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The relationship between the psychological distress derived from COVID-19 and the loss aversion is modulated by the alexithymia trait

La relación entre el distrés psicológico derivado del COVID-19 y la aversión a las pérdidas es modulada por el rasgo de alexitimia

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Abstract: studies on stress and decision-making usually address acute and artificial stressors. However, COVID-19 outbreak set the perfect scenario to address how decision-making, and specifically loss aversion, could be affected by a real and persistent stressor, able to promote a significant psychological distress. In parallel, alexithymia has been identified as a potential moderator of the loss aversion expression, since it could impair the incorporation of emotional information when making a decision, leading to "cold" decisions. Through a within-subjects design (N = 70), our aim was to study the relationship between the psychological distress caused by the pandemic context and the loss aversion changes, considering alexithymia as a moderating factor. Our results show a significant increment in both psychological distress and loss aversion, merely one month after the confinement's onset. Moreover, both variables were positively associated only when alexithymia was low, i.e., the alexithymia buffered the effect of psychological distress on decision-making: a higher alexithymia implied a lower loss aversion increase.

Keywords: decision-making, cognitive bias, loss aversion, alexithymia, psychological distress, COVID-19, confinement, stress.

Resumen: los estudios sobre estrés y toma de decisiones suelen abordar estresores agudos y artificiales. Sin embargo, el brote de COVID-19 creó el escenario perfecto para abordar cómo la toma de decisiones, y específicamente la aversión a las pérdidas, podría verse afectada por un estresor real y persistente, capaz de promover un distrés psicológico significativo. Paralelamente, la alexitimia ha sido identificada como un potencial moderador de la expresión de la aversión a las pérdidas, ya que podría perjudicar la incorporación de información emocional a la hora de decidir, conduciendo a decisiones "frías". Mediante un diseño intrasujeto (N = 70), nuestro objetivo fue estudiar la relación entre el malestar psicológico derivado del contexto pandémico y los cambios en la aversión a las pérdidas, considerando la alexitimia como factor moderador. Nuestros resultados muestran un incremento significativo tanto del malestar psicológico como de la aversión a las pérdidas, tan solo un mes después del inicio del confinamiento. Además, ambas variables se asociaron positivamente solamente cuando la alexitimia era baja; es decir, la alexitimia amortiguaba el efecto del distrés psicológico en la toma de decisiones: cuanto mayor era la alexitimia, menor era el aumento de la aversión a las pérdidas.

Palabras clave: toma de decisiones, sesgo cognitivo, aversión a las pérdidas, alexitimia, distrés psicológico, COVID-19, confinamiento, estrés.

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Introduction

Decision-making is a complex and heterogeneous executive function, which is often studied within different contexts and conditions, breaking it down into more analyzable pieces (Starcke and Brand, 2012, 2016). One of the most studied scenarios are risky contexts, where the decision options or prospects are well defined, and the outcomes' probabilities are known (Volz and Gigerenzer, 2012). Here, it can be assessed whether people use more logical and rule-based strategies, such as utility maximization (Camerer, 2003; Starcke and Brand, 2016), or conversely, they are more prone to be affected by emotional phenomena, such as loss aversion (Kahneman, 2003; Kahneman *et al.*, 1991; Sokol-Hessner and Rutledge, 2019).

Loss aversion, the principle that "losses loom larger than gains" (Kahneman and Tversky, 1979, p. 279), is one of the most studied biases in decision-making, because of its important influence in shifting the balance in favor of risk avoidance. So, for example, potential gains should be at least twice as large as potential losses for someone to risk on a bet (Sokol-Hessner and Rutledge, 2019). It is often considered a generalizable and fundamental principle (Gal and Rucker, 2018), or even a stable behavioral trait (Hadlaczky *et al.*, 2018). However, the current position is that a more contextualized view of loss aversion should be considered, since it could be moderated by several factors (Gal and Rucker, 2018; Mrkva *et al.*, 2020).

Many studies are focusing on the contextual factors that could influence loss aversion, from the most stable, such as culture (Wang *et al.*, 2017); to the more situational, such as repulsive odors (Stancak *et al.*, 2015) or even oxygen saturation in the environment (Pighin *et al.*, 2014). Since stress has increased alarmingly in the last two decades (Ward *et al.*, 2020) and many of our decisions are made under stress, this factor is receiving substantial attention (Starcke and Brand, 2012, 2016).

Although a few evidence did not show significant effects on loss aversion (Metz *et al.*, 2020; Sokol-*Hessner et al.*, 2016), most studies report that stress reduce its manifestation (Margittai *et al.*, 2018; Molins *et al.*, 2021; Pighin *et al.*, 2014). These results could be supported by the 'alignment hypothesis' (Margittai *et al.*, 2018), i.e., stress triggers additional reward salience by enhancing the firing rate of dopaminergic neurons in key centers of the reward system, such as the ventral striatum (Mather and Lighthall, 2012), thereby balancing the weight of losses and gains and reducing loss aversion (Margittai *et al.*, 2018; Metz *et al.*, 2020). Nevertheless, the stress response is heterogenous, and it could depend on the nature, duration and intensity of the stressor (Hidalgo *et al.*, 2019). A frequent feature in most studies is that they involve acute and artificial laboratory stressors (e.g., stressful video; Molins *et al.*, 2021) ranging from 5 to 15 minutes, and loss aversion is usually assessed when the stressor is already gone or, at most, during an unconscious stressful condition (e.g., hypoxia; Pighin *et al.*, 2014). In fact, some stressors only affected at a physiological level, without inducing subjective stress or changes in the mood (Margittai *et al.*, 2018; Pighin *et al.*, 2014). Rarely, however, it can be studied how loss aversion is influenced by a real, persistent stressor (still present during the decision-making assessment), which promotes significant psychological distress. This opportunity was provided by the COVID-19 pandemic context.

On 30 January 2020, COVID-19 outbreak was proclaimed a public health emergency of international concern by the World Health Organization (Mahase, 2020), and several countries, such as Spain, were responding through confinement strategies. Confinement involves loss of freedom, social isolation, boredom, routine detriment, sleep disturbances, among many other factors which, along with the fear or concern about the virus contagion itself, were disrupting normal psychosocial life and promoting an important psychological distress, characterized by poorer mood and symptoms of anxiety and depression (Brooks *et al.*, 2020; Ingram *et al.*, 2020; Liang *et al.*, 2020; Pierce *et al.*, 2020; Shuja *et al.*, 2020).

Other fear-related stressors which led to psychological distress have been associated with the salience-network interconnectivity (Hermans *et al.*, 2014; Hermans *et al.*, 2011), enhancing key nodes of the loss aversion neural bases, such as the amygdala (Sokol-Hessner and Rutledge, 2019). Thus, in line with the 'salience-of-losses

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hypothesis' (Margittai *et al.*, 2018), hypervigilance to losses could be increased and, with it, behavioral loss aversion. Complementarily, survivors of other catastrophes such as the Fukushima Daiichi Nuclear Disaster, who also experienced severe psychological distress, reported higher levels of loss aversion (Iwasaki and Sawada, 2015). Finally, an elevated level of this phenomenon is usually observed in patients with anxiety and depression (Baek *et al.*, 2017; Sip *et al.*, 2018). Based on the above, it could be expected that the distressing situation arisen from COVID-19 context were increasing loss aversion.

However, it should be noted that loss aversion is an emotional response to the 'pain of losses' (Hintze *et al.*, 2015; Sokol-Hessner and Rutledge, 2019). From an intrapersonal level, therefore, how sensitive a person is to his or her own emotions should also be considered, as this variable could moderate the degree to which emotions such as loss aversion influence decision-making. In this line, recent studies underline the important role of alexithymia, which is considered a personality trait characterized by difficulties identifying, describing and regulating one's emotions (Patwardhan *et al.*, 2019; Shah *et al.*, 2016; Walker *et al.*, 2011). In the decision-making field, it has been found that alexithymia impairs the incorporation of emotional information when deciding, leading to "cold" decisions (Kano *et al.*, 2011; Shah *et al.*, 2016). Indeed, other emotional phenomena closely linked to loss aversion, such as framing effect, were diminished when the alexithymia was high (Manzoor *et al.*, 2021; Shah *et al.*, 2016). Consequently, the influence of COVID-19-derived stress on loss aversion might be moderated by alexithymia, although this has not been tested to date.

In this study, we were able to assess the loss aversion level of a Spanish population sample one month after the confinement onset and compare it to the level they had before this safety measure was implemented. We hypothesize that, in comparison to pre-confinement measurements, individuals will display a higher psychological distress with increased symptoms of depression and anxiety, as well as higher loss aversion during the confinement. Moreover, considering the moderating role that alexithymia could play on the loss aversion expression, we also hypothesize that alexithymia will buffer the expected increase in loss aversion during confinement. So, the higher alexithymia, the lower increment in loss aversion will be found. Finally, we hypothesize that psychological distress will be associated with the loss aversion increase, but this relation will also depend on the alexithymia level. With this study we aim to contribute to a better understanding of COVID-19 pandemic's impact on mental health and behavior, specifically on decision-making.

Material and methods

Participants

An *a priori* power analysis using G*Power indicated a pre-requisite of 15-20 participants to find a medium effect size (d = 0.50, power = 80 %, α = 0.05) when performing a repeated-measures ANOVA testing for differences in loss aversion, pre- and during-confinement, including the alexithymia's interaction. 85 Spanish participants, all of them students of Psychology from the University of Valencia, were recruited pre-confinement by asking them if they wanted to participate in exchange for academic credits. However, 15 participants did not answer during-confinement and could not be compared. So, a total of 70 participants (women: 71.4 %, and men: 28.6 %) were finally included in the study. They filled out a self-administered questionnaire to confirm they met the following inclusion criteria when first contacted: not having neurological or psychiatric diseases; not consuming drugs regularly; not consuming more than 5 cigarettes a day and not having experienced a highly stressful event in the last month.

Procedure

This research was approved by the Ethics Research Committee of the University of Valencia in accordance with the ethical standards of the 1969 Declaration of Helsinki. Participants were first recruited in February 2020 to participate in another study not reported here. They read and

signed informed consent and completed the first battery of questionnaires, which included biometric and socio-economic questions, as well as the pre-confinement measurements of psychological distress and loss aversion. We contacted the participants telematically for the second assessment one month after the declaration of the state of alarm in Spain. Participants were informed about the study's objectives, signed a new consent, and completed a new battery of questionnaires. It was focused on their current level of psychological distress and loss aversion, but also addressed their alexithymia trait and several informative variables about confinement.

Questionnaires

Socio-economic questions were developed *ad hoc* for the research purpose and gathered information about age, gender, and socio-economic status. The latter using a 10-point Likert scale where 0 is the worst socioeconomic situation and 100 the best, taking as a reference the socioeconomic situation in Spain.

For psychological distress, pre- and during-confinement, we used the Spanish version of the General Health Questionnaire (GHQ, $\alpha = .86$) (Rocha *et al.*, 2011). GHQ is a self-report measure extensively recommended and administered in epidemiological surveys (Gnambs and Staufenbiel, 2018). Its short form with 12 items (in a Likert-scale ranging from 0 - not at all, to 3 - much more than usual), allows a screening of psychological distress during the last month and the risk of developing psychiatric disorders (Gnambs and Staufenbiel, 2018; Puustinen *et al.*, 2011). GHQ-12 has a two-dimensional structure: 8 items corresponding to depression symptoms and 4 to anxiety symptoms, where higher scores indicate the manifestation of more symptoms. In our sample the Cronbach's alpha pre-confinement was .88, and during-confinement .85, i.e. GHQ had a high reliability.

An *ad hoc* Spanish translation of the Lottery Choice Task (Gächter *et al.*, 2007) was employed to measure loss aversion pre- and during-confinement. In this task, participants had to decide along six lotteries whether they would accept or reject the bet. In each lottery the gain was fixed at 6 € and the loss varied through bets (ranging from 2 to 7 €), yielding a successively decreasing expected value for each lottery. Following Hadlaczky *et al.* (2018), loss aversion is defined as the inverse of the highest accepted gamble, thus providing a continuous variable ranging from 0 to 6, where higher scores indicate higher loss aversion, since the ratio gains/losses would be higher. This ratio would show how big the potential gain must be in relation to the potential loss for the bet to be accepted.

For alexithymia, the Spanish version of the Toronto Alexithymia Scale (TAS-20, $\alpha = .78$) (Martínez, 1996) allowed the extraction of a general alexithymia factor by adding the scores of all items together. The higher the total score, the greater the alexithymia trait. Nevertheless, only scores above 60 indicate clinical alexithymia. The questionnaire is composed by 20 items in a Likert-scale, ranging from 1 – total agreement, to 5 – total disagreement. In our sample, the Cronbach's alfa was .80, indicating a high reliability of the questionnaire.

Finally, during confinement, we also asked whether the participants or their families had been infected, as well as with whom they lived during this situation.

Statistical analyses

Kolmogorov-Smirnov test with Lilliefors correction and Q-Q plots were used to check for normality. Psychological distress and loss aversion measurements were contrasted in a within-subjects design (pre- vs during-confinement) through repeated-measures ANOVAs (controlling for the alexithymia interaction when addressing loss aversion). In addition, to further explore how alexithymia was moderating the evolution of loss aversion, we carried out a moderation analysis for Two-Instance Repeated-Measures designs and followed the Johnson-Neyman procedure and the simple-slopes method with the recently developed MEMORE macro for SPSS (Montoya, 2019). Johnson-Neyman method selects a continuum of hypothetical values for the moderator variable (in this case, alexithymia) and identifies impor-

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tant transition or critical points (JN) where this moderator's effect over Y (changes in loss aversion), shifts from significant to non-significant, or vice versa (see Montoya, 2019 for a detailed explanation). The simple-slopes method is similar to the previous one, but instead of selecting a continuum of values for the moderator variable, it chooses three of them that represent, regarding this variable, a low, intermediate and high level based on the mean (M) and plus/minus one SD from the mean. Thus, it is possible to see the conditional change of "Y" at each of the three levels of one or more moderators (again, see Montoya, 2019 for more details). In every analysis, the α significance level was set at .05 and partial eta square (η2p) represents the effect size. They were carried out with IBM SPSS Statistics 25.

Results

Sample description

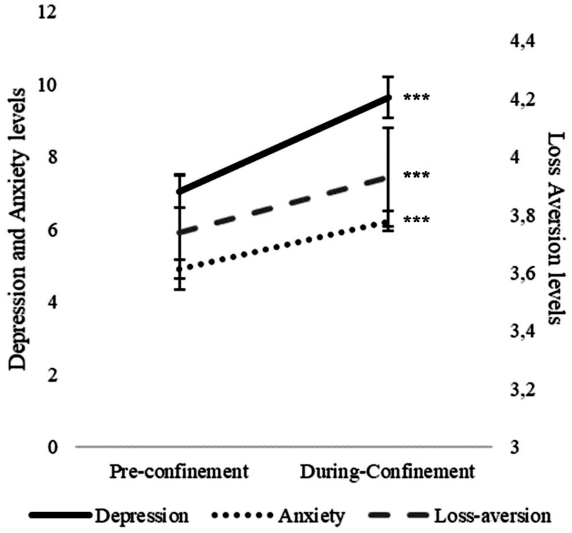
A description of the sample and its status during confinement is shown below. Participants were young people (age: M = 22.56, SD = 2.58), all of them psychology students at the University of Valencia (Spain), with a BMI (M = 23.14, SD = 3.39) within normal range (18.5-24.9), and with an intermediate socio-economic status (M = 60.30, SD = 10.15). Moreover, their alexithymia level (M = 42.50, SD = 8.94) significantly differed from the established score (60 points) that identifies clinical alexithymia, t (69) = -19.33, p < .001. Besides, it must be noted that neither of the participants, nor their loved ones were infected by COVID-19, plus they were not alone during confinement: 75.7 % of them were living with their family; 12.9 % with their (romantic) partner; and 11.4 % with friends or flatmates.

Psychological distress

To test whether the COVID-19 context was increasing psychological distress, pre- and post-confinement symptoms of anxiety and depression assessed with GHQ-12 were compared through repeated-measures ANOVAs. Significant differences were found in both variables, showing higher levels during confinement (see Figure 1). So, the pre-confinement depressive symptoms average was 7.05 (SD = 3.7), and during-confinement 9.69 (SD = 4.7), F(1.68) = 9.01, p = .004, η2p = .12; while the pre-confinement anxiety symptoms average was 4.89 (SD = 2.21), and during-confinement 6.23 (SD = 2.28), F(1.68) = 8.03, p = .006, η2p = .17.

Figure 1

Depression symptoms, anxiety symptoms (with GHQ-12) and loss aversion levels, pre-confinement, and one-month after the confinement onset



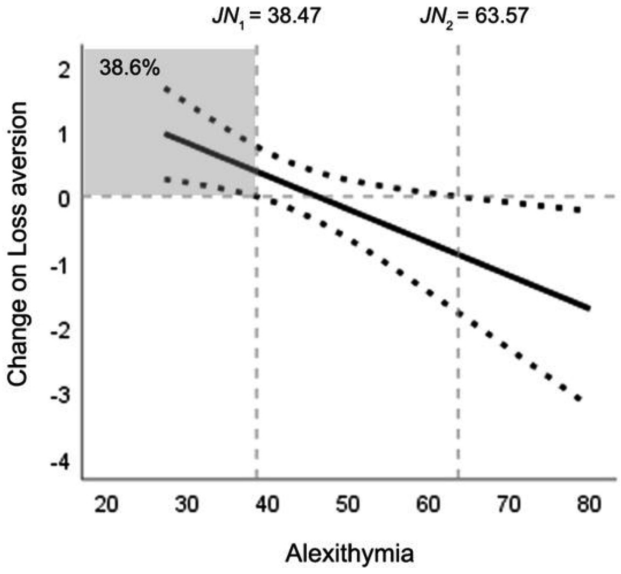
Loss aversion and the moderating role of alexithymia

The aim of this study was to test whether loss aversion grew during the distressful context, as well as whether alexithymia was moderating this increase. Hence, we performed a repeated-measures ANOVA controlling for alexithymia. A significant increment was found during-confinement (see Figure 1). Loss aversion average pre-confinement was 3.74 (SD = 1.6), whereas during-confinement it was 3.91 (SD = 1.4), $F(1.68) = 7.52$, $p = .008$, $\eta 2p = .10$. Moreover, a significant alexithymia*moment interaction was also found, $F(1.68) = 6.72$, $p = .012$, $\eta 2p = .10$, which highlighted that alexithymia was influencing the evolution of loss aversion.

To further explore the direction of these results, we carried out a moderation analysis on repeated-measures. The resulting regression equation was $\hat{Y}_{post}$-$\hat{Y}_{pre}$=$\hat{Y}_{D}$= 2.33 - .05W_i, indicating that during-confinement, it was expected an increment of 2.33 units on loss aversion since pre-confinement, $t(69) = 2.7$, $p = .007$. However, for each unit of alexithymia (W_i), there was a .05 unit decrease in the difference in loss aversion, $t(69) = –2.5$, $p = .01$. Following the Johnson-Neyman procedure, we found two critical points in alexithymia levels (see Figure 2). Alexithymia scores lower than 38.47 suffered a significant increase in loss aversion during-confinement, but scores greater than 63.57, which indicate clinical alexithymia, experienced the opposite. Nevertheless, the latter point is outside of our data's range and methodologists do not recommend interpreting those results (Montoya, 2019). Finally, scores ranging between both critical points did not show a significant change in their loss aversion level. Therefore, the increase in loss aversion was only significant when alexithymia level was low (below 38.47 points).

Figure 2

Graph of the conditional change on Loss aversion as a function of Alexithymia



Note: A JN point is where the confidence interval around the condition effect intersects zero on the y-axis. Thus, the shaded quadrant is the region of significance, i.e., those values of alexithymia for which the change in loss aversion is significant. As can be seen, these changes are only significant for low values of alexithymia. This quadrant includes the actual percentage of participants who fall within these alexithymia scores. Finally, another region of significance is observed that has not been shaded (for high values of alexithymia), this is because none of our participants have such high alexithymia scores and methodologist recommend to not interpret these results.

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Complementarily, to explore whether changes in psychological distress were associated with significant changes in loss aversion, and whether alexithymia moderated this association, we conducted a repeated-measures moderation analysis that included as outcome ($\hat{Y}_{post}$-$\hat{Y}_{pre}$=$\hat{Y}_{D}$) the change in loss aversion and, as moderators, both the level of alexithymia and the change in anxiety/depression symptoms (i.e. the level during-confinement minus pre-confinement level). To our knowledge, and as the MEMORE macro specifies, "Johnson-Neyman procedure is not available for models with more than one moderator", nonetheless, the simple-slopes method is. Using this method, three levels of each moderator (lower, medium, and high) were selected based on the mean value and plus/minus one SD from the mean. Results from this analysis revealed that the increase on anxiety symptoms was only associated with a significant increase on loss aversion when the alexithymia was low and the anxiety increase was either medium ($t(67) = 2.47$, $p = .016$) or high ($t(67) = 2.24$, $p = .02$). For lower levels of anxiety increase and medium or high alexithymia levels, no significant changes in loss aversion were observed. However, the increase on depression symptoms was associated with the significant increase on loss aversion at all levels of change in depression: low ($t(67) = 2.25$, $p = .02$), moderate ($t(67) = 2.59$, $p = .011$) and high ($t(67) = 1.94$, $p = .04$), as long as alexithymia level was low. Otherwise, no significant changes in loss aversion were found for any level of change in depression symptoms.

To sum up, psychological distress (anxiety and depression symptoms) was associated with significant increments on loss aversion when the level of alexithymia was low. Contrarily, for moderate or higher alexithymia levels, even if psychological distress worsened, no significant changes in loss aversion were found.

Conclusions and discussion

Previous studies addressed how stress influences decision-making and, specifically, the psychological impact of losses or loss aversion. However, most utilized acute and artificial stressors, many of which only affected at the physiological level but did not produce psychological distress (Margittai *et al.*, 2018; Pighin *et al.*, 2014). In our study, however, we had the opportunity to address a real and persistent stressor, derived from the pandemic situation experienced with COVID-19. Our results, obtained through a within-subjects design, indicated that this stressful context produced a significant increase in psychological distress, and, as expected, a higher level of loss aversion only one month after the confinement onset. Moreover, alexithymia played an important moderating role by buffering the increase in loss aversion. These results will be discussed in depth below.

First, psychological distress was assessed using the GHQ-12 questionnaire, which provides information on symptoms of anxiety and depression. As expected, both depression and anxiety symptoms increased significantly from their pre-confinement measurement, which would evidence that the stressful pandemic context was producing a significant psychological distress. Thresholds for determining the symptomatology's significance can vary (Goldberg *et al.*, 1998), but a reference adapted from the original GHQ Manual (Goldberg and Williams, 1988) indicates 8 points for depressive symptoms, and 4 points for anxiety symptoms. On average, during confinement, our sample showed scores above these thresholds in both depression ($M = 9.69$, $SD = 4.7$) and anxiety ($M = 6.23$, $SD = 2.28$). But the most concerning aspect is that these levels were reached in just one month. Since GHQ-12 is a good predictor of developing psychiatric disorders (Gnambs and Staufenbiel, 2018), it is not surprising that, months later, various systematic reviews and meta-analyses highlighted that the prevalence of all forms of depression, anxiety, stress, sleep problems, and psychological distress in general population was higher during COVID-19 pandemic (Lakhan *et al.*, 2020; Salari *et al.*, 2020).

However, the main objective of this study was to analyze how this psychological distress affected the perception of economic losses and, therefore, decision-making. As hypothesized, and in line with previous evidence on survivors of other

distressing contexts (Iwasaki and Sawada, 2015), loss aversion increased during the COVID-19 outbreak. This would fit with the enhancing role that psychological distress is thought to exert on the salience network (Hermans *et al.*, 2014, 2011). So, this would promote increased activity in regions such as the amygdala or insula, which, in turn, constitute the main nodes of the neural loss aversion (Sokol-Hessner and Rutledge, 2019). Therefore, this context would promote an alert state that provides greater salience to losses and behavioral loss aversion (Margittai *et al.*, 2018).

It should be noted that greater loss aversion is not good or bad *per se* (Sokol-Hessner *et al.*, 2016). From the classical approach of economic rationality (Camerer, 2003), loss aversion is an emotional phenomenon that would hinder logical or rule-based decision-making. However, in line with the ecological rationality approach (Gigerenzer and Gaissmaier, 2011), loss aversion must be analyzed in terms of its context. So, given the concerning situation, an increase in loss aversion could be considered adaptive, leading to more cautious decisions. In fact, Presti *et al.* (2022) found that confinement adherence was mostly predicted by loss-averse attitudes. Nevertheless, since anxiety and depressive disorders use to be associated with higher levels of loss aversion (Baek *et al.*, 2017; Sip *et al.*, 2018), our results could also constitute further evidence of the mental health worsening. Thus, rather than cautious decisions, increments in loss aversion could represent the maladaptive decision-making commonly found on mood and anxiety disorders (Alexander *et al.*, 2017; Bishop and Gagne, 2018). Therefore, it would be important to deeper study whether loss aversion continued growing, as well as to obtain additional behavioral measurements, in order to explore whether this phenomenon was related only to risk avoidance or, on the contrary, was leading to procrastination, indecisiveness, and other maladaptive ways of deciding, typical in anxiety and depression (Alexander *et al.*, 2017; Bishop and Gagne, 2018; Pushkarskaya *et al.*, 2017).

One possible explanation is that the increase in loss aversion may be adaptive in the early stages of this pandemic context, but if psychological distress deteriorates over time, loss aversion may eventually become very high and lead to maladaptive decisions. In fact, our data support that increased psychological distress at least partially predicted loss aversion increments. Consequently, higher levels of loss aversion could be found when mental health worsens even more. However, an important finding in our study is that alexithymia seems to play a key role in the evolution of loss aversion. The lower alexithymia was associated with the higher increment in loss aversion. Indeed, for levels of alexithymia greater than 38 points, no significant changes in loss aversion were found. This result would be in line with evidence that point out that alexithymia could difficult the incorporation of emotional states (such as the negative affect derived from the psychological distress) into the decisional process, leading to "cold" or rational decisions (Manzoor *et al.*, 2021; Shah *et al.*, 2016; Zhang *et al.*, 2017). Complementarily, our moderation analyses also showed that increased symptoms of anxiety and depression were only associated with a significant increase in loss aversion when levels of alexithymia were low.

An explanation could be drawn from neuroimaging studies. As explained before, the neural bases of loss aversion (Sokol-Hessner and Rutledge, 2019) involve an aversive system (mainly the amygdala and the insula) which reacts disproportionately to losses and sends the information to prefrontal cortex (mainly dorsolateral and ventromedial regions), where it would be synthetized and decisions would be determined. Under conditions of anxiety or depression (even subclinical), several studies showed an increased amygdala and insula reactivity (e.g. Klumpp *et al.*, 2012; Laeger *et al.*, 2012; Stein *et al.*, 2007). As these regions are the main hubs for loss aversion, this may explain why this phenomenon use to be high in these disorders (Alexander *et al.*, 2017; Bishop and Gagne, 2018). Yet, it has also been seen that alexithymia is characterized by hypoactivity of the ventromedial prefrontal cortex, as well as reduced connectivity between the latter region and the insula (Sutherland *et al.*, 2013). This has been proposed as the mechanism by which emotional responses are not adequately incorporated into the decisional process (Kano *et al.*, 2011; Zhang *et al.*, 2017). In this line, although symptoms of

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anxiety and depression increase, and with it, the aversive system's activity, loss aversion could remain low since the emotional information may have difficulties reaching the prefrontal cortex when the alexithymia is high. Nonetheless, this is only speculation, and more research is needed to address the specific mechanisms that explain our results. Indeed, it should not be forgotten that the study's nature is correlational and not experimental, so explanations in the opposite direction may also be plausible. For example, it could be that there were increases in loss aversion, but only those with low alexithymia developed more symptoms of anxiety and depression. Thus, using objective neurophysiological or neuropsychological techniques to address these issues would be very helpful.

In fact, since this is a natural study and participants could not come to the laboratory to take that kind of measures, this is one of our main limitations. Moreover, given the abrupt situation, more pre-confinement variables that could have also been important to consider were not evaluated. In addition, our data must be interpreted based on our specific sample: young people, with middle socioeconomic status, and accompanied during confinement. It is likely that other factors, such as loneliness or a precarious economic condition, may show different results. It would be necessary to replicate our study in broader samples to test whether our results can be extrapolated beyond young psychology students. On the other hand, all analyses were replicated including the gender variable. Results were very similar, and the variable gender did not show significant main effects, nor interaction effects. However, the sample was disproportionate, and this conclusion should not be taken firmly, since analyses could be underpowered. In fact, there is evidence for gender influencing emotional responses to stress, being men less likely to develop psychological symptoms (e.g. Liu *et al.*, 2020; Moccia *et al.*, 2020). Thus, it would be necessary to incorporate a bigger and more balanced sample in the future.

Despite limitations, our study was a first step for understanding how the distressing context generated by COVID-19 was influencing decision-making, and specifically loss aversion. As seen, our data shows that the connection between psychological distress, alexithymia and loss aversion exists must be considered, beyond attending to the different variables separately or in pairs. So, psychological distress seems to enhance loss aversion as long as the level of alexithymia is low. Future lines of research should address whether increased loss aversion in a threatening context such as the COVID-19 outbreak should be understood as a protective factor or, on the contrary, as a manifestation of poorer mental health. Furthermore, alexithymia should be considered in future studies on decision-making and stress, as it seems to be an important factor in the decisional process.

References

Alexander, L. F., Oliver, A., Burdine, L. K., Tang, Y. and Dunlop, B. W. (2017). Reported maladaptive decision-making in unipolar and bipolar depression and its change with treatment. *Psychiatry Research, 257*, 386-392. https://doi.org/10.1016/j.psychres.2017.08.004

Baek, K., Kwon, J., Chae, J. H., Chung, Y. A., Kralik, J. D., Min, J. A., Huh, H. J. J., Choi, K. M., Jang, K.-I., Lee N.-B., Kim, S., Peterson, B. S. and Jeong, J. (2017). Heightened aversion to risk and loss in depressed patients with a suicide attempt history. *Scientific Reports, 7*(1), 1-13. https://doi.org/10.1038/s41598-017-10541-5

Bishop, S. J. and Gagne, C. (2018). Anxiety, depression, and decision making: A computational perspective. *Annual Review of Neuroscience, 41*, 371-388. https://doi.org/10.1146/annurev-neuro-080317-062007

Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N. and Rubin, G. J. (2020). The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *The Lancet, 395*(10227), 912-920. https://doi.org/10.1016/S0140-6736(20)30460-8

Camerer, C. F. (2003). Behavioral game theory: Plausible formal models that predict accurately. *Behavioral and Brain Sciences, 26*(2), 157-158.

Gächter, S., Johnson, E. and Herrmann, A. (2007). Individual-level loss aversion in riskless and risky choices. *CeDEx Discussion Paper Series*, (2010-20), 1-26.

Gal, D. and Rucker, D. D. (2018). The loss of loss aversion: will it loom larger than its gain? *Journal of Consumer Psychology, 28*(3), 497-516. https://doi.org/10.1002/jcpy.1047

Gigerenzer, G. and Gaissmaier, W. (2011). Heuristic decision making. *Annual Review of Psychology, 62*, 451-482. https://doi.org/10.1146/annurev-psych-120709-145346

Gnambs, T. and Staufenbiel, T. (2018). The structure of the General Health Questionnaire (GHQ-12): two meta-analytic factor analyses. *Health Psychology Review, 12*(2), 179-194. https://doi.org/10.1080/17437199.2018.1426484

Goldberg, D. P., Oldehinkel, T. and Ormel, J. (1998). Why GHQ threshold varies from one place to another. *Psychological Medicine, 28*(4), 915-921. https://doi.org/10.1017/S0033291798006874

Goldberg, D. P. and Williams, P. (1988). *A user's guide to the General Health Questionnaire*. nferNelson.

Hadlaczky, G., Hökby, S., Mkrtchian, A., Wasserman, D., Balazs, J., Machín, N., Sarchapione, M., Sisask, M. y Carli, V. (2018). Decision-making in suicidal behavior: The protective role of loss aversion. *Frontiers in Psychiatry, 9*,1-9. https://doi.org/10.3389/fpsyt.2018.00116

Hermans, E. J., Henckens, M. J. A. G., Joëls, M. and Fernández, G. (2014). Dynamic adaptation of large-scale brain networks in response to acute stressors. *Trends in Neurosciences, 37*(6), 304-314. https://doi.org/10.1016/j.tins.2014.03.006

Hermans, E. J., Van Marle, H. J. F., Ossewaarde, L., Henckens, M. J. A. G., Qin, S., Van Kesteren, M. T. R., Schoots, V., Cousijn, H., Rijpkema, M., Oostenveld, R. and Fernández, G. (2011). Stress-related noradrenergic activity prompts large-scale neural network reconfiguration. *Science, 334*(6059), 1151-1153. https://doi.org/10.1126/science.1209603

Hidalgo, V., Pulopulos, M. M. and Salvador, A. (2019). Acute psychosocial stress effects on memory performance: Relevance of age and sex. *Neurobiology of Learning and Memory, 157* 48-60. https://doi.org/10.1016/j.nlm.2018.11.013

Hintze, A., Olson, R. S., Adami, C. and Hertwig, R. (2015). Risk sensitivity as an evolutionary adaptation. *Scientific Reports, 5*, 1-7. https://doi.org/10.1038/srep08242

Ingram, J., Maciejewski, G. and Hand, C. J. (2020). Changes in diet, sleep, and physical activity are associated with differences in negative mood during COVID-19 lockdown. *Frontiers in Psychology, 11*, 2328. https://doi.org/10.3389/FPSYG.2020.588604/BIBTEX

Iwasaki, K. and Sawada, Y. (2015). Evacuation and *psychological distress: new evidence of reference-dependent utility and loss aversion*. 行動経済学, *8*, 77-80. https://doi.org/10.11167/JBEF.8.77

Kahneman, D. (2003). Maps of bounded rationality: Psychology for behavioral economics. *American Economic Review, 93*(5), 1449-1475. https://doi.org/10.1257/000282803322655392

Kahneman, D., Knetsch, J. L. and Thaler, R. H. (1991). Anomalies: The endowment effect, loss aversion, and status quo bias. *Journal of Economic Perspectives, 5*(1), 193-206. https://doi.org/10.1017/CBO9780511803475.009

Kahneman, D. and Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica, 47*(2), 263-291. https://doi.org/10.1017/CBO9780511803475.003

Kano, M., Ito, M. and Fukudo, S. (2011). Neural substrates of decision making as measured with the iowa gambling task in men with alexithymia. *Psychosomatic Medicine, 73*(7), 588-597. https://doi.org/10.1097/PSY.0b013e318223c7f8

Klumpp, H., Angstadt, M. and Phan, K. L. (2012). Insula reactivity and connectivity to anterior cingulate cortex when processing threat in generalized social anxiety disorder. *Biological Psychology, 89*(1), 273-276. https://doi.org/10.1016/j.biopsycho.2011.10.010

Laeger, I., Dobel, C., Dannlowski, U., Kugel, H., Grotegerd, D., Kissler, J., Keuper, K., Eden, A., Zwitserlood, P. and Zwanzger, P. (2012). Amygdala responsiveness to emotional words is modulated by subclinical anxiety and depression. *Behavioural Brain Research, 233*(2), 508-516. https://doi.org/10.1016/j.bbr.2012.05.036

Lakhan, R., Agrawal, A. and Sharma, M. (2020). Prevalence of Depression, Anxiety, and Stress during COVID-19 Pandemic. *Journal of Neurosciences in Rural Practice, 11*(4), 519-525. https://doi.org/10.1055/S-0040-1716442/ID/JR_40

Liang, L., Ren, H., Cao, R., Hu, Y., Qin, Z., Li, C. and Mei, S. (2020). The effect of COVID-19 on youth mental health. *Psychiatric Quarterly, 91*(3), 841-852. https://doi.org/10.1007/S11126-020-09744-3/TABLES/5

Liu, N., Zhang, F., Wei, C., Jia, Y., Shang, Z., Sun, L., Wu, L., Sun, Z, Zhou, Y., Wang, Y. and Liu, W. (2020). Prevalence and predictors of PTSS during COVID-19 outbreak in China hardest-hit areas: Gender differences matter. *Psychiatry Research, 287*, 112921. https://doi.org/10.1016/j.psychres.2020.112921

Mahase, E. (2020). China coronavirus: WHO declares international emergency as death toll exceeds 200. *BMJ (Clinical Research Ed.), 368*(January), m408. https://doi.org/10.1136/bmj.m408

Manzoor, N., Molins, F. and Serrano, M. Á. (2021). Interoception moderates the relation between

Print ISSN: 1390-6291; electronic ISSN:1390-8618

alexithymia and risky-choices in a framing task: A proposal of two-stage model of decision-making. International *Journal of Psychophysiology, 162*, 1-7. https://doi.org/10.1016/j.ijpsycho.2021.01.002

Margittai, Z., Nave, G., Van Wingerden, M., Schnitzler, A., Schwabe, L. and Kalenscher, T. (2018). Combined effects of glucocorticoid and noradrenergic activity on loss aversion. *Neuropsychopharmacology: official publication of the American College of Neuropsychopharmacology, 43*(2), 334-341. https://doi.org/10.1038/npp.2017.75

Martínez, F. (1996). Adaptación española de la escala de Alexitimia de Toronto (TAS-20). *Clínica y Salud, 7*(1), 19-32. http://bit.ly/3JdlbdEv

Mather, M. and Lighthall, N. R. (2012). Risk and reward are processed differently in decisions made under stress. *Current Directions in Psychological Science, 21*(1), 36-41. https://doi.org/10.1177/0963721411429452

Metz, S., Waiblinger-Grigull, T., Schulreich, S., Chae, W. R., Otte, C., Heekeren, H. R. and Wingenfeld, K. (2020). Effects of hydrocortisone and yohimbine on decision-making under risk. *Psychoneuroendocrinology, 114*,104589. https://doi.org/10.1016/j.psyneuen.2020.104589

Moccia, L., Janiri, D., Pepe, M., Dattoli, L., Molinaro, M., De Martin, V., Chieffo, D., Janiri, L., Fiorillo, A., Sani, G. and Di Nicola, M. (2020). Affective temperament, attachment style, and the psychological impact of the COVID-19 outbreak: an early report on the Italian general population. *Brain, Behavior, and Immunity, 87*, 75-79. https://doi.org/10.1016/j.bbi.2020.04.048

Molins, F., Ayuso, C. and Serrano, M. Á. (2021). Emotional stress and decision-making: an emotional stressor significantly reduce loss aversion. *Stress, 24*(6), 780-786. https://doi.org/10.1080/10253890.2021.1919617

Montoya, A. K. (2019). Moderation analysis in two-instance repeated measures designs: Probing methods and multiple moderator models. *Behavior Research Methods, 51*(1), 61-82. https://doi.org/10.3758/s13428-018-1088-6

Mrkva, K., Johnson, E. J., Gächter, S. and Herrmann, A. (2020). Moderating loss aversion: loss aversion has moderators, but reports of its death are greatly exaggerated. *Journal of Consumer Psychology, 30*(3), 407-428. https://doi.org/10.1002/JCPY.1156

Patwardhan, I., Mason, W. A., Chmelka, M. B., Savolainen, J., Miettunen, J. and Järvelin, M. R. (2019). Prospective relations between alexithymia, substance use and depression: findings from a National Birth Cohort. Nordic *Journal of Psychiatry, 73*(6), 340-348. https://doi.org/10.1080/08039488.2019.1634758

Pierce, M., Hope, H., Ford, T., Hatch, S., Hotopf, M., John, A., Kontopantelis, E., Webb, R., Wessely, S., McManius, S. and Abel, K. M. (2020). Mental health before and during the COVID-19 pandemic: a longitudinal probability sample survey of the UK population. *The Lancet Psychiatry, 7*(10), 883-892. https://doi.org/10.1016/S2215-0366(20)30308-4

Pighin, S., Bonini, N., Savadori, L., Hadjichristidis, C. and Schena, F. (2014). Loss aversion and hypoxia: Less loss aversion in oxygen-depleted environment. *Stress, 17*(2), 204-210. https://doi.org/10.3109/10253890.2014.891103

Presti, S. Lo, Mattavelli, G., Canessa, N. and Gianelli, C. (2022). Risk perception and behaviour during the COVID-19 pandemic: Predicting variables of compliance with lockdown measures. *PLOS ONE, 17*(1), e0262319. https://doi.org/10.1371/JOURNAL.PONE.0262319

Pushkarskaya, H., Tolin, D., Ruderman, L., Henick, D., Kelly, J. M. L., Pittenger, C. and Levy, I. (2017). Value-based decision making under uncertainty in hoarding and obsessive- compulsive disorders. *Psychiatry Research, 258*, 305-315. https://doi.org/10.1016/j.psychres.2017.08.058

Puustinen, P. J., Koponen, H. and Kautiainen, H. (2011). Psychological distress measured by the GHQ-12 and mortality: A prospective population-based study. *Scandinavian Journal of Public Health, 39*, 577-581. https://doi.org/10.1177/1403494811414244

Rocha, K. B., Pérez, K., Rodríguez-Sanz, M., Borrell, C. and Obiols, J. E. (2011). Propiedades psicométricas y valores normativos del general health questionnaire (GHQ-12) en población general española. *International Journal of Clinical and Health Psychology, 11*(1), 125-139. https://bit.ly/3mQnr37

Salari, N., Hosseinian-Far, A., Jalali, R., Vaisi-Raygani, A., Rasoulpoor, S., Mohammadi, M., … Khaledi-Paveh, B. (2020). Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: A systematic review and meta-analysis. *Globalization and Health, 16*(1), 1-11. https://doi.org/10.1186/s12992-020-00589-w

Shah, P., Catmur, C. and Bird, G. (2016). Emotional decision-making in autism spectrum disorder: the roles of interoception and alexithymia. *Molecular Autism, 7*, 43. https://doi.org/10.1186/s13229-016-0104-x

Shuja, K. H., Aqeel, M., Jaffar, A. and Ahmed, A. (2020). Covid-19 pandemic and impending global mental health implications. *Psychiatria Danubina, 32*(1), 32-35. https://doi.org/10.24869/psyd.2020.32

Sip, K. E., Gonzalez, R., Taylor, S. F. and Stern, E. R. (2018). Increased loss aversion in unmedicated patients with obsessive-compulsive disorder. *Frontiers in Psychiatry, 8*, 1-10. https://doi.org/10.3389/fpsyt.2017.00309

Sokol-Hessner, P., Raio, C. M., Gottesman, S. P., Lackovic, S. F. and Phelps, E. A. (2016). Acute stress does not affect risky monetary decision-making. *Neurobiology of Stress, 5*, 19-25. https://doi.org/10.1016/j.ynstr.2016.10.003

Sokol-Hessner, P. and Rutledge, R. B. (2019). The psychological and neural basis of loss aversion. Current *Directions in Psychological Science, 28*(1), 20-27. https://doi.org/10.1177/0963721418806510

Stancak, A., Xie, Y., Fallon, N., Bulsing, P., Giesbrecht, T., Thomas, A. and Pantelous, A. A. (2015). Unpleasant odors increase aversion to monetary losses. *Biological Psychology, 107*, 1-9. https://doi.org/10.1016/j.biopsycho.2015.02.006

Starcke, K. and Brand, M. (2012). Decision making under stress: A selective review. Neuroscience and *Biobehavioral Reviews, 36*(4), 1228-1248. https://doi.org/10.1016/j.neubiorev.2012.02.003

Starcke, K. and Brand, M. (2016). Effects of stress on decisions under uncertainty: A meta-analysis. *Psychological Bulletin, 142*(9), 909-933. https://doi.org/10.1037/bul0000060

Stein, M. B., Simmons, A. N., Feinstein, J. S. and Paulus, M. P. (2007). Increased amygdala and insula activation during emotion processing in anxiety-prone subjects. *American Journal of Psychiatry, 164*, 318-327.

Sutherland, M. T., Carroll, A. J., Salmeron, B. J., Ross, T. J. and Stein, E. A. (2013). Insula's functional connectivity with ventromedial prefrontal cortex mediates the impact of trait alexithymia on state tobacco craving. *Psychopharmacology, 228*(1), 143-155. https://doi.org/10.1007/s00213-013-3018-8

Volz, K. G. and Gigerenzer, G. (2012). Cognitive processes in decisions under risk are not the same as in decisions under uncertainty. *Frontiers in Neuroscience, 6*, 1-6. https://doi.org/10.3389/fnins.2012.00105

Walker, S., O'Connor, D. B. and Schaefer, A. (2011). Brain potentials to emotional pictures are modulated by alexithymia during emotion regulation. *Cognitive, Affective and Behavioral Neuroscience, 11*(4), 463-475. https://doi.org/10.3758/s13415-011-0042-1

Wang, M., Rieger, M. O. and Hens, T. (2017). The Impact of Culture on Loss Aversion. *Journal of Behavioral Decision Making, 30*(2), 270-281. https://doi.org/10.1002/bdm.1941

Ward, G., Collins, H., Norton, M. I. and Whillans, A. V. (2020). *Work values shape the relationship between stress and (un) happiness*. Harvard Business School.

Zhang, L., Wang, X., Zhu, Y., Li, H., Zhu, C., Yu, F. and Wang, K. (2017). Selective impairment of decision making under ambiguity in alexithymia. *BMC Psychiatry, 17*(1), 1-8. https://doi.org/10.1186/s12888-017-1537-2

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