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Title: Relationship between school sports club membership and depressive symptoms among new recruits of the Japan Self-Defense Force: a longitudinal study

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Abstract

The relationship between participation in extracurricular school club activities in adolescence and subsequent depressive state experiences in adulthood, after joining the workforce, is unclear. The present study aimed to explore this relationship in new recruits of the Japan Ground Self-Defense Force (JGSDF). In April 2013, 925 recruits of the JGSDF, all of whom were male and aged 18–27 years, were enrolled. Club activity status during high school was categorized as follows: participated in sports club, participated in nonsport club, or no club participation. Depressive symptoms were assessed with the 20-item version of the Center for Epidemiologic Studies Depression scale (CES-D), at the baseline survey and a second survey conducted 2 months later, in June 2013. Analysis of covariance was used for association between club activity status and changes in CES-D scores. After 2-month period, results showed significantly higher average of CES-D score changes for participants with nonsport club activities ($\beta = 3.90$, 95% confidence interval = 2.22–6.71) or those with no club activities ($\beta = 2.24$, 95% confidence interval = 0.20–2.94), compared to those with sports clubs. These findings were adjusted for age, baseline CES-D score, regular exercise, smoking status, alcohol consumption, sleep duration, and breakfast habits. Recruits without a history of sports club participation may be at higher risk of developing depressive symptoms than those who participated in sports club. Our results may be useful for the early detection of people who are susceptible to depression engaged in occupations such as the JDSF.

Keywords: depression, sports, extracurricular club activity, young adult
陸上自衛隊の新入隊員における高校時代の運動部活動が入隊後の抑うつ症状に及ぼす影響：縦断研究による検討

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抄録
思春期における部活動の経験と社会人になった後の成人期の抑うつ症状との関連は明らかになっていない。本研究の目的は、陸上自衛隊の新規採用隊員を対象に、高校時代の部活動の経験とその後の抑うつ症状の関連を明らかにすることを目的とした。2013年の4月に陸上自衛隊に入隊した18〜27歳の男性925名を対象にベースライン調査を実施した。高校時代の部活動は、運動部、運動部以外、所属無しに分類した。抑うつ症状は、the Center for Epidemiologic Studies Depression Scale (CES-D)日本語版を用いて、20項目の合計値によるCES-D得点を算出し、抑うつ症状を評価した。2回目の調査は2か月後の2013年6月に実施した。高校時代の部活動とベースラインから2か月後のCES-D得点の変化との関連について、年齢、ベースラインのCES-D得点、運動習慣、喫煙習慣、飲酒習慣、睡眠時間、朝食習慣の要因で調整した共分散分析によって検討した。その結果、運動部の経験者と比較したCES-D得点の変化の平均値（95%信頼区間）は、運動部以外の部活動経験者：3.90（2.22〜6.71）、部活動の所属無し：2.24（0.20〜2.94）と、CES-D得点の平均値が有意に増加した。高校時代に運動部の経験がない新入隊員は、運動部の経験がある新入隊員よりもと比較して、抑うつ症状を発症するリスクが高くなることが明らかとなった。本研究の結果は、自衛隊などの職業におけるうつ病リスクの早期発見に役立つ可能性がある。
Introduction

The prevalence of mental illnesses, such as depression, has rapidly increased worldwide in the recent three decades \(^1\). Depression is a common mental health disorder among the workers \(^2,3\). Previous findings reported that workers with depression are likely to have experienced discrimination in the workplace and higher retirement rates \(^4\), moreover, those with higher depressive symptoms have a poor work performance \(^5\).

Thus, solving the mental health problems of workers is an important social issue.

The mission of the Japan Self Defense Force (JSDF) includes purposes such as national defense, disaster relief operations, and United Nations peacekeeping operations. For example, when the Great East Japan Earthquake occurred on March 11, 2011, the JSDF mobilized approximately 107,000 members for a disaster relief operation that saved human lives and served water and food. \(^6\). Therefore, it is important that JSDF members maintain good mental health to achieve the mission of the JSDF. However, in Japan, an annual defense white paper reported that the suicide rate of JSDF members was approximately 1.5 times higher than in the general population \(^7\).

In addition, a previous study reported that new army recruits had higher depressive symptoms compared to new civil servants in China \(^8\).

On the other hand, in Japan, extracurricular activities, such as sports or cultural clubs, are conducted in schools and many students take part in these clubs (termed Bukatsudo) as part of their secondary education \(^9\). Participation in extracurricular activities in adolescence has been found to be an important factor for achieving better academic, educational, and behavioral outcomes \(^10,11\), and several cross-sectional studies have suggested that participation in extracurricular activities is inversely associated with depressive symptoms \(^12-14\), and participation in school sports teams
could protect against suicidal ideation. A four-year follow-up prospective study on adolescents aged 13–18 at baseline also found that participation in sports reduced depressive symptoms. However, whether taking part in club activities during adolescence can reduce depressive symptoms in adulthood, after people have started working, remains unclear.

The present study aimed to explore the impact of participation in school club activities during high school on depressive symptoms among new recruits after employed by the JSDF.

Material and Methods

Study participants

Participants were sourced from 15 stations of the Japan Ground Self-Defense Force (JGSDF) in Hokkaido, northern Japan, in April 2013. In Japan, students usually graduate from high school in March, at the age of 18 years; therefore, through a person in charge of implementing the training for newly enrolled members, we invited all new males aged 18 to 27 years to take part in this study. The new members of the JGSDF participated in a similar training program provided to 15 stations. The study protocol was approved by the ethics committee of the Health Sciences University of Hokkaido (2017, no. 9). We provided a written explanation to the participants and the person responsible for conducting the training for newly enrolled members, clarifying that participation in the survey was voluntary. Additionally, we obtained written informed consent from all participants.

Data collection and measures
Questionnaires assessing depressive status and lifestyle factors were distributed to and collected from participants via persons in charge of implementing new recruits’ 2-months training. Depressive symptoms were assessed by using the Japanese version of the Center for Epidemiologic Studies Depression Scale (CES-D)\textsuperscript{17,18}. The CES-D comprises 20 items to detect depressive state symptoms, which are rated on a 4-point Likert-type scale that ranges from 0 (rarely or none of the time; less than 1 day) to 3 (most or all of the time; 5–7 days). Total scores range from 0 to 60, with higher scores indicating a greater level of depressive symptoms.

Information on the participants’ club activity status during high school was assessed with the following question: “Did you participate in club activities in your high school days?” Response options were as follows: participated in sports club, participated in activities other than sports club, or no club participation. Current lifestyle factors were also evaluated in the questionnaire: frequency of regular exercise within the last 1 year (two times/week or more/less than two times/week), smoking status (current smoker, former smoker, or never smoked), frequency of alcohol consumption (every day, 5–6, 3–4, 1–2 times/week, or none), sleep duration (less than 6 hours, 6–6.9, 7–7.9, or 8+ hours/day), and frequency of having breakfast (every day, 4–5, 2–3 days a week, or never).

In addition, we assessed a sense of coherence (SOC), as conceptualized by Aaron Antonovsky,\textsuperscript{19} which is an indicator of stress coping skills. SOC was assessed using the translated Japanese version of the 13-item Sense of Coherence scale (SOC-13)\textsuperscript{20}. The 13 items are rated on a 7-point scale with responses that range from “never” (1) to “very often” (7). Scores range from 13–91, and higher scores indicate greater stress coping ability.
Follow-up

The CES-D was administered for a second time 2 months later, in June 2013, when the participants had finished their new recruit training period.

Statistical analysis

Continuous variables are presented as mean ± standard deviation; categorical variables are presented as numbers (percentages). We performed an analysis of covariance, adjusted for these potential confounders, to elucidate the association between participation in club activities during high school and changes in CES-D scores over the 2-month period. In model 1, association was adjusted for age, the CES-D scores at baseline. In model 2, we further adjusted for age, CES-D scores at baseline, frequency of regular exercise, smoking status, frequency of alcohol consumption, nightly sleep duration, and frequency of having breakfast. In addition, previous longitudinal studies indicated that depressive symptoms were related to early retirement among workers \(^{21,22}\), and an association to non-working status has been observed especially among young workers aged 26–45 \(^{23}\). Therefore, as sensitivity analysis, for participants who resigned from the JGSDF during the study period and could not respond to the second survey, we imputed CES-D scores. We used the multiple imputation method \(^{24}\) with the fully conditional specification method \(^{25}\) to generate 1,000 complete datasets. These datasets were created using practical data from participants during the baseline survey. The SAS PROC MI and PROC MI ANALYZE procedures were employed to calculate the individual datasets and the pooled results. No auxiliary variable was utilized in this process. The relative efficiency (%) was
calculated as the percentage of missing values of the dataset among the total data by
multiple imputations. A higher percentage indicates that closer to ideal estimate.
Moreover, to further clarify the effect of participation in school club activities on
depressive symptoms, we repeated analyses for the participants aged 18–19 shortly after
graduation from high school. All analyses were performed using JMP clinical 5.0
software (SAS Institute Inc. Cary, NC, USA), a package that combines SAS and JMP
software, and statistical significance was set at p < 0.05.

Results

Of the 971 new recruits we approached, 953 (98.1%) replied to the baseline
survey. After eliminating participants with missing data for baseline CES-D scores or
who did not report their club activity status during high school, 925 participants were
evaluated in the final model, and 59 (6.4%) of whom resigned from the JGSDF during
the survey period.

Table 1 shows the characteristics of the study participants at baseline, according
to their club activity status during high school. Of all participants, 66.3% were members
of sports club, 8.0% took part in activities other than sports club, and 25.7% did not take
part in any club activities. Compared with sports club participants, those who took part
in nonsport club activities or no club activities were less regular exercise, were less
likely to be current smokers, and were having lower SOC scores and higher CES-D
scores (17.1 ± 10.0 in sports club, 19.7 ± 12.0 in nonsport club and 18.9 ± 11.9 in no
club activities). Those who did not participate in any club activities also tended to be
nondrinkers, get less sleep, skip breakfast, and show high resignation rates from the
JGSDF compared with respondents who participated in sports and other club type
activities.

Table 2 shows the changes in average CES-D scores after 2 months, according to club activity status during the high school period. After adjusting for all related variables, participants who had engaged in activities other than sports club and those who did not participate in club activities had a significantly higher CES-D score change than those who had participated in sports club (nonsport club activities: $\beta = 3.90$, 95% confidence interval [CI] = 2.22–6.71; no club activities: $\beta = 2.24$, 95% CI = 0.20–2.94). These associations did not change when multiple imputation methods were applied.

Table 3 shows the analysis of the changes in average CES-D scores after 2 months according to club activity status during the high school period in participants aged 18–19. The analysis showed similar results. Participants who engaged in activities other than sports club and those who did not participate in club activities had significantly higher CES-D score changes than those who participated in sports club (nonsport club activities: $\beta = 2.06$, 95% CI = 0.26–3.87; no club activities: $\beta = 1.91$, 95% CI = 0.09–3.72). When multiple imputation methods were performed, a similar association was found for those with nonsport club activities, but the significant association disappeared for those with no club activities ($\beta = 1.70$, 95% CI = -0.14–3.56).

Discussion

We found that after finishing the 2-month new recruits’ training program, members of the JGSDF who had participated in nonsport club activities or who had not participated in any club activities during high school showed significantly higher CES-D score changes than those who had participated in sports club did. These associations
did not change after considering participants who had retired early from the JGSDF during the study period.

The mean scores of the CES-D in the present study participants were 17.9 point which are generally consistent with 15.6–17.6 point of men in 20–29 years among general worker population \(^{26-28}\). In the present study, changes in the prevalence of depressive symptoms defined as CES-D score of 16 points or more \(^{29}\) from baseline to 2 months later, which were participants with sports club decreased from 48.8\% to 38.6\%, those with other than sports club increased from 50.0\% to 53.1\% and those with no club activities decreased from 56.7\% to 50.5\%. Therefore, participants in sports club had a reduced prevalence of depressive symptoms after 2-months compared to other two groups, which may have clinical significance in an improving depressive symptoms.

Potential mechanisms involved in preventing depressive status among participants who took part in sports club in high school might be as follows: In Japan, students typically belong to only one club during junior and/or high school \(^{30}\). The purposes of school sports club is not only to train the body and engage in athletic activity but also to build team spirit \(^{9}\) through learning to cooperate with peers in order to win a game \(^{31}\). Long-term commitment to sports club activity is conducive to individuals’ emotional engagement through receiving peer support \(^{32}\) and improving emotional attachment \(^{33}\). Strong emotional attachments develop in response to emotion regulation \(^{34}\), which involves skills, behaviors, and strategies that initiate, control, modulate, inhibit, or enhance emotional experiences and expressions in order to adapt to a specific situation \(^{35}\); thus, through these process of growth, a protective effect of participation in sports club against depressive disorders might be observed \(^{36}\). Moreover, participants who were involved in sports club had a higher baseline SOC
score than those who participated in nonsport club activities or who did not participate in club activities. One cross-sectional study suggested that workers with low SOC may have dysregulation of emotion \cite{37}. In addition, some previous studies found that students who participated in sports club learned how to build good relationships with friends and had superior social skills compared to culture club participants or nonclub participants \cite{38,39}; this might be one reason why individuals who had participated in sports club were more likely to successfully adapt to a workplace environment.

**Strength and Limitations**

Our prospective cohort study has a number of strengths. First, the unique study setting, whereby all participants resided in the restricted environment of station of the JGSDF, which was a community that had fixed wake-up, sleep, and meal times. The 2-month new recruitment program included strenuous training with strict discipline that was conducted together with colleagues and necessitates getting along by helping each other. Because the same environmental factors surrounded all participants, our results might be derived from their personal factors. Second, we distinguished between different types of club activities, which previous studies have not done, and found significant differences in the CES-D score changes between sports club and nonsport club activity participants. Third, the participation rate was high (98.1%). Fourth, we used a prevalidated scale to assess depressive symptoms. Fifth, participants were mandated to have three meals in the dining hall of the JGSDF stations. This requirement allowed us to exclude the potential influence of an imbalanced diet on depressive symptoms.

The present study however does have several limitations. First, the resignation
rate during the 2-month study period was higher among nonsport club participants and
people who did not participate in any club activities than it was among those who had
participated in sports club at high school. Therefore, bias from inability to follow-up
these participants may have affected our results. However, because we found that the
resigned participants were more likely to show depressive symptoms and unhealthy
lifestyle habits at baseline (data not shown), we used multiple imputation methods to
minimize this bias. Our sensitivity analysis did not significantly change results, which
indicates that our results might show the true association. Second, the generalizability of
our findings to other populations may be limited because this study was conducted
during the 2-month new recruits’ training program for the JGSDF. In addition, one
reason for heightened depressive symptoms during a short period of time might be the
drastic lifestyle changes that occurred after entering the JGSDF, which rarely occurs in
other workplaces. Third, because the age range of the participants was 18 to 27, and
usually in Japan, students graduate from high school at age 18, other factors may have
had an influence on their depressive symptoms other than participation in a school club
(e.g., a social experience before entering the JGSDF). However, as shown in the
analysis limiting participants to ages 18 and 19, a similar result was found when
compared to the data for all participants. Fourth, some participants might engage in club
activities other than school clubs during high school days; the effect of such activities
on depressive symptoms remains unclear. Fifth, although a previous study has indicated
that adolescent athletes playing individual sports have a higher risk of depressive
symptoms than those playing team sports (40), the information we obtained regarding the
club activities participants engaged in during high school, simply pertained to whether
or not they participated in sports clubs. Further studies examining the details of club
activities would enhance our understanding of possible mechanisms. Sixth, we did not obtain potential confounding factors in the present study. For example, a possible reason for participants who have not participated in club activity during high school might be their mental health problems. However, in the JSDF enlistment requirements, persons with a history of mental health disease are not allowed to enlist. Finally, the relatively small sample size might have affected the statistical power of the analysis of limiting participants. Further studies with numerous participants is to needed revalidate and confirm this study’s results.

In conclusion, a new recruit who was not part of sports club in their high school days may experience higher depressive symptoms after joining the workforce than a person who was part of sports club does. Our results may be useful for the early detection of people who are susceptible to depression while engaged in an occupation such as the JDSF. Further study is needed to ascertain whether similar finding would be obtained in other type of job.

Conflict of Interests

All authors have nothing to disclose.

Author Contributions

TK and KS conceived the research and designed a project. TK drafted the manuscript, and AT and SU review and editing. SU and T Kimura conducted an analysis of multiple imputation method. All authors have read and approved the final manuscript.
References


14) Tanihata T, Kanda H, Osaki Y, Ohida T, Minowa M, Wada K, Suzuki K and


10.1177/070674370905401207.


10.1002/(sici)1097-0258(19990330)18:6<681::aid-sim71>3.0.co;2-r.


36) Silk JS, Steinberg L and Morris AS. 2003. Adolescents' emotion regulation in


Table 1. Characteristics of the study participants at baseline according to participation in club activities during high school period.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Code</th>
<th>Participation in sports club</th>
<th>Participation in activities other than sports club</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td></td>
<td>n=613</td>
<td>n=74</td>
<td>n=238</td>
</tr>
<tr>
<td>Regular exercise</td>
<td>Two times/week or more</td>
<td>19.8 ± 2.4</td>
<td>20.4 ± 2.6</td>
<td>20.1 ± 2.5</td>
</tr>
<tr>
<td>Smoking status</td>
<td>Current smoker</td>
<td>354 (57.8)</td>
<td>198 (32.4)</td>
<td>30 (4.9)</td>
</tr>
<tr>
<td></td>
<td>Former smoker</td>
<td>17 (23.0)</td>
<td>2 (2.7)</td>
<td>12 (5.0)</td>
</tr>
<tr>
<td></td>
<td>Never smoker</td>
<td>383 (62.7)</td>
<td>55 (74.3)</td>
<td>162 (68.1)</td>
</tr>
<tr>
<td>Alcohol consumption</td>
<td>Everyday</td>
<td>7 (1.2)</td>
<td>0 (0.0)</td>
<td>2 (0.8)</td>
</tr>
<tr>
<td></td>
<td>5-6 times/week</td>
<td>9 (1.5)</td>
<td>5 (6.8)</td>
<td>5 (2.1)</td>
</tr>
<tr>
<td></td>
<td>3-4 times/week</td>
<td>44 (7.2)</td>
<td>6 (8.1)</td>
<td>14 (5.9)</td>
</tr>
<tr>
<td></td>
<td>1-2 times/week</td>
<td>91 (14.9)</td>
<td>7 (9.4)</td>
<td>19 (8.0)</td>
</tr>
<tr>
<td></td>
<td>none</td>
<td>459 (75.2)</td>
<td>56 (75.7)</td>
<td>197 (83.2)</td>
</tr>
<tr>
<td>Sleep duration (hours)</td>
<td>&lt;6</td>
<td>168 (27.4)</td>
<td>18 (24.3)</td>
<td>72 (30.2)</td>
</tr>
<tr>
<td></td>
<td>6-6.9</td>
<td>159 (25.9)</td>
<td>15 (20.3)</td>
<td>59 (24.8)</td>
</tr>
<tr>
<td></td>
<td>7-7.9</td>
<td>125 (20.4)</td>
<td>21 (28.4)</td>
<td>44 (18.5)</td>
</tr>
<tr>
<td></td>
<td>≥8</td>
<td>161 (26.3)</td>
<td>20 (27.0)</td>
<td>63 (26.5)</td>
</tr>
<tr>
<td>Having breakfast</td>
<td>Everyday</td>
<td>304 (49.7)</td>
<td>44 (59.5)</td>
<td>102 (42.9)</td>
</tr>
<tr>
<td></td>
<td>4-5 days/week</td>
<td>100 (16.3)</td>
<td>10 (13.5)</td>
<td>27 (11.3)</td>
</tr>
<tr>
<td></td>
<td>2-3 days/week</td>
<td>29 (4.7)</td>
<td>3 (4.0)</td>
<td>17 (7.1)</td>
</tr>
<tr>
<td></td>
<td>none</td>
<td>179 (29.2)</td>
<td>17 (23.0)</td>
<td>91 (38.2)</td>
</tr>
<tr>
<td>SOC score</td>
<td></td>
<td>55.8 ± 12.5</td>
<td>52.4 ± 13.3</td>
<td>52.7 ± 13.6</td>
</tr>
<tr>
<td>CES-D score</td>
<td></td>
<td>17.1 ± 10.0</td>
<td>19.7 ± 12.0</td>
<td>18.9 ± 11.9</td>
</tr>
<tr>
<td>Number of resigee</td>
<td></td>
<td>33 (5.4)</td>
<td>6 (8.1)</td>
<td>22 (9.2)</td>
</tr>
</tbody>
</table>

Values are expressed as mean ± standard deviation or number (%). CES-D: the Center for Epidemiologic Studies Depression Scale.
Table 2. Change in average of the CES-D scores after two months according to participation in club activities during high school period.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Without resigee</th>
<th>Multiple imputation</th>
<th>Relative efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Model 1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Model 2&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Participation in sports club</td>
<td>582</td>
<td>ref</td>
<td>ref</td>
</tr>
<tr>
<td>Participation in activities other than sports club</td>
<td>68</td>
<td>3.59 (1.23-5.94)</td>
<td>3.90 (2.22-6.71)</td>
</tr>
<tr>
<td>None</td>
<td>216</td>
<td>2.35 (1.01-3.69)</td>
<td>2.24 (0.20-2.94)</td>
</tr>
</tbody>
</table>

CI = confidence interval. CES-D: the Center for Epidemiologic Studies Depression Scale.

<sup>a</sup> adjusted for age, the CES-D scores at baseline.

<sup>b</sup> adjusted for age, the CES-D scores at baseline, regular exercise, smoking status, alcohol consumption, sleep duration and having breakfast.

<sup>c</sup> Result after imputation for missing the CES-D score at second survey, adjusted for age, the CES-D scores at baseline, regular exercise, smoking status, alcohol consumption, sleep duration and having breakfast.

<sup>d</sup>The relative efficiency (%) was calculated as the percentage of missing values of the dataset among the total data by multiple imputations. A higher percentage indicates that closer to ideal estimate.
Table 3. Change in average of the CES-D scores after two months according to participation in club activities during high school period among aged 18-19.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Without resigenee</th>
<th>Multiple imputation</th>
<th>Relative efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>β (95%CI)</td>
<td>β (95%CI)</td>
</tr>
<tr>
<td>Participation in sports club</td>
<td>349</td>
<td>ref</td>
<td>ref</td>
</tr>
<tr>
<td>Participation in activities other than sports club</td>
<td>33</td>
<td>3.24 (0.04-6.45)</td>
<td>2.06 (0.26-3.87)</td>
</tr>
<tr>
<td>None</td>
<td>124</td>
<td>3.84 (0.66-7.02)</td>
<td>1.91 (0.09-3.72)</td>
</tr>
</tbody>
</table>

CI = confidence interval. CES-D: the Center for Epidemiologic

a adjusted for age, the CES-D scores at baseline.

b adjusted for age, the CES-D scores at baseline, regular exercise, smoking status, alcohol consumption, sleep duration and having breakfast.

c Result after imputation for missing the CES-D score at second survey, adjusted for age, the CES-D scores at baseline, regular exercise, smoking status, alcohol consumption, sleep duration and having breakfast.

dThe relative efficiency (%) was calculated as the percentage of missing values of the dataset among the total data by multiple imputations. A higher percentage indicates that closer to ideal estimate.