"TO YOUR HEALTH . . ." —ALCOHOL AND WELL-BEING

By Brian Goslin and Joanne Messink-Talarek

For millennia, alcoholic beverages have been a central feature of religious ceremonies, feasts, and celebrations. Alcohol can enhance social occasions by promoting relaxation and reducing social inhibitions. Alcohol can also be used to forget one's troubles, impair judgment, and alter neuromuscular control. The quantity of alcohol consumed, and the circumstances under which the consumption occurs play a vital role in determining whether the immediate effects on behavior are positive or negative. Of course alcohol is a substance foreign to the human body. In fact, it is a drug that the body absorbs and must metabolize. Understanding this process can lead to a better understanding of the impact of alcohol on well-being.

Metabolism. Alcohol is absorbed into the bloodstream from both the stomach and the upper part of the small intestine. Absorption is affected by the carbonation of the beverage (the higher the carbonation the more rapid the absorption), food in the stomach, and the strength of the alcoholic beverage (slower absorption with more food and hard liquor). The liver is the main site of alcohol metabolism. At low concentrations alcohol induces relaxation and euphoria while at higher levels it acts as a central nervous system depressant, impairing reaction time and motor control while reducing social inhibitions (Insel and Roth, 2006). Ethanol is more than a psychoactive

drug. It has considerable energy value (7.1 kcal per gram) which can lead to profound effects on nutritional status. Alcohol consumption may cause primary malnutrition because of this high energy content, or secondary malnutrition resulting from maldigestion or malabsorption of nutrients caused by gastrointestinal complications in the pancreas and the small intestine. Furthermore, alcohol is toxic to the liver, causing cirrhosis and other liver disorders, mainly by generating oxidative stress through its microsomal metabolism (Leiber, 2000).

Cerebral Function. The brain is also affected by habitual consumption of alcohol. About half of the alcoholics in the USA have cognitive impairments ranging from mild to severe that include alcohol-induced persisting amnesic disorder and dementia both of which seriously affect language, reasoning, and problem-solving ability. Areas of the brain especially vulnerable to alcohol related damage are the cerebral cortex, the limbic system (feelings and emotions), the thalamus (critical for communication within the brain), the hypothalamus (hormone release), and the forebrain (involved in learning and memory). One hypothesis suggests that alcohol-related brain atrophy occurs. This brain shrinkage results in permanent or transient cognitive deficits. Alcohol may be associated with thiamine deficiencies due to blood vessels breaking in the hypothalamus. Thiamine is important to prevent short-term memory loss. Neurons in the brain communicate using specific chemicals called neurotransmitters. The major excitatory neurotransmitter is the amino acid glutamate. Alcohol has been shown to interfere with glutamate action. Gamma-aminobutyric acid (GABA), a major inhibitory neurotransmitter, is initially enhanced by alcohol leading to an increase in inhibition. However, over time, the number of GABA receptors is reduced by regular alcohol consumption. This may lead to over-excitation throughout the brain when alcohol

While occasional alcohol use helps you sleep, too much can bring increased wakefulness.

consumption ceases (Oscar-Berman and Marinkovic, 2003). While the brains of those with Alzheimer's Disease and those with alcoholism are similarly atrophied (shrunken), the similarities are superficial. There is no epidemiological evidence suggesting that there is causal relationship between alcohol consumption and Alzheimer's Disease (Tyas, 2001).

The effect of alcohol consumption on sleep is related to its impact on brain function. Healthy, non-alcoholics who occasionally use alcohol, both in high and low doses find an initial improvement in sleep, although high doses can result in increased wakefulness during the second half of the nocturnal sleep period. These disturbances occur after the alcohol has been metabolized when adjustments in the amount of REM (rapid eye movement) sleep are occurring in an effort to maintain a normal sleep pattern. People rapidly develop tolerance to the sedative effects of alcohol on sleep. Alcohol interacts with sleep deprivation and sleep restriction to exacerbate daytime sleepiness and performance impairments (Roehrs and Roth, 2001).

Heart Disease. Diseases of the heart and blood vessels are a major cause of morbidity and mortality in the USA. There is substantial evidence that moderate alcohol consumption (1 or 2 standard drinks a day where a standard drink is one 12 ounce can of beer or bottle of wine cooler, one 5 ounce glass of wine, or 1.5 ounces of distilled spirits) lowers the risk of coronary artery disease (blockage of the heart's blood supply) and of ischemic stroke (blockage of the brain's blood supply). Most studies place the reduction in risk, compared with abstainers, at 25%. The mechanisms by which this reduction in risk occurs include increases in "good" cholesterol (HDL), reduced likelihood of blood clotting (lower fibrinogen levels), and may include decreased levels of lipoprotein-a, inhibition of platelet aggregation (reduces likelihood of blood clots plugging up arteries), lower levels of markers of blood vessel inflammation (C-reactive protein), and increased endothelial cell production of nitric oxide, a molecule made in blood vessel walls that

relaxes blood vessels and allows improved blood flow to organs such as the heart (Klatsky, 1999, Mukamal and Rimm, 2001, Puddey *et al*, 2001). Cooper *et al*, (2004) explored these concepts further in their examination of the "French paradox" in which the French have a low overall coronary mortality rate despite saturated fat intakes and cholesterol levels similar to those in the USA. They suggest that the polyphenols in the red wine consumed by the French have a positive effect of relaxing the blood vessel walls through nitric oxide release from the epithelial cells lining the inside walls. Red wine phenolics also assist in inhibiting platelet aggregation. Wine consumption appears to reduce the susceptibility of low density lipoprotein (LDL-cholesterol) to oxidation and increase blood serum antioxidant capacity, both of which would limit the potential for clogging of the arteries. Moderate alcohol consumption has also been associated with reduced fasting and post-load insulin levels, which would contribute to reduced heart disease risk (Mayer *et al*, 1993).

Lest one think that if a moderate amount of alcohol is good for the heart, a larger amount would be even better, all the research has indicated that heavier drinking (3 or more standard drinks a day) is related to higher risk of heart muscle disorders (cardiomyopathy), high blood pressure (hypertension), brain damage from ruptured blood vessels (hemorrhagic stroke), and heart rhythm irregularities (arrhythmias) (Klatsky, 1999, Klatsky, 2003, Wellbery, 2003).

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Cancer. Alcohol consumption has been linked to increased risk for a number of cancers. Alcohol most strongly increased the risk for cancers of the oral cavity, pharynx, esophagus, and larynx. It also significantly increased the risk for cancers of the stomach, colon, rectum, liver, female breast and ovaries. It was

noted that alcohol, itself, is not thought to be carcinogenic. Rather, it may act in a co-carcinogenic fashion, whereby it promotes or accelerates cancer development when in the presence of a cancer-causing (carcinogenic) agent. Female breast cancer is thought to be linked to alcohol consumption through the role of alcohol in raising levels of the hormone estrogen (Bagnardi *et al*, 2001). Minkin (2003) points out that alcohol consumption, when combined with post-menopausal hormone replacement therapy, increases the risk of breast cancer more than either one alone. Bagnardi *et al* (2001) did not identify any threshold level of alcohol consumption below which no increased risk for cancer was evident.

Bone Health. Bone is a living tissue that undergoes remodeling throughout life. Bone cells are broken down (resorption) and replaced (formation) in a dynamic process. When there is a negative imbalance between resorption and formation bone density and mass decrease. This disease process is known as osteoporosis. When bone density drops below critical levels fractures may occur as a result of daily activity. Alcohol use has a negative effect on the growing skeleton, reducing bone density and contributing to osteoporosis at a much earlier age. Men who drink alcohol have lower bone mass than men who abstain. Women who drink alcohol, on the other hand, have higher bone mass than those who abstain. In women, particularly post-menopausal women, moderate alcohol consumption has a neutral or generally beneficial skeletal effect, . Alcohol might reduce bone loss in post-menopausal women by increasing the circulating levels of estrogen or by acting on bone cells to reduce bone remodeling (Turner and Sibonga, 2001, Register *et al*, 2002).

Sexual Functioning, Reproduction and Pregnancy. Alcohol consumption has immediate effects on sexual functioning: in men, reduced erectile response; in women, reduced vaginal lubrication. Chronic use of alcohol in women, even in amounts insufficient to cause major damage to the liver or other organs,

disrupts female puberty and often results in menstrual irregularities and infertility. Men who chronically use alcohol suffer impotence and testicular atrophy (Emanuele *et al*, 2002, Insel and Roth, 2006). Alcohol consumption, even in small quantities, can lead to Fetal Alcohol Syndrome with brain damage and developmental problems. This is a major cause of mental retardation. Drinking alcohol at any point during a pregnancy in any amount can severely affect growth and impair learning, memory, attention span, and social behavior as the child develops (Brundage, 2002).

Stress. It has long been observed that stressful situations may induce alcohol consumption. Alcohol consumption is considered a way of relieving stress. Recent research indicates that alcohol consumption reduced stress in some studies, did not affect stress responses in other analyses, and exacerbated stress in other investigations. The factors involved in these disparate results seem to be individual differences and genetic predisposition toward alcoholism. Situational variables modify the stress-reducing effects. Alcohol has been shown to reduce stress reliably when drinking occurs in the presence of pleasant distractions. Drinking before experiencing a stressor tends to attenuate stress, while drinking after experiencing a stressor may have no effect or may even exacerbate stress. The precise pharmacological mechanisms underlying alcohol's stress reducing effects remain unclear (Sayette, 1999).

It is revealing to note that there is a substantial positive relationship between depression and alcohol abuse, and some studies have shown a causal link between the two that may be a result of genetic factors that contribute to both disorders. Substance abuse is often a precursor to treatment for depression-like symptoms that can be ameliorated with abstinence (Mehrabian, 2001). Problematic alcohol use tends to begin early in

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life. Rhode *et al* (2001) pointed out that problematic adolescent drinking should not be ignored. They indicated that compared to adolescents with no symptoms of alcohol use disorder, adolecents with subthreshold problematic alcohol use had higher rates of future alcohol use disorder, substance use disorder, depression, and antisocial personality disorder symptoms as young adults.

Medication Interactions. Many medications can interact with alcohol, even at moderate alcohol levels. Alcohol can interfere with the metabolism of the medication in the liver and may decrease or enhance the effect of the medication. For example, alcohol will increase levels of tricyclic antidepressants and may cause seizures and irregular heartbeat. When alcohol is consumed, warfarin levels (coumadin) may increase or decrease resulting in serious bleeding or clotting problems, respectively. Certain oral diabetic and seizure prevention medications are also effected in this way by alcohol, with potentially serious results. Antibiotics such as Flagyl and Cefotan and some antifungal medications react with alcohol to cause severe flushing, and nausea and vomiting. (Weathermon and Crabb, 1999).

Conversely, some medications speed the absorption or block the metabolism of alcohol, causing unexpectedly elevated blood alcohol levels from an otherwise small or moderate serving. Aspirin and some medications used to treat gastric reflux (Tagamet, Zantac, and Axid) enhance alcohol's effects in these ways. The antibiotic Erythromycin increases gastric emptying, speeding up alcohol absorption. (NIAAA 1995) (Weathermon and Crabb, 1999).

Because it targets the same receptor sites in the central nervous system (CNS), alcohol has an additive or synergistic (more than additive) effect when taken with certain medications. Loss of coordinated motor skills and alertness, progressing to loss of consciousness can occur when CNS suppression or sedation is compounded. In addition, respirations become depressed, blood pressure drops, and cough and gag reflexes are suppressed. These effects cause the accidental injuries and

deaths sometimes seen when such medications are mixed with alcohol. It is estimated that alcohol-medication interactions may be a factor in as many as 25 percent of emergency room admissions (NIAAA 1995). Examples include antihistamines (except the non-drowsy types); sedatives including prescription and herbal sleep aids; muscle relaxants; narcotic pain relievers; and benzodiazepines such as Valium, Xanax, and Ativan. (Weathermon and Crabb, 1999).

Alcohol consumption increases the risk of gastrointestinal bleeding when taking aspirin or NSAIDs (ibuprofen, Motrin, naproxen). Finally, by decreasing antioxidants, some medications increase the liver's susceptibility to damage from toxic metabolites. Acetaminophen (Tylenol), Isoniazid (antibiotic used to treat Tuberculosis), and antipsychotic drugs can affect the liver in this way. With heavy drinking, as little as 2–4 grams of acetaminophen can cause liver damage. Despite efforts to be aware of interactions with their prescription medications and over the counter medications, many people can be caught unaware by combination cold, cough, flu, or allergy medications. These often contain some combination of aspirin, acetaminophen, antihistamine, and alcohol. (NIAAA 1995) (Weathermon and Crabb, 1999).

Drinking, Driving, and Unintentional Injury. Every year more than 2 million college students aged 18–24 drive after drinking; more than 3 million ride in motor vehicles with drinking drivers; over one-half million are injured because of drinking; and, 1,400 die from alcohol-related traffic crashes. Compared with persons first drunk at age 19 or older, those first drunk prior to age 19 are significantly more likely to be alcohol de-

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pendent and frequent heavy drinkers, to report driving after any drinking, driving after 5 or more drinks, riding with a driver who was high or drunk, and after drinking, sustaining injuries that require medical attention. Those first drunk at younger ages believed they could consume more drinks and still drive safely and legally (Hingson *et al*, 2002).

Center for Disease Control and Prevention data indicate alcohol attributable deaths (AAD) cause an average of 30 years of potential life lost per death. In order of frequency, 2001 data shows motor vehicle accidents (13,674) as the most common acute (differentiated from chronic illness) cause of AAD, followed by homicide (7655), suicide (6969), falls (4766), poisoning (alcohol or alcohol-drug interaction)(4295), fires (1167), and water accidents and drowning (912). (CDC 2004).

Sexual Assault and Risky Sexual Behavior. Approximately half of all sexual assaults, including rape, involve alcohol consumption by the perpetrator, victim, or both. Sexual assaults involving alcohol consumption are more likely than other sexual assaults to occur between men and women who do not know each other well. Alcohol-involved sexual assaults tend to occur at parties or in bars, rather than in either person's home. The perpetrators of sexual assault generally are heavy consumers of alcohol. They harbor stereotypes about drinking women being sexually available and appropriate targets. They tend to spend time in bars and at parties, and use drinking as an excuse for socially unacceptable behavior. Alcohol's cognitive impairments enhance the misperception of the woman's friendly cues as sexual, and encourage an aggressive response if the man feels he as been "led on." The victims of sexual assault often spend time in bars and at parties, and engage in heavy alcohol consumption. Alcohol's cognitive impairments reduced the victim's ability to evaluate risk and reduce their ability to resist effectively (Abbey *et al*, 2001). Sexually transmitted diseases (STDs) can be largely prevented by engaging in safe-sex practices, including using a condom for every act of sexual intercourse and oral sex. Acute alcohol consumption signifi-

cantly predicts the likelihood that a participant would have sex without a condom. Other factors that contribute to this decision are gender, impulsivity, self-reported alcohol expectancies, frequency of heavy drinking, lifetime number of sexual partners and frequency of condom use. As we have already seen, alcohol impairs higher order cognitive processes, including abstraction, conceptualization, planning and problem solving. Impaired individuals focus on immediate superficial cues (like one's own sexual arousal), rather than covert or distal ones (like potential disease or norms about casual sex). It is pointed out that the full range of individual, social and situational factors that influence intoxicated decision-making need to be evaluated (Abbey *et al*, 2005).

Alcohol Use by Students at Oakland University. Graham Health Center employed the National College Health Assessment in Spring, 2003 to identify health behaviors and perceptions of Oakland University (OU) undergraduates (Talarek, 2003). Of the 1300 surveys distributed, 517 were returned, the majority of which came from female students (72%). The average age of the OU sample was 22.3 years.

How Much Do Oakland University Students Drink?

Safe decision-making around alcohol use was measured in a variety of ways. OU students rated 5–9% better than the national pool in areas such as use of a designated driver, monitoring one's own consumption, and predetermining the amount and rate of consumption. Of students who drink, 7% of the OU sample reported driving after 5 or more drinks compared to 12% in the national sample.

Binge Drinking. Binge drinking is generally defined as having 5 or more drinks on one occasion, meaning in a row or within a short period of time. Among women, binge drinking is often defined as having 4 or more drinks on one occasion. The lower

Table 1—30 day prevalence—Alcohol use among Oakland University undergraduate students compared to the 2002 national sample.

30 Day Prevalence	Oakland University students (%)	National Sample (%)
Never used	25	17
Used, but not in last 30 days	19	12
Used 1–9 days in last 30	47	50
Used 10–29 days in last 30	8	20
Used all 30 days	1.2	1

cut-off for women relates to the fact of women generally being of smaller stature than men, and they absorb and metabolize alcohol differently than men. It should be pointed out that binge drinking 7 drinks on one day, once a week does not have the same health-related consequences as drinking 1 drink a day, every day for a week. Binge drinking is associated with a number of adverse health effects, including unintentional injury (e.g., motor vehicle crashes, falls, burns, drownings, and hypothermia); violence (homicide, suicide, child abuse, domestic violence); sudden infant death syndrome; alcohol poisoning; hypertension (high blood pressure); myocardial infarction (heart attack); gastritis (intestinal upset); pancreatitis (inflammation of the pancreas); sexually transmitted diseases; meningitis (inflammation of the membrane covering the brain); and poor control of diabetes. About 1 in 3 adult drinkers in the USA report past-month binge drinking (CDC, 2005).

Summary. A substantial portion of the population drinks alcohol. Forty-four percent of adults aged 18 years and older (more than 82 million people) report having consumed 12 or more alcoholic drinks in the past year. Nearly 10 percent of current drinkers (about 8 million people) meet diagnostic cri-

teria for alcohol dependence. Alcohol use and alcohol-related problems are common among adolescents. Age at onset of drinking strongly predicts development of alcohol dependence over the course of the lifespan (Healthy People 2010, 2005).

Light-to-moderate drinking can have beneficial effects on the heart, particularly among those at greatest risk for heart attacks. Such drinking can also help prevent osteoporosis in post-menopausal women. Moderate drinking refers to consuming 1 to 2 drinks per day. Moderate drinking cannot be achieved by averaging binge drinking once a week over the whole week.

Long-term heavy drinking increases the risk for high blood pressure, heart rhythm irregularities, heart muscle disorders, and stroke. Such drinking increases the risk for some forms of cancer including esophagus, mouth, throat, larynx, colon, and rectal cancer, and breast cancer in women. Cirrhosis and other liver disorders result from long-term heavy drinking.

Alcohol use has been linked to a substantial number of injuries and deaths from motor vehicle crashes, falls, fires, and drownings. It is a factor in homicide, suicide, marital violence, and child abuse. It has been associated with high risk sexual behavior. The World Health Organization lists alcohol consumption as number 8 on the list of the "10 Greatest Global Health Risks" (Rosenthal, 2003).

Conclusion and Health Implications. Achieving a balance between the health risks and benefits of alcohol consumption remains difficult, as each person has a different susceptibility to the adverse health consequences associated with alcohol consumption (Mukamal and Rimm, 2001). Because of the increased non-cardiovascular disease mortality among heavier drinkers, the overall alcohol-mortality risk curve is more or less J-shaped with heavier drinkers at highest risk, lighter drinkers at lowest risk, and abstainers at intermediate risk. Heavier drinkers are at increased risk of major social, personal and ad-

verse health consequences and should abstain from alcohol or reduce their level of consumption. Because most non-drinkers have important personal or health reasons for abstention, indiscriminate advice to drink for health should not be given (Klatsky, 1999). Insel and Roth (2006) encourage everyone who drinks to drink moderately and responsibly by drinking slowly, spacing your drinks, eating before and while drinking, and knowing your alcohol limits.

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