

———— History and Theory ————

COPYRIGHTED MATERIAL

A Brief History of Alcohol

Harvey A. Siegal and James A. Inciardi

Our media tend to make us believe that we are currently in the midst of a “drug craze” worse than any ever known. Harvey Siegal and James Inciardi point out that people have used drugs distilled from various plants and foods since the beginning of known history. Focusing on alcohol, the most widely used drug on the planet, they look at the way it first developed and then evolved over centuries. Readers will be interested to learn some basic facts about what differentiates assorted kinds of alcohol, what substances have been added to it to modify its color and effects, and how it influences our bodies and our health.

The desire to temporarily alter how our minds process the information brought by our senses is perhaps one of the oldest and most pervasive of humanity’s wishes. In fact, some researchers have suggested that the need to do so is as powerful and permanent as the in-born drives of self-preservation, hunger, and security. In its pursuit, people have, at various times and in various places, subjected their bodies to beatings and mutilation, starvation and sensory deprivation; they have focused their minds solely on a single object, or let consciousness expand without direction; and they have often pursued a more direct route, changing the brain’s chemistry by ingesting a chemical substance. Of all of these,

the chemical that has probably been used by more of the earth’s people in more places and times is one of the by-products of a simple organism’s conversion of sugar and water into energy. It is ethanol, or beverage alcohol. Each year, countless millions of people experience, both positively and negatively, the effects of this domesticated drug we call alcohol.

More is known about alcohol than any other drug; yet, how much more remains to be learned staggers the imagination. Our experiences with this most familiar and comfortable of drugs could readily constitute a social history of civilization. We’ve lauded and vilified it. We’ve brought it into our most important

religious rituals and have included it as part of our significant rites-of-passage. Conversely, we've discouraged its use, even prohibited its manufacture and sale by constitutional amendment. Wars have been fought over it, and underworld empires have been built on the proceeds from its sales. It's been acclaimed as having the power to comfort and cure and is held responsible for thousands of deaths each year, billions of dollars in losses, and an incalculable amount of human suffering. All of us, in some way, have been touched or influenced by this drug, so let's take a brief look at its history.

Early History

Like many significant inventions, the specifics of alcohol's discovery are not known. We conjecture that it likely occurred during the neolithic age. Perhaps someone left wild berries, fruit, or even grapes in a vessel for a few days. When they returned, airborne yeasts had already begun fermenting the mixture. The result – which we call “wine” – undoubtedly proved to be more interesting and enjoyable than the original fruit, and, like other innovations, it did not take people long to improve their invention.

As people settled into communities and began cultivating plants and domesticating animals instead of just simply hunting and gathering their food, they found that a surplus often ensued. Surplus grains could also be fermented once the starch in them – which by itself would not ferment – could be rendered into sugar. To accomplish this, as is still done in parts of the world today, these early agriculturists found that chewing the grain somehow changes it into a fermentable mixture. We know now that the chemical responsible for this transformation – ptyalin – is found naturally in saliva. Other societies discovered that by allowing the grain to germinate, then roasting the new shoots, the fermentation process could be initiated. In this way, the beverage we know as “beer” came into being. People discovered that not only fruits, berries, and grains could be used to produce alcohol, but leaves, tubers, flowers, cacti, and even honey could be fermented as well.

These early concoctions (roughly designated as wines or beers), however, were limited in their alcoholic

strength. As yeasts metabolize the sugar, carbon dioxide (which is what makes bread rise, wine bubble, or gives beer a head) and alcohol are released as by-products. When the alcoholic content of the mixture exceeded 11 percent or 12 percent the process slowed markedly; as it approached 14 percent, the yeasts were rendered inactive (i.e., killed), and the process of fermentation stopped entirely. In addition to the limitation imposed by the biology of the yeasts, the alcoholic content could be affected by the producers themselves. For example, including more sugar (or fermentable material) would increase the amount of alcohol that would be produced. Whether the producers were willing to allow the yeasts the time necessary to complete the fermentation process or were too eager to consume the brew to wait, this influenced its alcohol content.

It was not until the time of the Crusades that Europeans were able to consume alcoholic beverages more potent than beer or wine. The Crusaders returned from the Holy Lands having learned a process known as “distillation.” To distill wine, it first would be heated. Because alcohol has a lower boiling point than water, it would vaporize first. Then, as this vapor cooled, it condensed back into liquid form. This distillate made a considerably more potent beverage. In fact, beverages of quadruple potency now became possible. These were known as “distilled spirits” or “liquors,” referring to the essence of the wine.

Aqua Vitae: The Water of Life

What is this drug which has been called by some the “water of life” – *aqua vitae*, in scholastic Latin, or *ambrosia*, the nectar of the gods – and “the corrupter of youth” and the “devil's own brew” by others? Ethyl alcohol or ethanol (whose chemical formula is C_2H_5OH) is a clear, colorless liquid with little odor but a powerful burning taste. Ethanol is just one of many alcohols such as methyl (wood) and isopropyl (rubbing) alcohol. All others are poisonous and cannot be metabolized by the body.

In addition to ethanol and water, alcoholic beverages generally contain minute amounts of substances referred to as “congeners.” Many of these chemicals are important to the flavor, appearance, and aroma of the beverage. Brandy, for example, is relatively rich in

congeners while vodka contains relatively few. Alcoholic beverages differ in strength. Beer generally has an alcoholic content of 5 percent; malt liquors are slightly higher. Natural wine varies in alcoholic content between 6 percent and 14 percent. Fortified wines – i.e., those that have had additional alcohol added – contain between 17 percent and 20 percent alcohol. Liquor or spirits contain approximately 40 percent ethanol. The common designation of “proof” originated centuries ago in Britain as a test for the potency of a beverage. To accomplish this test, if gun powder saturated with alcohol burned upon ignition, this was taken as “proof” that the liquor was more than half pure alcohol. In the United States, proof is calculated as being roughly twice the proportion of ethanol by unit volume of beverage; for example, an 86-proof Scotch is 43 percent alcohol.

Although the relative strengths of the beverages differ, current standard portions that are consumed actually provide the same amount of ethanol to the drinker. For example, the same quantity of alcohol is consumed if someone drinks either a 12-ounce can or bottle of beer, a three- to four-ounce glass of wine, or a mixed drink made with one and one-half ounces (i.e., one shot) of distilled spirits. Thus, the claim that “I don’t drink much alcohol, but I do drink a lot of beer” is simply not true.

Alcohol’s Effects

Unlike most other foods, alcohol is absorbed directly into the bloodstream without digestion. A small amount passes directly through the stomach lining itself; most, however, progresses on to the small intestine, where it is almost entirely absorbed. The feeling of warmth that one experiences after taking a drink results from the irritating effect that alcohol has on the tissues of the mouth, esophagus (food-tube), and stomach. Alcohol does not become intoxicating until the blood carrying it reaches the brain. The rapidity with which this occurs is in large measure determined by the condition of the stomach. An empty stomach will facilitate the absorption of the alcohol, while a full stomach retards it. To some degree, the type of beverage consumed has an effect on absorption, as well. Beer, for example, contains food substances which tend to retard this absorption.

Drinks which are noticeably carbonated – such as champagne – seem to “quickly go to one’s head,” since the carbon dioxide facilitates the passage of alcohol from the stomach to the small intestine.

Alcohol is held in the tissues of the body before it is broken down (i.e., metabolized), like any other food or chemical substance. The body metabolizes alcohol at a steady rate, with the individual being able to exercise virtually no control over the process. Therefore, a healthy man who weighs approximately 160 pounds, drinking no more than three-fourths of an ounce of distilled spirits every hour, could consume more than a pint in a day’s time without experiencing any marked intoxication. If the same quantity was consumed over an hour or two, however, the person would be very drunk. Today, much research is directed at finding an “antidote” for alcohol: a chemical that would either break down the alcohol itself, or accelerate the body’s metabolic process. Although several promising lines of research are under way, it will likely be many years before something is commercially available. Finally, the belief that black coffee (i.e., caffeine) is an “antidote” is without fact. What the caffeine does do, however, is to stimulate the drinker – the intoxicated person is still “drunk,” but he or she may, after several cups of black coffee, feel more awake.

Ethanol is broken down (metabolized) by the liver. In experiments, animals have had their livers removed, and then were given ethyl alcohol. The alcohol remained, much like wood (methyl) alcohol, in their bodies without being metabolized and exhibited the toxic effects – such as nerve damage – brought on by unpotable alcohols. How does this process work? The liver produces and holds the enzymes responsible for alcohol metabolism. Once in the liver, alcohol combines with its enzymes. Alcohol is initially transformed into acetaldehyde, a chemical considerably more toxic than alcohol. Almost instantaneously, other enzymes convert the acetaldehyde into acetic acid (the same compound that constitutes vinegar), an essentially innocuous substance. The acetic acid is then further metabolized into carbon dioxide and water. Interestingly, one of the treatment strategies for managing alcoholism employs this metabolic process itself. In it, disulfiram (Antabuse), a chemical which compromises the body’s capacity to convert acetaldehyde to acetic acid, is used as an adversive agent. By itself, disulfiram has little effect on a

patient who takes a daily dose of it. If alcohol is consumed while disulfiram remains in the body, the produced acetaldehyde collects quickly, much to the great discomfort of the drinker. The patient is warned of this unpleasant effect, and the consequent fear of it can help increase his or her motivation to abstain from alcohol.

Alcohol does have some nutritional value. The primitive brews and concoctions were probably richer in nutritional value, especially carbohydrates, vitamins, and minerals, than the highly refined beverages we consume today. Alcohol itself is a rich source of calories which are converted into energy and heat. An ounce of whiskey, for example, provides approximately 75 calories, the equivalent of a potato, an ear of corn, a slice of dark bread, or a serving of pasta. The caloric content of mixed drinks is greater, since the sweeteners of the mixer provide additional calories. These extra calories are, of course, fattening, if the drinker does not reduce his or her intake of other foods.

The fact that alcohol provides sufficient calories for subsistence provides an additional health hazard. Many heavy drinkers express a preference to “drink their meals.” While alcohol does provide calories, other nutrients, such as proteins, vitamins, and minerals vital to health and well-being, are entirely lacking. These heavy drinkers often suffer from chronic malnutrition and vitamin-deficiency diseases. In fact, adult malnutrition apart from heavy drinking is extremely rare in the United States.

Alcohol exerts its most profound effects on the brain. The observable behavior produced by drinking is as much a result of the social situation in which a person drinks as it is the drinker’s mood and expectations about what the drinking will do and the actual quantity of alcohol consumed. For example, after drinking the identical quantity and type of beverage, one might experience euphoria or depression, while another may feel full of energy or simply wish to sleep; or a drink found initially stimulating might encourage sleep. Pharmacologically, alcohol is a central nervous system depressant drug. Currently, neuroscientists are studying the operation of specific biochemical mechanisms, but some research has suggested that alcohol acts most directly on those portions of the brain which control sleep and wakefulness.

The amount of alcohol within a person is conventionally described as Blood Alcohol Content

(BAC). This measures the proportion of alcohol that might be found within an individual’s bloodstream and can be assessed by analyzing body substances such as blood, breath, or urine. Although, as we mentioned, the effects vary by both drinking situation and the experience that the drinker has had, we can roughly expect to see some of the following occur. After two or three drinks in a short period of time, a person of about 160 lbs. will begin to feel the effects of the drug. These include feelings of euphoria, freeing of inhibitions, and perhaps impaired judgment. Such a person would have an approximate BAC of 0.04 percent.

If our subject has another three drinks in a short period, his or her BAC will elevate to around 0.1 percent. Now, besides affecting the higher centers of thought and judgment located in the cerebral cortex, the alcohol is beginning to act on the lower (more basic) motor areas of the brain. By law, in virtually all the states, this person would now be judged incapable of operating a motor vehicle and, if caught doing so, would be charged with Driving Under the Influence (DUI). The person would have some difficulty walking and appear to lurch somewhat; there would be noticeable decline in activities requiring fine hand-eye coordination; and one’s speech would be somewhat slurred.

At higher concentrations of alcohol, from 0.2 percent BAC and up (resulting from the consumption of at least 10 ounces of spirits), more of the central nervous system is affected. The drinker has difficulty coordinating even the simplest of movements and may need assistance to even walk. Emotionally, he or she appears very unstable and readily changes from rage to tears and then back again. At 0.40 percent to 0.50 percent BAC alcohol depresses enough of the central nervous system’s functions that the drinker may lapse into a coma. At concentrations of 0.60 percent BAC and above, the most basic centers of the brain – those that govern respiration – are so suppressed that death may occur.

Alcohol and Health

Abusive drinking has a profoundly negative influence on virtually every one of the body’s organ systems. This negative impact occurs directly through the irritating

and inflaming properties the drug has, and indirectly as an effect of alcohol's metabolism by the liver. Further, like many other drugs, tolerance (both physiologic and psychologic) to alcohol occurs. As such, one needs to drink more to achieve the desired effects. Naturally, the more one drinks, the greater the (potential and actual) damage caused by alcohol.

Alcohol irritates the lining of the stomach, which in turn causes an increase in the amount of gastric juices secreted. These irritate, inflame, and ultimately can chemically abrade the stomach's lining, causing ulcers. Alcohol can damage the small intestine itself, compromising the organ's ability to absorb nutrients, especially vitamins. Other organs that are involved in the digestive process, such as the pancreas, are damaged as well; adult-onset diabetes is typically linked to abusive drinking.

Because the liver is responsible for metabolizing the alcohol consumed, it is this organ which is most affected. Not only is the liver abused by the irritating and inflaming properties of alcohol, but, as it metabolizes the drug, proteins broadly described as "free fatty acids" are released. These settle throughout the liver and other internal organs, ultimately compromising their function by blocking blood and other vessels. The livers of alcohol abusers are characterized by fatty deposits, dead and dying tissues, and evidence of scarring. Ultimately, the organ may be so compromised that it fails entirely, and death follows.

Although there is support for the notion that very moderate alcoholic consumption – i.e., never more than two glasses of wine a day – has healthful benefits, heavy drinkers have increased rates of cardiovascular

problems. Heart disease is more prevalent among this group – who are more likely to be heavy cigarette smokers as well – than the general population.

Chronic abuse of alcohol can have disastrous effects on the central nervous system. Alcohol is a tolerance-producing and ultimately addicting drug. For the addicted person, withdrawal distress can be life threatening. Longer term, permanent damage can include dementia, profound memory loss, the inability to learn, and impaired balance and coordination. Alcoholic people have higher rates of depression, suicide, and evidence of other mental illnesses.

Alcohol abuse is linked with automobile accidents, especially among adolescents. It is estimated that almost one-half of fatal crashes involve drinking. Other accidents, drownings, burns, and trauma are strongly associated with drinking. Drinking has been associated with violence, especially domestic violence and child abuse. Finally, when consumed by a pregnant woman, alcohol can cause profound damage to the fetus. Babies born suffering from fetal alcohol syndrome are less likely to survive, more likely to fail to thrive, and manifest both physiologic and psychologic developmental problems.

Alcohol, humanity's oldest domesticated drug, is also one of its greatest enemies. In the United States, we estimate that there are almost 10 million alcohol dependent or alcoholic people and perhaps twice that proportion of "problem drinkers." We estimate that each year alcohol abuse costs our nation well in excess of one hundred billion dollars in terms of loss, health care, and decreased productivity. We do pay a large personal and societal price for this chemical comfort.

Questions

- 1 If the need and desire to alter our consciousness is as powerful and permanent as the in-born drives of self-preservation, hunger, and security, what does this mean for the success of US prohibitionist drug policy?
- 2 Given the psychoactive properties and negative impacts of abusive drinking, if alcohol were introduced as a new drug today, would it be legal? Why or why not? Where might it be placed on the five schedules?
- 3 According to the article, alcohol abuse is linked with automobile accidents. What about our society's cultural and spatial landscape contribution to drinking and driving?