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Self-compassion as a protective factor against post-traumatic stress symptoms induced by adverse childhood experiences: A cross-sectional study among Japan air self-defense force new recruits

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ABSTRACT

Adverse childhood experiences (ACEs) may result in long-term mental health complications, including post-traumatic stress disorder (PTSD). ACEs are known to be more frequent among military personnel, despite their need to maintain their mental health to accomplish their missions. Self-compassion, or treating oneself with kindness and understanding, can mitigate the psychological effects of adversity but is also affected by adversity. This cross-sectional study aimed to identify the complex relationships between ACEs, self-compassion, and PTSD symptoms among 752 new recruits of the Japan Air Self-Defense Force, of whom 537 with ACEs completed the PTSD Checklist for DSM-5. Hierarchical multiple regression analysis was used to examine the independent effect of self-compassion, measured using the Self-Compassion Scale, on PTSD symptoms. Mediation effect analysis with self-compassion as a mediator was conducted on the relationship between ACEs and PTSD symptoms. We confirmed high levels of ACEs among our participants compared to a healthy population of a previous study, and approximately 6% presented PTSD symptoms above a threshold. Self-compassion was significantly negatively associated with PTSD symptoms ($\beta = -.22$, 95% confidence interval [CI], −.34 to −.11). Mediation effect analysis revealed that self-compassion partially mediated the relationship between ACEs and PTSD symptoms, explaining 6.9% of this effect, and ACEs were negatively associated with self-compassion ($\beta = -.13$, 95% CI, −.22 to −.04). These findings suggested that self-compassion is a protective factor against PTSD symptoms, whereas ACEs can decrease self-compassion. Further research should explore educational interventions to enhance self-compassion among individuals with ACEs to mitigate PTSD symptoms.

1. Introduction

Adverse childhood experiences (ACEs) encompass instances of an adverse environment, such as family dysfunction, physical abuse, neglect, emotional abuse, and sexual abuse, predominantly occurring before the age of 18 years (World Health Organization, 1999). Previous studies have indicated that ACEs contribute to various mental and physical health complications in adulthood, including depression, post-traumatic stress disorder (PTSD), and somatic conditions such as heart disease (Felitti et al., 1998; Hughes et al., 2017). ACEs were significantly associated with PTSD diagnosis among military patients with PTSD (Hossack et al., 2020). Considering these findings,

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researchers and policymakers have been struggling to establish measures to address ACEs (Anda et al., 2020). Despite ongoing efforts, ACEs persist as a social issue warranting attention, with 57.8% of the U.S. population having experienced one or more ACEs (Giano et al., 2020). The number of consultations for abuse in Japan has been increasing since the 1990s (Nakamura, 2002), reaching a record high of approximately 220,000/year by 2022 (The Japan Times, 2023). Moreover, a social survey on PTSD revealed that 6.9% of those who experienced a traumatic event in their life encountered violence from a caregiver (Kawakami et al., 2014), underscoring the significance of ACEs countermeasures in Japan.

ACEs directly and indirectly impact PTSD symptoms. Certain studies have demonstrated a direct relationship between ACEs and the onset of PTSD symptoms (Choi et al., 2019; Hoeboer et al., 2021; McRae et al., 2022). Other studies have shown that ACEs increase the risk of developing PTSD after traumatic stress (Frewen et al., 2019; McLaughlin et al., 2017). Biologically, toxic stress resulting from ACEs may lead to increased sensitivity to new potential traumatic events (PTEs), increasing the likelihood of PTSD symptom representation after future PTEs (Nelson et al., 2020). Furthermore, ACEs are associated with developmental brain deficits, which may result in long-term PTSD symptoms (Herzog and Schmahl, 2018).

Blosnich et al. identified a higher prevalence of ACEs among military-experienced individuals compared to non-military-experienced individuals in the U.S., suggesting that military employment may be an option for individuals to escape their ACE situation and other problems at home and achieve independence (Blosnich et al., 2014). Therefore, considering ACEs in the mental health assessment of soldiers is crucial. A meta-analysis by Crede et al. found that ACEs were associated with PTSD severity in the military (Crede et al., 2023), However, no data is available on the impact of ACEs on Japan Self-Defense Forces (JSDF) personnel. ACEs may have a substantial impact on the mental health of military personnel, particularly in new recruits who have been recently separated from their familial environments. Clarifying the association between PTSD symptoms attributable to ACEs in new recruits is pivotal for preventing PTSD in current and future JSDF members.

The psychological concept of self-compassion is a known protective factor that may mitigate the impact of ACEs on PTSD symptoms. Self-compassion is associated with improved mental health outcomes. Self-kindness, an aspect of self-compassion, involves being kinder and more supportive toward oneself and can lead to less harsh self-judgment. Common-humanity, defined as recognizing negative experiences as common to all human beings, can reduce feelings of isolation. Mindfulness, another aspect of self-compassion, aids in decreasing rumination on negative experiences (Braehler and Neff, 2020). Self-compassion has been reported to be associated with improved well-being, decreased psychopathology (MacBeth and Gumley, 2012; Zessin et al., 2015), and the mitigation of PTSD symptoms (Ramon et al., 2022).

Winders et al.'s review indicated a negative correlation between self-compassion and PTSD symptoms, emphasizing the potential protective role of self-compassion (Winders et al., 2020). Furthermore, previous research suggested that self-compassion-based education mitigates PTSD symptoms (Eriksson et al., 2018). Another meta-analysis examining the relationship between ACEs and self-compassion suggested that ACEs may decrease self-compassion (Zhang et al., 2021). Thus, a complex relationship exists among ACEs, self-compassion, and PTSD symptoms, but few studies have examined these associations in detail (Guo et al., 2021).

We hypothesized that self-compassion is a protective factor against PTSD symptoms induced by ACEs and may mediate the relationship between ACEs and PTSD among new recruits in the Japan Air Self-Defense Force (JASDF). This study aimed to investigate the relationship between ACEs and PTSD symptoms and the potential mediating effect of self-compassion on this relationship.

2. Methods

2.1. Procedures

We conducted a survey employing an anonymous cross-sectional design using Google Forms. Participants were given an announcement paper to access the website, with instructions to complete a self-administered questionnaire between June 15 and June 30, 2023. Only participants who consented to the study accessed the website, without input of any personal information. The website additionally provided detailed information about the study. Responses were collected during the basic education period of JASDF's new recruits. To elucidate PTSD symptoms associated with ACEs, the survey directed only those who reported having any ACEs to respond to the questionnaire item measuring PTSD symptoms under the following instruction: "If you had a stressful experience in your childhood in a nurturing environment, please indicate the extent to which you were troubled by this problem during the past month."

2.2. Participants

The age range for new recruit applicants is 18–32 years old. New recruits joining the JASDF undergo three months of basic education, which starts on April 1, and are subsequently assigned to their units nationwide. All 1682 new recruits who enlisted in 2023, were potential participants in the current study. Of the 881 respondents (with a response rate of 52.4%), 752 (44.7%) were included in the analysis, after excluding 129 participants who did not respond to any of the required questions on the measures. Overall, 537 participants who reported having at least one or more ACEs responded to the question measuring PTSD symptoms caused by ACEs (Fig. 1).

2.3. Measures

Demographic characteristics. Demographic data, including age, gender, marital status, and educational history, were collected.

Post-traumatic stress symptoms. The 20-item Post-traumatic Stress Disorder Checklist for Diagnostic and Statistical Manual for Mental Disorders 5 (PCL-5) Japanese and the previous month's version were used to measure PTSD symptoms related to ACEs. Only participants who reported having at least one ACE were asked to complete the PCL-5. This scale comprises seven symptom subscales (Ito et al., 2019). The scale responses are from "0 (Not at all) to 4 (Extremely)", and the total score can range from 0 to 80. The PCL-5 total score in this study had an internal consistency coefficient (Cronbach's α) of .95. Previous research showed that PCL-5 has good properties for measurements in the Japanese population (Ito et al., 2019). Based on the manual and previous research, probable PTSD (p-PTSD) was defined as a score of $\geq$38 (Weathers et al., 2013).

Adverse childhood experiences. ACEs were measured using the Child Abuse and Trauma Scale (CATS) (Saito et al., 2019; Sanders and Becker-Lausen, 1995; Tanabe et al., 2010). We used the 22-item version, and five subscales obtained from a factor analysis of Japanese healthy individuals and patients with mood disorders (Saito et al., 2019). The responses range from "0 (Not at all) to 4 (Always)," and the total score can range from 0 to 88. The total score of ACEs was calculated by dividing the total score by the number of items, and the subscale scores were similarly calculated. The Cronbach's α for CATS total score was .95. Regarding the five subscales, emotional abuse/neglect (internal consistency coefficient [McDonald's ω] = .91) constitutes six items (e.g. "Did your parents insult you or call you names?"), physical abuse (McDonald's ω = .93) constitutes eight items (e.g. "Were you physically mistreated as a child or teenager?"), loneliness/psychological stress (McDonald's ω = .82) constitutes four items (e.g. "Were you lonely as a child?"), parents' discord (McDonald's ω = .78) constitutes two items (e.g. "Did your parents verbally abuse each other?"), and traumatic sexual

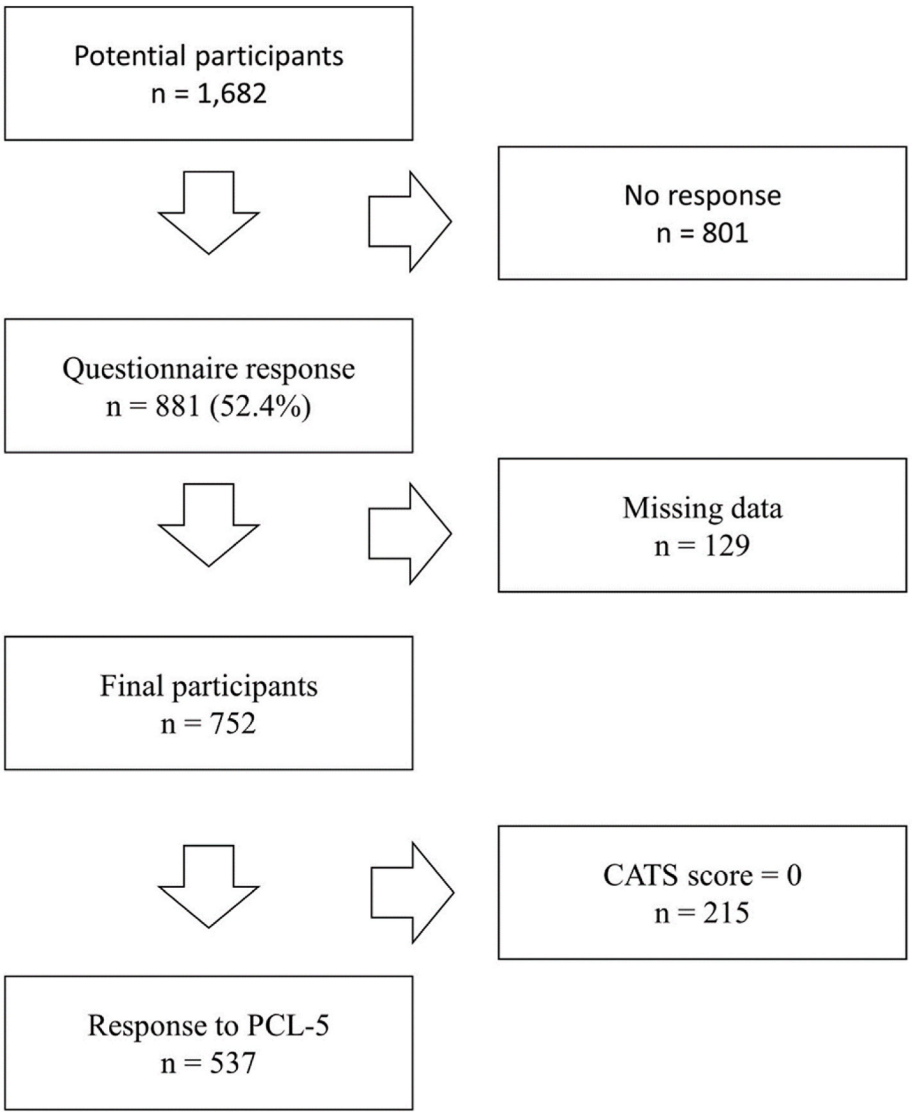

Fig. 1. Flowchart of the participant inclusion process
Note. PCL-5, Post-traumatic Stress Disorder Checklist for Diagnostic and Statistical Manual for Mental Disorders 5. CATS, Child Abuse and Trauma Scale.

experiences (McDonald's $\omega = .85$) constitutes two items (e.g. "Did you have traumatic sexual experiences as a child or teenager?").

Self-compassion. Self-compassion was measured using the Japanese version of the 26-item Self-Compassion Scale (SCS) (Arimitsu, 2014; Neff, 2003). The SCS has three subscales: self-kindness, common-humanity, and mindfulness. The total score can range from 26 to 130, with item responses ranging from "1 (Almost never) to 5 (Almost always)." The Cronbach's α was .82. The total score of SCS was calculated by dividing the total score by the number of items. A high SCS total score indicates high self-compassion. A previous study confirmed the validity of SCS in the Japanese population (Arimitsu, 2014).

Self-esteem. The Japanese version of the 10-item Rosenberg Self-Esteem Scale (RSES) was used to measure self-esteem (Mimura and Griffiths, 2007; Rosenberg, 1965), a self-concept akin to self-compassion. The total score can range from 10 to 40, with responses ranging from "1 (Strongly disagree) to 4 (Strongly agree)." The Cronbach's α was .87. The total score of the RSES was calculated by dividing the total score by the number of items. A high score indicates high self-esteem. A previous study confirmed the validity of the RSES in the Japanese population (Mimura and Griffiths, 2007).

2.4. Data analysis

First, the total and subscale scores of the ACEs were calculated, followed by the computation of correlations among the measurements. Correlation coefficients were evaluated according to the criteria proposed by Cohen (small = .10, medium = .30, large = .50) (Cohen, 1992). Moreover, we examined the prevalence of p-PTSD caused by ACEs.

A hierarchical multiple regression analysis was conducted to confirm the independent association between self-compassion and PTSD symptoms after controlling for other variables including self-esteem. The majority of PCL-5 responses had a 0 value, skewing the score distribution; therefore, the PTSD symptoms score as the dependent variable was transformed to a natural logarithmic value after adding 1 to the total PCL-5 score to correct the positively skewed distribution closer to a normal distribution. Model 1 adjusted for demographic characteristic variables, each ACE subscale, and self-esteem. Model 2 additionally adjusted for self-compassion as an independent variable. The improvement from Model 1 to Model 2 was verified by an analysis of variance. Owing to the inclusion of categorical variables, the multicollinearity among the variables in Model 2 was assessed by checking the generalized variance inflation factor (VIF), adjusted by the degree of freedom for each independent variable (Fox and Monette, 1992). VIF >5 was

used as a reference for the criteria for evaluating the multicollinearity of the model (Kutner et al., 2004). Moreover, 95% confidence intervals (CI) of the standardized regression coefficients were calculated.

We conducted the 16 regression models to detail the relationships among the total and subscale scores of CATS and SCS and PCL-5 total score: total and each single subscale score of CATS and SCS as independent variables to PCL-5 logarithmic total score as the dependent variable and total and each single subscale score of CATS as independent variables to SCS total score as the dependent variable. Each single variable of subscale score was standardized, and each regression model included the variables age, gender, marital status, and educational history as potential confounders.

A mediation effect analysis was conducted to identify the relationship between ACEs and PTSD symptoms with self-compassion as a mediator. We hypothesized that decreased self-compassion due to ACEs contributes to certain PTSD symptoms. A mediation effect analysis was applied to the standardized SCS total score as a mediator between the standardized CATS total score and the standardized PCL-5 total score in the mediated-effect model, while revealing the effect size and 95% CI estimated using a nonparametric 5000 bootstrap (Preacher and Kelley, 2011). Furthermore, we conducted the three mediation effect analyses replacing the SCS total score with each single subscale of SCS as a mediator to reveal the details of SCS elements using the nonparametric bootstrap. We determined the coefficients between ACEs, self-compassion, and PTSD symptoms and applied model fitting using a structural equation model (SEM) for a direct-effect and a mediated-effect model. The latent variables of ACEs, self-compassion, and PTSD symptoms, respectively, constituted manifest variables from the CATS, SCS, and PCL-5 measurements in both the direct- and mediated-effect models. The covariance was set between items within each subscale of measurements. CFI >.95, TLI >.95, RMSEA <.06, and SRMR <.08 were used as references for the criteria evaluating the fit of the model (Hu and Bentler, 1999).

We conducted a simple regression analysis of the respective variable as a sensitivity analysis to check for multicollinearity. Furthermore, to confirm the different effects of self-compassion regarding different types of ACEs, we conducted five regression models similar to Model 2 with the interaction term of each CATS subscale and SCS total score. In addition, the current hierarchical multiple regression analysis and mediation effect analysis targeted only the participants with ACEs. To support our analyses, we conducted sensitivity analyses of the hierarchical multiple regression analysis and the mediation effect analysis including participants without ACEs, for whom PCL-5 scores were imputed as 0.

2.5. Missing data

Overall, missing values were negligible (.64%) and were imputed using the random forest method following a previous study (Stekhoven and Bühlmann, 2012). This method is preferred owing to its accuracy as a non-parametric approach that references other responses (Hong and Lynn, 2020).

All statistical analyses were performed using R software (version 4.2.2) (R Core Team, 2022) and R studio (version 2022.12.0.353) (Posit team, 2022). We used the main packages “psych” and “MBESS” for mediation effect analysis (Kelley et al., 2018; Revelle, 2022), “lavaan” (version .6.12) for SEM analysis (Rosseel, 2012), and “randomForest” (version 4.7.1.1) for imputing the missing values (Liaw and Wiener, 2002). Statistical significance was set at $p < .05$. The R codes used in the analyses are included in the supplementary materials.

3. Results

Of the 752 participants, 560 (74.5%) were men, 182 (24.2%) were women, and 10 (1.3%) identified as other. The mean age was 20.60 years (SD = 2.99), and 745 (99.1%) were unmarried, which can be explained by the young age of participants. Moreover, 444 (59.0%) participants attained a high school level of education. Overall, 537 participants (71.4%) reported at least one ACEs. Figure s1 in the supplementary materials details these demographic characteristics.

The mean total score of CATS was .47 (SD = .64), including 215 respondents who had never experienced ACEs (CATS = 0). The mean scores of each subscale were as follows: emotional abuse/neglect (mean = .40, SD = .71), physical abuse (mean = .51, SD = .73), loneliness/psychological stress (mean = .42, SD = .72), parents’ discord (mean = .89, SD = 1.12), and traumatic sexual experiences (mean = .14, SD = .51) (Table 1).

Pearson’s correlation coefficients were calculated to assess the relationships between each measurement, ranging from −.40 to .65 (Table s1 in the supplementary materials). RSES and SCS showed negative medium correlations with CATS and PCL-5. On the other hand, CATS showed a positively large correlation with PCL-5. The prevalence of p-PTSD meeting the criteria for a PCL-5 total score of ≥38 was 5.85% (n = 44).

The hierarchical multiple regression analysis of 537 individuals with PCL-5 responses demonstrated a significant improvement from Model 1 to Model 2 (F (1, 521) = 15.09, $p < .001$), with significant regression coefficients in Model 2 for loneliness/psychological stress ($\beta = .32$, 95% CI .20 to .44), traumatic sexual experiences ($\beta = .18$, 95% CI .10 to .26), RSES total ($\beta = -.31$, 95% CI −.43 to −.19), and SCS total ($\beta = -.22$, 95% CI −.34 to −.11). The VIF ranged from 1.02 to 2.15. These measurements had high correlation coefficients; however, the multicollinearity of this model was denied by VIF. In addition, simple regression analysis supported the rejection of multicollinearity of this model, as each variable did not exhibit a large difference and showed the same direction between simple and multiple regression analysis (Table 2).

The CATS total score showed significant relationships with both the

Table 1
Demographic characteristics and results of psychological measures of participants.

		Total (n = 752)	
		n	%
Gender			
	Men	560	74.5
	Women	182	24.2
	Other	10	1.3
Marital status			
	Married	7	.9
	Not married	745	99.1
Educational history			
	High school	444	59.0
	Technical college	58	7.7
	Junior college	22	2.9
	University	174	23.1
	Others	54	7.2
		Mean	SD
Age		20.60	2.99
CATS	Total	.47	.64
	Emotional abuse/neglect	.40	.71
	Physical abuse	.51	.73
	Loneliness/psychological stress	.42	.72
	Parents’ discord	.89	1.12
	Traumatic sexual experiences	.14	.51
RSES	Total	2.53	.61
SCS	Total	3.02	.56
	Self-kindness	2.97	.64
	Common-humanity	3.09	.66
	Mindfulness	3.00	.67
PCL-5	Total	11.08	13.80

Note. PCL-5 values were based on n = 537.
SD, standard deviation; CATS, Child Abuse and Trauma Scale; RSES, Rosenberg Self-Esteem Scale; SCS, Self-Compassion Scale; PCL-5, Post-traumatic Stress Disorder Checklist for Diagnostic and Statistical Manual for Mental Disorders 5.

Table 2
Simple regression analysis and Hierarchical multiple regression analysis for PCL-5 as a dependent variable in Model 2.

	Simple regression analysis						Multiple regression analysis						
n = 537	B	β	SE (β)	95% CI		p-value	B	β	SE (β)	95% CI		p-value	VIF
				Lower	Higher					Lower	Higher		
Intercept							3.39	1.58	.07	1.44	1.71	<.001	
Age	.03	.08	.06	−.03	.19	.15	.02	.05	.05	−.05	.15	.36	1.27
Gender (ref. men)													1.02
Women	−.18	−.18	.13	−.43	.08	.18	−.09	−.09	.10	−.29	.11	.40	
Others	.59	.59	.47	−.34	1.5	.21	.23	.23	.36	−.48	.94	.52	
Marital status (ref. No)													1.03
Yes	−.06	−.06	.59	−1.2	1.1	.92	−.00	−.00	.46	−.91	.90	1.00	
Educational history (ref. High school)													1.07
Technical college	−.06	−.06	.23	−.51	.39	.81	−.24	−.24	.18	−.58	.11	.18	
Junior college	.40	.40	.37	−.33	.11	.29	.09	.09	.29	−.48	.66	.76	
University	−.15	−.15	.14	.42	.11	.26	−.14	−.14	.13	−.39	.11	.27	
Others	.45	.45	.23	.01	.90	.05	.22	.22	.18	−.13	.58	.22	
CATS													
Emotional abuse/neglect	.81	.64	.05	.54	.73	<.001	.07	.05	.08	−.12	.21	.57	2.15
Physical abuse	.75	.57	.05	.47	.67	<.001	.15	.11	.08	−.05	.27	.17	1.97
Loneliness/psychological stress	.85	.67	.49	.58	.77	<.001	.44	.32	.06	.20	.44	<.001	1.54
Parents' discord	.33	.38	.05	.27	.48	<.001	.03	.03	.05	−.07	.13	.51	1.22
Traumatic sexual experiences	.82	.49	.05	.38	.59	<.001	.35	.18	.04	.10	.26	<.001	1.17
RSES total	−.94	−.58	.05	−.68	−.48	<.001	−.52	−.31	.06	−.43	−.19	<.001	1.41
SCS toral	−.92	−.53	.05	−.63	−.43	<.001	−.40	−.22	.06	−.34	−.11	<.001	1.38

Note. Simple regression analysis results are presented in each row, where each row corresponds to a separate simple regression model with a single independent variable. Multiple regression analysis shows the results of the hierarchical multiple regression model. The top row value of each categorical variable indicates the VIF value of the corresponding independent variable.
B, unstandardized coefficient; β, standardized coefficient; SE, standard error; 95% CI, standardized 95% confidence intervals; VIF, variance inflation factor, adjusted by the degree of freedom; PCL-5, Post-traumatic Stress Disorder Checklist for Diagnostic and Statistical Manual for Mental Disorders 5; CATS, Child Abuse and Trauma Scale; RSES, Rosenberg Self-Esteem Scale; SCS, Self-Compassion Scale.

SCS total score ($\beta = -.21$, 95% CI, −.28 to −.14) and PCL-5 total score ($\beta = .64$, 95% CI, .55 to .73), and the SCS total score was inversely associated with the PCL-5 total score ($\beta = -.52$, 95% CI, −.62 to −.42). All subscales of CATS had positive coefficients with the PCL-5 total score and negative coefficients with the SCS total score. All subscales of SCS had negative coefficients with the PCL-5 total score (Table 3).

The mediation effect analysis indicated that the indirect effect was .04 (95% CI, .02 to .07), 6.9% of the total effect, and the effect size of residual-based standardized gamma (Γ^2) was .026 (95% CI, .009 to .049). Each subscale of SCS had an indirect effect (Figure s2 in the supplementary materials). We deemed the mediated-effect model as interpreted because the fit values met the cutoff criteria. The standardized coefficients from ACEs to PTSD symptoms decreased from .63 (95% CI, .57 to .69) in the direct-effect model to .59 (95% CI, .53 to .65) in the mediated-effect model. Furthermore, ACEs had a negative coefficient for self-compassion ($\beta = -.13$, 95% CI, −.22 to −.04) (Fig. 2).

Sensitivity analysis of the five simple regression analyses with interaction terms revealed the non-significance of all interaction term coefficients. The hierarchical multiple regression analysis including participants without ACEs showed that the significant regression coefficients of junior high school education history, physical abuse, and parents' discord were satisfied in multiple regression Model 2 (Table s2in the supplementary materials). The indirect effect in the sensitivity analysis was .05 (95% CI, .03 to .07) and 7.7% of the total effect. Moreover, ACEs were negatively related to self-compassion in the mediated-effect model of SEM (Figure s3 in the supplementary materials).

Table 3
Associations between the total and subscale scores of CATS, SCS, and PCL-5 using regression analysis.

	PCL-5 total				SCS total			
n = 537	β	95% CI		p-value	β	95% CI		p-value
		Lower	Higher			Lower	Higher	
CATS total	.64	.55	.73	<.001	−.21	−.28	−.14	<.001
Emotional abuse/neglect	.57	.48	.66	<.001	−.22	−.29	−.15	<.001
Physical abuse	.54	.44	.64	<.001	−.18	−.25	−.11	<.001
Loneliness/psychological stress	.61	.52	.69	<.001	−.19	−.27	−.12	<.001
Parents' discord	.37	.26	.47	<.001	−.14	−.21	−.07	<.001
Traumatic sexual experiences	.41	.32	.50	<.001	−.09	−.17	−.02	.01
SCS total	−.52	−.62	−.42	<.001				
Self-kindness	−.42	−.52	−.32	<.001				
Common-humanity	−.43	−.53	−.33	<.001				
Mindfulness	−.47	−.57	−.37	<.001				

Note. The table includes the 16 regression analyses. Each row shows one regression model, respectively. Total and each single subscale score of the CATS and SCS as independent variables to the PCL-5 total score as the dependent variable. Total and every single subscale of CATS as independent variables to the SCS total score as the dependent variable. Each variable was standardized, and each model included the variables age, gender, marital status, and educational history as confounders.
CATS, Child Abuse and Trauma Scale; SCS, Self-Compassion Scale; PCL-5, Post-traumatic Stress Disorder Checklist for Diagnostic and Statistical Manual for Mental Disorders 5; β, standardized coefficient. 95% CI, standardized 95% confidence intervals.

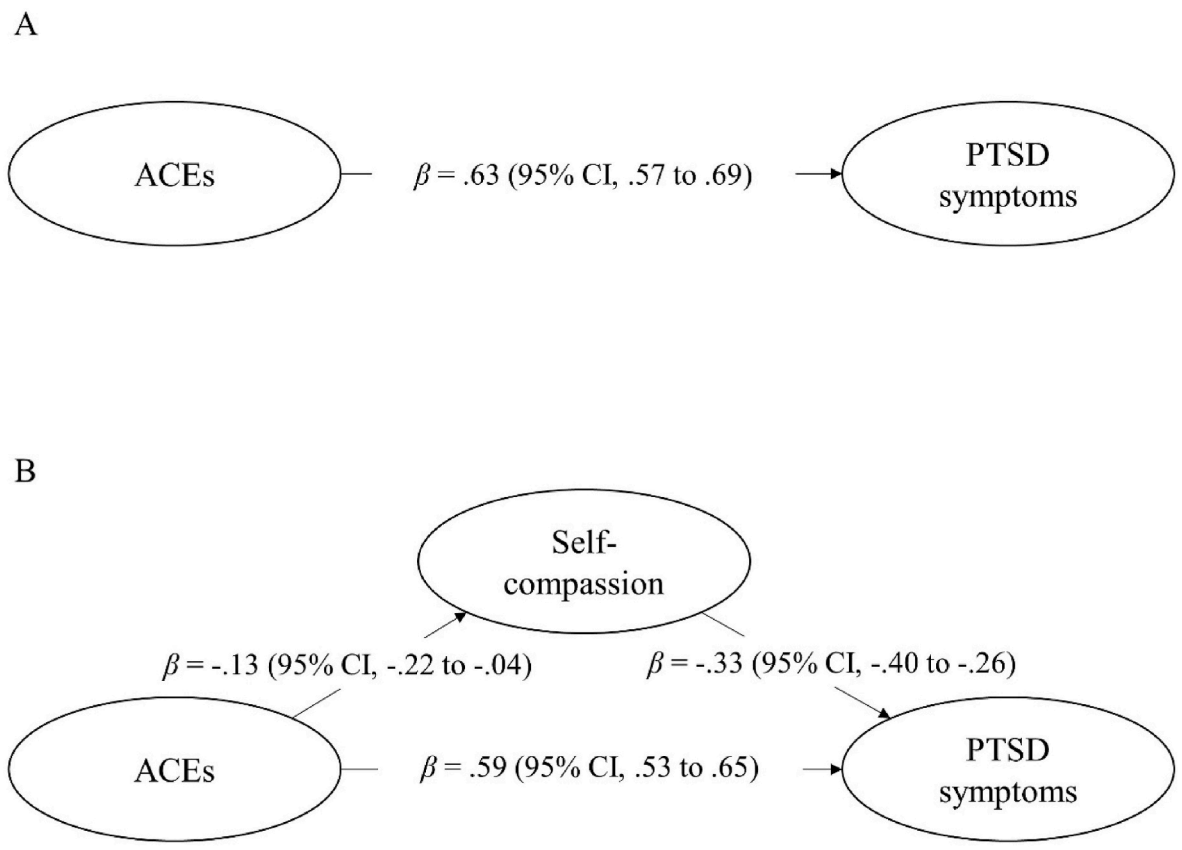

Fig. 2. The structural equation model of self-compassion as a mediator between ACEs as an independent variable and PTSD symptoms as a dependent variable
Note. A represents the direct-effect model using the structural equation model (fit measures, CFI = .91, TLI = .90, RMSEA = .06, 95% CI .06 to .06, SRMR = .06). B represents the mediated-effect model (fit measures, CFI = .87, TLI = .86, RMSEA = .05, 95% CI .05 to .05, SRMR = .07). The direct effect between ACEs and PTSD symptoms was .63. After adding the self-compassion score as a mediating factor, the direct effect changed to .59. This figure does not show all the items as manifest variables and errors.
ACEs, adverse childhood experiences PTSD symptoms, post-traumatic stress disorder symptoms. Each latent variable comprises manifest item scores. β, standardized coefficient. 95% CI, standardized 95% confidence intervals.

4. Discussion

Our findings supported the hypothesis that ACEs contribute to PTSD symptoms among new recruits in the JASDF. Self-compassion had a protective association with PTSD symptoms. Furthermore, we clarified the complex relationship between ACEs and PTSD symptoms with self-compassion as a mediator. Sensitivity analysis was conducted by imputing data assuming the absence of PTSD symptoms for participants reporting no ACEs, revealing the robustness of the findings. To the best of our knowledge, this is the first study to investigate the relationship between ACEs and PTSD symptoms, with self-compassion as a potential mediator among new recruits in the JASDF.

The mean CATS total score in this study was higher than that reported in a previous study of healthy Japanese participants (Saito et al., 2019), indicating that JASDF new recruits may have experienced more ACEs than the general healthy Japanese population. Some new recruits may join the JASDF to gain early financial independence or avoid poverty and other adverse family circumstances, despite most Japanese high school graduates pursuing higher education at institutions such as universities (Ministry of education, 2023). Past ACEs increase the potential risk of developing PTSD in the future (Frewen et al., 2019; McLaughlin et al., 2017); it is essential for the JASDF to provide appropriate preventive interventions to reduce the future incidence of PTSD. Therefore, this study underscores the significance of closely monitoring ACEs among new recruits.

Direct comparison of PTSD prevalence rates is challenging owing to varying assessment methods; nevertheless, the p-PTSD rate attributable to ACEs in our study was approximately 6%, which was much higher than the 12-month prevalence rate of .7% reported in the Japanese population (Kawakami et al., 2014). A large study on Canadian Armed Forces recruits and officer cadets who experienced sexual abuse of ACEs revealed p-PTSD prevalence of approximately 9% for women and 15% for men, and sexual abuse in men associated with risk of p-PTSD (Gottschall et al., 2022). Considering that the absence of mental illness is a prerequisite for the enlistment of JASDF, a p-PTSD prevalence of approximately 6% among the JASDF recruits can be regarded as high within the Japanese context, although these participants did not receive a precise diagnosis. Furthermore, ACEs can substantially influence late-life PTEs, increasing both biological and psychological vulnerability (Nelson et al., 2020). Specifically, ACEs can increase the risk of developing future PTSD among new recruits after PTEs. First responders, such as firefighters deployed in disasters, are exposed to work-related PTEs during their duties (Bonumwezi et al., 2022). JSDF members are required to respond to emergencies, such as disasters and armed attack situations; therefore, implementing countermeasures, including appropriate interventions to mitigate the risk of future PTSD development linked to ACEs, is imperative.

Hierarchical multiple regression analysis revealed that loneliness/psychological stress, indicating isolation from parents or family and traumatic sexual experiences, indicating undesirable sexual experiences as a child, were significantly positively associated with PTSD symptoms. This finding is in line with that of a previous study indicating that physical and sexual abuse, neglect, and parental psychopathology were associated with an increased risk of PTSD symptoms compared to other

experiences of abuse (McLaughlin et al., 2017). Psychological stress due to isolation from parents and caregivers and traumatic sexual experiences may cause psychological disruption and mental health deterioration (Xerxa et al., 2023), and the current results support these findings. In particular, loneliness in childhood maltreatment may cause the child to develop self-criticism (Lassri et al., 2016). On the other hand, traumatic sexual experiences may cause feeling of shame (McElvaney et al., 2022). This highlights the importance of recognizing the presence of ACEs and considering their types when assessing the risk for PTSD symptoms.

The current study identified a negative association between self-compassion and PTSD symptoms after controlling for self-esteem. This implies that self-compassion has an independent protective effect on PTSD symptoms, consistent with the findings of a previous study (Neff, 2011). Self-compassion and self-esteem are partially overlapping constructs, but self-compassion is potentially easier to enhance through interventions (Muris and Otgaar, 2023). Targeting self-compassion may be more effective for promoting resilience than focusing on self-esteem. The unique protective effect of self-compassion on PTSD symptoms offers an additional perspective to the conventional concept of individual resilience.

The level of effect size appropriate for a clinically meaningful mediation effect has been an ongoing discussion (Lachowicz et al., 2018). However, a statistically significant indirect effect size of self-compassion on ACEs and PTSD symptoms has been identified, albeit with a small magnitude. The mediated-effect model revealed that ACEs were inversely associated with self-compassion. ACEs may have contributed to PTSD symptoms by lowering self-compassion, which allows buffering of PTSD symptoms. While the relationship between ACEs and self-compassion is intricate, prior research has indicated a negative association between ACEs and self-compassion (Barlow et al., 2017; Messman-Moore and Bhuptani, 2020). The result of the current mediated-effect model is consistent with these previous studies.

Inescapable ACEs, particularly loneliness and traumatic sexual experiences in childhood have also been linked to self-criticism and shame (Lassri et al., 2016; McElvaney et al., 2022), which may result in lower resilience. Self-compassion aids in improving emotion regulation and cognitive appraisal (Barlow et al., 2017; Chishima et al., 2018) and may decrease self-criticism and shame (Braehler and Neff, 2020). ACEs are difficult to change; therefore, PTSD symptoms should be mitigated by increasing self-compassion. The current study revealed that the mediation effect of self-compassion was a small but definite protective factor that may suppress certain PTSD symptoms caused by ACEs. These findings provide a basis for further interventional research. Psychological interventions addressing the reduction in self-compassion may be effective in mitigating PTSD symptoms.

Training programs may aid in fostering individuals' self-compassion (Gilbert, 2014; Neff and Germer, 2013). Prior studies have confirmed self-compassion improvement, in addition to stress and anxiety reduction, through self-compassion training programs (Eriksson et al., 2018; Ferrari et al., 2019; Joss et al., 2019). The application of prolonged exposure programs in patients with PTSD has been shown to improve self-compassion and mitigate PTSD symptoms (Hoffart et al., 2015). Furthermore, researchers have sought to find appropriate training interventions to increase self-compassion among military personnel (Steen et al., 2021). For example, loving-kindness meditation improved self-compassion and mitigated PTSD symptoms among military veterans with PTSD (Kearney et al., 2013). Fredrickson et al. also proposed that loving-kindness meditation affects positive emotion based on the broaden-and-build theory (Fredrickson et al., 2008). This form of meditation may increase the repertoires of action such as beneficial outcomes derived from social support. However, additional research is required to reach a definitive conclusion. The JASDF provides training to all members with the objective of promoting individual resilience, as evidenced by the U.S. military (Reivich et al., 2011). Nevertheless, a considerable scope for improvement exists in this practice. Mindfulness-based self-compassion education has the advantage of being already translated into Japanese and standardized (Neff et al., 2019). Our current findings provide a novel perspective on improving JASDF training by introducing mindfulness-based self-compassion education, such as through the standardized program. We must accumulate further evidence using strategic methods, such as a practical randomized controlled trial. This trial would compare standardized self-compassion training as the intervention with the current training as the control within the JASDF members. Future research on training interventions for self-compassion is essential to strengthen individual resilience among military personnel.

This study had several limitations. First, mediation effect analysis in the cross-sectional survey design does not identify temporal nor causal relationships between independent and mediating variables (Maxwell and Cole, 2007). Therefore, whether self-compassion reduces PTSD symptoms or whether individuals with lower PTSD symptoms had higher self-compassion could not be determined. Further longitudinal surveys and analyses, including time-lagged methods, are required to reveal causal relationships (Falkenström et al., 2020). Second, PTEs other than ACEs remain unknown. Although the instructions explicitly asked about PTSD symptoms from ACEs, other PTEs may have influenced the PTSD symptom responses, resulting in complex confounding factors that may have affected the results. Furthermore, other variables, such as social support, seemed to be protective factors but were not included. Social support may be an important factor owing to its role in recovery from ACEs based on the stress-buffering model (Cohen and Wills, 1985; McCutchen et al., 2023). Therefore, social support should be considered in educational interventions based on self-compassion. In addition, alternative protective factors for self-compassion should be considered. Third, the retrospective ACE survey may have introduced recall bias, wherein the participants may have had a false recollection of their memories. This recall bias, influenced by current impressions, poses challenges in precisely characterizing ACEs solely as events not rated by the participants (Baldwin et al., 2019). Furthermore, even with anonymized responses, events that are distressing for individuals or those that they may unconsciously prefer not to recall, such as childhood abuse, can be challenging to report accurately and are often underestimated (McKinney et al., 2009). In addition, JASDF recruits may have underreported ACEs and PTSD symptoms owing to stigma or seeking desirability from their surroundings. Further research using corroborative reports or longitudinal designs is required. Fourth, self-compassion indicated the potential to protect against PTSD symptoms induced by ACEs. However, previous research revealed that different types of ACEs correlate differently with PTSD symptoms (Gottschall et al., 2022). Our findings could not reveal this difference. Further research is required to reveal correlations based on ACEs type. Finally, caution should be adopted when generalizing the results since the response rate was only 44.7% and all participants were members of the JASDF. In particular, non-response bias may have underestimated the prevalence of ACEs in the target population. Even if the survey was conducted anonymously, it is possible that new recruits with serious ACEs were hesitant to respond, resulting in a low response rate. In addition, the percentage of women in all new recruits in the Ministry of Defense in 2023 was 16.6% (Ministry of Defense, 2024) compared to 24.2% in the current study. Current findings may have the potential heterogeneity, necessitating caution in generalizability.

In conclusion, this study revealed a high prevalence of ACEs among JASDF new recruits, with approximately 6% presenting with ACEs-related p-PTSD. We identified self-compassion as a potential protective factor against PTSD symptoms induced by ACEs. Furthermore, our study demonstrated that ACEs were associated with a lower level of self-compassion in the mediated-effect model and that ACEs may have contributed to PTSD symptoms by lowering self-compassion through the indirect route. These findings suggest that self-compassion may be a target for mitigating PTSD symptoms resulting from ACEs. Psychological intervention focusing on improving self-compassion may be effective for

the alleviation of PTSD symptoms associated with ACEs. Self-compassion has the potential to provide valuable perspectives for fostering and sustaining good mental health in new recruits. Hence, further research is required to explore effective self-compassion training interventions to reinforce self-compassion, which may contribute to alleviating PTSD symptoms and improving the mental health of military personnel.

CRediT authorship contribution statement

Masato Kitano: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Florentine H.S. van der Does:** Writing – review & editing. **Taku Saito:** Writing – review & editing, Conceptualization. **Erik J. Giltay:** Writing – review & editing, Visualization, Validation, Supervision, Software, Methodology, Investigation, Formal analysis, Data curation. **Toshinori Chiba:** Writing – review & editing. **Naoki Edo:** Writing – review & editing. **Fumiko Waki:** Writing – review & editing, Conceptualization. **Hisateru Tachimori:** Writing – review & editing. **Minori Koga:** Writing – review & editing. **Nic J. van der Wee:** Writing – review & editing, Supervision. **Eric Vermetten:** Writing – review & editing, Supervision. **Masanori Nagamine:** Writing – review & editing, Supervision, Conceptualization.

Availability of data and materials

The dataset used and analyzed in the present study is available from the corresponding author upon reasonable request.

Ethical approval

This study was conducted in accordance with the Declaration of Helsinki and Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines. This study was approved by the Ethics Committee of the National Defense Medical College (approval no. 4637). All participants who participated in this study provided informed consent.

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Declaration of competing interest

The author declares no conflicts of interest.

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List of abbreviations

ACEs	adverse childhood experiences
CATS	Child Abuse and Trauma Scale
CFI	comparative fit index
CI	confidence interval
JASDF	Japan Air Self-Defense Force
JSDF	Japan Self-Defense Forces
PCL-5	Post-traumatic Stress Disorder Checklist for Diagnostic and Statistical Manual for Mental Disorders 5
PTSD	post-traumatic stress disorder
PTEs	potential traumatic events
RSES	Rosenberg Self-Esteem Scale
RSMER	root mean square error of approximation
SCS	Self-Compassion Scale
SD	standard deviation
SEM	structural equation model
SRMR	standardized root mean square residual
TLI	Tucker–Lewis index

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpsychires.2024.10.010.

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