

Water

Physiological Functions

Water is considered an essential nutrient because it must be consumed from exogenous sources to satisfy metabolic demand. Water constitutes approximately 60% of adult body weight. It is a catalyst for a majority of enzymatic reactions including those involved in nutrient digestion, absorption, transport, and metabolism. It is also required for facilitating excretion of metabolic waste by the kidneys. Inadequate intake of water compromises cell functions by contributing electrolyte imbalances, contraction of plasma volume, and inability to regulate body temperature.

Factors Affecting Availability

Water is not consumed in sufficient amounts by most individuals since thirst does not develop until body fluids are depleted well below levels required for optimal functioning. Mechanisms that trigger thirst sensations are stimulated by increased osmolality or decreased extracellular volume which are not detected until significant contraction of plasma volume has occurred. Groups most vulnerable to dehydration, infants, elderly adults, and athletes, are either not able to adequately express thirst sensations or to detect them. With extreme heat and excessive perspiration, thirst may lag behind actual water requirements. To prevent dehydration, a minimum of eight cups of fluid is required daily from beverages and foods.

Water Balance			
WATER INTAKE (milliliters)			
Beverages		1400	
Solid Food		700	
Cellular Oxidation		200	
Total		2300	
WATER OUTPUT (milliliters)			
	Normal Ambient Temperature	High Ambient Temperature	Prolonged Exercise
Urine	1400	1200	500
Feces	100	100	100
Perspiration	100	1400	5000
Evaporative Losses			
Skin	350	350	350
Respiratory Tract	350	250	650
Total	2300	3300	6600

* Source: Mahan, L.K. and Escott-Stump, S. *Krause's Food, Nutrition & Diet Therapy*, 10th ed., 2000.

Deficiency

Loss of body water amounting to 10% of the body weight impairs work performance and is associated with nausea, weakness, delirium, and hyperthermia. Signs of dehydration include poor skin turgor, skin tenting on the forehead, decreased urine output, concentrated urine, sunken eyes, dry mucous membranes in the mouth and nose, orthostatic blood pressure changes and tachycardia. Water losses exceeding 20% of body weight are life-threatening.

Toxicity

Water intoxication may develop if large amounts of water are provided to patients to replenish fluids lost with surgery, trauma or other conditions associated with fluid and electrolyte losses, especially if compromised renal function or hormonal imbalances are also present. The ensuing increase in intracellular fluid volume can cause swelling of brain tissue accompanied by headaches, nausea, vomiting, muscle twitching, convulsions, and even death.

Requirements

Consumption of approximately 2.5 to 3 liters (10.4-12.5 cups daily) of water is recommended to maintain optimal hydration. Both foods and beverages can satisfy this requirement. The equivalent of 8 cups of water (64 fluid ounces or 2 liters) is the MINIMUM amount of fluid recommended daily to replace water losses under conditions of moderate activity, ambient temperature, and altitude. More specific guidelines are provided in the table below:

Life Stage	Fluid (mL)/pound of body weight	Fluid (mL)/kg of body weight
Infants	68	150
Children	22.7-27.3	50-60
Adults	5.9	35

Strenuous Activity:		
Before	During	After
One hour prior	15-20 minute intervals	Per pound of weight loss
16 fluid oz	5-10 fluid oz	24 oz
0.5 L	150-300 mL OR	750 mL
	20-40 fluid oz/hr	
	600-1200 mL/hr	

Dietary Sources

Water requirements are most effectively met by consumption of plain water or beverages which are > 90% water by volume. Water may also be obtained from solid foods such as fruits and vegetables which have a high water content. Low moisture foods such as grains and meat products do not contribute significantly to water intake. See table below for a listing of food and beverage sources of water.

Water Content of Selected Foods			
91-100% WATER	80-90% WATER	70-79% WATER	<69% WATER
Water, any type	Soda	Peas	Potatoes
Milk	Fruit juices	Frozen yogurt	Bread
Coffee, tea	Non-carbonated fruit drinks	Popsicle	Pasta
Soup	Cantaloupe	Banana	Rice
Sports drink	Orange	Some fish	Beef
Watermelon	Apple	Eggs	Poultry
Strawberries	Pear	Casseroles	Nuts
Broccoli	Grapes		Baked goods
Lettuce	Peach		Crackers
Tomato	Gelatin		Chips

* Source: Nutrient Data System 2.93 software program