The Relationship between Physical Activity Level and Stress Response in University Students

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Abstract

The purpose of this study was to discuss the relationship between the physical activity level and stress response in the university freshmen from six universities in Kanto and Tokai district (male: 159, female: 184). An anonymous self-rating questionnaire method survey was conducted. A survey in the form of a questionnaire was conducted after explaining the aim and obtaining consents. The questionnaires were collected on the spot (collective survey method). The survey was performed in the first ten days of February 2005. Obtained data were statistically processed with SPSS ver.11 for windows. Analysis methods included the reliability analysis of scale, Pearson's product moment correlation coefficient, and one-way analysis of variance. The results of this study showed the following items:

1) Pearson's product moment correlation coefficient was calculated in order to discuss the relationship between the physical activity level and the stress response. The result showed a statistically significant correlation between the physical activity level one week before the test and the stress response total score, and the physical activity level one week before the test and several subscales (depression, emotional confusion, withdrawal, physical fatigue, overactivity of autonomic nervous system) though the correlation was statistically weak.

2) Differences in the average score of the stress response scale and each subscale were compared among physical activity levels (gentle, moderate and heavy intensity physical activity group). The result showed significant differences in the "stress response total score" and several factors (depression, anxiety, emotional confusion and withdrawal).

Introduction

The number of underexercised university students who are always in a sitting posture demonstrates an upward trend. The ratio of students showing symptoms of lifestyle-related diseases (i.e., increased body fat, etc) is also increasing¹. Accompanying that, mental health issues of university students are growing into a serious problem and are recognized as social problem². The importance of stress management for prevention has been pointed out. It has been demonstrated that moderate exercise and physical exertions improve the lifestyle-related diseases and the risk factors of lifestyle-related disease and contributes to reestablishing of health³. Further, their effectivity to improve mental health has also been confirmed⁴⁻⁵.

However, the relationship between the physical activity level and stress response in university students is less well understood. It is supposed that it is of significance to clarify these issues from a viewpoint of preventive ef-
fect of physical activities.

The word "physical activities" used here are the collective term of the movements of the body generated with skeletal muscles. As a result, they are all activities that accompany energy consumption.12

The purpose of this study is to discuss the relationship between the physical activity level and stress response of university students. Two specific agendas include 1) clarifying the relationship between the physical activity level and stress response one week before the test, and 2) comparing the stress response total score by physical activity level, and the difference in averages of each subscales one week before the test. This study investigates these agendas and confirms the physical activity can be a stress management method for university students.

Methods

1. Subjects and method

Subjects included 343 university freshmen from six universities in Kanto and Tokai district (male: 159, age: 18.50 ± 0.80, female: 184, age: 18.33 ± 0.76). Subjects are general students belonging to liberal arts courses such as education, humanities, social welfare and social science. An anonymous self-rating questionnaire method survey was conducted. A survey in the form of a questionnaire was conducted after explaining the aim and obtaining consents. The questionnaires were collected on the spot (collective survey method). The survey was performed in the first ten days of February 2005. The reason why performing the survey in the period was that most of university students felt stressed in the period more than in other periods because periodic examinations were performed in the period in all universities. The period was supposed to be a special period when university students expressed stress responses readily.

2. Configuration of the questionnaire

Outline of criteria of analysis targets in the questionnaire used in the survey is as follows:

① Physical activity scales

This is an existing scale developed by Uechi et al.13 to measure the physical activity status in an entire week before a survey. This scale was developed considering the environment of school for children. However, the question items generally cover physical activity status of ordinary living in university students. From the results of a preliminary survey, this scale was considered to be usable for university students. Thus, we added one item of "holiday" to the five-item version by Uechi et al. and used the six-item scale. With regard to the scoring, 3 points are given if "taking exercise well" is selected. If "intermediate" is selected, 2 points are given. If "taking less exercise" is selected, 1 point is given. A score is obtained from the total of the points in the six questions. A higher score meant a larger amount of physical activities in a week. The reliability coefficient, Cronbach's alpha coefficient in this study was 0.62.

② Stress self-rating scale for university students (stress response scale)

This is an existing scale developed by Ozeki et al.14 to measure the mutual relationship between the psychological stress processes (stressors, cognitive appraisals, copings, social supports, humors and stress responses) in each stage. In this study, only the "Stress response scale" was used among the five subscales to measure the psychological stress process. With regard to scoring, if "Very true" is selected among the options about all items, three points were given, if "Significantly true" is selected, two points were given, if "Somewhat true" is selected, one point was given. Total score was the total ratings of 35 items. Further, this scale can be classified into seven subscales including "emotional reaction (depression and anxiety, anger)", "cognitive behavioral reaction (emotional confusion and withdrawal)", "physical reaction (physical fatigue and overactivity of autonomic nervous system)". Score of each subscale is obtained from the separate total of the score of five items corresponding to them. Higher score indicates higher stress reaction. The reliability coefficient, Cronbach's alpha coefficient in this study was "depression" 0.87, "anxiety" 0.81, "anger" 0.89, "emotional confusion" 0.74, "withdrawal" 0.79, "physical fatigue" 0.81 and "overactivity of autonomic nervous system" 0.78.

3. Analysis method

Obtained data were statistically processed with SPSS ver.11 for windows. Analysis methods included the reliability analysis of scale, Pearson's product moment correlation coefficient, and one-way analysis of variance.

Results and Discussion

1) Relationship between physical activity level and stress response

Pearson's product moment correlation coefficient was calculated in order to discuss the relationship between the physical activity level one week before the test and
the stress response total score, and the relationship physical activity level one week before the test and the stress response subscales. Fig. 1 shows the results. There was a statistically significant correlation between the physical activity level one week before the test and the stress response total score though the correlation was statistically weak \((r = -0.168, p < .01)\). Additionally, there also was a statistically significant correlation between the physical activity level one week before the test and subscales though the correlation was statistically weak (depression: \(r = -0.113, p < .05\), emotional confusion: \(r = -0.186, p < .01\), withdrawal: \(r = -0.195, p < .01\), physical fatigue: \(r = -0.160, p < .01\), overactivity of autonomic nervous system: \(r = -0.132, p < .05\)).

Norris et al.\(^\text{(5)}\) investigated the relationship between the psychological measures such as stress events, health status, subjective stress, anxiety, depression, hostility, etc and habit of exercise targeting at junior high school and high school students. Students with higher exercise habit score showed a tendency of lower psychological measure score. They reported that statistically significant correlation was only observed between the exercise habit and subjective stress and depression score.

However, the correlation coefficient between the physical activity level and stress response indicated by this study was low. It is quite unlikely to consider that performing physical activities directly contributes to the reduction of stress response.

The three factors of the mechanism that performing physical activities reduces the stress response include physiological, psychological and social factors. Not only physiological changes in the living body directly contributes to the stress response but also interactions with friends through physical activities, feeling of competence and sense of pride generated by improved physical strength and learning of motor skills is likely to reduce the stress reaction indirectly.

This study focuses on the relationship between the physical activity level one week before the test and the stress reaction. It does not discuss the effect of temporary physical activity on the stress reaction. However, considering that the physical activity level one week before the test is the accumulation of physical activities on a daily basis, it was suggested that the activation to improve the amount of physical activities is effective to reduce several stress responses. In this study, the relationship between physical activities and stress responses was clarified partially. Some interactions may be speculated for the relationship. In some people, depressive feeling of anxious condition occurs due to accumulated stressors, causing to decrease the activity level in comparison with the ordinary level. Accordingly, in such condition, it is not necessary to reduce the physical activity level and conduct physical activities. Or, its reverse is also considered. In the future, more detailed studies taking these points into consideration are desired. In the future, it is required to discuss the causal relationship between them and the parameters lying between the relationships of them.

2) Comparison of stress response total score by physical activity level and average of each subscale

An one-way analysis of variance was performed on the stress response total score and score of each subscale using the physical activity level (gentle, moderate and heavy intensity physical activity group) one week be-
fore the test as independent variable. With regard to the criteria of grouping of the physical activity level, based on the ratio of accumulated percentages, the subjects were classified into the three groups including "6-8 points: gentle intensity physical activity group", "9-11 points: moderate intensity physical activity group" and "12-16 points: heavy intensity physical activity group". Table 1 shows the results.

Major effect of physical activity level was observed in the "stress response total score" and stress response subscales including "depression", "anxiety", "emotional confusion" and "withdrawal" (stress response total score (F (2/340) = 6.98, p < .001; depression: (2/340) = 7.83, p < .001; anxiety: (2/340) = 4.05, p < .05; emotional confusion: (2/340) = 4.44, p < .05; withdrawal: (2/340) = 8.69, p < .001). As a result of the multiple comparison by HSD method by Tukey, the gentle intensity physical activity group showed significantly high "stress response total score" compared to the moderate and heavy intensity physical activity group. The gentle intensity physical activity group showed significantly high value of "anxiety" compared to the moderate intensity physical activity group.

With regard to the correlation between the physical activity level one week before the test and stress response total score, and each subscale, there was a significant difference in the "stress response total score" and several subscales (depression, anxiety, emotional confusion and withdrawal) by the physical activity level. In other words, the students in the moderate and heavy intensity physical activity group had lower tendency of "depression", "anxiety", "emotional confusion" and "withdrawal" than the students in the gentle intensity physical activity group. As a whole, the students in the moderate and heavy intensity physical activity group showed a lower tendency to express the stress response. However, in this study, there was no significant difference among "anger", "physical fatigue" and "overactivity of autonomic nervous system" by physical activity level.

According to the most of the cross-sectional researches that discussed the relationship between the habit of exercise and amount of physical activities, and emotion and feeling, people having the custom of doing exercise or people having much body activities showed favorable state of emotion and feeling[10-17]. Takenaka[18] also reported that chronic psychological effects of physical activities included effects to reduce anxiety and depression and effects on stress responses. Basically, this study sup-

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Averages and standard deviations of the stress response totals score by physical activity level, and each subscale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>gentle</td>
</tr>
<tr>
<td>number</td>
<td>94</td>
</tr>
<tr>
<td>depression</td>
<td>4.48</td>
</tr>
<tr>
<td></td>
<td>(4.02)</td>
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<tr>
<td>anxiety</td>
<td>3.60</td>
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<tr>
<td></td>
<td>(2.86)</td>
</tr>
<tr>
<td>anger</td>
<td>3.11</td>
</tr>
<tr>
<td></td>
<td>(3.52)</td>
</tr>
<tr>
<td>emotional confusion</td>
<td>3.66</td>
</tr>
<tr>
<td></td>
<td>(2.88)</td>
</tr>
<tr>
<td>withdrawal</td>
<td>2.38</td>
</tr>
<tr>
<td></td>
<td>(3.10)</td>
</tr>
<tr>
<td>physical fatigue</td>
<td>4.25</td>
</tr>
<tr>
<td></td>
<td>(3.26)</td>
</tr>
<tr>
<td>overactivity of autonomic nervous system</td>
<td>1.19</td>
</tr>
<tr>
<td></td>
<td>(2.02)</td>
</tr>
<tr>
<td>stress response total score</td>
<td>22.66</td>
</tr>
<tr>
<td></td>
<td>(17.13)</td>
</tr>
</tbody>
</table>

( ) Numeric values in parentheses are standard deviations. *p < .05, ***p < .001
ports the results of the precedent studies.

The results of this study suggest that the strengthened physical activity is effective for reducing several stress responses. However, some questions also remain. We assumed the final examination as a homogenous stressor among the entire subjects of multiple universities. However, because the samples were obtained from multiple universities, it may be unlikely that the final examination including differences among universities, interval between examinations, and the number of courses taken became a homogenous stressor for the subjects. More detailed studies taking these points into consideration may be needed. Moreover, more detailed knowledge about the relationship between physical activity level and stress response will be obtained by investigating its gender difference for the relationship.

Physical-education teachers in universities should make as many students as possible understand the importance of the physical activities in daily life through lectures and show them devices and methods to increase the physical activities voluntarily in the free time in the daily life by the theory and practice.

Conclusion

The purpose of this study was to discuss the relationship between the physical activity level and stress response in the university freshmen from six universities in Kanto and Tokai district (male: 159, female: 184). The results of this study showed the following items:

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References