The Effects of Alcohol on Static Balance in University Students

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Abstract. [Purpose] The purpose of this study was to compare the participants' balance before and after the alcohol intake. [Subjects] This study conducted experiments by selecting adult subjects between the ages of 19 and 27. Thirty subjects (men=15, woman=15) were arranged into three groups. There were 10 people in each group. [Method] The three groups drank 0.05 mL/kg, 0.4 mL/kg and 0.8 mL/kg of alcohol, respectively. Romberg’s test was applied to measure static balance ability. A static balancing ability test was conducted by applying Romberg’s test in order to evaluate proprioceptive function. [Results] The results were similar for Romberg’s test with the eyes open and closed. The results for Group III were mostly decreased immediately after alcohol intake. For 6 hours after alcohol intake, Groups I and II showed various levels of recovery including return to a normal status. However, Group III showed the least recovery. [Conclusion] The results indicate that the amount of alcohol intake affects on balance. This result also shows that having alcohol before work that requires intensive concentration would cause more accidents and injuries, as alcohol affects human static balance.

Key words: Alcohol, Static, Balance

INTRODUCTION

Balance is an ability that plays an crucial role in every motion performance in daily life; it maintains the body in the state of equilibrium, maintains the center of gravity within the base of support, and continuously maintains equilibrium in the movement of the body¹. In addition, balance is a complicated process in which the movement of the body is recognized through the senses and the information is integrated into the central nervous system, enabling the musculoskeletal system to function in a proper manner; it is a complex motor control task that includes the integration of sensory information, processes of the nervous system, and biomechanic factors². A static balance ability is an ability that can maintain the body in the standing posture on a fixed base of support, and a dynamic balance ability is an ability that can make the body balanced, preventing it from falling to the ground during the movement³. As a special neurophysiological process to help the body maintain stability, the factors affecting balance can be divided into a musculoskeletal factor and a neurological factor. Postural alignment and flexibility of the musculoskeletal system affect balance, and this is referred to as the musculoskeletal factor. The sensory process, integration of the central nervous system and exercise programs influence physical balance control based on muscular strength and endurance, and this is referred to as the neurological factor⁴. Balance should integrate accurate information from sensory impulses, effective processing by the central nervous system, and adequate reactions for motion control⁵, and any disorders that affect balance performance caused by damage to the central nervous system, joint or muscle diseases, visual impairments, or vestibular organ diseases can cause damage to the maintenance of comfortable standing and control of weight bearing. They can also be an obstacle to rehabilitation of balance performance in patients. The central nervous system and peripheral nervous system are involved in maintenance of balance⁶. The proprioceptors in the neck, ankle and leg muscle and the vestibular nervous system recognize the actual position⁷. Alcoholic drinks decrease concentration during movement and attention to environmental stimulation and cause lowered ambulatory activity and a light type of delirium⁸. Romberg’s test generally reveals the symptoms of proprioceptive deficiency and is used to evaluate disorders of vestibular organs. A positive Romberg’s reaction is reportedly used to reveal the weakening of motion on one or both sides and peripheral, cerebellar, and vertebrobasilar disorders⁹.

The precedent studies of alcohol were mainly led by studies on the state of nutritional intake, eyesight, and blood components after drinking alcohol. However, a study evaluating the relation between alcohol and static balance is trivial. This study focuses on the correlation between alcohol and balance ability. Therefore, it investigates the differences between groups and between time process and the effect on the human body by verifying the relation of static balance with alcohol intake through Romberg’s test.
SUBJECTS AND METHODS

Subjects
The number of subjects was 30 (men of 15 and women of 15), among whom 10 persons (5 men and 5 women) were assigned respectively into each of three groups. The participants were not informed about specific processes, and the alcohol intakes of the three groups differed as follows: 0.05 mL/kg, 0.4 mL/kg and 0.8 mL/kg, respectively (Table 1). All of the subjects fully understood the test contents and voluntarily participated in the test. They filled out a translated version of English language consent form from a children's hospital in Los Angeles, CA, USA. The subjects of the study were all normal adults and were chosen by the following standard. The subjects were fully informed of the purpose of this study and contents and individually agreed to participate in the therapy program. The study was approved by the ethics committee of health and welfare at Daegu University. To be included in this study, the subjects had to meet the following criteria: no alcohol or drug addiction, no specific reaction, and nothing significant to psychologically report; no chronic diseases, such as deteriorative or active disorders, hypertension, diabetes, hepatitis, and renal insufficiency; no use of other drugs that can affect alcohol intake or metabolism; and no alcohol intake 3 days before test and with an empty stomach 4 hours before test.

Methods
This study designed the following tests in order to investigate the correlation between balance ability and alcohol intake and compare the difference between groups and in time process according to intake of Korean Soju alcohol. The subjects were tested at the following time points: before alcohol intake, immediately after intake, 2 hours later, 4 hours later, and 6 hours later.

Proprioceptive function was evaluated with a static balance ability test conducted using Romberg’s test. The subject was instructed to hold both hands at the waist and to place the non-test heel of the foot close to the test heel of the foot. And then the subject was instructed to stand the test leg after extending the non-test knee joint. The balance maintenance time was then measured 3 times in a row with a stopwatch, and the average value was calculated. The test was performed with the eyes open and closed. Data are shown as means±SD. One-way ANOVA and repeated measures one-way ANOVA were used for statistical analyses of the data. Statistical significance was accepted for values of p less than 0.05.

RESULTS

Table 1. Characteristics of the subjects

<table>
<thead>
<tr>
<th>Items</th>
<th>N</th>
<th>Age</th>
<th>Height (cm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental group I</td>
<td>10</td>
<td>23.1 ± 2.3</td>
<td>167.9 ± 13.1</td>
<td>63.7 ± 7.5</td>
</tr>
<tr>
<td>Experimental group II</td>
<td>10</td>
<td>20.4 ± 1.6</td>
<td>169.1 ± 9.1</td>
<td>58.6 ± 7.6</td>
</tr>
<tr>
<td>Experimental group III</td>
<td>10</td>
<td>22.1 ± 2.7</td>
<td>165.7 ± 9.6</td>
<td>63.1 ± 5.2</td>
</tr>
</tbody>
</table>

Note. Values are means±SD. * Significantly different (p<0.05) Experimental group I: 0.05 mL/kg alcohol group, Experimental group II: 0.4 mL/kg alcohol group, Experimental group III: 0.8 mL/kg alcohol group

Table 2. Romberg’s test with the eyes open

<table>
<thead>
<tr>
<th>Group</th>
<th>Rest</th>
<th>Immediate</th>
<th>2 hours</th>
<th>4 hours</th>
<th>6 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>16.8 ± 9.97</td>
<td>15.2 ± 8.06</td>
<td>15.1 ± 8.54</td>
<td>15.2 ± 9.24</td>
<td>15.4 ± 8.55</td>
</tr>
<tr>
<td>II</td>
<td>17.2 ± 5.78</td>
<td>12.2 ± 4.18</td>
<td>11.9 ± 4.04</td>
<td>13.4 ± 3.68</td>
<td>14.0 ± 3.73</td>
</tr>
<tr>
<td>III</td>
<td>14.6 ± 8.59</td>
<td>5.5 ± 4.12</td>
<td>6.1 ± 5.17</td>
<td>7.1 ± 5.04</td>
<td>8.3 ± 4.40</td>
</tr>
</tbody>
</table>

Note. Values are means±SD. unit: sec

The results of Romberg’s test with the eyes open were analyzed by repeated measures ANOVA and revealed a significant difference in the interaction between time and groups (p<0.05), indicating that there was a significant difference between groups by time. In Group I, the Romberg’s test result decreased from 16.76 ± 8.97 sec to 15.23 ± 8.06 sec immediately after alcohol intake, and it subsequently decreased to 15.09 ± 8.54 sec after 2 hours. After 4 hours, it increased to 15.24 ± 9.24 sec, and it increased to 15.39 ± 8.55 sec after 6 hours. In Group II, the Romberg’s test result decreased from 17.16 ± 5.78 sec to 12.17 ± 4.18 sec immediately after alcohol intake, and it subsequently decreased to 11.96 ± 4.04 sec after 2 hours. After 4 hours, it increased to 13.40 ± 3.68 sec, and it increased to 14.02 ± 3.73 sec after 6 hours. In Group III, the Romberg’s test result decreased from 14.60 ± 8.59 sec to 5.51 ± 4.12 sec immediately after alcohol intake, and it subsequently decreased to 6.07 ± 5.17 sec after 2 hours. After 4 hours, it increased to 7.13 ± 5.04 sec, and it increased to 8.32 ± 4.40 sec after 6 hours (Table 2).
The purpose of this study was to investigate the influence of alcohol on static balance. Posture control is the ability to control the location of the body in a space, and this ability is essential to perform daily motions, walking, and other tasks. It utilizes sight, hearing and a vestibular organ, proprioception, sense of position, muscle strength, spasticity, cognitive function, etc., and in specific, it involves sight, a vestibular organ, and a somesthesia biofeedback mechanism10). Balance is the result of complicated interactions among a proprioceptive organ, a musculoskeletal organ, a vestibular organ, and a visual organ11).

In this study, Romberg’s test was used to measure the change in static balance after intake of 0.05 mL/kg, 0.4 mL/kg of alcohol by 0.5 mL/kg of alcohol14). The results of organ, and a visual organ11).

Postural stability by using Romberg’s test after applying a small and middle amount of alcohol showed that the tests with the eyes open and closed revealed a relation between the velocity and range of postural sway. That study, demonstrated that there was a significant difference between the groups by time. In the results of the analysis with repeated measures, it was delayed as the amount of alcohol increased. The results were the same as those in the precedent cases. This study restrictively applied its target to 30 healthy university students in a certain range of age, which makes it difficult to generalize the results. A subjective factor was involved in the measurement method, and the measured values changed according to the subject’s will to participate, meaning that they lacked objectivity. However, the activities of the subjects were restricted after alcohol intake in order to minimize errors, and exposure of the experiment process was prevented. In the future, a variety of studies utilizing more objective and accurate measurement methods and more subjects should be performed.

REFERENCES