

Kaplan USMLE Step 1: What nutrient is elevating blood pressure?

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If you're preparing for the United States Medical Licensing Examination[®] (USMLE[®]) Step 1 exam, you might want to know which questions are most often missed by test-prep takers. Check out this example from Kaplan Medical, and read an expert explanation of the answer. Also check out all posts in this series.

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This month's stumper

A 38-year-old woman comes to the physician for a routine health maintenance examination. She has two children and no significant medical history. She has had no major changes in her health over the past year, but she has started a new role in her career as a lawyer and has been much busier than in the past.

She describes frustration with the lack of time to exercise and prepare healthy meals, and she has been eating fast food more often than she would like. She has additionally started drinking multiple sodas during the day to keep up with her workload. Her blood pressure, as measured in the physician office, is 133/97 mm Hg, elevated from her previous readings. Her weight has remained stable at 62 kg (137 pounds) and her body mass index is 27 kg/m².

Excess consumption of what nutrient is most likely directly contributing to her elevated blood pressure?

A. Animal protein.

- B.** Fructose.
- C.** Insoluble fiber.
- D.** Saturated fat.
- E.** Sodium.

The correct answer is B.

Kaplan Medical explains why

Basic science and clinical data have implicated excess fructose consumption as being a primary driver of the early pathogenesis of metabolic syndrome and essential hypertension. The mechanism is related to increased production of uric acid, which is the mediator of pre-glomerular microvascular injury, resulting in the salt-sensitive essential hypertension.

Specifically, uric acid increases plasma renin levels, thereby activating the renin-angiotensin-aldosterone system, as well as causing vascular smooth muscle proliferation and atherosclerotic changes in the pre-renal vasculature.

Excess consumption of fructose has been shown to induce hypertension in as little as a week, with the effect relieved by uric acid lowering therapy. Common sources of fructose in the standard U.S. diet are soda, sweetened pastries and other sources of sugar. High-fructose corn syrup is 55% fructose plus 45% glucose, compared to regular table sugar which is 50:50.

Why the other answers are wrong

Choice A: Although animal protein was previously thought to be associated with kidney damage, this is not the case in individuals with healthy kidneys. Lean sources of animal protein are part of a healthy diet and are not associated with the development of essential hypertension.

Choice C: Insoluble fiber, which comprises complex polysaccharides that are not broken down by human digestive enzymes, is found in fruits and vegetables and is associated with improved health outcomes. High-fiber diets are associated with a lower risk of stroke, cardiovascular disease and diabetes, and are also helpful in the prevention and treatment of several gastrointestinal conditions, including irritable bowel syndrome, constipation and hemorrhoids.

Choice D: Whereas excess consumption of saturated fat is associated with hyperlipidemia and cardiovascular disease, it has less of a causal role in the development of hypertension.

Choice E: Sodium consumption in the setting of essential hypertension will worsen disease, but it does not have a causal role in the initial development of primary hypertension. Reducing sodium consumption can lower blood pressure, but typically by only 1–4 mm Hg. In a healthy patient, the kidneys are very efficient at maintaining sodium-water balance, and short-term overconsumption of sodium is unlikely to result in clinically significant hypertension.

Tips to remember

- Excess fructose consumption is associated with the development of metabolic disease and essential hypertension.
- The effect is mediated by a uric acid mediated mechanism, whereby uric acid activates the renin-angiotensin-aldosterone system and causes vascular smooth muscle proliferation.
- Sodium consumption worsens hypertension in the setting of existing disease but is not associated with its initial development, and short-term overconsumption in healthy patients

has little effect on blood pressure.

- Poor diet quality is a significant driver of disease, and knowledge of basic nutrition and relative risks associated is important for physicians.

For more prep questions on USMLE Steps 1, 2 and 3, view other posts in this series.