

# Hydration: critical action needed in U.S. policy

MAUREEN L. STOREY  
 American Beverage Association  
 1101 16<sup>th</sup> Street, NW  
 Washington, D.C. 20036, USA



**ABSTRACT:** This paper provides a perspective on the importance of hydration in health. Water is an essential nutrient and is the largest constituent in the human body. Beverages and drinking water provide about 80 percent of total water needed every day for adequate hydration. Adequate Intakes (AI), based on age and gender, are outlined in the Institute of Medicine (IOM) report on Dietary Reference Intakes for Water and other electrolytes. The U.S. government through two of its policy documents – 2005 Dietary Guidelines for Americans (DGs) and Physical Activity Guidelines, 2008 (PAGs) – recommends healthy eating patterns and urges all Americans to be more physically active. The DGs are currently under revision for release in 2010. It is time to integrate the IOM science with these two policy documents by including a hydration guideline, especially given the greater emphasis on physical activity.

## INTRODUCTION

Water is an essential nutrient that is vital for life. The IOM of The National Academies, in 2005, published a report that outlined adequate intakes of total water across the lifecycle based on age and gender (1). Beverages and drinking water are the most important sources of total water, contributing more than 80 percent of total water to the human diet. The DGs are being revised currently and will be released in 2010. Given the essentiality of water and the importance of being physically active, now is time for these revised guidelines to include hydration as a key message for Americans.

## WATER – THE MOST ESSENTIAL NUTRIENT

There is no question that water is vital for life and many consider it the most essential nutrient. Humans can live only a few days without water and are incapable of producing enough water endogenously. All biochemical processes require water, which acts as the primary substrate for bodily fluids. At the cellular level, water transports other nutrients to and from tissues and organs; cushions joints; regulates muscle contractions; helps maintain blood volume; removes waste products produced by the kidneys and digestive tract; and regulates body temperature (2). Insufficient water consumption leads to cognitive and neurologic dysfunction, organ failure, and death in a short period of time (3). Water is the single largest constituent in the body, comprising about

60 percent of body weight (4). Total body water, on a fat-free mass basis, varies depending on age, however. Newborn infants have the highest body water content that may exceed 75 percent; fat-free mass of adults is about 70-75 percent water. Body water is lost through respiration, urinary and gastrointestinal tracts, sweating, and insensible losses. A small amount of water is produced through normal metabolism (250-350 mL/d) (5).

## ADEQUATE INTAKES AND SOURCES OF WATER

Adequate intakes of water vary according to age and gender (Table 1) (6). Water intake from foods and beverages and plain water is shown in Table 2 (7). Sources of water include beverages, drinking water, and food. According to data from National Health and Nutrition Examination Survey III (1988-1994), adults in the United States obtained total water from the following sources: 35-54 percent drinking water; 49-63 percent from other beverages; and 19 to 25 percent from foods. Water content of selected beverages, juices, fruit, and vegetables is shown in Table 3 (9).

## HYDRATION AND PHYSICAL AND MENTAL PERFORMANCE

Dehydration negatively affects physical and mental performance (10, 11). It is vital during exercise that drinking water and/or beverages are available to prevent dehydration and maintain mental and physical

Age	AI of Total Water		AI Total Beverages and Drinking Water	
0 – 6 months	0.7 L/d, assumed to be from human milk			
7 – 12 months	0.8 L/d		0.6 L (~3 cups)	
1 – 3 years	1.3 L/d		0.9 L/d (~4 cups)	
4 – 8 years	1.7 L/d		1.2 L/d (~5 cups)	
Age/Gender	Males		Females <sup>2</sup>	
	Total Water	Water from beverages and drinking water	Total Water	Water from beverages and drinking water
9 – 13 years	2.4 L/d	1.8 L/d (~8 cups)	2.1 L/d	1.6 L/d (~7 cups)
14 – 18 years	3.3 L/d	2.6 L/d (~11 cups)	2.3 L/d	1.9 L/d (~8 cups)
19 – 70+ years <sup>1</sup>	3.7 L/d	3.0 L/d (~13 cups)	2.7 L/d	2.2 L/d (~9 cups)

<sup>1</sup> The IOM report outlined total water and water from beverages and drinking for 19-30, 31-50, 51-70, and >70 years age categories.

Estimated AIs were the same for males and females in each of these age groups and, therefore, were combined in this table.

<sup>2</sup> Values are for non-pregnant, non-lactating females. AI during pregnancy is 3.0 L/d total water including 2.3 L (~10 cups) as total beverages and drinking water; AI during lactation is 3.8 L/d total water including 3.1 (~13 cups) as total beverages and drinking water.

Table 1. Estimated Daily Adequate Intake (AI) of Total Water, Total Beverages, and Drinking Water (6).

	Males	Females
Food and beverages	2.40	1.76
Plain water	1.34	1.22

Table 2. Mean Water Intake (L/day) among Adults 19+ Years†

Foods and beverages	% Water
Carbonated soft drinks, cola-type, full-calorie	90.3
Carbonated soft drinks, cola-type, no calorie	99.5
Milk, 2%	89.3
Milk, skim	90.8
Juice, tomato	93.9
Tomato, raw	94.5
Tomato sauce	91.2
Juice, orange	88.3
Orange, raw, without peel	86.0
Juice, carrot	88.9
Carrot, raw	88.3

Table 3. Water content of selected beverages, fruits, and vegetables (%).


performance, which may be adversely affected particularly in a hot environment (12-14). Studies show that increasing ambient temperature reduces exercise performance, but consuming large volumes of dilute carbohydrate drinks extended time to exhaustion (15-17). In hot environmental conditions, some people may not drink enough to stay hydrated (18, 19). Children are less heat-tolerant, have a lower sweating capacity, lower cardiac output, and are slower to acclimate in hot environments. Children, especially toddlers, are at greater risk of dehydration and need to be monitored to ensure they drink enough fluids. Dehydration is common in older adults and is associated with increased risk of falls, urinary tract infections, dental disease, broncho-pulmonary disorders, kidney stones, cancer, constipation, impaired cognitive function, and possibly, stroke (20, 21). There is evidence that older adults may not compensate for water deficits as well as younger adults do during exercise (22, 23).


#### FEDERAL POLICY RECOMMENDATIONS ON HEALTHY LIFESTYLE

The U.S. *Dietary Guidelines for Americans* (DG) are the single most important policy document that includes advice on diet and physical activity for all healthy Americans over the age of two (24). The 2005 DG recognized the importance of being physically active, which was highlighted by the U.S. Department of Agriculture's consumer communication instrument, *MyPyramid*. To amplify the importance of physical activity, the U.S. Department of Health and Human Services released *Physical Activity Guidelines for Americans* (PAGs) in October, 2008 (25). A large body of scientific evidence shows the health benefits of physical activity regardless of body weight, age, gender, and physical condition (26-29). Fewer than half of American adults get the recommended level of physical activity, however (30). The integration of dietary guidelines, physical activity recommendations, and hydration is well-illustrated by the Modified MyPyramid for Older Adults and should be used as a model to convey this message (31). The base of this modified food pyramid features physical activities with the tier above showing glasses of liquids.

#### CONCLUSION

Beverages are important sources of water and hydration, but it is critical to consider individual energy needs when choosing beverages. Given the 2008 PAGs and the importance of staying hydrated, the 2010 DG Committee should integrate the DGs with PAGs by including a guideline on hydration.






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