> Quercetin is important for heart health and blood vessel health by maintaining healthy blood pressure.<sup>14, 15</sup>

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



LEAFY VEGETABLES

Availability of leafy vegetables was relatively low across all regions accounting for only 12% or less of available vegetables. Lettuce and chicory were the predominant types of leafy vegetables available across all regions. Asia A and Asia B were the only regions that had aquatic plants.

Leafy vegetables deliver phytonutrients such as beta-carotene (e.g., spinach and romaine lettuce), lutein and zeaxanthin (e.g., lettuce and chicory, kale, spinach) and quercetin (e.g. radicchio).<sup>38, 39</sup> Lutein and zeaxanthin are key nutrients in supporting eye health throughout life.<sup>5-7</sup>

## GLOBAL PHYTONUTRIENT REPORT

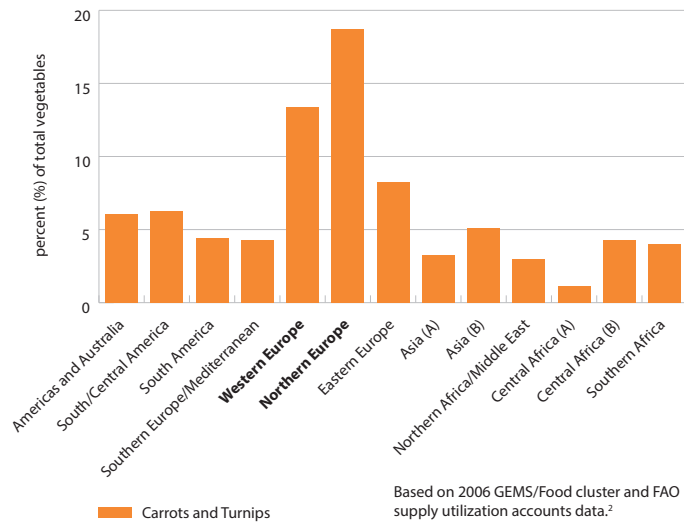
A Global Snapshot of Fruit and Vegetable Intake and Availability, and Implications for Phytonutrient Intakes

### VEGETABLE AVAILABILITY

#### ROOT VEGETABLES

Root vegetables (e.g., carrots and turnips) provided 13-19% of total vegetables available for consumption in Western and Northern Europe, while in all other regions they only accounted for 1%-8% of availability. Some root vegetables are excellent sources of carotenoids, including alpha- and beta-carotene (e.g., carrots).<sup>38, 39</sup> Alpha- and beta-carotene are important for vision health<sup>21, 24</sup> as well as healthy growth and development.<sup>22</sup>

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



#### KEY FINDINGS

The vegetable availability data presented in this section highlight the variations in vegetable availability across the globe. These differences suggest that both quantity and variety of phytonutrient consumption may vary widely in different regions of the world.



### CONCLUSION

## CONCLUSION

In summary, a large proportion of adults around the world (60-87%) consume fewer than the recommended minimum of five servings of fruits and vegetables each day. In addition, there are notable differences in the availability of different types of fruit and vegetables across geographical regions. Because different types of fruits and vegetables provide various levels and kinds of phytonutrients, variability in availability may influence both quantity and variety of phytonutrient consumption. Other factors such as the form in which fruits and vegetables are consumed (e.g., cooked or raw) may also impact phytonutrient intakes. While this report considers potential intake of phytonutrients from fruits and vegetables, it is important to note that other plant-based foods may be a source of the phytonutrients reviewed in this report.

Using the data on the availability of different types of fruits and vegetables in geographic regions across the globe and information on sources of phytonutrients in these fruits and vegetables, the Nutralite Health Institute concluded that commonly available fruits and vegetables in most regions worldwide and their associated phytonutrients include:



**Tropical and subtropical fruits**, for example, plantains (alpha-carotene, beta-carotene), mangos (beta-carotene), papayas (beta-cryptoxanthin) and guavas (lycopene).



**Fruiting vegetables**, for example, tomatoes (alpha-carotene, beta-carotene, and lycopene), corn (lutein/zeaxanthin), and eggplants (anthocyanidin).

Additional analyses providing insight on associations between health and intakes of different fruits and vegetables and the variety of phytonutrients they contain, as well as how these intakes vary by gender, age and urban versus rural locations hold potential to further our understanding of phytonutrient intakes globally.

To learn more about the phytonutrient research led by Nutralite Health Institute, please contact Lindsay Pott at [lindsay.pott@amway.com](mailto:lindsay.pott@amway.com) or Clare Wade at [clare.wade@amway.com](mailto:clare.wade@amway.com). For Nutralite Health Institute news, please visit [globalnews.amway.com](http://globalnews.amway.com).

# GLOBAL PHYTONUTRIENT REPORT

A Global Snapshot of Fruit and Vegetable Intake and Availability, and Implications for Phytonutrient Intakes

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## GLOBAL PHYTONUTRIENT REPORT

A Global Snapshot of Fruit and Vegetable Intake and Availability, and Implications for Phytonutrient Intakes

### APPENDIX

## 2006 GEMS/FOOD CLUSTERS AND WORLD HEALTH SURVEY (WHS) 2002-2004 Fruit and Vegetable Consumption Data by Country

Source: Exponent, Inc. Global Assessment of Phytonutrient Intake by Level of Fruit and Vegetable Consumption. March 2014.

2006 GEMS/FOOD CLUSTERS		WHS 2002-2004 FRUIT AND VEGETABLE CONSUMPTION DATA	2006 GEMS/FOOD CLUSTERS		WHS 2002-2004 FRUIT AND VEGETABLE CONSUMPTION DATA
CLUSTER	COUNTRY NAME		CLUSTER	COUNTRY NAME	
<b>A</b>	Angola		<b>C</b>	Libya Arab Jamahiriya	
	Burundi			Morocco	YES
	Cameroon			Saudi Arabia	
	Central African Republic			Syrian Arab Republic	
	Comoros	YES		Tunisia	YES
	Côte d'Ivoire	YES	<b>D</b>	Albania	
	Djibouti			Armenia	
	Eritrea			Azerbaijan	
	Ethiopia	YES		Belarus	
	Gabon			Bosnia and Herzegovina	YES
	Guinea			Bulgaria	
	Guinea Bissau			Georgia	YES
	Liberia			Iran, Islamic Rep of	
	Madagascar			Kazakhstan	YES
	Mauritius	YES		Kyrgyzstan	
	Rwanda			Moldova, Republic of	
	Sao Tome & Principe			Romania	
	Seychelles			Russian Federation	YES
	Sierra Leone			Serbia and Montenegro	
	Somalia			Tajikistan	
Uganda		The former Yugoslav Rep of Macedonia			
Yemen		Turkmenistan			
<b>B</b>	Cyprus			Ukraine	YES
	Greece			Uzbekistan	
	Israel			<b>E</b>	Austria
	Italy		Belgium		
	Lebanon		Croatia		YES
	Portugal		Czech Republic		YES
	Spain	YES	Denmark		
	Turkey	YES	France		
	United Arab Emirates	YES	Germany		
			Hungary		YES
		Ireland			
		Luxembourg			
<b>C</b>	Algeria		Malta		
	Egypt				
	Iraq				
	Jordan				
	Kuwait				

## GLOBAL PHYTONUTRIENT REPORT

A Global Snapshot of Fruit and Vegetable Intake and Availability,  
and Implications for Phytonutrient Intakes

### APPENDIX

2006 GEMS/FOOD CLUSTERS		WHS 2002-2004 FRUIT AND VEGETABLE CONSUMPTION DATA	2006 GEMS/FOOD CLUSTERS		WHS 2002-2004 FRUIT AND VEGETABLE CONSUMPTION DATA	
CLUSTER	COUNTRY NAME		CLUSTER	COUNTRY NAME		
<b>E</b>	Netherlands			Paraguay	YES	
	Poland			Peru		
	Slovakia	YES		Saint Kitts & Nevis		
	Slovenia	YES		St. Vincent & Grenadine		
	Switzerland					
	United Kingdom					
<b>F</b>	Estonia	YES		<b>I</b>	Benin	
	Finland			Botswana		
	Iceland			Cape Verde		
	Latvia	YES		Ghana	YES	
	Lithuania			Kenya	YES	
	Norway			Lesotho		
	Sweden			Malawi	YES	
<b>G</b>	Afghanistan			Mozambique		
	Bangladesh	YES		Namibia	YES	
	Cambodia			South Africa	YES	
	China	YES		Swaziland	YES	
	India	YES		Togo		
	Indonesia			United Republic of Tanzania		
	Laos	YES		Zambia	YES	
	Malaysi	YES		Zimbabwe	YES	
	Mongolia			<b>J</b>	Burkina Faso	YES
	Myanmar	YES		Chad	YES	
	Nepal	YES		Congo	YES	
	Pakistan	YES		Congo, Democratic Rep of		
	Sri Lanka	YES		Gambia		
	Thailand			Mali	YES	
	Viet Nam	YES		Mauritania	YES	
<b>H</b>	Bolivia			Niger		
	El Salvador			Nigeria		
	Guatemala	YES		Senegal	YES	
	Haiti			Sudan		
	Honduras			<b>K</b>	Antigua & Barbuda	
	Mexico			Bahamas		
	Nicaragua			Barbados		
	Panama			Belize		
			Brazil			
			Columbia			

## GLOBAL PHYTONUTRIENT REPORT

A Global Snapshot of Fruit and Vegetable Intake and Availability, and Implications for Phytonutrient Intakes

### APPENDIX

2006 GEMS/FOOD CLUSTERS		WHS 2002-2004 FRUIT AND VEGETABLE CONSUMPTION DATA
CLUSTER	COUNTRY NAME	
<b>K</b>	Costa Rica	
	Cuba	
	Dominica	
	Dominican Republic	YES
	Ecuador	YES
	Grenada	
	Guyana	
	Jamaica	
	Saint Lucia	
	Suriname	
	Trinidad and Tobago	
Venezuela		
<b>L</b>	Brunei Darussalam	
	Democratic People's Rep of Korea	
	Fiji	
	Japan	
	Kiribati	
	Maldives	
	New Caledonia	
	Papua New Guinea	
	Philippines	YES
	Republic of Korea	
	Solomon Islands	
	Vanuatu	
<b>M</b>	Argentina	
	Australia	
	Canada	
	Chile	
	New Zealand	
	United States	
	Uruguay	YES

