ASCENDANCY OF LIQUOR ON ATHLETIC ABILITIES AND RECUPERATION AMONG MALE ATHLETES

Dr. Biju Thomas, Associate Professor
Baselius College Kottayam) &
Mr. Faazil Mohammed Khan, Research Scholar
MG University Kottayam, Kerala

Abstract

Alcohol is one of the most widely used recreational substances worldwide. It is in fact deeply embedded in various cultures especially in western societies. The sports community too is not free from its influence. Many a times athletes consume more alcohol compared to the general public despite of its negative impact on sporting performance. While this recommendation may seem sensible, the impact alcohol has on recovery and sports performance is complicated and depends on many factors, including the timing of alcohol consumption post- exercise, recovery time required before recommencing training/competition, injury status and dose of alcohol being consumed. In general, acute alcohol consumption, at the levels often consumed by athletes, may negatively alter normal immunoendocrine function, blood flow and protein synthesis so that recovery from skeletal muscle injury may be impaired. Therefore people responsible for well being of athletes including themselves should be careful with the use of alcohol.Intrestingly, it is also noted that if athletes are to consume alcohol after sport/exercise, a dose of approximately 0.5 g/kg body weight is unlikely to impact most aspects of recovery and may therefore be recommended if alcohol is to be consumed during this period.

Keywords: Alcohol, Ethanol, Hydration, Protein Synthesis and immune function.

Introduction

World Health Organization (WHO) has certain limits for consumption of alcohol. It classifies safe or low levels of alcohol consumption as four standard drinks per day for males and two standard drinks per day for females, with a standard drink being classified as any beverage containing 8g of ethanol. However, the definition of a standard drink differs between countries; for example, in New Zealand and Australia a standard drink contains 10 g of alcohol whereas in Japan a standard drink contains 19.75 g of alcohol. The majority of countries listed in a review of international drinking guidelines defined a standard drink as containing between 8 and 14 g of alcohol. Above the safe levels recommended by the WHO, alcohol consumption becomes hazardous (4–6 or 2–4 standard drinks per day for males and females, respectively). Even larger amounts are classified as harmful and may significantly increase the risk of negative mental and physical health issues, such as a range of cancers, hypertension, stroke and injuries related to violence. In addition to hazardous, chronic alcohol consumption, heavy acute episodic or binge drinking, classified as the consumption of 60 g of alcohol in a single drinking instance is associated with significant physical, psychological and social harm. Approximately 16.5 % of the world's population is believed to engage in heavy drinking on a weekly basis.

Methods

An online research was done to find out details about the drinking habits of athletes and the acute effects alcohol may have on exercise, sports performance and recovery. Various available research works were analyzed to get an idea on the influence of alcohol on athletes. These studies consistently reveal that students involved or partly involved in sports not only drink alcohol more regularly, they also have a higher tendency to drink to get drunk and therefore binge on alcohol more often than those students with no involvement in sports [. Similarly, while French sporting students reported drinking less frequently than their peers in the general population, they reported more frequent instances of alcohol intoxication. A strong relationship was evident between sex and frequency of intoxication, with males more likely to be intoxicated on ten or more occasions in a year compared with the females surveyed. Regular, hazardous alcohol consumption has been found amongst sportspeople, both student and non-student, competing at all levels of competition, with at least half of those surveyed reporting regular hazardous, binge-drinking behavior. Given the rate of such behavior in the general population is approximately 16.5 % the results of these studies are cause for concern. Of note, hazardous drinking is typically most evident in males and team-sports participants, a fact supported by the high rates of hazardous alcohol use reported by males competing in contact team sports.

TABLE 1
STUDIES MEASURING THE INFLUENCE OF PRE-EXERCISE ALCOHOL CONSUMPTION PUBLISHED SINCE THE RELEASE OF THE AMERICAN COLLEGE OF
SPORTS MEDICINE'S POSITION STAND ON ALCOHOL AND SPORT.

S. No	Reference	Consumption	Measure of Performance	Effect
1	Poulsen et al	1.59 g and 1.48 g/kg BW for males and females respectively	Isometric and isokinetic strength	Nill
2	McNaughton and Preece	Breath alcohol of 0.01 mg/ml and 0.1 mg/ml	100-m run	No effect
			200-m run	Increased time (dose-dependent)
			400-m run	Increased time (dose-dependent)
			800-m run	Increased time (dose-dependent)
			1,500-m run	Increased time (dose-dependent
3	Kendrick et al	25 ml 10 min before and 30 min after the onset of exercise	Treadmill run at 80–85 % VO2max intensity	Three of the four subjects failed to complete the allocated time
4	Lecoultre and Schutz	0.5 g/kg lean BW	60-min cycling time trial	Decrease in total work done
5	Houmard et al	Breath alcohol below 0.5 mg/ml	5-mile treadmill time trial	Nill
6	Bond et al	0.88 ml/kg BW of 95 % ethanol	Maximal, progressive cycling test	Nill
7	Bond et al	0.44 ml/kg BW of 95 % ethanol	Maximal, progressive cycling test	Nill

**BW Body weight, V02 Maximal oxygen intake

The ACSM Position along with the findings of Lecoultre and Schutz , Kendrick et al. and McNaughton and Preece strongly suggest that low to moderate doses of alcohol do not positively influence performance; rather, they are likely to decrease endurance performance. It is less clear whether alcohol use impacts measures of strength, with the Position Stand reporting mixed results for measures of strength after alcohol consumption. Although alcohol may act at a number of locations important to force production within the central nervous system (CNS), the results of Poulsen et al. further suggest that muscular strength is not affected even at high doses.Given what is now known about the alcohol use of athletes, that they are more likely to consume alcohol after exercise, the findings of previous research, including the ACSM] Position Stand

and the subsequent research outlined above, seem to have limited application to much of the sporting population.

A close look at alcohol, recovery and subsequent performance

Studies into the effects of post-exercise alcohol use on recovery have mainly focused on factors that influence the recovery, or proxies for recovery, rather than checking whether a return to optimal performance is impaired by post-exercise alcohol use. For example, strategies such as rehydration, restoration of energy stores and accelerated injury repair are thought to be essential if optimal recovery is to be achieved. Whether or not these indirect measures help restoration of pre-exercise performance is debatable

Metabolic Recovery

While doing intense exercise, the liver and muscle glycogen stores may be reduced, while sweating can result in dehydration (fluid loss of 2–5 % body mass or greater) . Dehydration has been shown to impair performance
and hence adequate rehydration and restoration of electrolytes after exercise is important. Equally important is the recovery is the repletion of muscle glycogen. Optimal refueling strategies depend on the type and duration of exercise as well as the time between exercise bouts or events. It has been suggested that the best opportunity for optimising glycogen stores occurs when carbohydrate is consumed in the initial hours after exercise; after that time, glycogen storage rates decrease significantly. However, in many sports this period after competition may be spent consuming alcohol instead of following correct nutritional strategies.

Post Exercise Rehydration

The negative effect alcohol has on the restoration of fluid balance after exercise has been confirmed by Shirreffs and Maughan. A range of doses, equivalent to approximately 0, 0.24, 0.49 and 0.92 g of alcohol/kg body weight (BW), were utilized to investigate the effects of acute alcohol consumption on rehydration after dehydrating exercise. Only the highest dose was found to significantly increase urine output, reduce the recovery rate of blood volume and therefore delays recovery from the dehydrated state, suggesting that alcohol in dilute concentrations has little effect on rehydration.

Post Exercise Glycogen-Re-synthesis

Although the consumption of alcohol may impact hepatic gluconeogenesis, glucose utilization and glucose uptake into skeletal muscle, all of which could contribute to decreased performance if alcohol was consumed prior to exercise, it appears that alcohol has little or no effect on the re-synthesis of muscle glycogen after exercise. Burke and colleagues compared the effects of three recovery diets, two of which contained alcohol, on post-exercise muscle glycogen re-synthesis. Consumption of alcohol (1.5 g alcohol/kg BW) in conjunction with a high carbohydrate diet had no impact on post-exercise glycogen storage compared with a diet containing no alcohol.

Immune Function

Under normal circumstances, the innate immune system responds to trauma by initiating a complex inflammatory response. Acute alcohol exposure upsets the balance of normal inflammatory processes, resulting in a net shift towards an anti-inflammatory environment through selective alterations in cytokine activity. A major contributor to this altered immune state is the alcohol-induced down regulation or impairment of tumor necrosis factor (TNF)-a production. Such impairment results in a decrease in endothelial cell activation and therefore a reduction in the expression of cell adhesion molecules (CAMs), thus negatively affecting neutrophil–endothelial cell adhesion. Furthermore, without normal concentrations of TNF-a, the endothelium is unable to produce a number of pro- inflammatory molecules which usually act to magnify the inflammatory response. In addition, acute alcohol treatment also inhibits interleukin (IL)-1b and IL-6 expression, further limiting the pro-inflammatory response to trauma.

In addition to these acute alterations in immune function, which may negatively affect the outcome of skeletal muscle injury, the chronic use of alcohol at harmful or hazardous levels may further compromise the immune system so that an individual's susceptibility to illness and infection is greatly increased. It is possible that, when combined with acute and chronic alcohol-related changes to the immune system, the temporary immunosuppression associated with exercise may further reduce an athlete's ability to deal with illness. Further research is required to understand this relationship.

Skeletal Muscle Blood Flow

Absistance from alcohol is normally advised when injured. The evidence for this recommendation, however, appears to be mostly anecdotal, stemming from the known vasodilatory effect of alcohol. Evidence from animal studies suggests that changes in the normal response to trauma, including elevations in vasopressin, adrenaline and noradrenalin, are inhibited when alcohol is consumed prior to trauma. This inability to limit blood flow to the site of injury is likely to contribute to the increased edema that has been observed when alcohol is consumed prior to experimentally-induced trauma. Coupled with alterations in immune function, increased blood flow to the site of injury may increase the severity of the injury and impacts the rate and outcome of recovery.

Protein Synthesis

Acute alcohol consumption may impact skeletal muscle recovery via its effects on protein synthesis. Both whole body and skeletal muscle protein synthesis, but not degradation, have been shown to be altered by acute alcohol treatment in rats, with skeletal muscle protein synthesis decreasing by as much as 75 % for at least 24 h post alcohol treatment. In muscle, type II fibers appear to be more susceptible to alcohol than type I fibers. Similarly, in vitro studies have shown a decrease in protein synthesis through the alcohol- and acetaldehyde-mediated impairment of insulin-like growth factor (IGF)-1 and insulin. Whether these effects are seen in humans at physiological circulating alcohol concentrations is unknown.. Recently, Parr et al. investigated the effects of 1.5 g alcohol/kg BW, equivalent to 12 ± 2 standard drinks, on muscle protein synthesis after a bout of concurrent training. Even when nutritional status was optimized in the post-exercise period, alcohol consumption was found to impair normal post-exercise muscle protein synthesis. This finding suggests alcohol consumption, post-exercise, may impact recovery and adaptation negatively. Given the importance of protein synthesis in recovery and adaptation after strenuous exercise, there is considerable scope for further research in this area.

Endocrine Effects

As with the innate immune system, the acute consumption of alcohol has been shown to have a profound impact on the endocrine system; a summary of the acute effects of alcohol on a select number of hormones is presented in Table 2 Alcohol detrimentally impacts normal hormonal balance so that a range of factors, including sleep quality, mood, metabolism and cardiovascular function, may all be affected during and/or after alcohol consumption. Importantly for males, when consumed acutely in large doses (1.5 g alcohol/kg BW), alcohol has a negative effect on testosterone production which, together with an increased conversion rate of testosterone and androstenedione to their respective estrogens, leads to feminizing effects such as gynecomastia and testicular atrophy.

TABLE 2
THE EFFECTS OF ALCOHOL ON A SELECT NUMBER OF HORMONES, AND THE PHYSIOLOGICAL IMPLICATIONS OF THESE CHANGES

S. No	Hormone	Effect	Physiological Implication
1	Adrenaline	Increase	Increased heart rate, tachycardia, hypertension
2	Cortisol	Increase	Negatively affect reproductive function, increase blood glucose
3	Dopamine	Increase	May reinforce alcohol use
4	Estrogen	Increase	May have feminising effects on males
5	Human growth hormone	Decrease	May impact a number of biochemical process
6	Insulin	Increase	Hypoglycemia, if in a fasted state or if consumed with high carbohydrate food
7	Luteinizing hormone	Decrease	Decrease testosterone production
8	Melatonin	Decrease	Sleep fragmentation and disruption
9	Serotonin	Decrease	Aggression, dysphoria
10	Testosterone	Decrease	Decreased muscle function, osteoporosis, anaemia, decresed libido, impotence, infertility
11	Vasopressin	Decrease	Increase in urine output

Table 2 clearly shows the negative impact of alcohol on important hormones secreted by the body. This can have physiological as well as psychological effects on sports person. This can not only affect sporting performance but also day to day lives. For example, lowered melatonin means lack of proper sleep, similarly decrease in testosterone, an important male hormone can decrease muscle function and can badly affect libdo and with chances of infertility. Cortisol and Insulin also can have long lasting effects. It is not surprising to find a person who was once active in sports suffering from diabetes primarily due to less physical activity post retirement along with alcohol consumption. Similarly decreased serotonin can lead to aggression and dysphoria. This not only affects sporting performance but also day to day lives. Thus, we can see that alcohol has a negative effect on both physiological as well as mental wellbeing on sports persons.

Findings and Conclusion

Alcohol use by athletes often occurs during the post- competition period at hazardous levels in excess of those seen in the general population. Such behaviour may increase the athlete's risk of alcohol-related illness and other harm while also detrimentally altering normal endocrine and immune function. Particularly important for males, in both athletic and general populations, is the reduced production of testosterone and subsequent effects on body composition, protein synthesis and muscular adaptation/regeneration; these effects are likely to inhibit recovery and adaptation to exercise. Low doses of alcohol, approximately 0.5 g/kg BW, post-exercise are unlikely to be detrimental to repletion of glycogen, rehydration and muscle injury; however, the effects of alcohol are depen- dent on the timing of consumption, nutritional status and the priority given to optimal rates of recovery. Higher doses, around 1 g/kg BW, should be avoided if injury to skeletal muscle has occurred. While very high, hazardous doses of alcohol consumed after strenuous exercise may not directly impact performance in the days after exercise, such bingeing behavior is associated with long-term physical, psychological and social harm and should therefore be avoided; it should be remembered that alcohol is a poison and as such should be treated as one. While less likely to occur than drinking large volumes of alcohol after sports, the consumption of even low doses of alcohol prior to athletic endeavour should be discouraged due to the ergolytic effects of alcohol on endurance performance.

Future research should investigate the effects alcohol has on recovery and performance in female athletes as very little information currently exists on this topic. Further research into the effects of both chronic and acute alcohol consumption, at levels relevant to the athletic population, on adaptation to exercise, particularly protein synthesis, and immune function are required so a more complete recommendation can be made on the safe use of alcohol by athletes.

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