Alcohol and Health

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This paper was originally presented at the MBAA 112th Anniversary Convention, Keystone, Colorado, 1999.

ABSTRACT

Considerable research continues to be published regarding the effects of the consumption of alcohol beverages on health, and the topic has an obvious far-reaching impact on the brewing industry. This generates opinionated debate as people become quite polarized in their personal views of alcohol beverages and health. On one side, the detrimental effects of alcohol beverage misuse and abuse on an individual and on society as a whole are used to justify a view of increased regulation and neo-prohibition. On the other side, the beneficial effects of responsibly and moderately consuming alcohol beverages are used to support a view that alcohol beverages should be part of our nutritional diet. These conflicting views leave the average consumer confused as to the true impact of ingesting alcohol beverages on individual health. The objective of this paper is to summarize existing medical research on the health effects of consuming alcohol beverages and to suggest practical guidelines in helping define appropriate use. Criteria are suggested for use in determining an individual’s susceptibility to problems with the consumption of alcohol beverages. Specific attributes that might be considered for beer as a preferred alcohol beverage are also presented.

Keywords: alcohol, drinking, health, moderation, education

INTRODUCTION

Alcohol has been a part of man’s life since the beginning of recorded time. The pleasures of drinking alcohol, as well as problems with drunkenness and irresponsible consumption, have been described throughout history. Alcohol is an important, yet variable, part of culture, religion and society. Norms on alcohol are diverse, emotionally loaded, and often contradictory. Throughout history, there have been times when alcohol has been regulated, controlled and even prohibited. Government taxation of alcohol beverages has been used as an instrument to raise revenue.

The opinions of the impact of alcohol range from a harmless source of relaxation and enjoyment to a demon responsible for serious health and social consequences. To some people, prevention of alcohol abuse means the implementation of restrictive controls over availability or outright prohibition. These neo-prohibitionists believe that the substance itself is responsible for alcohol abuse. By prohibiting alcohol, the neo-prohibitionists think that many of the problems associated with alcohol abuse will disappear. Prohibition has been tried in the U.S. and in other countries, in many instances with serious enforcement issues and less than expected impact on alcohol-related problems. To other people, the use of alcohol is considered to be a

SINTÉSIS

Se continúa publicando una considerable cantidad de investigación con respecto a los efectos del consumo de bebidas alcohólicas en la salud y el tema tiene obviamente una impacto profundo en la industria cervecera. Esto genera un debate apasionado ya que la gente se vuelve bastante parcial en cuanto a sus opiniones personales sobre bebidas alcohólicas y la salud. Por un lado, los efectos perjudiciales del mal uso y abuso de las bebidas alcohólicas en un individuo y en la sociedad en conjunto, se usan para justificar una opinión de mayor regulación y neo-prohibición. Por otro lado, los efectos benéficos del consumo responsable y moderado de bebidas alcohólicas se usan para apoyar una opinión de que las bebidas alcohólicas deberían ser parte de nuestra dieta nutritiva. Estas opiniones conflictivas confunden al consumidor promedio en cuanto al verdadero impacto del consumo de bebidas alcohólicas en la salud del individuo. El objetivo de este documento es el resumir la investigación médica existente de los efectos en la salud del consumo de bebidas alcohólicas y el sugerir normas prácticas para ayudar a definir el uso apropiado. Se sugieren criterios para usarse en la determinación de la susceptibilidad del individuo a problemas por el consumo de bebidas alcohólicas. También se presentan atributos específicos que pueden ser considerados en el caso de que la cerveza sea la bebida alcohólica preferida.
responsible part of the diet and is integrated into daily living. The moderate and appropriate consumption of alcohol is considered to be the responsibility of the individual, similar to the responsibility and consequences of other personal behaviors. For people of this opinion, the consequence of behavior, more than the substance alcohol, is considered to be the cause of alcohol-related problems. The average individual is confused over weighing these somewhat conflicting views in establishing personal decisions about alcohol.

No original research is presented here; rather, the objective is to present a review from a lay person’s perspective of current research on alcohol, its use and abuse, and drinking patterns. The scope of this paper is limited to alcohol itself; the influence of other compounds unique to the type of alcohol beverage is also important but is not presented here. The medical community has spent considerable effort to research, investigate, and treat alcohol-related issues. The alcohol beverage industry, as well as the consumer, is faced with a substantial amount of scientific research and literature to find answers to questions about alcohol use and misuse. There is, of course, the realization that some individuals who should not drink any alcohol have been identified. But for the vast majority of individuals, drinking alcohol can be an enjoyable experience with some positive health benefits if done in the proper setting and in appropriate moderation. A call to action is necessary for further education to inform as many people as possible about the impact of alcohol on health, which is based on research rather than emotion. Education is a critical aspect of informing people about the interaction of alcohol with health, and is vital in helping individuals make decisions about alcohol and behavior.

"Honest education about the nature and effects of alcohol, combined with instilling norms about the limits of appropriate and inappropriate behavior, serves as a kind of 'immunization' against drinking problems." [31]

The drinking patterns and consequences are summarized here in a format that can be understood and used by many others without having to review the immense amount of published literature. Armed with this information, individuals will hopefully recognize their responsibility for appropriate drinking patterns and the associated consequences as well as potential benefits.

**SOCIAL ASPECTS**

Drinking alcohol is a pleasurable activity and is predominantly associated with sociability and hospitality. Alcohol is widely accepted as important to social interaction, social integration and even bonding. Alcohol has the capacity to put people in the mood for excitement, joviality and relaxation. Drinking is frequently a part of special occasions and the celebration of key events. Drinking alcohol is often a marker separating the boundary between labor and leisure, public and private times, and the workplace and home. The drink is a signal for an important change of pace or venue [28]. Alcohol can be enjoyed by the majority of people and is readily metabolized when consumed in moderate quantities. This can reduce fatigue, ease stress, enhance sociability and make life a little more pleasant [31]. It is when alcohol is misused that significant problems arise.

**CULTURE, SOCIAL AND FAMILY NORMS**

The norms of a culture have significant impact on individual behavior with regard to drinking alcohol. The socioeconomic status of an individual has been shown to correlate with the way in which the person drinks alcohol. Religion is a powerful predictor of drinking patterns and people can be significantly motivated by spiritual systems [65]. Legal consequences can alter drinking behavior. Social pressures, especially from friends, are powerful in manipulating an individual’s drinking behavior. The influence of personal environment, particularly the early family experience, can leave a lasting impression about alcohol. Social and family norms that allow for acceptance of safe and moderate alcohol consumption, respect for abstinence, and disapproval of abuse are most likely to foster a healthy environment for an individual’s decision about appropriate alcohol use [19]. Reinforcement of healthy norms by family and friends are likely to be more effective in the long run than increasing emphasis on social norms such as legal and regulatory controls [30].

**DRINKING PATTERNS**

The basis of alcohol policy in the past has been the assumption that average per capita consumption directly correlates with a wide range of health and social problems. Actually, considerable research has shown that patterns of drinking are a better predictor for alcohol-related problems. There is substantial evidence indicating that drinking patterns - the way a person drinks, the amount and frequency of drinking, and the number of heaviest drinking days - have a significant impact on health and social consequences [27]. Health, social and demographic patterns related to alcohol misuse are significantly predicted by heavy drinking patterns rather than aggregate level of consumption [53, 66, 71]. Binge drinking and drinking to intoxication are associated with acute consequences, particularly for light drinkers who occasionally drink excessively [32, 67].

**ALCOHOL USE AND MISUSE**

Alcohol interacts with the function of many different nerve cells, and therefore has diverse and profound effects. There are specific individuals at greater risk for alcohol abuse and dependence based on environmental and cultural risk factors, biomedical and genetic risk factors, and psychological and developmental risk factors. Alcohol dependence can be compared to other forms of addictive behavior.

**Dependence Signals**

Alcohol abuse is generally characterized as repetitive patterns of drinking, not necessarily involving heavy drinking patterns, with adverse consequences. There are signs that a person potentially has an alcohol dependence problem that are not necessarily related to chronic heavy drinking patterns [1, 38, 77]:

- impaired control over alcohol intake
- alcohol withdrawal symptoms
- increasing tolerance for alcohol
- continuing to drink despite significant social consequences, health consequences, and alcohol-related problems
- impaired ability to fulfill responsibilities
- negative effects on social/interpersonal functioning
Gender

On the average, males drink more often, tend to drink more, and have more alcohol-related problems than females. Females tend to develop higher blood alcohol concentrations than males when they consume equal quantities of alcohol, even when taking into account body weight, body water and body fat. Females tend to metabolize alcohol more slowly than males, possibly due to slower gastric alcohol metabolism. Females who develop alcohol problems tend to start abusive drinking later in life than males with similar problems. Females have increased risk of developing health complications from excessive drinking.

Fetal Development

The effects of alcohol on the fetus are acutely harmful and can lead to fetal alcohol syndrome (FAS). Effects of FAS range from subtle behavioral difficulties to significant physical birth defects and mental impairment. Research indicates that women who are pregnant or are trying to conceive should abstain from alcohol use because of the risk of these consequences.

Underage

Exposure to alcohol in underage drinkers disrupts the normal development of the immune system. Underage binge drinking with more than 5 consecutive drinks at least once in the prior 2 weeks occurs at alarming rates for teenagers – up to 28% of high school seniors from one survey. Alcohol use frequently coincides with other high risk behaviors such as tobacco use, illegal drug use, sexual activity, depression, suicide or other anti-social behaviors, school problems and vehicle safety.

Youth with high risk behaviors have distinctive traits: 
- poor impulse control
- inability to form close relationships
- inability to concentrate
- lack of self-reliance and confidence
- tendency to withdraw under stress
- difficulty in negotiating the transition into adulthood

Protective factors that have been identified to help prevent adolescent high risk behaviors, including alcohol abuse: 
- a caring and nurturing adult, strong family support
- high and realistic expectations by significant adults
- opportunities for meaningful participation in school or community

Young Adults

Young adults aged less than 30 abuse alcohol more than older people aged greater than 50. The highest alcohol consumption rate is among young adults from drinking age (as low as 18) to mid 30’s. This age group has drinking patterns associated with a higher proportion of alcohol abuse problems and severe consequences including alcohol-related traffic fatalities.

Aging

The ability to metabolize alcohol decreases with age. Changes occur as people age which tend to limit excessive alcohol consumption. Moderate alcohol use may improve quality of life by reducing stress and risk of heart attack. However there is also higher risk due to increased susceptibility to the depressant effects of alcohol.

Ethnic Minorities

Ethnic and cultural influence affect heavy drinking and alcohol related problems:
- Comparing 1990 with 1984 U.S. national surveys indicates heavy drinking and resulting social consequences have significantly decreased for the U.S. White population, but have not significantly decreased for U.S. Hispanic and Black populations.
- Some specific research indicates American Indian veterans have significantly higher alcohol dependence than other veterans, and Japanese men have much higher average alcohol consumption than Japanese-American men.

Genetics

Genetics plays an integral role in increased risk for alcohol dependence, although there is an interaction between biological and environmental factors. First degree relatives of an alcohol dependent family, and especially sons of alcoholic fathers, are much more likely to have an alcohol dependence problem. Research continues on identifying the gene(s) responsible for a pre-disposition to alcohol dependence. The ability to metabolize alcohol is a genetic trait. Two primary enzyme groups are involved in the metabolism of alcohol. The first, alcohol dehydrogenase, breaks down ethanol into acetaldehyde. The second, aldehyde dehydrogenase, breaks down ethanal into acetate, which then breaks down into CO2 and water.

Alcohol Sensitivity

People vary widely in their reaction to alcohol. Individuals with a lower intensity reaction to alcohol might drink more to achieve the same pleasurable and activating effects as those highly sensitive to alcohol. Also, these individuals may have higher risk for alcohol problems because they lack effective feedback mechanisms, especially for recognition of the sedating and illness effects of high levels of alcohol consumption.

Stress

The pleasurable effects, including the reduction of tension and anxiety, are both the reward and reinforcement for alcohol consumption. People are at higher risk for alcohol problems if drinking significantly reinforces a reduction in stress. The extent to which alcohol and stress are related is complex, and is
dependent on the nature of the stressor. Alcohol consumption followed by stress may interfere with the individual’s ability to appraise the nature of the stressor. Alternately, occurrence of the stressor before alcohol consumption can heighten the stress response by impairment of coping strategies [59]. Females implicated in early childhood victimization are at extremely high risk for alcohol problems [60].

Expectations
Compared to moderate drinkers, heavy drinkers anticipate a greater benefit from alcohol consumption that is focused on the arousing and positive effects of drinking. People who may have alcohol problems have a high expectation that drinking alcohol is necessary to feel relaxed or to have fun with friends [125].

Personality Traits
Some of the personality traits that have been linked with alcohol abuse and dependence, particularly in adolescents and borderline personalities, include: [44, 64, 75]

- emotionality
- anxiety and depression
- sense of inferiority
- self-indulgent tendencies
- aggressiveness
- impulsiveness, novelty seeking, sensation seeking
- unconventionality
- over-activity and being anti-social

Alcohol and Health Review
The impact of drinking patterns on overall health is complicated and subject to debate. For example, research has shown that light to moderate drinkers may or may not have mortality rates and longevity different than abstainers [112, 16, 17]. Heavy drinking has negative effects on all areas of the body: liver, brain, pancreas, cardiovascular system and immune system. The relationship between drinking patterns and consequences has been researched for many specific health issues. A few serious health problems, such as liver disease, increase exponentially with alcohol consumption. The effects of drinking alcohol on many health issues, such as hypertension, can have a linear relationship. There are some beneficial health consequences, notably a decrease in cardiovascular disease, associated with moderate alcohol consumption. This relationship is one in which moderate drinkers have lower health risk than both abstainers and heavy drinkers, known as a “U” or “J” shaped relationship.

The assignment of drinking patterns and the associated consequences, although somewhat subjective, are summarized in Table format. The characteristics associated with light, moderate and heavy drinking are summarized in Table 1. Unacceptable drinking patterns and consequences are summarized in Table 2 and Table 3 respectively. Research results indicating debatable or borderline consequences are summarized in Table 4. Acceptable drinking patterns and consequences are summarized in Tables 5 and 6 respectively.

The overall results of alcohol research are clear: Excessive drinking, binge drinking and heavy drinking lead to acute health and psychological distress. Moderate and responsible drinkers do not encounter these severe consequences, and may in fact gain some positive benefits.

<table>
<thead>
<tr>
<th>TABLE 1 Consensus on Alcohol Consumption and Health</th>
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<tbody>
<tr>
<td><strong>Consumption (drinks)</strong></td>
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<tr>
<td><strong>(Blood Alcohol Content)</strong></td>
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<tr>
<td>Low Level</td>
</tr>
<tr>
<td>(&lt; none - 1 daily)</td>
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<tr>
<td>Moderate Level</td>
</tr>
<tr>
<td>(&lt; 1 - 2 daily and in appropriate circumstances)</td>
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<tr>
<td>High Level,</td>
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<tr>
<td>Episodic</td>
</tr>
<tr>
<td>(&gt; 5 daily or on an intense occasion)</td>
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</table>

Note: One drink is defined as containing ~ 12 grams ethanol = one 12 oz. beer

BAC Factors: rate of alcohol intake, genetics, weight, lean body mass, gender, age, health

<table>
<thead>
<tr>
<th>TABLE 2 Patterns of Unacceptable Drinking</th>
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<tbody>
<tr>
<td>• Drinking beyond permissible limits, inexperienced drinking.</td>
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<tr>
<td>• Excessive drinking (&gt; 5 drinks daily), binge drinking (&gt; 5 drinks in any one intense occasion), and drinking with the intention of getting drunk</td>
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<tr>
<td>• Encouraging others to drink irresponsibly</td>
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<tr>
<td>• Not willing to seek help if needed, unwilling to relearn behaviors</td>
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<tr>
<td>• Drinking alcohol if you or your family have a genetic predisposition to alcohol dependence</td>
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<tr>
<td>• Drinking alcohol if you don’t have enzymes to break down alcohol</td>
</tr>
<tr>
<td>• Drinking alcohol if you have a low reaction to alcohol’s effects</td>
</tr>
<tr>
<td>• Expectation that alcohol is needed to feel relaxed or to have fun</td>
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<tr>
<td>• Children, teenagers and underage adults should abstain from drinking alcohol</td>
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<tr>
<td>• Women who are pregnant or trying to conceive should not consume alcohol</td>
</tr>
<tr>
<td>• Do not consume alcohol before driving or operating machinery</td>
</tr>
<tr>
<td>• Alcohol taken with aspirin [55] and some ulcer drugs, i.e., cimetidine [61], disables alcohol dehydrogenase enzyme and increases blood alcohol concentration. Alcohol taken with Tylenol can place additional strain on the liver</td>
</tr>
<tr>
<td>• Alcohol with tranquilizers, sleeping pills, barbiturates or illicit drugs is a lethal combination</td>
</tr>
</tbody>
</table>
Alcohol initially encourages sleep but reduces overall sleep and
20 - 30
At levels of alcohol consumption of more than
grams
Vitamin loss and induced malnutrition, susceptibility to systemic
diseases and depression of the immune system
Difficulties with attention, intellectual memory, concept shifting,
abstract thinking, problem solving, and serious brain disorders –
destroys memory (Korsakoff’s syndrome)
Liver disease, cirrhosis and incapacitation
May increase pancreatitis
Significant sexual dysfunction
Cessation of drinking produces withdrawal symptoms such as
anxiety, tremors, hallucinations and seizures [19]
Difficulties with family members and friends
Job-related problems, legal troubles, behavioral problems and
financial difficulty
Greatly increased probability of harm [161 – abuse, violence,
serious accidents, critical injuries and casualties
Significant sexual dysfunction [78]
Liver disease, cirrhosis and incapacitation
Increased risk of hypertension
Increased risk of sudden death secondary to stroke
Increased risk of hemorrhagic stroke (rupture of artery in
the brain) [12, 71]
Increased coronary artery disease
Increased risk of gastritis (inflammation of the stomach)
Increased risk of esophageal cancer
Vitamin loss and induced malnutrition, susceptibility to systemic
illness, infectious diseases and depression of the immune system
[11, 43]
Difficulties with attention, intellectual memory, concept shifting,
abstract thinking, problem solving, and serious brain disorders –
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There are multiple patterns of alcohol use, which lead to associ­
ted health and social consequences. Alcohol dependence,
excessive drinking, and binge drinking have negative conse­
cquences for individuals and for society. A moderate and respon­
sible pattern of drinking, which is practiced by the vast majority
of individuals, can have a positive outcome on health and well­
being. There continues to be a need for education toward the
healthy use of alcohol [152]. The best advice for individuals might
be expressed [15] in the maxims at the Temple of Apollo at
Delphi: Know thyself and nothing to excess.

**TABLE 3**
Consequences of Unacceptable Drinking
- Leads to confusion, incoordination, sedation, impaired cognition,
  coma and sometimes death [19]
- Significantly increased risk of alcohol dependence [148]
- Tolerance to alcohol’s effects, leading to craving and dependence
- Cessation of drinking produces withdrawal symptoms such as
  anxiety, tremors, hallucinations and seizures [19]
- Difficulties with family members and friends
- Job-related problems, legal troubles, behavioral problems and
  financial difficulty
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  illness, infectious diseases and depression of the immune system
- Difficulties with attention, intellectual memory, concept shifting,
  abstract thinking, problem solving, and serious brain disorders –
  destroys memory (Korsakoff’s syndrome)

**TABLE 4**
Borderline Consequences of Drinking
- At levels of alcohol consumption of more than 20 – 30 grams
  per day, individuals are likely to accumulate some risk of harm [21]
- Caution should be exercised when drinking alcohol and attempting
to perform complex mental activities
- Caffeine and ethanol consumed together can significantly
  reduce sleep
- Alcohol initially encourages sleep but reduces overall sleep and
  causes restlessness by reducing REM sleep time (which is
  necessary for learning procedural tasks)
- Alcohol stimulates sexual desire but takes away performance
  capability
- Sensitivity to alcohol increases with age so the amount of alcohol
  consumed should be reduced
- Females are more sensitive to alcohol because of genetic differences
  in alcohol metabolism enzymes
- May increase risk of breast cancer in women
- May increase risk associated with smoking for cancers of the
  mouth, pharynx, and larynx
- May increase risk of colorectal cancer [24]
- May increase pancreatitis [20]

**TABLE 5**
Acceptable Drinking Patterns
- Drinking 1-2 drinks daily or on any one occasion
- With properly functioning enzymes, the liver can detoxify 15 – 20
  grams of ethanol in one hour (approximately 1 drink)
- Drinking during appropriate social and relaxation times
- Drinking with some food in the stomach to slow alcohol
  metabolism [13]
- Riding with a designated driver when drinking moderately
- Accepting personal responsibility for one’s drinking patterns and
  behaviors
- Recognizing there are differences regarding alcohol effects
  among individuals
- Encouraging and modeling acceptable drinking behaviors [26]
- Developing and practicing behaviors to resist social and peer
  pressure for unacceptable drinking patterns
- Developing good diet, health and life style practices

**TABLE 6**
Beneficial Consequences of Acceptable Drinking
- Leisure and time out activity
- Pleasurable and stimulating activity that enlivens social activities
  and enhances relaxation
- Can enhance and sustain quality of life
- Increase in blood levels of high density lipoprotein
  (HDL - “good cholesterol”) [141]
- Decrease in clotting factor activity and reduced platelet
  activation [157]
- May lower the risk (as much as 35% compared to abstainers) [130]
  of coronary heart disease, atherosclerosis (clogged arteries) and
  heart attacks [53]
- May reduce risk of ischemic stroke (occlusion of blood vessel in
  brain from embolism – blood clot) [173]
- May reduce psychiatric distress compared to abstainers

**CONCLUSION**

Many factors, including genetics, age and social norms among
others, influence drinking patterns and the effects of alcohol. There are multiple patterns of alcohol use, which lead to associ­
ted health and social consequences. Alcohol dependence,
excessive drinking, and binge drinking have negative conse­
cquences for individuals and for society. A moderate and respon­
sible pattern of drinking, which is practiced by the vast majority
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