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Flum DR: Acute appendicitis—appendectomy of the “antibiotics first”

strategy. N Engl J Med 372:1937, 2015. Khan S et al: Endoscopic retrograde appendicitis therapy: Is it really a need of the hour. Ann Surg 277:e1, 2023. Moris D et al: Diagnosis and management of acute appendicitis adults. JAMA 326:2299, 2021. Ohle R et al: The Alvarado score for predicting acute appendicitis: A systematic review. BMC Med 9:139, 2011. Talan DA, DiSaverio S: Treatment of acute uncomplicated appendi citis. N Engl J Med 385:1116, 2021. Vons C et al: Amoxicillin plus clavulanic acid versus appendicectomy for treatment of acute uncomplicated appendicitis: An open-label, non-inferiority, randomised controlled trial. Lancet 377:1573, 2011. Section 2 Nutrition Johanna T. Dwyer

Nutrient Requirements

and Dietary Assessment PART 10 Disorders of the Gastrointestinal System Nutrients are substances that are essential but not synthesized in suf ficient amounts in the body and therefore must be supplied by the diet. Nutrient requirements for groups of healthy persons have been determined experimentally. The absence of essential nutrients leads to growth impairment, organ and metabolic dysfunction, and failure to maintain nitrogen balance or adequate status of protein and other nutrients. For good health, we require energy-providing nutrients (pro tein, fat, and carbohydrate), vitamins, minerals, and water. Require ments for organic nutrients include 9 essential amino acids, several fatty acids, glucose, 4 fat-soluble vitamins, 10 water-soluble vitamins, dietary fiber, and choline. The inorganic nutrients include 4 minerals, 7 trace minerals, 3 electrolytes, and the ultra trace elements that must also be supplied by diet. Individuals of different ages and physiologic states differ in the amounts of nutrients they require. Conditionally essential nutrients are not required in the diet but must be supplied to certain individuals such as those with genetic defects; pathologies such as infection, disease, or trauma with nutri tional implications; and some developmentally immature infants who need them because they do not synthesize inositol, taurine, arginine, and/or glutamine in adequate amounts. Many other organic and inorganic bioactive compounds that are present in foods and dietary supplements may also have health effects, including pesticides, heavy metals like lead, phytochemicals, zoochemicals, and microbial products. ■ ■ESSENTIAL NUTRIENT REQUIREMENTS Energy The estimated energy requirement (EER) is the predicted average requirement to maintain energy balance and health in an adult of a defined age, sex, weight, height, level of physical activity, and life stage. For weight to remain stable, energy intake must match total energy expenditure (TEE). The major components of TEE are resting energy expenditure (REE) and the physical activity level (PAL), and minor components include the energy cost of metabolizing food (ther mic effect of food, or specific dynamic action) and cold-induced (shiv ering) thermogenesis. The average energy intake is ~2600 kcal/d for American men and ~1800 kcal/d for American women, but individuals vary with body size and activity level. Although estimates introduce considerable error, energy intakes are usually calculated from formulas

rather than measuring TEE directly. In individuals whose weights are stable, for males, REE = 900 + 10m, and for females, REE = 700 + 7m, where m is mass in kilograms. The calculated REE is then multiplied by the appropriate PAL to account for physical activity that ranges from 1.4 (inactive) for individuals who perform only essential activities of daily living (e.g., 30 minutes walking and 90 minutes light to moderate activity) to 1.6 (low active), 1.75 (active), and 2.05 (very active). The result is the estimated energy (EER) or intake. When describing their PALs, sedentary, inactive, and low active individuals tend to overes timate, and so in practice, use of PALs of 1.2 to 1.4 may be closer to their actual activity levels. The EER provides a rough target for plan ning caloric needs for a person of a certain age, sex, weight, height, and physical activity level who is neither gaining nor losing weight. For further discussion of energy balance in health and disease, see Chap. 345. Protein Dietary protein consists of both “essential” (e.g., not synthesized endogenously and must be supplied by diet) and “nones sential” (e.g., synthesized endogenously or obtained from diet) amino acids that are all required for protein synthesis. The nine essential amino acids are histidine, isoleucine, leucine, lysine, methionine/ cystine, phenylalanine/tyrosine, threonine, tryptophan, and valine. Several amino acids, such as alanine, arginine, aspartic acid, glutamic acid, glutamine, and glycine can also be converted to glucose and used for energy and gluconeogenesis. When energy intake is inadequate, protein intake must be increased, because ingested amino acids are diverted into pathways of glucose synthesis and oxidation. In extreme energy deprivation, protein-calorie malnutrition may ensue (Chap. 345). For adults, the recommended dietary allowance (RDA) for protein is ~0.8 g/kg desirable body mass per day, assuming that energy needs are met and that the protein is of relatively high biological value. Current recommendations for a healthy diet call for at least 10–14% of calories from protein. Most American diets provide at least those amounts. Bio logic value tends to be highest for animal proteins, followed by proteins from legumes (beans), cereals (rice, wheat, corn), and roots. Combina tions of plant proteins that complement one another in their essential amino acid profiles or combinations of animal and plant proteins can increase biologic value and lower total protein intakes necessary to meet requirements. In healthy people with adequate diets, the timing of protein intake over the course of the day has little effect. Protein needs increase during growth, pregnancy, lactation, and rehabilitation after injury or undernutrition. Tolerance to dietary pro tein is decreased in renal insufficiency (with consequent uremia) and in liver failure. Usual protein intakes can precipitate encephalopathy in patients with cirrhosis of the liver. Fat and Carbohydrate Carbohydrate (4 kcal/g), fat (9 kcal/g), and protein (4 kcal/g) all provide energy. So does alcohol (ethanol) (7 kcal/g), but it is not a nutrient. Fats are a concentrated source of energy and constitute, on average, 34% of calories in U.S. diets. However, for optimal health, fat intake should total no more than 30% of calories. Saturated fat and trans-fat should be limited to <10% of calories and polyunsaturated fats to <10% of calories, with monounsaturated fats accounting for the remainder of fat intake. At least 45–55% of total calories should be derived from carbohydrates, with <10% and prefer ably <6% from added sugars. The brain requires ~100 g of glucose per day for fuel; other tissues use ~50 g/d. Some tissues (e.g., brain and red blood cells) rely on glucose supplied either exogenously or from muscle proteolysis. Over time, during hypocaloric states, adaptations that lower carbohydrate needs are possible. Water For adults, 1–1.5 mL of water per kilocalorie of energy expenditure is sufficient under usual conditions to allow for normal variations in physical activity, sweating, and the diet’s solute load. Water losses include 50–100 mL/d in the feces; 500–1000 mL/d by evaporation or exhalation; and, depending on the renal solute load, ≥1000 mL/d in the urine. If external losses increase, intakes must increase accordingly to avoid underhydration. Fever increases water losses by ~200 mL/d per °C; diarrheal losses vary but may be as great as 5 L/d in severe diarrhea. Heavy sweating, vigorous exercise, and

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