REVIEW ARTICLE

Alcohol hangover- its effects on human body: Review

Loveleen Bajaj, Ranjeet Singh

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ABSTRACT

A hangover is a syndrome of physical and mental symptoms that occurs after 8 to 16 hours of consumption with a zero level of alcohol. The aim of the current study is to investigate the effects of the alcohol hangover. The impairing effects on memory functioning such as delayed recall, irritation, lack of concentration and after acute alcohol intoxication. Normally the body might use cytokines to trigger a fever of inflammatory response to battle infection leading to unpleasant effects include nausea, vomiting, dizziness, fatigue and hormonal imbalance in the body. Dehydration is believed to be the cause of hangover as it leads to anti diuresis state in the body. The most compelling theory that, at the moment, is that hangover results from a buildup of acetaldehyde, a toxic compound in the body. The congener amount in the particular alcoholic beverage is believed to be increase the extent of severity of hangover. Methanol, found in highest levels in whiskey and red wine has received a larger amount of blame for showing that it can linger in the body after all alcohol has been eliminated, perhaps accounting for the enduring effects of hangover.

Key Words: *Alcohol hangover; Headache; Tremulousness; Nausea; Diarrhea; Fatigue*

Alcohol hangover is defined as the changes that occur after the consumption and full metabolism of alcohol with sufficient severity to disrupt the performance of daily tasks and responsibilities. It is characterized by headache, tremulousness, nausea, diarrhea and fatigue combined with decreased occupational, cognitive or visual spatial performance. In addition, hangover characteristics may depend on the type of alcohol beverage consumed and the amount the person drinks (1). Typically, hangover begins within several hours after the cessation of drinking when a person's blood alcohol concentration (BAC) is falling. Symptoms usually peak about the time BAC is zero and may continue for up to 24 hours thereafter. Generally, greater the amount and duration of alcohol consumption the more prevalent is the hangover. A survey of Hardburg and colleagues on the prevalence of hangover found that approximately 75% of the subjects who drank to intoxication reported experiencing hangover at least some of the time.

In a study 2, 160 Finnish men, researchers found an association between increased weekly alcohol consumption and frequency of hangover. 43. 8% of group of harvest drinkers (who drank more than 106 g of alcohol per week or 9 drinks) reported experiencing a hangover over monthly or more often compared with remaining study subjects other reports, however claim that hangover occurs less often in heavy drinkers. Anes and collegues revealed that half of interviewed workers reported being at work while having a hangover. During hangover, workers felt significantly sicker, had conflicts or fights with co -workers and their supervisors, problems in completing the job and fell asleep at work. Reduced productivity is common when having hangover at work (2). Studies confirmed that beverage with higher congener content produce more severe hangover symptoms (3). Alcohol initially reduces the sleep onset latency and may increase total sleep time at low doses (0.16 g/kg) but not at a moderate or high dose. While the main cause of hangover symptoms is ethanol congeners may increase symptom severity (4). Laurell and Tornos obtained a 20% decrease in psycomotor ability in drive task at 3 hours after BAC reached 0 when a high dose was administered. Anderson and Dawson determined that the ability to drive was affected during hangover, evidenced by the inability to collocate the cognitive resources on the completing stimuli. Petros et al. investigated the possibility that hangover could induce effects only in some abilities necessary for flight performance (5). Overlap exists between hangover and symptoms of mild alcohol withdrawal (AW) leading to the assertion that hangover is a menifestation of mild withdrawal. Hangover, however may occur after a single bout of drinking, whereas withdrawal occurs usually after task performance and thereby increase the risk of injury.

LITERATURE REVIEW

Alcohol hangover develops when the blood alcohol concentration (BAC) returns to zero and is characterized by a feeling of general misery that may last for more than 24 hours (6). Several factors are known to be involved including acetaldehyde accumulation, changes in immune system and glucose metabolism, dehydration. Hangover is suggested to be early stage of alcohol withdrawal. Acetaldehyde, a breakdown product of alcohol metabolism, plays a role in producing symptoms. Chemicals formed during alcohol processing and maturation known as congeners increase the frequency and severity of hangover. Congeners may be produced along with ethanol during fermentation, generated during ageing or processing through the degradation of the beverage's organic components, or added to the beverage during production process. They contribute to taste, smell and also contribute to the flavor of the alcoholic beverage. Liquors such as brandy, wine, tequila, whiskey and other dark liquors containing congeners tend to produce severe hangover. Whereas the clear liquors such as rum, vodka, gin cause hangover less frequently (7). Alcohol dehydrogenase produces acetaldehyde which is toxic which is converted to acetic acid which is later converted to fatty acid and water. Also, alcohol dehydrogenase produces methanol (hangover causing congener) gets converted to formaldehyde and formic acid. The changes in central nervous system takes place in response to chronically administered depressant substances. These changes include alterations in two types of receptors embedded in nerve cell membranes. One type receptors binds with an important chemical messenger (i.e. neurotransmitter) called gamma aminobutyric acid (GABA) and other type binds with another neurotransmitter, glutamate. Both GABA and glutamate are critical in regulating nerve cell activity. Following chronic alcohol exposure, the body decreases (i.e. downregulates) the number or sensitivity of glutamate receptors in an effort to counterbalance alcohol's sedative effect. When alcohol is removed from the body the central nervous system and the portion of nervous system that coordinates responses to stress remain in unbalanced "overdrive" state. Thereby sympathetic nervous system hyperactivity accounts for tremors, sweating, tachycardia observed in both hangover and alcohol withdrawal syndrome. After being injested, ethanol is first converted to acetaldehyde by enzyme alcohol dehydrogenase and then to acetic acid by oxidation and egestion process. This reaction also converts (NAD+) to its reduced form NADH in redox reaction. By causing an imbalance of NAD+ (NADH redox system, alcoholic beverages make normal bodily functions more difficult.

Effects on human body

Ethanol has a dehydrating effect by causing increased urine production (diuresis), which could cause thirst, dry mouth, dizziness and may lead to an electrolyte imbalance. Studies suggest the genesis of alcohol hangover and are caused by dehydration effects (8). Hyperglycemia has been thought to play an important role in the pathogenesis of hangover. It is due to the inhibition of vasopressin released from posterior pituitary gland. During withdrawal from

Department of Food Science and Technology, Khalsa College, Amritsar, Punjab, India

Correspondence: Dr. Loveleen Bajaj, Department of Food Science and Technology, Khalsa College, Amritsar, Punjab, India. Telephone 0183-5015511, email bloveleen06@gmail.com

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alcohol vasopressin is released resulting in water retention (antidiuresis) (9). There have a few studies that proposed that dehydration itself is cause of memory impairment. There is significant relationship between immune factor and hangover severity is the most convincing factor studied. Drinking too much alcohol weakens the immune system, making body to much easily encounter a disease (10). An imbalance of immune system in particular of cytokine metabolism has been identified as playing a role in pathophysiology of the hangover state. Especially the hangover symptoms nausea, headache, and fatigue have been suggested to be mediated by changes in immune system. The concentration of several cytokines has been found to be significantly increased in the blood after alcohol consumption. It includes interleukin 12, interferon gamma and interleukin 10 (11). Drinking to intoxication can slow your body's ability to produce cytokines that ward off infections by causing inflammations. Chronic alcohol use reduces the ability of white blood cells to effectively engulf and swallow harmful bacteria. Alcohol jumbles the process of sending enzymes out to the small intestine to metabolize food. It causes the pancreas to secrete its digestive juices internally, rather than sending enzymes to the small intestine. These enzymes, as well as acetaldehyde–a substance produced from metabolizing, or breaking down to alcohol are harmful to the pancreas. Alcohol actually irritates stomach and intestine causing inflammation of the stomach lining and delayed emptying of the stomach contents. It also causes the production of more gastric acid alongside increasing the level of pancreatic and intestinal secretions (12). Any of these factors can result in upper abdominal pain, nausea, vomiting experienced during a hangover. Alcohol damages pancreatic cells and influence metabolic processes involving insulin. This process leaves the pancreatic open to dangerous inflammations. Acetaldehyde dehydrogenase produced during alcohol metabolism is chemically reactive substance that binds with proteins and other biologically important compounds. At higher concentrations, it causes toxic effects, such as rapid pulse, sweating, skin flushing, nausea, and vomiting. In most people, ALDH metabolizes acetaldehyde quickly and efficiently so that this intermediate metabolite doesn't accumulate in high concentrations, although small amounts are present in blood during intoxication. In some people, however, genetic variants of the ALDH enzyme permit acetaldehyde to accumulate. Those people routinely flush, sweat, and become ill after consuming small amounts of alcohol. Alcohol has sedative effects that can promote sleep onset, the fatigue experienced during a hangover results from alcohol's disruptive effects on sleep. Alcohol induced sleep may be shorter duration and poor quality because of rebound excitation. Alcohol relaxes the throat muscles resulting in increased snoring and possibly periodic cessation of breathing (i.e. sleep apnea). The higher the intake of alcohol, the shorter the corresponding sleep latency. Polysomnograpic assessments revealed that alcohol consumption decreased sleep efficiency and rapid eye movement sleep and increased weak time and next-day self-reported sleepiness. Hangover severity was worse in subjects with higher hangover severity scores had a reduced sleep time and spent less time in rapid eye movement sleep (13). Alcohol interferes with other biological rhythms as well, and these persist into the hangover period. For example, alcohol disrupts the normal 24 hours rhythms in body temperature, including a body temperature that is abnormally low during intoxication and abnormally high during hangover (14). Alcohol intoxication also interferes with circadian nighttime secretion of growth hormone which is important for bone growth and protein synthesis. In contrast alcohol induces the release of adrenocorticotrophic hormone from the pituitary gland, which in turn stimulates release of cortisol, a hormone that plays a role in normal circadian rise and fall of cortisol levels. Overall alcohol's disruption of circadian rhythms induces a "jet lag" that is hypothesized to account for some of the deterious effects of a hangover. Along with dizziness, nausea and anxiety, a hangover can cause the brain to function at a much lower rate of efficiency. Alcohol can actually slow the pace of communication between the neurotransmitters in the brain that are necessary for brain information translation to the rest of the body. The alcohol stimulates an inflammatory response to the immune system, which causes a lot of the characteristic signs of a hangover: the inability to concentrate, decreased appetite, and loss of interest in usual activities. It is found that increase of 30% of the performance error among hangover participants and overall 5%-10% drop in working memory (15). The memory retrieval processes are significantly impaired during alcohol hangover. Memory and psychomotor impairment during alcohol intoxication has been consistently reported. The impairing effects on memory retrieval processes are in line with those observed after observed after acute alcohol intoxication and those found in alcoholics (16). Alcohol can disrupt the sympathetic nervous system which among other things control the construction and dilation of the blood vessels in response to stress, temperature, exertion, etc. Heavy drinking and bingeing in particular can cause blood pressure to rise. Over time, this effect can become chronic. High blood pressure can lead to many health problems, including kidney diseases, heart diseases and stroke. Alcohol containing drinks can decrease the blood pressure of the body by widening of the blood vessels that supply to the brain. These changes can produce pain and sensitivity, resulting in headache. A negative mood before drinking alcohol can predispose some people to migraine headaches independent of what they drink. A headache may begin within few hours after drinking or starts after 16 hours later (17). Drinking seems to increase both systolic and diastolic blood pressure during intoxication but not during hangover. During the period when blood alcohol levels are decreasing, usually at night, both pressure levels fall to less than the basic level (18). Out of all the organs that are damaged by heavy alcohol use, the liver often suffers the most, typically through alcoholic hepatitis which involves swelling, pain and cirrhosis (irreversible scarring of liver) affects between 15%-30% of the people who abuse alcohol. Not only does alcoholic liver disease affect liver function itself, it also damages the brain. The liver breaks down most of the alcohol a person consumes. But the process of breaking alcohol down generates the toxins even more harmful than the alcohol itself. During this process, alcohol's byproducts damage the liver cells. These damaged liver cells no longer function as well as they should and allow too much of these toxic substances, ammonia and manganese in particular, to travel to the brain. These substances proceed to damage brain cells, causing a serious and potentially fatal brain disorder known as hepatic encephalopathy. Eventually, these problems can disrupt the body's metabolism and impair the function of other organs. Because the liver plays such a vital role in alcohol detoxification, it is especially vulnerable to damage from excessive alcohol. Alcoholism can cause a thiamine (vitamin B12) deficiency which can cause rapid eye movements, weakness or paralysis to eye muscles. Consuming larger quantities of alcohol on a regular basis can interfere with the amount of thiamine absorbed by the body by reducing thiamine uptake in the gut, and by preventing cells from absorbing adequate amounts of vitamin (19).

DISCUSSION

Alcohol has huge effect on the fetal development. It can affect the brain at any stage -even before birth. It occurs due to prenatal alcohol exposure. A range of problems called fetal alcohol spectrum disorders (FASD) can occur. FASD symptoms include baby's physical abnormalities, learning difficulties and emotional problems, can often last lifetime. It includes reduction in brain function and overall growth. For women the risk of breast cancer rises with alcohol use. Alterations of the somatic growth and specific minor inflammations are most characteristic (20). The central nervous system is greatly affected. It makes harder to talk, causing slurred speech. It also affects coordination, interfering with balance and ability to walk. In longer term, drinking can actually shrink the frontal lobes of the brain. Acute alcohol withdrawal can lead to seizures and delirium. And severe alcoholism can progress to permanent damage, causing dementia. Damage to nervous system can result in pain, numbness or abnormal sensations in feet and hands. Alcoholic neuropathy a form of nerve damage can produce a painful pins and needles feeling or numbness in the extremities as well as muscle weakness, in continence, constipation, erectile dysfunction can occur. Alcoholic neuropathy may arise because alcohol is toxic to nerve cells, or because nutritional deficiencies attributable to heavy drinking compromise nerve function. It can affect both movement and sensation. Symptoms range from slight discomfort to major disability. Areas of the body affected by alcoholic neuropathy are arms and legs, urinary and bowel, impotency, heart intolerance, vomiting, nausea, dizziness and impaired speech (21). Alcohol can cause blood sugar level to fall. If the blood sugar level dips to low fatigue, weakness, shakiness, mood disturbances and even seizures are experienced.

CONCLUSION

Hangover, a common disorder, has substantial morbidity and societal cost. Recent studies reveal that the alcohol hangover induces the disturbance in the electrolyte balance ultimately leading to dehydration. The imbalance in the immune system in particular of cytokine metabolism is identified playing an important role. The biological rhythms are also affected leading to disturbance in the sleep pattern. Alcohol actually slow down the pace of communication resulting in slurred speech, nausea, headache, etc. Hallucinations are experienced by one fourth of the alcohol dependents on withdrawal. Due to extreme reactivity, alcohol has the potential to affect virtually every organ or biochemical pathway in the human body. These adverse changes arise due to the extreme biochemical or chemical activity of ethanol itself or its reactive metabolite acetaldehyde. In addition to the biological effects of ethanol the psychological and socio-economic effects are devasting for patients in chronic alcoholism. The aim is to change the negative effect of congeners and other by products in such a way to stop the harmful effect on body.

CONFLICT OF INTEREST

None.

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