Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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The effect of ego-resiliency and COVID-19-related stress on mental health among the Japanese population

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ABSTRACT

Due to the negative psychological consequences of the COVID-19 pandemic worldwide, it is necessary to study the factors that improve mental health. In this study, we evaluated changing income, self-restraint, fear of COVID-19, depression, anxiety, stress, and ego-resiliency, to investigate the main and moderating effects of ego-resiliency on psychological distress. We analyzed 222 Japanese samples from the dataset of Primary Survey in Japan (PSJ) in the Resilience to COVid-19 in Each Region (RE-COVER) project. The results showed significant main effects of ego-resiliency on depression and stress, and a significant interaction effect of self-restraint and ego-resiliency on depression. We also tested the significance of the moderating effect of ego-resiliency on the relationship between self-restraint and depression. The simple slope of ego-resiliency was only significant for individuals with high self-restraint. Our findings provide empirical evidence on mental health associated with the COVID-19 pandemic among the Japanese population, proving that ego-resiliency functioned to cope with the specific stresses associated with COVID-19.

1. Introduction

The novel coronavirus disease (COVID-19), originating from China, has rapidly spread all over the world; so far, a total of 30.6 million infected cases and 950,000 deaths have been reported due to COVID-19 (World Health Organization, 2020). Countermeasures against this pandemic, including quarantine and personal preventive behaviors (the practice of social distancing, avoiding crowded places, using personal protective equipment, etc.), have been implemented in each country. However, while these measures actually reduce the threat of infection from other people, at the same time, adherence to these measures is often associated with negative psychological consequences (Brooks et al., 2020).

The deterioration of the economy and daily life conditions due to the continued pandemic are expected to increase stress and isolation, and lead to increased difficulties in our lives (Masten & Motti-Stefanidi, 2020). In this situation, where the fear of being infected with COVID-19 and losing one's life is ever present among the people, researchers have suggested that psychological problems such as panic, anxiety, and depression are likely to increase (Duan & Zhu, 2020; Qiu et al., 2020; Wang et al., 2020). Furthermore, obvious changes have occurred in people's work and daily lifestyle, and these changes are well-known to play an important role in mental health (Lima et al., 2020). One study found that suffering from post-traumatic stress symptoms due to COVID-19 led to negative consequences such as poor mental health and reduced work capacity (Bo et al., 2020). These early reports show that this ongoing pandemic caused COVID-19-related stress which worsened mental health, and this situation urgently requires preventative measures for mental health care.

Psychological problems can be considered to be the result of several kinds of stress. A study found that the unpredictability, uncertainty, and seriousness of the disease, misinformation about the disease, and social isolation all contributed to stress (Zandifar & Badrfam, 2020). Uncertainty creates a fear of developing an infectious disease. Fear of infection is an important psychological factor in the current pandemic situation (Masuyama et al., 2020). Indeed, fear is an adaptive defense mechanism that is fundamental for survival and involves several biological processes of preparation for a response to potentially threatening events such as a pandemic (Ornell et al., 2020). However, if fear becomes chronic or unbalanced, it can be detrimental and lead to various psychological problems (Garcia, 2017). In addition, the economic impact of COVID-19 has also affected public well-being and caused panic

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behaviors such as hoarding and stockpiling of limited resources (Shigemura et al., 2020). A study during the lockdown period of COVID-19 in Spain revealed that having negative self-perceptions about aging and lower perceived self-efficacy was found to be associated with loneliness and psychological distress (Losada-Baltar et al., 2020). Given these findings, it can be concluded that the economic impact of the pandemic and home lockdown are major stressors which lead to worsening mental health in this situation. Thus, it is necessary to protect oneself against the effects of these perceived stresses in order to avoid serious psychological problems.

In order to improve public mental health during this pandemic, accumulated knowledge on ego-resiliency can be used to provide practical solutions to cope effectively with the challenges. Ego-resiliency is the ability to flexibly adapt to difficult and stressful conditions (Block, 2002; Block & Block, 1980; Farkas & Orosz, 2015; Letziring et al., 2005). It is a psychological resource with stable properties over time (Vecchione et al., 2010) and across different cultures and countries (Alessandri et al., 2012). As a result of this adaptive flexibility, individuals with a high level of ego-resiliency are likely to exhibit better psychological adjustment than individuals with a low level of ego-resiliency (Block & Kremen, 1996; Klohnen, 1996). Both young and elderly people have been found to possess and use this psychological resource for adapting to difficult situations (MacLeod et al., 2016). Research on people who faced natural disasters offers compelling evidence of resilience in situations of disaster and trauma, and shows how resilience makes a difference to well-being under these conditions (Masten & Motti-Stefanidi, 2020). Empirical research also showed significant negative correlations between ego-resiliency and depression, anxiety, and stress among people displaced due to armed conflict (Mujeeb & Zubair, 2012). in another study, ego-resiliency buffered the effect of daily hassles on exhaustion, and thus on emotional dynamics (Alessandri et al., 2020). Therefore, during the COVID-19 pandemic, ego-resiliency has the potential to help reduce the negative effects of the pandemic on people's mental health.

However, the relationship between ego-resiliency and mental health during the COVID-19 pandemic has not been adequately explored. Therefore, the purpose of this study was to examine the effect of ego-resiliency on mental health during the current pandemic. First, this study examined the effect of ego-resiliency on mental health. Thus, we formed the first hypothesis, stating that ego-resiliency is negatively related to depression, anxiety, and stress. Second, the study examined whether ego-resiliency moderated the effects of COVID-19-related stress on mental health. We examined environmental, economic, and psychological stressors, namely, self-restraint, changing income, and fear of COVID-19, respectively, as the COVID-19-related stressors. The second hypothesis stated that ego-resiliency moderates the effect of self-restraint, changing income, and fear of COVID-19 on depression, anxiety, and stress. Gaining insight into the protective psychological factors against the pandemic is important because it can help develop better prevention and treatment strategies. Thus, it is necessary to clarify the function of ego-resiliency in the current pandemic situation.

2. Materials and methods

2.1. Participants

For this study, we used the dataset of Primary Survey in Japan (PSJ) in the Resilience to COVid-19 in Each Region (RE-COVER) project. The RE-COVER project aims to reveal recovery factors that re-energize mental health during the COVID-19 pandemic, focusing on psychological resilience and several positive psychological aspects, in four countries: Japan, the United States, China, and Malaysia (Sugawara et al., 2020).

The PSJ aimed to explore the effect of psychological resilience on mental health during the COVID-19 pandemic, and was conducted on July 13, 2020, using an online survey form hosted by Questant (https://questant.jp). The survey recruited participants through the website and targeted the Japanese population over 18 years old. It included 222 Japanese individuals (125 men, 56.3%; 97 women, 43.7%), and consisted of various psychological measures (e.g., Fear of COVID-19 Scale, Depression Anxiety Stress Scales, and Ego-Resilience Scale). The mean age of the participants was 46.71 years (standard deviation = 13.28; range = 19–87 years). The survey also inquired about the respondents' type of job. At the time of the survey, there were approximately 21,798 people infected with COVID-19 in Japan, and approximately 981 related deaths. In this study, we used the survey data for the Fear of COVID-19, Depression, Anxiety, Stress Scales (DASS-21), and Ego-Resilience Scale to investigate the main and moderating effect of ego-resiliency on psychological distress during the pandemic.

2.2. Measures

We examined environmental, economic, and psychological stressors, namely, self-restraint, changing income, and fear of COVID-19, respectively, as the COVID-19-related stressors.

2.2.1. Self-restraint and changing income

We developed a questionnaire to measure self-restraint and changing income. Self-restraint was assessed by a single item which assessed the frequency of going out. Participants responded to the item on a 3-point scale ranging from "1 = time of going out decreased in the last month," "2 = time of going out was the same as before in the last month," and "3 = time of going out increased in the last month." A higher score indicated lower self-restraint. Changing income was assessed with a single item on a 5-point scale ranging from "1 = largely decreased" to "5 = largely increased."

2.2.2. Fear of COVID-19 Scale

The Fear of COVID-19 Scale (FCV-19S; (Ahorsu et al., 2020) was used to assess fear of COVID-19 among the people. In this study, we used the Japanese version of FCV-19S (FCV-19S-J), validated by Masuyama et al. (2020), with sufficient reported reliability. The FCV-19S-J consists of the original seven items of the FCV-19S, but is divided into two subscales: emotional responses (items 1, 2, 4, and 5) and physiological responses (items 3, 6, and 7). Participants responded to each item on a 4-point scale ranging from "1 = strongly disagree" to "4 = strongly agree." A higher score indicated a greater fear of COVID-19. In this study, the total score of all items was used in the analysis. All items showed high internal consistency ($\alpha = 0.83$, $\omega = 0.81$).

2.2.3. Ego-Resilience Scale

The Ego-Resilience Scale (ER89) measures the extent to which individuals show flexibility in response to changing environmental demands (Block & Kremen, 1996). We used the Japanese version of ER89, validated by Ushio and Onodera (2013) with sufficient reported reliability. The ER89 consists of 14 items which are rated on a 4-point scale ranging from "1 = does not apply at all" to "4 = applies very strongly." A higher score indicated a greater ego-resiliency. In this study, the total score of all items was used in the analysis. Scoring requires the summation of responses to all 14 items. All items showed high internal consistency ($\alpha = 0.90$, $\omega = 0.90$).

2.2.4. Depression Anxiety Stress Scale

The Japanese version of the Depression Anxiety Stress Scales (DASS; Lovibond & Lovibond, 1995), was used to assess multiple aspects of mental health. In previous research, the scale has been used to measure mental health of the general public under pandemic conditions (Wang et al., 2020). The Japanese scale consists of the 21 items of the original DASS, divided into three subscales: depression, anxiety, and stress (7 items in each). Participants responded to each item on a 4-point scale ranging from "did not apply to me at all" to "applied to me very much, or most of the time." Higher scores indicated greater depression, anxiety or

stress. In this study, the total scores of each subscale items were used in the analysis. The three factors showed high internal consistency (depression: α = 0.93, ω = 0.93; anxiety: α = 0.92, ω = 0.92; stress: α = 0.92, ω = 0.92).

2.3. Data analysis

The following analyses were performed to determine the effect of ego-resiliency on depression, anxiety, and stress. The main outcome variables were depression, anxiety, and stress. First, we conducted descriptive and correlational analyses on participants' sex, age, changing income, self-restraint, fear of COVID-19, depression, anxiety, stress, and ego-resiliency. Second, a 4-step hierarchical regression analysis was conducted on depression, anxiety, and stress. In step 1, we controlled for the effects of sex and age. We excluded the effect of demographic variables in testing models by controlling for sex and age based on suggestions from previous studies (Hjemdal et al., 2011; Ozamiz-Etxebarria et al., 2020). In step 2, we entered changing income, self-restraint, and fear of COVID-19, followed by ego-resiliency in step 3. In step 4, we analyzed whether ego-resiliency interacted with changing income, self-restraint, and fear of COVID-19 to influence depression, anxiety, and stress. Finally, to test the indirect effects of variables with interactions, we used the SPSS macro PROCESS (http://www.afhayes.com), as suggested by Hayes (2013). All analyses were conducted using the SPSS software (version 23.0).

3. Results

3.1. Descriptive and correlational analyses

Descriptive statistics and correlations of the main outcome variables are presented in Table 1. Ego-resiliency was found to be negatively related to depression ($r = -0.28, p < .01$) and stress ($r = -0.15, p < .05$); however, it was not related to changing income, self-restraint, fear of COVID-19, or anxiety. Changing income showed a negative correlation with stress ($r = -0.14$, $p < .05$). Fear of COVID-19 was found to be positively correlated with depression ($r = 0.26$, $p < .01$), anxiety ($r = 0.37, p < .01$), and stress ($r = 0.39, p < .01$). Self-restraint was not found to be correlated with depression, anxiety, or stress. Based on these results, it can be concluded that although no correlation was found between ego-resiliency and COVID-19-related stress, individuals who reported higher levels of ego-resiliency tended to have better mental health during the pandemic situation.

3.2. Main analysis

To investigate the unique interaction and contribution of the COVID-19-related predictors to depression, anxiety, and stress, we conducted a hierarchical multiple regression analysis where the predictors, namely self-restraint, changing income, fear of COVID-19, and ego-resiliency were used as independent variables. The interaction effects were calculated according to the procedure recommended by Aiken and West (1991). Prior to the analysis of the interaction effects, the independent variables were all centered around the mean to reduce multicollinearity. Results of the analysis of interaction effects are presented in Table 2. To test the main effect of ego-resiliency and the interaction effect of ego-resiliency and COVID-19-related stress on mental health, we entered participants' sex and age as control variables in the first block, and self-restraint, changing income, and fear of COVID-19 in the second block. Ego-resiliency was added in the third block, and the mean-centered predictors to estimate the interaction effects (ego-resiliency × self-restraint, ego-resiliency × changing income, ego-resiliency × fear of COVID-19) were entered in the fourth block.

The main effect of ego-resiliency on depression ($\Delta R^2 = 0.07, p < .01$) and stress ($\Delta R^2 = 0.02$, $p < .05$) was significant. This indicates that a higher level of ego-resiliency leads to lower levels of depression and stress. The interaction effect of self-restraint and ego-resiliency on depression was significant ($\beta = 0.19, p < .01$; $\Delta R^2 = 0.05, p < .01$). This demonstrated that the strength of the effect of self-restraint on depression changed depending on the level of ego-resiliency. To interpret the interaction effect, we obtained predicated values for the depression levels by substituting regression coefficients in the multiple regression equation and derived regression equations for each level of ego-resiliency (Aiken & West, 1991; Cohen et al., 2003). The result is shown in Fig. 1. When self-restraint was high, depression levels decreased as ego-resiliency increased. When self-restraint was low, there was no difference in depression levels with an increase in ego-resiliency.

Meanwhile, since ego-resiliency and self-restraint are continuous variables, we needed to determine the specific conditions wherein the interaction effect occurred. To this end, we examined the interaction effect at specific values (e.g., mean ± 1 SD) and then tested the statistical significance of the slopes (Aiken & West, 1991). Hence, we tested the significance of the slope of simple regression lines representing the relationship between ego-resiliency and depression levels at the mean ± 1 SD values of self-restraint. This simple slope of ego-resiliency was significant for individuals who reported high self-restraint ($B = -0.278$, $t(218) = -4.522, p < .001$) and not for individuals who showed low self-restraint ($B = -0.150$, $t(218) = -1.663$, *ns*). Thus, individuals who reported high self-restraint showed a decrease in depression level with greater ego-resiliency, whereas individuals with low self-restraint did not exhibit this association.

In addition, mediation analysis was performed to calculate the indirect effect of the variables that interacted in the hierarchical multiple regression analysis. We used the procedure described by Preacher and Hayes (2008). Using the estimates on the basis of these 2000 bootstrap samples, the indirect effect and confidence intervals (CIs) were calculated. These CIs were used to determine whether each effect is statistically significant. For each effect, we examined the 95% CI, and if the value of 0 did not fall within the range of the CI for that effect, then the finding was statistically significant at $p < .05$.

We used Hayes' SPSS macro PROCESS to analyze the model in which ego-resiliency mediates self-restraint and depression. The results

Table 1
Descriptive statistics for COVID-19-related stress, mental health, and ego-resiliency.

		M	SD	N	1	2	3	4	5	6	7	8
1	Sex (male = 0)	0.44	0.50	222								
2	Age	46.71	13.28	222	−0.28**							
3	Changing income	2.57	0.85	222	0.02	0.07						
4	Self-restraint	1.71	0.64	222	0.03	−0.08	0.22**					
5	Fear of COVID-19	20.91	5.31	222	0.15*	0.05	−0.14*	−0.01				
6	Depression	11.05	4.80	222	0.03	−0.14*	−0.10	0.02	0.26**			
7	Anxiety	9.22	3.72	222	−0.06	−0.03	−0.13	0.09	0.37**	0.77**		
8	Stress	10.82	4.53	222	0.05	−0.16	−0.14*	0.07	0.39**	0.86**	0.84**	
9	Ego-resiliency	33.69	7.10	222	0.00	0.10	−0.12	−0.13	0.00	−0.28**	−0.06	−0.15*

* $p < .05$.
** $p < .01$.

Table 2
Results of hierarchical regression analysis predicting mental health with COVID-19-related stress and ego-resiliency.

Variable		Depression				Anxiety				Stress			
		B	SE	β	ΔR^2	B	SE	β	ΔR^2	B	SE	β	ΔR^2
Step 1	Sex (male = 0)	−0.07	0.67	−0.01	0.02	−0.52	0.52	−0.07	0.01	0.00	0.63	0.00	0.03
	Age	−0.05	0.03	−0.14*		−0.01	0.02	−0.05		−0.06	0.02	−0.16*	
Step 2	Sex (male = 0)	−0.50	0.66	−0.05	0.08***	−0.99	0.49	−0.13*	0.16***	−0.59	0.59	−0.06	0.17***
	Age	−0.06	0.02	−0.16*		−0.02	0.02	−0.07		−0.06	0.02	−0.19**	
	Changing income	−0.34	0.38	−0.06		−0.41	0.28	−0.09		−0.48	0.34	−0.09	
	Self-restraint	0.21	0.50	0.03		0.66	0.37	0.11		0.57	0.44	0.08	
	Fear of COVID-19	0.24	0.06	0.27***		0.26	0.04	0.38***		0.34	0.05	0.39***	
Step 3	Sex (male = 0)	−0.41	0.63	−0.04	0.07***	−0.98	0.49	−0.13*	0.00	−0.55	0.58	−0.06	0.02*
	Age	−0.05	0.02	−0.13*		−0.02	0.02	−0.06		−0.06	0.02	−0.17**	
	Changing income	−0.51	0.37	−0.09		−0.44	0.28	−0.10		−0.57	0.34	−0.11	
	Self-restraint	0.00	0.48	0.00		0.63	0.37	0.11		0.47	0.44	0.07	
	Fear of COVID-19	0.24	0.06	0.26***		0.26	0.04	0.37***		0.33	0.05	0.39***	
	Ego-resiliency	−0.19	0.04	−0.28***		−0.02	0.03	−0.05		−0.09	0.04	−0.14*	
Step 4	Sex (male = 0)	−0.44	0.62	−0.05	0.05**	−0.99	0.49	−0.13*	0.03	−0.61	0.58	−0.07	0.02
	Age	−0.05	0.02	−0.15*		−0.02	0.02	−0.08		−0.06	0.02	−0.18**	
	Changing income	−0.77	0.37	−0.14*		−0.53	0.29	−0.12		−0.69	0.34	−0.13*	
	Self-restraint	−0.02	0.48	0.00		0.52	0.37	0.09		0.42	0.44	0.06	
	Fear of COVID-19	0.26	0.06	0.28***		0.27	0.04	0.39***		0.35	0.05	0.41***	
	Ego-resiliency	−0.18	0.04	−0.26***		−0.01	0.03	−0.02		−0.09	0.04	−0.14*	
	Ego-resiliency × changing income	0.06	0.05	0.09		0.06	0.04	0.12		0.03	0.04	0.04	
	Ego-resiliency × self-restraint	0.19	0.07	0.19**		0.05	0.05	0.06		0.08	0.06	0.09	
	Ego-resiliency × fear of COVID-19	0.00	0.01	0.01		0.00	0.01	−0.05		−0.01	0.01	−0.08	
R^2 (at final step)		0.22				0.20				0.24			
Adjusted R^2		0.19				0.16				0.20			

* $p < .05$.
** $p < .01$.
*** $p < .001$.

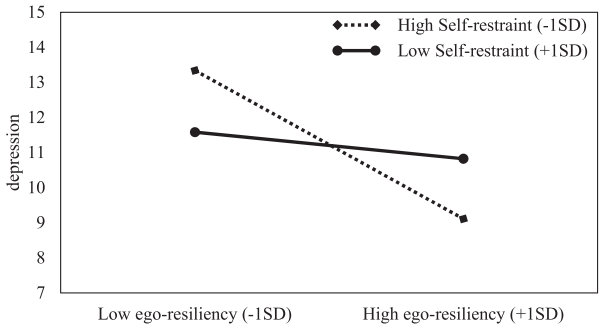

Fig. 1. Interaction effect of self-restraint and ego-resiliency on change in depression levels.

showed that the indirect effect was statistically significant (indirect effect = 0.04, 95% CI = 0.001–0.089). These results indicate that ego-resiliency has a mediating effect on the relationship between self-restraint and depression.

4. Discussion

In the present study, we investigated the effect of ego-resiliency on mental health during the COVID-19 pandemic, in Japan. Furthermore, this study examined the interaction effect of ego-resiliency and COVID-19-related stresses—self-restraint, changing income, and fear of COVID-19—on depression, anxiety, and stress. Our results showed that ego-resiliency had a negative association with depression and stress, and a moderating effect on depression levels for people with high self-restraint. This suggests that ego-resiliency functioned to cope with the specific stresses associated with COVID-19 and promote adaptation during the pandemic situation.

Our first hypothesis stated that ego-resiliency is negatively related to depression, anxiety, and stress. In other words, higher levels of ego-resiliency are correlated to lower levels of depression, anxiety, and stress. The results showed a significant effect of ego-resiliency on the reduction of depression and stress, excluding anxiety. Therefore, this hypothesis was partially confirmed. Although no effect of ego-resiliency on anxiety was noted, our results are almost consistent with prior research; for example, ego-resiliency among individuals in earthquake-affected areas was found to be inversely related with depression, anxiety, and stress (Aslam & Tariq, 2010). In another study, ego-resiliency among internally displaced persons due to armed conflict was found to be inversely related with depression, anxiety, and stress (Mujeeb & Zubair, 2012).

The second hypothesis stated that ego-resiliency moderates the effect of self-restraint, changing income, and fear of COVID-19 on depression, anxiety, and stress. The results interestingly found that high ego-resiliency decreased the depression level among individuals who reported high self-restraint; there was also an indirect effect showing that ego-resiliency mediates the effect of self-restraint on depression. This result is consistent with prior studies which indicated that highly ego-resilient individuals show flexible adaptation to difficult and stressful conditions, and are possibly more likely to experience better psychological adjustment than individuals with a low level of ego-resiliency (Block & Kremen, 1996; Klohnen, 1996). Therefore, our second hypothesis was also partially confirmed. Among individuals who have high self-restraint, high ego-resiliency may help maintain mental health; however, low ego-resiliency may adversely affect their mental health due to limited daily activities outside the home. Although restrictive public health measures, including movement and behavioral restrictions, have unintended serious psychological and social consequences (Brooks et al., 2020; Galea et al., 2020), it is speculated that high ego-resiliency prevents a serious decline in mental health in such conditions. By assessing ego-resiliency, it may be possible to provide effective psychological care to those who develop mental health problems due to the abovementioned behavioral restrictions. In contrast, among individuals who showed low self-restraint, ego-resiliency did not predict depression. People with low self-restraint do not all go out for the same reasons; for some, going to work is unavoidable, despite the presence of fear. A previous study reported that health care workers who had to go out for work encountered a considerable degree of stress, anxiety, depression, and insomnia due to the COVID-19 pandemic

(Spoorthy et al., 2020). Our study did not clearly classify the reasons for going out, and therefore, further research is needed to examine these reasons to clarify the effect of ego-resiliency on mental health.

Even after controlling for age in the statistical analyses, the effects of ego-resiliency were evident. These results were considered to be generalizable for people from all stages of life from young adulthood to old age, which is consistent with the findings of a previous study which showed that ego-resiliency promotes stress adaptation for both young and old people (MacLeod et al., 2016). However, the current study did not include the younger generation (children below the age of 18), and therefore, further research is needed to observe the effects of ego-resiliency in this group.

There are some other interesting points in this study. First, no moderating effect of ego-resiliency was found in the relationship between COVID-19-related stress and mental health, except for the variable of self-restraint. This suggests that ego-resiliency did not moderate the relationship between these stressors and mental health during the pandemic. As reported previously, changes in income lowered well-being and caused panic behaviors such as hoarding and stockpiling of resources (Shigemura et al., 2020). Under such economic changes, ego-resiliency was expected to promote self-regulation and effective coping, but such an effect was not observed in the present study. If the stress was created due to economic problems, instrumental support may be considered as the best option for alleviating such stress (Cohen & Wills, 1985). In this case, ego-resiliency may not be as essential as instrumental support to improve deterioration of mental health caused by financial problems, and it may be for this reason that there was no link between ego-resiliency and changes in income. The fear of COVID-19 also showed no interaction effect with ego-resiliency on mental health. Fear of COVID-19 can be an important psychological factor in research on mental health (Masuyama et al., 2020), since chronic or unbalanced fear can cause various psychological problems (Garcia, 2017). Although we need to pay attention to the detrimental aspects of fear, we must remember that fear is also an adaptive instinctive defense mechanism to respond appropriately to potentially threatening events such as a pandemic (Ornell et al., 2020); hence, this might be a possible reason why ego-resiliency did not alleviate fear in the present study. While excessive fear is expected to cause deterioration of mental health during the ongoing pandemic, it is also important to investigate the adaptive aspect of the fear of COVID-19.

Second, there was a positive correlation between self-restraint and changes in income. In this survey, we did not inquire about the details of self-restraint (e.g., how many times did the person go out or why they went out), but it was assumed that going out behavior includes going out for work. A lot of people found it difficult to work during the pandemic, especially those who had to work outside their homes. Some of them may have been able to go to work, and their income may have remained the same or even increased. However, other people who were forced to refrain from working outside may not have been able to work at all, leading to a decline in their income. To examine this assumption, further research is necessary, taking into consideration that participants in our sample went out for purposes other than work; furthermore, those who did not go out might have found work which they could do from home, thus preventing a decline in income.

Third, there was no correlation between ego-resiliency and anxiety as well as fear of COVID-19. A lack of association between ego-resiliency and these negative emotions indicated that ego-resiliency did not reduce these emotions to adapt to difficult situations. Ego-resiliency provides individuals with necessary resources (such as psychological and emotional resources) to self-regulate their behavior and successfully adapt to stressful circumstances (Letziring et al., 2005). Ego-resiliency often helps to reduce negative emotions; however, it seems that during the current pandemic, it was not effective in reducing these negative emotions. However, the fact that ego-resiliency did not reduce anxiety and fear during the pandemic situation may have been because these emotions helped people to adapt more effectively to this situation. Just as fear was found to function adaptively (Ornell et al., 2020), it is possible that anxiety and fear of COVID-19 led to people practicing better hygiene and infection prevention behaviors, resulting in better mental and physical adaption to the pandemic.

5. Limitations

Several limitations of this study must be discussed. First, this was a cross-sectional study. Future research can strengthen the present findings using a longitudinal design that could examine the mediating role of ego-resiliency in developmental changes over time. Second, the data were derived from self-report questionnaires. These findings can be strengthened with the addition of multiple methods of data collection, such as home, classroom, workplace, or laboratory observation. Third, the variables of self-restraint and changing income were measured with a single item. These interesting variables are multifaceted and need to be measured using multiple items. Finally, there were limited indicators of perceived stress for COVID-19. The perceived stressors for COVID-19 may differ depending on age, infection status, countermeasures, and job type. Thus, these factors should be considered in future studies.

6. Conclusion

This study sought to examine the effect of ego-resiliency and COVID-19-related stress on public mental health, in Japan. The results showed a significant effect of ego-resiliency on reduction of depression and stress levels. The study also provided support for the interaction effect of ego-resiliency and self-restraint on depression; that is, high levels of ego-resiliency lowered depression levels in those who reported high self-restraint. This suggests that high levels of ego-resiliency can allow individuals to effectively cope with the perceived stresses of COVID-19 and show better adaptation to the pandemic situation.

Informed consent

All participants provided informed consent.

Ethics declarations

All the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Declaration of Helsinki.

CRediT authorship contribution statement

Study planning: Author 1, 2, 3, Data analysis: Author 1, 2, Writing manuscript: Author 1, Review and editing: Author 2, 3.

Declaration of competing interest

None.

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