

# BIOAVAILABILITY AND BIOLOGICAL ACTIONS: Effects of Sources, Chemical Forms and Interactions

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The bioavailability of a nutrient for depends on absorption and utilization, and influences both beneficial and adverse effects. Bioavailability is sometimes defined as the proportion of a nutrient consumed that is utilized for structure or other functions. With the few exceptions of nutrients that have functions in the intestinal tract without absorption, the first event necessary for bioavailability is absorption. Absorption must be followed by transport to the target site and incorporation into the active molecular structures. Dietary potency (the amount of effect per unit of nutrient ingested) is modified by multiple factors, including the efficiency of absorption, the chemical form absorbed, the availability of unsaturated transport mechanisms, the availability of unsaturated utilization mechanisms, and the rates of metabolism and excretion. Gastric acidity to help dissolve water-soluble ingredients, bile for emulsification of lipid-soluble materials, and digestive enzymes are crucial for uptake and utilization. Slow or impaired catabolism and excretion generally increase bioavailability, except when it is activation reactions that are slowed. *In vitro* tests for bioavailability are problematic because the relationship between solubility and absorption is complex. The only useful meaning of these tests is the negative—if a product does not disintegrate, its ingredients cannot be dissolved and absorbed. Low solubility, however, does not necessarily mean low bioavailability.

With a few exceptions, regulatory agencies do not control potency or claims on the basis of bioavailability because it is so quantitatively variable. Bioavailability can change in response to other many dietary components, age, and many health conditions. The usual regulatory requirement is for the ingredient to have sufficient bioavailability for it to have “nutritive value”—that is, the ingredient must be well-enough disintegrated, dissolved, absorbed, and utilized for it to serve as a meaningful source of the nutrient it contains. Most recommended minimum (Recommended Dietary Allowances) and maximum intakes (Tolerable Upper Intake Levels) are not adjusted for relative bioavailability because a large number of dietary factors and physiological conditions are such strong influences. With few exceptions, the available data are insufficient to allow specific regulations on the basis of bioavailability.