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EFFECTS OF ALCOHOL CONSUMPTION ON THE MOTOR PERFORMANCE OF COLLEGE –AGED ATHLETIC FEMALES

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ABSTRACT

Pecha TK, Sweere KM, Conlon KM, Peterson ME, Heldstab PJ. Effects of Alcohol Consumption on the Motor Performance of College-Aged Athletic Females. *Journal of Undergraduate Kinesiology Research* 2007;3(1):72-78. Alcohol is widely consumed by the collegiate population, including athletic females. **Purpose:** The purpose of this study is to determine the impact of alcohol consumption on the motor performance of athletic females. **Methods:** Subjects were 10 apparently healthy, active, college females over the age of 21. Subjects were randomized into two groups; one that participated in baseline testing first the other participated in hungover testing initially. Each subject participated in a baseline and hungover test of reaction time, grip strength, vertical jump, push-ups and 40-yard dash. **Results:** Our research found a significant decrease in the reaction time variable [M=-1.22, t(9)=-1.36, p=0.21]. There were no significant decreases in grip strength, vertical jump, push-ups and 40-yard dash performance. **Conclusion:** Based on our results, low to moderate alcohol consumption was not significant in decreasing the performance of grip strength, vertical jump, push-ups and 40-yard dash in college-aged athletic females. However, there was a significant decrement in reaction time performance. Although reaction time was the only significant decrease in performance, when applied to real life athletic situations all performance decrements can be practically relevant.

Key Words: Drinking, Sports, Athletes, Hangover, Intoxication

INTRODUCTION

Alcohol is the most widely used drug on college campuses especially among athletes[1]. The average number of drinks per week for non-collegiate athletes is four drinks compared to the average of eight drinks per week for collegiate athletes[1]. It has been found that 50% of women involved in athletics reported binge drinking[1]. For females, binge drinking is defined as consuming three or more drinks in approximately two hours[9]. Alcohol has been shown to diminish performance on motor tests, eye movement responses, and short-term memory recall[2]. The present study was designed to determine if alcohol consumption decreases next-day motor performance.

Previous studies reported that the number and intensity of next-day hangover symptoms correlated (r= 0.33) with the amount of alcohol consumed the previous night[3]. Symptoms tracked included headache, dizziness, nausea, upset stomach, tremors, fatigue, dry mouth, and irritability. Subjects ranked their symptoms on a scale from zero to six, zero (not at all) and six (very much). The perceived hangover affect for each symptom increased directly with the amount of drinks consumed[3,4].

Another study showed that the amount of alcohol consumed the night before (0, 2, 4, or 6 bottles of Labatt beer; 5% alcohol; 13.5 g alcohol/bottle) had no significant effects on physiological and physical functioning factors such as resting heart rate, resting blood pressure, grip strength, and reaction time. The morning after drinking all subjects blew a blood alcohol concentration of 0.0 mg/dL. However, the same study demonstrated that dose did have an impact on the number and severity of hangover symptoms and did increase the rate of reaction time errors. This was interpreted as having the same reaction time, but making incorrect choices during next-morning testing[3]. Finding this is important because fast reaction time is necessary to catch or hit a ball, return a serve, or pass to a teammate. Previous studies have looked at hangover symptoms and physiological response after alcohol consumption. To our knowledge, the influence of drinking on other measures that are important predictors of performance such as muscle endurance, vertical jump, and 40-yard dash time, have not yet been studied.

The alcohol consumption in the aforementioned studies was performed in laboratory settings with pre-determined doses. To increase the ecological validity of this study, our subjects drank their typical dose in their “normal” social environment. The purpose of this study was to analyze the impact of alcohol consumption on motor performance activities. In this study, we defined motor performance as the ability of the neuromuscular system to perform various tests. We used the term hungover to define the subject’s state the morning after drinking, however we did not record any hangover symptoms. This study is important for both recreational and collegiate athletes as well as their coaches. For athletes, our results will illustrate the impact of alcohol consumption and its influence on next-day performance. For coaches, our results could provide valuable evidence on whether or not to implement team drinking limitations. We attempted to determine decrements on next-day motor performance due to alcohol consumption.

METHODS

Subjects: Ten females who are recreational or collegiate athletes, or who meet the ACSM requirements for physical activity. The current ACSM recommendation for physical activity is moderately intense cardiovascular exercise for 30 minutes a day, 5 days a week or 20 minutes of vigorous cardiovascular exercise for at least 3 days a week. In addition each subject must resistance train at least 2 days a week consisting of 8-10 exercises with 8-12 repetitions[8]. Subjects were all over 21 years old and provided voluntary consent to participate. Each subject has had previous experience with alcohol and consumed alcoholic beverages at least one day a week. All subjects drank comparably to what they reported on the preliminary questionnaire. Females, rather than males, were recruited because of the need for hangover research with females and because their lower body water content produces a higher blood alcohol concentration[5]. All subjects were recruited through word of mouth or email. They were also asked to complete preliminary questionnaires to gather information on their personal drinking habits. Subjects gave us their permission to participate by signing an informed consent form. This study was approved by the University Human Subjects Institutional Review Board.

Instruments: Each subject’s hand grip strength was measured with a dynamometer (Grip A Takei Physical Fitness Test. T.K.K 5001). A 30.5 cm (12 in) ruler was used during the reaction time test. A tape measure (Creative Health Products) was used to measure the distance for the 40-yard dash.

The 40-yard dash was performed on an indoor rubber track using a stopwatch (Robic SC-500-E). Vertical jump was assessed using the Vertec (Questek Corp) vertical jump equipment.

Procedures: All subjects were tested once at baseline and once after a night of drinking that was comparable to other nights they had consumed alcohol. Subjects were randomized into two groups; one group performed baseline tests prior to hungover tests, the other group performed baseline tests following the hungover tests. Baseline data was collected after a night of total sobriety. Prior to the baseline testing, all subjects ate a breakfast of what they would typically consume in the morning and drank as much water as they usually do after a night of drinking. In addition, subjects were asked to not participate in any physical activity the morning of testing. A five to ten minute warm up of self-selected intensity was performed prior to testing. Tests were done in the order of reaction time, grip strength, vertical jump, push-ups and the 40-yard dash. After a night of typical drinking, the subjects came into the lab between the hours of 8 a.m. and 12 p.m. Subjects reported alcohol consumption with a 24-hour recall form.

The first variable of our testing circuit was the reaction time test, which measures hand reaction time in response to a visual stimulus. The procedures for the reaction time test included use of a 12-inch ruler, an administrator, a subject, and a table. The subject rested her hand on the table and lined the top of her thumb and fingers with the bottom of the ruler. The administrator waited 1-3 seconds and then dropped the ruler unannounced. Administrators then measured to the nearest 0.5 centimeter where the ruler was caught, again, measured from the top of the thumb. This test was performed three times and the scores were averaged.

Grip strength was measured with the use of a hand grip dynamometer with three trials on each hand. The subject squeezed the dynamometer as hard she could for approximately one second. The subjects alternated hands for a total of six trials. The scores were then averaged for both the right and left hands.

To measure the vertical jump, subjects stood along a wall with her dominant arm extended above her head to measure her standing vertical reach. Next, she started one step away from the Vertec, took one gathering step, and jumped as high as possible to hit the measuring vanes. The administrator measured the height and subtracted her standing vertical reach to calculate her vertical jump height. This test was performed three times. The average was recorded.

For the push-up test the subjects performed as many modified push-ups having their chin touch the ground with each repetition until fatigue. Modified form consists of subjects knees touching the floor and performing the push-ups from that position.

The 40-yard dash tests were performed on a rubber track. Subjects sprinted as fast as possible through the 40-yards. The timers started the stopwatches when the subject took their first step and stopped when the lead foot crossed the finish line. There were two timers for each attempt; timers averaged their results to more accurately standardize the sprint time. There were a total of three trials, the mean time of the three trials was recorded for each subject. Normal athletic shoes were worn and subjects used a standing start. No spikes or starting blocks were allowed.

There was a two minute rest period between performance tests. All testing sessions had at least 72 hours between them. Subjects had to have at least three days to a week between trials.

Variables:

Our dependent variables consisted of the effect of alcohol consumption on grip strength, muscular endurance, vertical jump, 40-yard dash time, and reaction time. Our independent variable was the amount of alcohol that was consumed by each subject (determined individually).

Statistical Analyses

All analyses were performed using Statistical Package for the Social Sciences, Version 15.0 (SPSS, Inc, Chicago, IL). Measures of centrality and spread are presented as mean ± *SD*. Mean

differences in sober and hungover performance (reaction time, grip strength, vertical jump, push-up test, and 40-yard dash) were assessed with paired *t*-tests. Pearson *r* was calculated to determine the correlation between number of alcoholic drinks and performance decrement being hungover. The probability of making a Type I error was set at $p \leq 0.05$ for all statistical analyses.

RESULTS

The baseline characteristics for subjects who completed the study are shown in Table 1. Comparisons of mean differences in sober and hungover performance revealed no significant ($p > 0.05$) differences: reaction time [M=-1.22, $t(9)$=-1.36, p=0.21]; right hand grip strength [M=0.85, $t(9)$=0.999, p=0.34]; left hand grip strength [M=0.21, $t(9)$=0.26, p=0.84]; vertical jump [M=3.98, $t(9)$=1.59, p=0.15]; push-up test [M=0.90, $t(9)$=0.23, p=0.83]; 40-yard dash time [M=-0.07, $t(9)$=-1.35, p=0.21].

The correlation values between number of alcoholic drinks and performance decrement being hungover were not significant ($p < 0.05$) for all performance measures, with the exception of reaction time: right hand grip strength (0.46), left hand grip strength (0.41), vertical jump (0.44), push-up test (-0.30), and 40-yard dash time (-0.30). The correlation values between number of alcoholic drinks and performance decrement in reaction time was significant ($r = 0.76$, $p < 0.05$). The mean values and standard deviations (SD) of all performances for both the sober and hungover testing sessions are presented in Table 2.

Table 1. Descriptive data of the subjects.

Characteristics	Measurement
Age (years)	21.70 ± 0.48
Height (cm)	18.59 ± 5.55
Weight (kg)	68.86 ± 5.49
Number of Drinks*	5.80 ± 1.23
* 1 Drink= 12 ounces beer, 1.0oz. liquor, or 6 oz. wine	

Table 2. Baseline vs. Hungover Performance

Variable	Baseline	Hungover	p<0.05
Reaction Time (cm)	12.97 ± 5.34	14.19 ± 4.65	0.21
Right Hand Grip (kg)	33.66 ± 5.89	32.81 ± 6.19	0.34
Left Hand Grip (kg)	32.45 ± 6.24	32.26 ± 6.54	0.84
Vertical Jump (cm)	46.10 ± 5.15	42.12 ± 10.83	0.15
Push-Ups (reps)	40.80 ± 14.41	39.90 ± 18.67	0.83
40- Yard Dash (s)	5.78 ± 0.27	5.85 ± 0.33	0.21

DISCUSSION

We found that a correlation was present between reaction time and number of drinks consumed. Although reaction time was the only significant variable, we feel that the decrements in all performance measures were practically significant. The practical significance of each of the performance decreases can be realized when they are applied to almost any sporting event. For example, in a 200-meter dash sprint event, the performance decrement can accumulate and result in placing poorly. A decreased vertical jump is practically significant when determining whether or not a volleyball spike is successfully blocked or if an athlete clears the bar in the high jump event.

Our research supports previous research by Liu[6], which found that alcohol decreased ability to perform tasks related to reaction time and visual perception. This study also supports research completed by Kruisselbrink et al. that claims that consuming moderate amounts of alcohol increases reaction errors but have minimal effects on physical and psychological performance. They also quatified hangover symptoms, a factor that we did not choose to include in our study[3]. Our results agree with Maughan's[7] research which showed that alcohol consumption only minimally impairs strength. This may suggest that strength is only significantly impaired after greater doses of alcohol are consumed. Other studies conducted research in a lab setting and subjects were administered specific amounts of alcohol, while we allowed subjects to drink their typical amount in their typical environment[2, 3].

Alcohol is a neurological depressant which would support the findings of decreases in performance of reaction time. More research should be performed on a larger scale and also on a sport-specific level. This would be warranted as different sports appear to have different drinking patterns[10]. Also, more research should be done to see how alcohol consumption affects resistance training and aerobic training. Researching binge drinking and its effects on next day performance would be relevant for a college-aged study.

This study has several limitations worth noting. One limitation was that we had no control over what the subjects ate, drank, or how many hours of sleep they got the night before testing. In addition, we had no control over how much time elapsed between the last drink imbibed and the testing session. Also, we had to believe that all subjects were recording the amount of alcohol consumed accurately, since we did not measure blood alcohol concentration. It was assumed that all subjects gave a maximal effort on all trials. Availability of space for testing was also an issue we encountered. We initially intended to have a larger sample size, which may have altered our final results. The number of subjects was also limited due sports season conflicts. The power of research was not very strong; a larger sample size would have increased the power and possibly shown more significant changes.

CONCLUSIONS

With the exception of reaction time there were no statistically significant performance decrements. Based on our results, alcohol consumption was not significant in decreasing the performance of grip strength, vertical jump, push-ups and 40-yard dash in college-aged females involved in collegiate sports or recreational exercise. However, there was a correlation present between the number of drinks consumed and a decrement in reaction time performance. Populations that would be most interested in our results include all college-aged female collegiate and recreational athletes who follow the ACSM recommendations for physical activity and who consume alcohol. Coaches of female collegiate athletes can use this research to determine the relevancy of team drinking regulations. The implication of this study is that increased alcohol consumption is related to decreased reaction time in young athletic women but has limited impact on other motor performance abilities in next-day testing.

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