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Is Wine a “Functional Food”?

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Learning Objectives

At the conclusion of this course, the student will be able to:

1. Define functional foods.
2. List the functional components of wine.
3. Describe the difference between red and white wine.
3. List four categories of compounds classified as polyphenols and food sources of each.
4. Explain how the polyphenols quercetin, catechin and resveratrol may act to prevent cardiovascular disease.
5. Explain why red wine is strongly associated with cardiovascular health, while white wine is not.
6. Define and describe what constitutes light, moderate, and heavy alcohol drinking.
7. List the recommended dietary guidelines for alcohol, including wine, consumption for men and women.
8. Summarize the health benefits of moderate drinking and hazards of heavy alcohol consumption.

Wine is no ordinary beverage. Wine has long been considered soothing for both the body and spirit. According to Plato, “No thing more excellent nor more valuable than wine was ever granted mankind by God.” It may even surprise you to learn that grapevines and wine are mentioned in the Bible more than any other plant (www.intowine.com, Accessed 1/22/04).

Wine is the alcoholic beverage of choice with meals, and 80 percent of all wine is consumed at home. Per capita, France consumes the most wine, followed by Italy, the United States, Germany, and Spain. Wine consumption has increased steadily over the past 20 years and is expected to continue to increase. In the US, sales of domestic and imported wine, rose 4 percent in 2007, for a total retail value of \$30 billion, making the US the largest retail wine market in the world. Table wine sales make up the majority of retail sales, followed by dessert wines, then sparkling wines (Clark, 2007).

Strong consumer interest is one reason for the consistent increase in annual sales (Clark, 2007).

One consumer interest is health. The potential health benefits of wine first received widespread US attention in November 1991, when *60 Minutes* featured a report on the “French Paradox,” a term coined to describe the finding that, although many French eat excessive amounts of saturated fats, have elevated cholesterol levels, smoke cigarettes and get very little exercise, they have one of the lowest heart attack rates in the world. Their regular moderate daily intake of red wine with meals was, and remains, the most likely explanation for this phenomenon.

Sales of red wine soared within weeks of the airing of this show (www.intowine.com, Accessed 1/22/04). In the 1990s, Baby Boomers, now in their 30s and 40s and increasingly affluent and sophisticated, also were beginning to worry about their cardiovascular health, and contributed to the increase in sales. Today the oldest Baby Boomers are in their 60s and concern regarding cardiovascular health remains high on their list of health concerns.

Were they foolish in believing that a glass of Cabernet or Shiraz a day could help prevent heart disease? More to the point, and more in today’s lexicon, should we consider wine a “functional food?”

Functionality

Functional foods are foods that contain physiologically active food components, and which therefore provide health benefits beyond basic nutrition. “Basic nutrition” provides for normal growth and development, while “beyond basic nutrition” refers to disease-preventing properties. These active ingredients include phytochemicals, which are non-nutritive components of plants that have disease-protective or therapeutic benefits (ADA, 1999; Brannon, 2008).

Many questions have been raised concerning the functionality of wine. What are the phytochemical components that offer disease protection? Do other sources of alcohol promote health benefits? Is it wine that offers disease protection or the lifestyles typical of wine drinkers? How much wine provides health benefits, but is not detrimental to a person’s health? Some of these questions can be answered in this article, but more research is needed before we can definitely answer other questions (www.tastersguildny.com, accessed 1/22/04).

Winemaking

Let’s begin by reviewing some basic information about wine. Wine is made from specially cultivated grapes. Wine growers carefully select the variety of grapes they will grow based on their particular soil and climate. Grapevines start their cycle in April, flower within about six weeks, and are harvested in the fall. Grapes are considered ripe when they have achieved the proper balance of sugar and acidity. The composition of grapes is about 80 percent water and about 20 percent sugar. Wine grapes are harvested when their sugar content is high. High sugar content is necessary for yeast to act on the sugar and convert it to alcohol during fermentation. In contrast, table, or “eating” grapes are harvested when their sugar content is relatively low. Wine grapes are smaller and have thinner skins than table grapes, which need thicker skins so they can be handled and transported (www.tastersguildny.com, accessed 1/22/04).

Wines are divided into two basic categories, red and white. A wine’s color comes from contact with the grape skins. Red, or more accurately purple-blue, grapes generally produce red wines and white or yellow grapes produce white wines. Both red and white grapes are yellow-gray inside. Wines can be lighter or darker in color, depending on their contact with the skins and the thickness of the skins. White

grapes are pressed and their skins removed before they are fermented. Red grapes can be used to make white wine if their skins are removed before fermentation.

After harvesting, grapes are placed into vats where yeast can form naturally on the grapes. Fermentation occurs, resulting in the conversion of grape juice into ethyl alcohol, or ethanol. After fermentation, the new wine is drawn off the vats and placed into wooden barrels or stainless steel tanks for aging before bottling (www.tastersguildny.com, accessed 1/22/04).

The ethyl alcohol ($\text{CH}_3\text{CH}_2\text{OH}$) in wine is the same type of alcohol found in all alcoholic drinks. A typical 4 oz glass of wine has about 100 kcal and contains water (250 gm), ethyl alcohol (25 gm), glycerine (3 gm), pectins (1 gm), acids (1 gm) and polyphenols (500 mg) and traces of flavor elements. It is primarily the alcohol in wine that provides the calories. Alcohol, like carbohydrates, protein, and fat, is an energy source for the body. One gram of alcohol provides 7 kcal.

Functional Components of Wine

Many scientific studies have indicated that moderate wine-drinking protects against cardiovascular disease (CVD) (Goldberg, *et al.*, 2001). In addition, recent preliminary studies are emerging that indicate wine may play a potential role in protecting against certain cancers, cognitive decline, dementia and reduced lung function, as well as increasing longevity (Goldberg, *et al.*, 2001; Scalberg and Williamson, 2000; Mukamal, *et al.*, 2003; Catchpole, 2003; www.sciencedaily.com, Accessed 2002; McElderyy, 1999; Sacanella, *et al.*, 2008; Baik and Shin, 2008; Geleijnse and Hollman, 2008; Barger, *et al.*, 2008).

The health benefits of wine are largely attributed to phytochemicals in wine. A foundational knowledge of phytochemicals is necessary to understanding the emerging research regarding wine's functionality. The following section defines, describes, and discusses the major phytochemicals in wine.

- **Polyphenols:** The most abundant antioxidants in our diets are polyphenols. Antioxidants protect against cellular damage caused by free radicals in the body. Cellular damage caused by free radicals can lead to development of diseases like heart disease and cancer (Scalbert and Williamson, 2000). Many phytochemicals act as antioxidants.

Several thousand natural polyphenols have been identified. Polyphenols are not evenly distributed in plants. The majority of polyphenols are located in the skins or peelings of fruits.

Grape polyphenols are located primarily in the skins. These polyphenols give red wine its color and its ability to age well. As noted, white grapes are pressed and their skins removed before they are placed in vats and fermented. Thus, white wine has a lower concentration of polyphenols than red wine, and does not age as well (Scalbert and Williamson, 2000). These phytochemicals give red wine its profound, astringent taste.

Most of the data on polyphenol content of foods are from scattered sources (Scalbert and Williamson, 2000), and it is difficult to estimate the polyphenol content of foods due to the diversity of their chemical structures. Polyphenols have very complex chemical structures, consisting of several benzene rings. Their chemical structure makes them distinct from other antioxidants, contributes to their strong antioxidant properties, and determines their bioavailability, metabolism, and absorption.

A few human studies have suggested that a large percentage — 75 to 100 percent — of ingested polyphenols are either absorbed through the gastrointestinal tract, absorbed and excreted in bile, or metabolized by the colonic microflora or other body tissues. Repeated dietary intake of polyphenols is necessary to maintain high plasma levels of polyphenols (Scalbert and Williamson, 2000).

• **Categories of Polyphenols:** Polyphenols include four categories of compounds, grouped according to their chemical configuration: phenolic acids, flavonoids, lignans, and stilbenes. Within each category there are several classes of compounds (Scalbert and Williamson, 2000; Brannon, 2008). These categories and the classes of polyphenols and their food sources are listed in the following chart.

Categories, Classes & Food Sources of Polyphenols*		
Category	Classes	Major Food Sources
Phenolic acids	<ul style="list-style-type: none"> • Caffeic acid, - Chlorogenic acid • Condensed Tannins • Hydrolyzable tannins: - Gallotannins - Ellagitannins 	Many fruits and vegetables, coffee Mango fruit Blackberries, raspberries, strawberries, wine, brandy aged in oak barrels
Flavonoids	<ul style="list-style-type: none"> • Flavones • Flavonols - Quercetin • Flavanols: - Catechins: • Flavanones: - Hesperetin • Isoflavones: - Genistein - Daidzein • Anthocyanins: - Cyanidin • Proanthocyanidins 	Sweet red pepper, celery Tea, onions, apples, many other fruits and vegetables Tea, especially green tea, chocolate, cocoa Oranges, citrus fruits Soybeans, soy protein containing foods Red fruits: cherries, plums, strawberries, raspberries, blackberries, grapes, red and black currants Apples, pears, grapes, red wine, tea
Lignans	<ul style="list-style-type: none"> • Enterodiol 	Flaxseed, flaxseed oil
Stilbenes	<ul style="list-style-type: none"> • Resveratrol 	Red wine

This is not an exhaustive list.
Reference: Scalbert A and Williamson G. Dietary intake and bioavailability of polyphenols. *J Nutr* 130: 2073S-2085S, 2000.

Wine, particularly red wine, is a rich source of a variety of phenolics, flavonoids, and resveratrol, a class of stilbenes. It is estimated that a 4 oz. glass of wine contains about 200 different types of polyphenols. Different varieties of grapes have different compositions of polyphenols (Scalbert and Williamson, 2000).

The flavonoids are the most abundant polyphenols in our diet. More than 4,000 flavonoids have been identified. Wine contains several classes of flavonoids, including the flavonols, catechins or flavanols, anthocyanins, and procyanidins. Persons who frequently consume fruits, red wine, tea, chocolate, or beer will have higher intake of flavonoids. In general, studies have found a positive association between dietary flavonoid intake and overall good health (Scalbert and Williamson, 2000).

Health benefits of the polyphenols in wine

• Cardiovascular disease protection

Polyphenols appear to play a role in protecting against cardiovascular disease (CVD) (Szmitko and Verma, 2005).

In vitro studies suggest that the phytochemicals in wine act by inhibiting LDL oxidation and/or by inhibiting platelet aggregation (the clumping together of particles in blood, resulting in blood clot formation or thrombosis, which occurs prior to a heart attack). More research is needed to determine conclusively the mode of action. Although *in vitro* studies support the ability of phenolic compounds to inhibit LDL oxidation, it is unclear if they have this same effect in humans. Oxidized LDL particles cause cellular injury that leads to plaque formation and ultimately the development of atherosclerosis. Therefore, the inhibition of LDL oxidation is important in preventing or delaying the progression of CVD.

Many *in vitro* studies also indicate that light-to-moderate consumption of alcoholic beverages, including but not limited to, wine, inhibits platelet aggregation. This decrease in platelet aggregation probably involves specific polyphenols (Goldberg, *et al.*, 2001). Quercetin, a flavonoid in wine, is a potent inhibitor of platelet aggregation. Two other polyphenols, catechin and resveratrol are less potent inhibitors (McElderyy, 1999).

One clinical study found that red wine intake reduced the susceptibility of low-density lipoprotein cholesterol (LDL) to oxidation (Nigdikar, *et al.*, 1998). Another study found that blood antioxidant activity was increased after wine intake (Maxwell, *et al.*, 1994). According to a study of 15 patients with coronary artery disease, daily intake of purple grape juice, a rich source of flavonoids, was also effective in reducing the susceptibility of LDL cholesterol to oxidation (Stein, *et al.*, 1999). The finding of this study raises the question of whether it is the alcohol itself or the wine polyphenols that offers disease protection.

Resveratrol. Within the past few years increasing attention has been focused on resveratrol, which is found in high amounts in grape skins and red wines and in lower amounts in grape juice, mulberries, and peanuts. Resveratrol is a phytoalexin, a type of antibiotic compound produced by plants to help defend against diseases like fungal infections that affect grapevines, especially grapes grown in cooler climates (McElderyy, 1999).

For centuries resveratrol has been as an ingredient in traditional Japanese and Chinese medicines used to treat a variety of conditions including inflammation and CVD. Like other polyphenols, it is an antioxidant and has been found to protect against CVD (Waterhouse, accessed 1/28/2004). Today nutritional supplements containing resveratrol are being marketed as “The French Paradox in a bottle” (Balk, 2002). However, more research is needed before recommending resveratrol supplements.

The search for the “Fountain of Youth” continues and some scientists believe that resveratrol is a key ingredient. At least one pharmaceutical corporation, GlaxoSmithKline, is investing over \$700 million in researching the potential anti-aging effect of resveratrol on sirtuins, protein agents in humans.

This area of research first began 20 years ago, but has recently opened up. This research involves the proposed ancient biological survival mechanism, that of switching the body's resources from fertility to tissue maintenance. It appears that if tissue maintenance is improved, then longevity and quality of life is greater because there is a reduction in the degenerative diseases of aging. It has been shown in laboratory rodents by up to 30 percent.

However, this theory has yet to be consistently proven in humans. Regardless, adhering to a calorie-restricted diet is not feasible for many humans. Recent interest has surged because it appears that resveratrol administration in mice can trigger a similar improvement in tissue maintenance by activating sirtuins resulting in increased longevity, and quality of life. It should be noted that, in a study involving rodents, the amount of resveratrol administered was equivalent to that obtained from drinking 100 bottles of wine a day (35 bottles a day in another study). Researchers are looking into extracting resveratrol and using it as a key ingredient in new and yet-to-be developed "anti-aging" drugs. More research, particularly clinical trials are needed (Barger, *et al.*, 2008).

• Potential breast cancer protection

The chemical structure of resveratrol is similar to estradiol, an endogenous estrogen, and diethylstilbestrol, a synthetic estrogen. Initial *in vitro* and *in vivo* (mice) studies indicate that resveratrol inhibits the growth of malignant tumors of the breast and prostate (17) Studies indicate resveratrol may have both an estrogen agonist and antagonist effect, depending on the dosage of resveratrol and the presence of estradiol.

It has been suggested that resveratrol may have an agonist effect in postmenopausal women, but exert an antagonist effect in premenopausal women. If proven, this hypothesis would explain the increased risk of breast cancer among postmenopausal women who drink wine, but not among premenopausal women (McElderyy, 1999; Balk, 2002; Feigelson, *et al.*, 2001; Bove, 2002).

In vitro and *in vivo* studies indicate that the procyanidins dimmer in red wine and grape may suppress estrogen biosynthesis, which is associated with breast cancer development (Eng, *et al.*, 2003).

• Potential skin cancer protection

Recent *in vitro* and *in vivo* (mice) studies suggest that resveratrol inhibits the growth of nonmelanoma skin cancer, the most common cancer caused by overexposure to solar ultraviolet radiation (Gaffney, 2003; Afaq, *et al.*, 2003). More research is needed before drawing any firm conclusions regarding the chemopreventative role of resveratrol in humans.

Alcohol: Functional component or health hazard?

Besides the likely benefit of polyphenols in wine, could it also be that alcohol itself is a functional ingredient? It has been suggested that moderate alcohol intake — one to two drinks a day — may provide some health benefits. One “drink” is defined as 5 oz. of wine, 12 oz. of regular beer, or 1.5 oz. of distilled spirits (www.ncadd.org, accessed 2/4/2003).

In vivo studies of atherosclerosis-prone mice demonstrate that addition of alcohol to their diet decreased atherosclerosis (Goldberg, *et al.*, 2001). Alcohol intake increases high-density lipoprotein (HDL) cholesterol levels. On average one to two drinks per day may increase HDL levels by an average of approximately 12 percent (Goldberg, *et al.*, 2001). HDL cholesterol is known as the “good” cholesterol.

Prospective clinical studies have found that moderate alcohol consumption is associated with decreased total mortality rates. However, higher daily alcohol intake, as outlined in the following chart, is associated with an increase total mortality (Goldberg, *et al.*, 2001).

We all know that alcohol intake can be hazardous to health. In fact, over 60 negative health effects have been associated with alcohol consumption (Gutjahr, *et al.*, 2001). Alcohol is considered a depressant drug because it slows down brain activity. Long-term abuse of alcohol can result in dependence or alcoholism. Alcoholism can lead to life-threatening liver disease.

For many people, alcohol is a source of excess calories and can result in elevated triglyceride levels, or hypertriglyceridemia, a risk factor for CVD. In addition, alcohol-related hypertriglyceridemia can exacerbate pancreatitis (Goldberg, *et al.*, 2001).

Classifications of Alcohol Drinkers			
	Moderate Drinking	“At Risk Drinking”	Heavy Drinking
Women	≤ 1 drink/day; ≤ 7 drinks/week	> 7 drinks/week or > 3 drinks per occasion	> 3 drinks/day; > 21 drinks/week
Men	≤ 2 drink/day; ≤ 14 drinks/week	> 14 drinks/week or > 4 drinks per occasion	> 5 drinks/day; > 35 drinks/week

_____. Alcohol Abuse: How to Recognize Problem Drinking. Website www.familydoctor.org, Accessed 2/4/03

It has also been suggested that alcohol may be a pro-oxidant because excessive alcohol intake is associated with mouth and throat cancers. It is unclear what the effects or role of alcohol, as a component of wine, play in promoting health benefits (Goldberg, *et al.*, 2001).

The Nurses’ Health Study, a large study involving women aged 30 to 55 years, indicates an association between daily intake of about two drinks and an increase risk of high blood pressure. This association is also true for men. Daily alcohol intake greater than one to two drinks is a clear risk factor for hypertension (Goldberg, *et al.*, 2001).

There is agreement that chronic, heavy alcohol intake increases a person's risk of all types of strokes, especially hemorrhagic strokes. The effect of moderate alcohol intake on stroke risk is less clear due to the conflicting findings of different studies. Some studies indicate that moderate alcohol intake may protect against strokes (Goldberg, *et al.*, 2001).

Health Benefits of Moderate Drinking

So, there is evidence for and against alcohol in general, and wine in particular. Let's look at some significant findings from clinical studies about the health benefits of wine regarding cardiovascular disease, lung conditions, mental functioning, and certain cancers.

- **Cardiovascular Protection:** In 1992 a study by Renaud and de Lorgeril formally established the truth of the "French Paradox," and proposed that moderate intake of red wine is associated with the low mortality rate in populations that consume a high-fat diet and have high blood cholesterol levels. There are now over 60 prospective studies that support this hypothesis.

In addition, a prospective cohort study involving over 36,000 healthy French men found that moderate wine drinking was associated with a lower hypertension-related mortality (Renaud, *et al.*, 2004).

Moderate alcohol consumption is associated with a lower risk of myocardial infarction or heart attack, but whether alcohol is truly protective or whether the amount, type, or pattern of intake is the most important factor is still under debate. A study involving slightly more than 4,000 participants in Costa Rica found that low to moderate consumption, defined as 1 to 2 drinks per week, was independently associated with a reduced risk of heart attack (Kabagambe, *et al.*, 2005).

It has not been clearly proven that red wine is more beneficial than other alcoholic beverages, although some studies have suggested that wine is more beneficial than beer or spirits (Goldberg, *et al.*, 2001; Janszky, *et al.*, 2005). A recent study involving women who had recently suffered an acute heart attack or undergone a revascularization procedure, angioplasty, coronary artery bypass grafting found an association between wine drinking and increased heart rate variability (HRV), but no association was found between intake of spirits or beer and HRV (Janszky, *et al.*, 2005).

To summarize, there is much evidence to support the hypothesis that moderate alcohol, particularly red wine, offers cardiovascular protection. More research is needed to determine and clarify the mechanisms of this cardiovascular protection (Parks and Booyse, 2002; Retterstol, *et al.*, 2005). The chart on the following page summarizes the possible cardiovascular health benefits versus adverse effect associated with alcohol intake.

- **Lungs:** Recent studies indicate that moderate wine drinking, one to three drinks daily, may improve lung function and capacity and even suppress lung diseases such as chronic obstructive pulmonary disease (COPD), emphysema, and chronic bronchitis. One study involving 1,555 men and women reported that white wine appeared to be more strongly related to better lung function than red wine one glass of wine daily equaled a 1.5 percent higher lung function, which could add 1 or 2 years to a person's life. Three glasses of wine per day improved lung capacity by 3 percent (Catchpole, 2003; www.sciencedaily.com, 2002)

- **Brain/Nervous System:** A recent study involving 6,000 persons reported that alcohol abstainers had about twice the odds of developing dementia compared to light drinkers (those drinking between one and six drinks weekly). Moderate drinkers (those drinking seven to 14 drinks weekly) had a 31

percent less chance of developing dementia, while heavy drinkers, (those drinking 15 or more drinks weekly) had a 22 percent lower risk of developing dementia (Mukamal, *et al.*, 2003). More research is needed to better understand this finding.

Cardiovascular Health Benefits versus Adverse Effects Associated with Alcohol Intake		
Health Benefits Associated with *Moderate Intake	Adverse Effects Associated with *Moderate Intake	Adverse Effects Associated with *Heavy Intake
Protection against CHD: <ul style="list-style-type: none"> • ↓ Platelet aggregation • ↑ HDL cholesterol levels • ↓ Susceptibility to LDL oxidation • Improve endothelium function ↓ CHD mortality – HTN mortality ↓ Total mortality 	Hypertension	Addiction to alcohol Liver diseases: <ul style="list-style-type: none"> • Fatty liver • Hepatic encephalopathy • Cirrhosis Fetal Alcohol Syndrome ↑ Total mortality Pancreatitis Certain Cancers ?
<small>* Moderate intake = Average intake of 1-2 drinks/day ** Heavy intake = Chronic intake of more than 3 drinks per day Reference Goldberg, <i>et al.</i>, 2001; Renaud, <i>et al.</i>, 2004; Szmítko and Verma, 2005.</small>		

• **Possible Cancer Protection:** Wine drinking, specifically red wine, has been linked to a reduced reduction of certain cancers (Kuper, *et al.*, 2000; Purdie, *et al.*, 2003; Eng, *et al.*, 2003).

Wine and alcohol drinking, specifically red wine, is associated with a reduced risk of breast cancer (Kuper, *et al.*, 2000; Eng, *et al.*, 2003). Postmenopausal women with very dense breast tissue, as determined by mammography have a higher risk (1.8 to 6 times higher) of breast cancer than women of the same age with normal breast tissue density. One study found that red wine consumption was inversely related to percentage of breast density, while white wine consumption was positively associated with breast tissue density (Purdie, *et al.*, 2003; Eng, *et al.*, 2003).

A recent pooled analysis of cohort studies analyzed data from seven prospective studies with nearly 400,000 participants and 3,137 cases of lung cancer found that there was a slightly greater risk of developing lung cancer with the daily consumption of 30 gm or more of alcohol compared to those participants that drank no alcohol. Alcohol consumption was strongly associated with greater risk in males that had never smoked (Freudenheim, *et al.*, 2005).

Summary of epidemiological and observational studies

It is important to note that epidemiological or observational studies can support a hypothesis, but cannot be definitive in declaring direct cause and effect. These studies include wide variations in methodology, error in measurement of alcohol intake, and biological variability in response to alcohol intake. In addition, other factors, including lifestyle, diet, age, race, smoking history, educational level, and cultural factors, that impact a person's health are not taken into account (Goldberg, *et al.*, 2001).

Studies have found that moderate drinkers are healthier overall than abstainers or heavy drinkers. However, is the better health of moderate wine drinkers due to the wine or to the typical lifestyles of most wine drinkers? Data collected from the UNC Alumni Heart Study at Duke University Medical Center, showed women prefer wine, while men indicated a preference for beer. The incomes of wine drinkers were higher than non-drinkers and drinkers of other alcoholic beverages. Wine drinkers reported eating healthier diets, in that they reported eating more servings of fruits and vegetables and fewer servings of red or fried meats, and their diets were lower in saturated fats and cholesterol and higher in fiber in comparison to persons who preferred beer or other alcoholic beverages. In addition, wine drinkers were less likely to smoke and more likely to exercise and had a lower mean body mass index (Barefoot, *et al.*, 2002).

Dietary recommendations

As nutrition counselors and health care educators, we need to carefully consider what dietary recommendations we make regarding alcohol intake. Do the benefits of moderate alcohol intake outweigh the potential addictive and harmful effects? A great concern is that chronic, heavy alcohol consumption can become addictive and result in adverse health effects, including fetal alcohol syndrome, cardiomyopathy, hypertension, stroke, cardiac arrhythmia, and sudden cardiac death (Goldberg, *et al.*, 2001).

It appears that one to two drinks per day — particularly of red wine — with meals may provide some health benefits. We need to carefully and clearly explain what “moderate intake” means and emphasize that it is best to consume wine with meals. It also appears that non-alcoholic grape juice and a diet high in fruits and vegetables offer the same benefits and disease protection (Lampe, 1999). Moderate wine drinking should not be advocated as a pro-active strategy for good health. It may be prudent to remember the words of King Solomon, “Wine is a mocker... whoever is led astray by it is not wise.”

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Examination for WIN08

1. Red wine:
 - a. does not age gracefully
 - b. has a sweet and mild taste due to its lower phytochemical content
 - c. has a higher concentration of polyphenols than white wine
 - d. is made by removing the skins before fermentation
 - e. all of the above

2. The most abundant polyphenols are:
 - a. flavonoids
 - b. pectins
 - c. stilbenes
 - d. isoflavones
 - e. none of the above

3. Polyphenols:
 - a. are weak antioxidants
 - b. found abundantly in plant foods
 - c. enhance platelet aggregation
 - d. increase low-density lipoprotein (LDL) oxidation
 - e. all of the above

4. Resveratrol is:
 - a. is found in high concentrations in grape skins
 - b. similar to estrogen in its chemical structure
 - c. a type of antibiotic compound produced by some plants
 - d. an effective anti-cancer agent
 - e. all of the above

5. Moderate alcohol intake is defined as:
 - a. one 5-oz. glasses of wine daily for women
 - b. one to two 6-oz. glasses of wine daily for both men and women
 - c. three 4-oz. glasses of wine daily for men only
 - d. three 6-oz. glasses of wine daily

6. Alcohol intake can:
 - a. increase HDL cholesterol and triglyceride levels
 - b. decrease HDL and LDL cholesterol levels
 - c. decrease triglyceride levels
 - d. increase total cholesterol and decrease triglyceride levels
 - e. none of the above

7. The polyphenol with a chemical structure similar to estradiol, a form of estrogen, is:
 - a. flavonoid
 - b. quercetin
 - c. resveratrol
 - d. enterodiol
 - e. catechin

8. A preliminary study found that risk of developing dementia was:
 - a. highest in heavy drinkers
 - b. decreased in moderate drinkers
 - c. lowest in abstainers
 - d. not affected by alcohol intake
 - e. none of the above

9. Preliminary studies have found that moderate wine intake:
 - a. Enhances or improves lung function
 - b. Enhances lung capacity
 - c. Suppress lung diseases like COPD and emphysema
 - d. All of the above
 - e. Has no effect on lung function or lung diseases

10. Resveratrol appears to:
 - a. Inhibit the growth of nonmelanoma skin cancer
 - b. Act as an estrogen antagonist
 - c. Act as an estrogen agonist
 - d. None of the above
 - e. All of the above

11. In comparison to abstainers and heavy drinkers, moderate wine drinkers typically:
 - a. eat a healthier diet including fruits and vegetables
 - b. have a lower body mass index
 - c. exercise regularly
 - d. all of the above
 - e. consume a higher fat diet and exercise less

12. Risk of hypertension is:
 - a. increased with intake of just one drink per day
 - b. increased with the intake of two or more alcoholic drinks per day
 - c. decreased with the intake of two or more alcoholic drinks per day
 - d. decreased in women, but not men, who drink two or more glasses of wine daily
 - e. not affected by alcoholic intake

13. Excessive or heavy alcohol intake is associated with:
 - a. increased risk of stroke
 - b. certain cancers
 - c. liver diseases
 - d. alcohol addiction
 - e. all of the above

14. It is recommended to:
 - a. drink 6 to 8 ounces of wine before bedtime
 - b. consume 1 to 2 glasses of wine with meals
 - c. drink 1 to 2 glasses of wine one to two hours before eating
 - d. drink wine, rather than grape juice, to receive health benefits of polyphenols
 - e. none of the above

15. Phytochemicals:
 - a. are found predominately in plant foods
 - b. provide health benefits beyond normal nutrition
 - c. are non-nutritive substances
 - d. are physiologically active compounds
 - e. all of the above

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