

## **Substance Abuse and Nutrition**

**By Alyssa Salz, MS, RD, LD**

*Suggested CDR Learning Codes: 5000, 5350; Level 2*

*Suggested CDR Performance Indicators: 8.1.5, 8.2.1, 8.3.6*

The dietitian's role in treating substance abuse is an important but often lacking part of patients' long-term recovery process. Nutrition therapy for substance abuse is complex, as the nutritional risks vary depending on the substance of choice and negative conditions for successful treatment are common, including poor support, co-occurring mental health disorders, or poverty.

Addiction is defined as a chronic brain disorder characterized by compulsive and relapsing behavior.<sup>1</sup> Predisposing factors for an addiction include psychological vulnerability, biochemical abnormalities, genetics, and environmental conditioning.<sup>1</sup> Social isolation, depression, and anxiety are common among substance abusers, and drugs and/or alcohol often are used to relieve these negative feelings because they increase dopamine activity, which boosts mood.

Proper nutrition and hydration are key to the substance abuse healing process because they help restore physical and mental health and improve the chance of recovery. Macro- and micronutrient deficiencies can lead to symptoms of depression, anxiety, and low energy, all of which can lead someone to start using drugs or alcohol or trigger a relapse.

Substance abuse generally leads to a lack of proper nutrition, either as a result of not eating enough throughout the day or eating foods that are low in necessary nutrients.<sup>2</sup> Certain substances, such as stimulants, may suppress appetite and disrupt metabolic and neuroendocrine regulation, leading to improper calorie consumption and impaired nutrient processing.<sup>1</sup> Other substances may lead to an increase in appetite, causing weight gain.

Many programs that target substance abuse prevention address nutrition because a healthful lifestyle can promote mental health. And for those who are battling substance abuse, nutrition plays the same key role in maintaining recovery while also improving the resulting health conditions and deficiencies.

Individualized nutrition counseling and comprehensive nutrition education programs provided to the substance abuse population have been found to significantly improve three-month sobriety success rates.<sup>3</sup> Just as patients with diabetes or heart disease receive nutrition education to manage their diseases, patients dealing with substance abuse should have nutrition education that addresses their specific risk factors and increases their chances of recovery.<sup>3</sup> Medical nutrition therapy (MNT) and nutrition education for this population should target the following goals:

- heal and nourish the body damaged by alcohol or substance abuse;
- stabilize mood and reduce stress;
- reduce cravings for drugs and alcohol;
- address medical conditions that are co-occurring or have resulted from substance abuse; and
- encourage self-care and a healthful lifestyle.

### **Heal and Nourish**

Substance abuse is known to lead to vitamin and mineral deficiencies that threaten physical and mental health, damage vital organs and the nervous system, and decrease immunity.<sup>4</sup> Harmful lifestyles often are associated with addiction, such as poor eating patterns, lack of exercise, and changes in sleep patterns. These compounding factors result in an increased risk of long-term health problems, including metabolic syndrome, diabetes, hypertension, weight problems, and eating disorders.

To help an individual recover from the effects of substance abuse, it's important to supply them with balanced, calorically appropriate meals. This may be difficult during the initial detox period but should be a targeted goal as soon as the patient is deemed stable for oral intake.<sup>1</sup> Calculating adequate calories for each patient will help them manage hypoglycemia, improve deficiencies, and achieve or maintain an appropriate weight. Encouraging them to consume regularly scheduled meals and snacks and to increase their level and amount of physical activity will help address these issues as well as contribute to stress management and improved sleep.<sup>2</sup>

It's vital to correct any nutritional deficiencies and address any medical conditions, as continued malnutrition and instability increase disease risk and will produce cravings for drugs or alcohol. Increased consumption of nutrient-dense foods (eg, fruits, vegetables, whole grains, fish) and antioxidants is important; these foods help decrease inflammation, reduce cell oxidation, and provide the basics of a healthful diet.<sup>4</sup>

Psychotherapy also is an important part of the healing process for substance abuse patients. They should be encouraged to seek regular help from counselors and/or support groups since psychological and social problems are common.

### **Normalize Neurotransmitters and Mood**

Psychoactive substances may lead to psychiatric problems, as the substances can have toxic effects on brain chemistry. Before detoxification, neurotransmitters are decreased due to poor nutrition and altered amino acid absorption and utilization.<sup>2</sup> This leaves addicts feeling depressed, agitated, and unregulated early in recovery. It's thought that these imbalances disappear over a period of weeks but may last as long as one year after an addict becomes sober.<sup>2</sup>

For some, mood and behavior abnormalities may have been present before the substance abuse. With proper diagnosis of any possible underlying mental health disorders, a healthful diet and education on how nutrition influences mood and brain chemistry, recovery can be enhanced.

An understanding of how food affects mood and the risk of substance abuse begins with macronutrients. Carbohydrates are the body's main source of energy; without this macronutrient, the brain can't properly function, blood sugar becomes unstable, and neurotransmitters become disrupted. Unstable blood sugar can lead to feelings of frustration, anxiety, and cravings.

Carbohydrates aid in the production of serotonin, which facilitates a happy, stable mood; aids in sleep; and helps curb food cravings. Low serotonin levels can result in sleep problems, irritability, and depression.

Insulin release following carbohydrate intake helps glucose enter cells, where it's used for energy and triggers tryptophan's entry into the brain.<sup>5</sup> Then folic acid and vitamins B<sub>6</sub> and B<sub>12</sub> help the synthesis of tryptophan to serotonin. Ensuring that clients receive adequate carbohydrates and tryptophan-rich foods, such as dairy and meats, helps stabilize these reactions.

Amino acids, the building blocks of protein, also are the foundation of neurotransmitters. Low levels of neurotransmitters, particularly dopamine, can trigger an individual to turn to substances to feel better, as most substances markedly impact the body's dopamine levels. Dopamine is made from the amino acid tyrosine, and serotonin is made from tryptophan.<sup>5</sup> If an individual lacks either of these amino acids, synthesis of the respective neurotransmitter is disrupted, which affects mood, aggression, and the desire for drugs or alcohol.<sup>5</sup>

Dietary fat also plays a role in maintaining mental health. Because it affects inflammation and cell membrane integrity, limiting dietary fat directly influences mood. Research has shown that increased inflammation or proinflammatory cytokines result in more depressive symptoms.<sup>6</sup>

Omega-3 fatty acid consumption may help with depression by assisting in the uptake of neurotransmitters and decreasing inflammation. Having a proper balance of omega-6 and omega-3 fatty acids helps neurotransmitter receptors function, which in turn helps increase the amount of neurotransmitters that can be active in the brain.<sup>4</sup> Supplements containing polyunsaturated fatty acids have been recommended to help reduce anxiety in people with substance abuse.<sup>4</sup>

Other vitamins important for mental health include iron, folate, and vitamins B<sub>6</sub> and B<sub>12</sub>. Deficiencies of any of these nutrients can mimic mental health problems such as depression, fatigue, poor attention, and altered sleep.<sup>2</sup>

Encouraging patients to drink adequate amounts of hydrating fluids also will help them manage mood while ensuring adequate absorption of any medications they take to prevent side effects from withdrawal or underlying psychiatric disorders. Common symptoms of dehydration include irritability, trouble concentrating, and disorientation. Dehydration also commonly results from detoxification, so monitoring daily intake and output values will help determine appropriate fluid intake recommendations.<sup>1</sup>

Caffeine intake should be monitored, as it triggers the same reward centers of the brain as do substances and can markedly impact anxiety and sleep. Low caffeine intake and smoking cessation have been shown to improve long-term sobriety for all addictions.<sup>1</sup>

## **Reduce Cravings**

Anxiety, irritability, and low mood or energy levels are triggers for cravings. All of these symptoms can result from low blood sugar, dehydration, high levels of caffeine, and an unbalanced diet. Increased relapse occurs when an individual has poor eating habits, mainly because of the impact on cravings. Encouraging balanced meals and regular eating times helps patients decrease these events. Generally, a diet relatively high in complex carbohydrates, moderate in protein, and low in fat and sugar is recommended to help sustain recovery.<sup>7</sup> It isn't wise to advise clients to follow a high-protein diet, as excess protein will strain the already damaged liver.<sup>7</sup>

Often in early recovery, patients struggle with differentiating hunger from cravings for drugs or alcohol and emotions. Addicts commonly forget what normal hunger feels like and may perceive a craving for substances when actually they're just hungry. Similarly, many addicts will switch to sweets to replace their drug dependency; some of this is a result of seeking pleasurable foods that trigger a physiological response (such as increasing dopamine), emotional eating, or experiencing irregular blood sugar levels. Monitoring sweets intake may be important with some clients because approximately 50% of substance abusers also have co-occurring eating disorders, so monitoring signs of binge behavior may help in properly identifying possible binge-eating disorder or bulimia.<sup>1</sup>

RDs can help educate patients on identifying physical hunger cues and encourage more frequent, balanced eating to help them maintain a normal level of hunger and satiety rather than getting overly hungry.

## **MNT for Substance Abuse**

Depending on the substances different individuals abuse, their nutritional status, weight problems, and disease may differ, leading to a need for a full assessment to determine their individual requirements. This course first examines the common needs for MNT in substance abuse and then discusses the specific nutritional threats each substance poses as well as the recommendations for addressing those threats.

### ***Malnutrition***

Malnutrition related to addiction is categorized as primary or secondary. Primary malnutrition occurs when the substance replaces other dietary nutrients.<sup>8</sup> Secondary malnutrition results from improper nutrient metabolism, absorption, utilization, or excretion even though the diet may be adequate. Both types of malnutrition can result from any substance use.

Patients struggling with multiple addictions show increased deficiencies due to malnutrition. One study revealed that 70% of addicts suffered vitamin D deficiency and low levels of vitamin C, and another showed that 50% were deficient either in iron or vitamins (vitamins A, C, and E being most common) during detox.<sup>9,10</sup>

MNT for malnutrition includes correcting any deficiencies, providing an adequate diet, and addressing any alterations that need to be made to the diet due to oral, digestive, or metabolic issues. A once-a-day, low-potency multivitamin/mineral supplement may be useful for those unable to consume a calorically adequate diet and those with dietary limitations or severe gastrointestinal damage.<sup>7</sup>

### **Metabolic Syndrome**

Substance abuse, especially alcohol abuse, is associated with an increased risk of metabolic syndrome, which consists of increased abdominal obesity, hyperglycemia, abnormal cholesterol, and hypertension. The mechanisms through which substance abuse contributes to this condition includes increased cell damage, reduced energy production, cells' reduced antioxidant potential, and enhanced excitotoxicity.<sup>11</sup> Some substances, including alcohol and marijuana, lead to higher calorie intakes, increased weight circumference, and poorer nutritional profiles, all of which will lead to an increased metabolic syndrome risk.

The prevalence of metabolic syndrome in substance abusers is reported to be 5% to 31%, with a higher risk for those who abuse alcohol and opioids.<sup>11</sup> Higher risk is thought to be associated with an increased period of dependence on a substance.<sup>12</sup>

Counseling patients on lifestyle changes to decrease their risk of cardiovascular disease and diabetes is important. This includes encouraging exercise, weight loss, dietary changes to reduce blood pressure and cholesterol, and quitting smoking.

### **Weight Management and Eating Disorders**

Weight management is a common nutritional concern related to substance abuse. Detoxification programs commonly lead to weight gain, as addicts turn to food instead of their drugs of choice. Biochemical changes result in increased appetite and a preference for highly palatable foods, and confusion in hunger/fullness cues arise. However, for some, weight gain is important due to significant protein-energy malnutrition and low BMI as a result of substance use.<sup>13</sup> Increased calorie intake and weight can lead to obesity, diabetes, hypertension, and cardiovascular disease, so RDs should monitor and counsel patients on healthful eating and weight management.

While in treatment, most patients reduce their levels of exercise either due to lack of time, the program structure, or lack of motivation. Increased abnormal liver tests are common in refeeding among hospitalized drug addicts, which is theorized to be caused by a lack of exercise and increase in weight.<sup>14</sup> In a study from the *Journal of the American Dietetic Association*, daily weight change had a significant positive correlation with changes in serum alanine transaminase or aspartate aminotransferase concentrations from admission to discharge.<sup>14</sup> RDs can help monitor weight gain and laboratory results and identify patient goals for achieving or maintaining a healthy weight. RDs also can work with program administrators to develop exercise programs during and after treatment that can help to level patients' liver enzymes and manage their weight.

With the high occurrence of eating disorders in the substance abuse population, care must be taken in making recommendations for weight management to ensure they aren't too restrictive and weight gain or loss is monitored and steady. In women younger than 30 with alcoholism, 72% also have an eating disorder, and other substances such as cocaine are associated with a higher prevalence of eating disorders, so precautions and available resources are helpful when working with these populations.<sup>1</sup>

## ***Pharmacotherapy***

Pharmacotherapy is a common component of addiction treatment. These medications are intended to improve mood stability and recovery success and to assist with any medical or mental health problems resulting from or co-occurring with detoxification. RDs can help manage the nutritional implications of these medications.

Medication-assisted treatment for substance abuse has been effective for alcohol and opioid dependence. It's important for dietitians to be familiar with these common medications, as the side effects may influence patients' nutritional status.

Dietitians need to be cautious when recommending supplementation in this population due to addicts' quick-fix mindset and already-taxed bodies. A damaged liver may not be able to correctly process certain supplements, and the supplements may ultimately have a negative impact on liver health.<sup>2</sup> However, a study funded by the National Institutes of Health suggested that a common over-the-counter herbal supplement, N-acetylcysteine, can reduce the cravings of cocaine and heroin addicts and possibly alcoholics during withdrawal.<sup>1</sup>

Naltrexone (ReVia, Vivitrol, Depade), disulfiram (Antabuse), and acamprosate calcium (Campral) are used to treat alcoholism. Naltrexone, which also has been used with opiate and narcotic dependence, may cause anorexia, weight loss, nausea, and vomiting.<sup>15</sup> Disulfiram may cause nausea and vomiting, and if patients ingest alcohol, they will become very ill. Therefore, care must be taken to ensure that all traces of alcohol are eliminated from patients' diets, including any that may be used in recipes.<sup>1,15</sup> Acamprosate calcium may cause an increase in appetite, increased weight, and taste changes.<sup>15</sup> Dietitians should take note of these side effects and work with patients to identify ways to promote adequate nutritional intake.

Medications used for opioid dependence include methadone, buprenorphine (Suboxone, Subutex), and naltrexone. Methadone treatment may produce extreme constipation, abdominal pain, dry mouth, appetite abnormalities, hypokalemia, hypomagnesemia, and weight gain.<sup>15</sup> Encouraging and outlining a diet with adequate fluids and fiber may help with these side effects. Methadone, like disulfiram, can cause patients to become very ill if they ingest alcohol, so abstinence should be advised.<sup>1,15</sup> Buprenorphine, like the other medications, can influence digestion and appetite, so dietitians should advise patients to slowly increase fiber and make sure meals are appetizing and aromatic.<sup>15</sup> Stool softeners also are commonly used to help manage secondary constipation in opiate and cocaine addicts.

Bupropion (Wellbutrin, Zyban) is commonly used for depression, nicotine dependence, and methamphetamine addiction, and tricyclic antidepressants (imipramine, desipramine) are used to help with depression, insomnia, and pain. Both of these medications can result in dry mouth, constipation, changes in appetite, and nausea.<sup>15</sup>

## **Substances' Nutritional Impact**

### ***Alcohol***

Alcohol is a major cause of nutritional deficiency in the United States.<sup>16</sup> Alcohol provides calories but little nutrition to the body. Many alcoholics are malnourished, either due to ingesting a nutritionally inadequate diet or changes in the body's ability to use the nutrients it receives.<sup>8</sup>

Alcoholism affects every area of the body. It can cause insomnia, anorexia, weight changes, gastrointestinal cramping, decreased digestive enzymes, ulcers, muscle wasting, liver disease, and abnormal glucose levels depending on the amount of alcohol ingested. Those who take in more than 30% of their total calories in alcohol generally have a significant decrease in their intake of all macronutrients and deficiencies in vitamin A, vitamin C, and thiamine.<sup>8</sup>

Alcohol's impact on digestion and the absorption of essential nutrients is important to understand when treating an alcoholic. Alcohol interferes with protein metabolism, leading to important clinical consequences, including low albumin levels, increased fluid in the abdomen, reduced blood clotting, and decreased urea production (resulting in excessive ammonia levels), which may increase the likelihood of altered brain function (eg, hepatic encephalopathy).<sup>8</sup>

Liver disease resulting from alcoholism alters the organ's ability to take up beta-carotene and/or convert it to vitamin A, causing disorders such as night blindness.<sup>8</sup> Dietitians should be cautious when treating alcoholics with low vitamin A levels because blood levels may be inconsistent with what's stored in tissues and because high doses are toxic. It's recommended that patients with low vitamin A and night blindness be treated with 2 mg of vitamin A per day for several weeks.<sup>8</sup> Zinc treatment also may be useful, as it's needed for vitamin A metabolism.<sup>8</sup>

The body moves through four stages of liver damage as alcoholism progresses: fatty liver, alcoholic hepatitis, cirrhosis, and encephalopathy or coma.<sup>1</sup> Protein-calorie malnutrition predicts survival in patients with alcoholic liver disease. Forty-five percent to 70% of alcoholics with liver disease also are glucose intolerant or diabetic.<sup>2</sup>

Treatment goals for patients with alcoholism are to reverse malnutrition, prevent alcoholic liver disease, and establish a healthful lifestyle and coping skills for avoiding alcohol use. If malnourished, alcoholics benefit from a diet high in carbohydrates and moderate in protein. Low-calorie diets and fasting should be avoided because of the nutritional risks and the possibility that a patient has an existing eating disorder or may cross over to a new addiction with food, dieting, or exercise.<sup>4</sup>

The diet should include a mix of omega-3 and omega-6 fatty acids since the amount and type of fats impact hepatic steatosis, fibrosis, and cirrhosis.<sup>1</sup> If tube feeding or total parenteral nutrition is required, dietitians should avoid glutamine-enriched formulas, as they increase ammonia levels. The amino acid taurine, in addition to patients' prescribed diets, has been used to help maintain recovery after detoxification, as it represses the rewarding effect in the brain associated with alcohol.<sup>4</sup>

Wernicke-Korsakoff's syndrome (wet brain), which occurs with heavy alcohol use due to a lack of thiamine, may be prevented with thiamine supplementation during intervention. Thiamin deficiency occurs because of decreased absorption as a result of the diuretic effect of alcohol and the utilization of thiamin in detoxifying alcohol.<sup>8</sup>

### ***Opioids (Narcotics)***

Opioids are used to treat pain and include codeine, oxycodone, heroin, methadone, and morphine. These drugs slow body movements and can cause sedation, leading to slower digestion and constipation.

Withdrawal symptoms can occur with opioids, even with a short duration of use. It brings a wide range of symptoms, mainly diarrhea, nausea, and vomiting, which can lead to poor oral intake, dehydration, and electrolyte imbalances.<sup>16</sup> Nutrient deficits may be caused by poor nutritional intake or the drug's impact on digestion and absorption. Opioids are water soluble, so they clear the body faster than do fat-soluble drugs but produce painful and uncomfortable detox periods. Heroin use can cause glucose intolerance, but this usually resolves with abstinence. For that reason, patients will require blood sugar monitoring and balanced, frequent meals.<sup>1</sup>

When newly abstaining from opioids, patients typically have very low pain tolerance, increased heart rate, anxiety, and trouble sleeping. These symptoms commonly cause them to relapse to their drug of choice. Pharmacotherapy, counseling, and lifestyle changes help prevent relapse in this population of addicts.

### ***Stimulants***

Stimulants, including crack, cocaine, amphetamines, methamphetamine, nicotine, and caffeine, generally lead to decreased appetite and weight loss. Cocaine has been associated with anorexia and eating disorders and may impact energy intake and requirements.<sup>13</sup> Large amounts of stimulants result in insomnia, paranoia, anxiety, malnutrition, and memory problems.<sup>1</sup>

When individuals first discontinue stimulant use, dehydration and electrolyte imbalances may occur, so careful monitoring is important. Since low weight and eating disorders may be of concern, encouraging and educating patients on proper nutrition and helping them achieve a healthy BMI is important.

Methamphetamine abusers commonly suffer severe dental problems that interfere with diet quality. One study reported that 41.3% of methamphetamine users had dental disease, and nearly 60% had missing teeth. Dietitians should offer nutrition education to support dental health and recommend foods with an appropriate consistency.<sup>17</sup>

### ***Marijuana***

Marijuana, which impairs memory, attention, judgment, and balance and increases heart rate, is the most commonly used drug in the United States. The main nutritional impact of this drug is increased appetite.<sup>16</sup> Long-term users may be overweight and may need a calorically restricted diet and an exercise program to help them achieve a healthy weight.

Since marijuana is a fat-soluble drug, it can take up to six months for a daily user's brain to return to normal functioning after abstaining.

### **Promoting Self-Care and a Healthful Lifestyle**

RDs should help promote a healthful lifestyle to accompany substance abuse patients' recovery. Important aspects of self-care include physical activity, proper sleep, and devoting time for pleasurable activities. These activities may help to keep patients positive, improve

health, establish new routines, and reduce idle time that may lead to relapse. Exercise is thought to stimulate some of the same circuits in the brain as do most substances, so promoting healthful activities may be a good way to replace old behaviors. Lack of sleep can lead to a decrease in well-being, reduced cognitive function, and reduced energy, so encouraging patients to practice healthful bedtime routines is beneficial.

Patients must be educated on the importance of nutrition in their recovery process. Grocery shopping, cooking, and preparing foods are important skills that dietitians can promote for patients in recovery. Cooking classes or recipes may be of interest to clients who are unsure about how to cook or are looking for ideas for healthful options. Financial struggles and unstable living situations are common obstacles to recovery that can lead to food insecurity, which significantly contributes to the nutritional status of drug abusers and to relatively unbalanced diets.<sup>13</sup> Educating patients on nutrition resources, budget-friendly options, and support may be helpful.

Overall, dietitians play an important part in the process of recovery for patients seeking help for substance abuse. Many patients must be encouraged to understand how nutrition can play an important part in their recovery process, and they need help navigating the struggles that arise so they can achieve a healthful lifestyle.

—Alyssa Salz, MS, RD, LD, is a behavioral health dietitian in St. Louis and a freelance food and nutrition writer.

## References

1. Escott-Stump S. **Nutrition and Diagnosis-Related Care**. 6th ed. Baltimore, MD: Lippincott Williams & Wilkins; 2008.
2. Emerson M, Dubois C, Hatcher A, et al. Psychiatric nutrition therapy: a resource guide for dietetics professionals practicing in behavioral health care. Dietetics in Developmental and Psychiatric Disorders Practice Group of the American Dietetic Association. [http://www3.nd.edu/~jkaiser/PsychPapers/Psychiatric Nutrition Therapy 08.31.06.pdf](http://www3.nd.edu/~jkaiser/PsychPapers/Psychiatric_Nutrition_Therapy_08.31.06.pdf). 2006.
3. Grant LP, Haughton B, Sachan DS. Nutrition education is positively associated with substance abuse treatment program outcomes. **J Am Diet Assoc**. 2004;104(4):604-610.
4. Carson RE. **The Brain Fix: What's the Matter With Your Gray Matter**. Deerfield Beach, FL: Health Communications; 2012.
5. Sathyanarayana Rao TS, Asha MR, Ramesh BN, Jagannatha Rao KS. Understanding nutrition, depression, and mental illnesses. **Indian J Psychiatry**. 2008;50(2):77-82.
6. Harrison NA, Brydon L, Walker C, Gray MA, Steptoe A, Critchley HD. Inflammation causes mood changes through alterations in subgenual cingulate activity and mesolimbic connectivity. **Biol Psychiatry**. 2009;66(5):407-414.
7. Althaus CB. The glucose factor: diet and addiction. **Foodservice Director**. 2001;14(10):62.

8. Lieber CS. Relationships between nutrition, alcohol use, and liver disease. ***Alcohol Res Health***. 2003;27(3):220-231.
9. Saeland M, Haugen M, Eriksen FL, et al. High sugar consumption and poor nutrient intake among drug addicts in Oslo, Norway. ***Br J Nutr***. 2011;105(4):618-624.
10. Ross LJ, Wilson M, Banks M, Rezannah F, Daghli M. Prevalence of malnutrition and nutritional risk factors in patients undergoing alcohol and drug treatment. ***Nutrition***. 2012;28(7-8):738-743.
11. Nebhinani N, Gupta S, Mattoo SK, Basu D. Prevalence of the metabolic syndrome in substance-dependent men. ***German J Psychiatry***. 2013;16(2):61-67.
12. Mattoo SK, Chakraborty K, Basu D, Ghosh A, Vijaya Kumar KG, Kulhara P. Prevalence and correlates of metabolic syndrome in alcohol and opioid dependent inpatients. ***Indian J Med Res***. 2011;134:341-348.
13. Forrester JE. Nutritional alterations in drug abusers with and without HIV. ***Am J Infect Dis***. 2006;2(3):173-179.
14. Fontaine KR, Cheskin LJ, Carriero NJ, Jefferson L, Finley CJ, Gorelick DA. Body mass index and effects of refeeding on liver tests in drug-dependent adults in a residential research unit. ***J Am Diet Assoc***. 2001;101(12):1467-1469.
15. Pronsky ZM, Crowe JP, Young VSL, Elbe D, Epstein S, Roberts W. ***Food Medication Interactions***. 15th ed. Birchrunville PA: Food-Medication Interactions; 2008.
16. Diet and substance abuse recovery. MedlinePlus website. <http://www.nlm.nih.gov/medlineplus/ency/article/002149.htm>. Updated March 22, 2013. Accessed October 7, 2013.
17. Shetty V, Mooney LJ, Zigler CM, Belin TR, Murphy D, Rawson R. The relationship between methamphetamine use and increased dental disease. ***J Am Dent Assoc***. 2010;141(3):307-318.

## Examination

- 1. Before detoxification, which of the following is decreased due to poor nutrition and altered absorption/utilization of amino acids?**
  - A. Neurotransmitters
  - B. Blood glucose
  - C. Digestive enzymes
  - D. Vitamin D
- 2. Having a proper balance of which of the following helps neurotransmitter regulation, decreases depression, and controls inflammation?**
  - A. Omega-3 and omega-6 fatty acids
  - B. Amino acids
  - C. Antioxidants
  - D. Carbohydrates
- 3. Intake of which of the following should be monitored because it triggers the same reward centers in the brain as do substances while also impacting sleep and anxiety?**
  - A. Sodium
  - B. Sweets
  - C. Monosodium glutamate
  - D. Caffeine
- 4. While detoxing from heroin, a woman experiences diarrhea, nausea, and disorientation. She struggles to eat or drink anything. It's important for a dietitian to monitor her for which of the following conditions and provide treatment if the condition is present?**
  - A. Glucose intolerance
  - B. Eating disorder
  - C. Dehydration
  - D. Digestive disorders
- 5. A 23-year-old man is about to be discharged after completing alcohol treatment. He has received proper nutrition education, tools for acquiring and preparing healthful foods, and exercise recommendations. What other recommendation would be included in his discharge plan?**
  - A. Adopt a low-calorie diet.
  - B. Take a multivitamin plus glutamine supplements.
  - C. Seek psychotherapy and/or a support group.
  - D. Adopt a high-protein, low-carbohydrate diet.

**6. Metabolic syndrome is most common among those who abuse which of the following substances?**

- A. Opioids
- B. Marijuana
- C. Stimulants
- D. Alcohol

**7. A patient has been prescribed disulfiram (Antabuse) while recovering from polysubstance abuse. It's important that a dietitian checks the foods/recipes for this patient to ensure they don't include which of the following?**

- A. Added sugar
- B. Alcohol
- C. Caffeine
- D. Gluten

**8. A patient with dental disease or missing teeth may need an altered-consistency diet and education on nutrition for dental health. Most likely this is a result of use of which of the following substances?**

- A. Methamphetamine
- B. Heroin
- C. Alcohol
- D. Marijuana

**9. Eating disorders co-occur in what percentage of patients recovering from substance abuse?**

- A. 10
- B. 25
- C. 35
- D. 50

**10. Which substance is known to be a leading cause of nutrition deficiencies?**

- A. Opiates
- B. Marijuana
- C. Alcohol
- D. Stimulants