Advanced Dietetics: Human Physiology and Health

Dietetics · Practice Test · 8 Questions

1. Which enzyme is primarily responsible for the de novo synthesis of fatty acids in the cytoplasm of mammalian cells, and what is its main regulatory step?

A) Acetyl-CoA carboxylase (ACC); irreversible phosphorylation by AMP-activated protein kinase (AMPK)
B) HMG-CoA reductase; substrate availability of acetyl-CoA
C) Lipoprotein lipase; binding to apolipoprotein C-II
D) Carnitine palmitoyltransferase I (CPT1); availability of carnitine

2. In the context of iron metabolism, what is the primary role of hepcidin, and how is its synthesis regulated by inflammation?

A) Hepcidin is a peptide hormone that downregulates duodenal iron absorption and macrophage iron release by degrading ferroportin; it is upregulated by pro-inflammatory cytokines like IL-6.
B) Hepcidin is an enzyme that catalyzes the reduction of ferric iron (Fe3+) to ferrous iron (Fe2+) in the intestinal lumen; it is downregulated by IL-6.
C) Hepcidin is a carrier protein that transports dietary iron across the intestinal epithelium; its production is inhibited by TNF-alpha.
D) Hepcidin is a transcriptional regulator of transferrin receptor expression; it is stimulated by hypoxia-inducible factor 1-alpha (HIF-1?).

3. What is the principal mechanism by which insulin exerts its glucose-lowering effect in peripheral tissues like muscle and adipose tissue?

A) Insulin promotes the translocation of GLUT4 glucose transporters from intracellular vesicles to the plasma membrane.
B) Insulin directly activates glucokinase in the liver to increase glucose phosphorylation.
C) Insulin inhibits glycogenolysis by allosterically activating glycogen phosphorylase.
D) Insulin stimulates gluconeogenesis in the kidney by increasing the expression of phosphoenolpyruvate carboxykinase (PEPCK).

4. Which of the following describes the primary function of ghrelin in energy homeostasis, and what is its primary site of production?

A) Ghrelin is a peptide hormone that stimulates appetite and gastric motility, primarily produced by the stomach.
B) Ghrelin is a satiety hormone that suppresses appetite, synthesized in the hypothalamus.
C) Ghrelin is an incretin hormone that enhances insulin secretion, released from the small intestine.
D) Ghrelin is a stress hormone that promotes lipolysis, produced by the adrenal glands.

5. In the absorption of dietary lipids, what is the role of bile salts, and how are they reabsorbed?

A) Bile salts emulsify fats, increasing their surface area for enzymatic digestion, and are reabsorbed primarily in the ileum via an active transport system.
B) Bile salts act as enzymes to directly hydrolyze triglycerides in the small intestine, and are passively absorbed in the jejunum.
C) Bile salts facilitate the formation of micelles containing cholesterol, and are absorbed along with other lipids via passive diffusion.
D) Bile salts are secreted by the pancreas to activate pancreatic lipase, and are then denatured and excreted.

6. What is the primary mechanism by which vitamin D (specifically calcitriol) regulates serum calcium levels?

A) Calcitriol increases the absorption of calcium from the gastrointestinal tract and promotes calcium reabsorption in the kidneys.
B) Calcitriol inhibits the release of calcium from bone matrix by osteoclasts.
C) Calcitriol enhances the urinary excretion of calcium, thereby lowering serum levels.
D) Calcitriol directly stimulates the parathyroid glands to secrete parathyroid hormone (PTH).

7. The metabolic pathway of branched-chain amino acids (BCAAs) involves unique enzymes. What is the rate-limiting step in BCAA catabolism, and which enzyme catalyzes it?

A) The initial irreversible deamination step, catalyzed by branched-chain ?-keto acid dehydrogenase complex (BCKDC).
B) The transamination of BCAAs to their corresponding ?-keto acids, catalyzed by alanine transaminase (ALT).
C) The decarboxylation of ?-keto BCAAs, catalyzed by glutamate dehydrogenase.
D) The conversion of propionyl-CoA to succinyl-CoA, a step in the catabolism of valine.

8. Regarding the role of dietary fiber in gut health, what is the primary mechanism by which soluble fiber is fermented by colonic bacteria?

A) Soluble fiber is fermented to produce short-chain fatty acids (SCFAs) such as acetate, propionate, and butyrate, which serve as energy for colonocytes and have systemic effects.
B) Soluble fiber directly stimulates the proliferation of enterocytes by providing a large surface area for nutrient absorption.
C) Soluble fiber binds to bile acids in the colon, preventing their reabsorption and promoting their excretion.
D) Soluble fiber acts as a prebiotic by directly inhibiting the growth of pathogenic bacteria in the gut.