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Basic Psychological Need-Satisfying Activities during the COVID-19 Outbreak

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Background: The rapidly spreading novel coronavirus outbreak (COVID-19) worldwide may increase fear and stress, and has a cost for people's well-being and their motivation toward activities. In this study, we applied principles from Self-Determination Theory to develop and test activities to satisfy basic psychological needs (autonomy, competence, and relatedness) to enhance the experience of need satisfaction, autonomous self-regulation, and subjective vitality, and to decrease the experience of need frustration, controlled self-regulation, amotivation, and perceived stress. **Method:** Using a 10-day experimental research design among an Iranian sample (N = 208, M_{age} = 23.52, SD = 5.00), we randomly allocated participants to either an experimental (basic psychological need-satisfying activities intervention, n = 98) or a control (neutral comparison group, n = 110) condition. **Results:** Repeated measure ANCOVA showed that participants in the experimental condition reported greater psychological need satisfaction, autonomous self-regulation, subjective vitality, and lesser psychological need frustration, amotivation, and perceived stress than did participants in the control condition. **Conclusion:** We conclude that the intervention was successful in helping participants enhance their motives and well-being and reduce their stress when life is surrounded by uncertainty and during social distancing restrictions.

Keywords: motivational self-regulation, need satisfaction, stressful situation, vitality

INTRODUCTION

Since December 2019, the novel coronavirus (COVID-19) pandemic has spread from China across the world. As of 27 April 2020, more than three million cases

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were confirmed in 210 countries, and the World Health Organization (WHO) set up an international alarm to fight COVID-19 (WHO, 2020a). The rapidly spreading COVID-19 that could infect people with no symptoms and be easily transmitted to others has created a fearful and stressful climate among all people (e.g. Beaumont et al., 2020; Broom, Chongwang, & Castilhos, 2020). During the COVID-19 crisis, to break the chain of transmission and prevent the spread of the disease, the WHO emphasises the importance of physical distance, while at the same time recommending social support to all people (WHO, 2020a, 2020b). Although these recommendations are necessary to save lives and break the transmission of the disease, it may result in an emerging feeling of loneliness and cost to people's psychological well-being (Brooks et al., 2020). In this stressful situation, it is important to provide psychological interventions to cope with stress and help reproduce daily routines (Duan & Zhu, 2020), as well as maintain people's motivation toward their activities. Moreover, psychological interventions would be most important in countries that have a high level of infection and where people may experience higher levels of stress, such as in Iran. In the current study, therefore, we employed self-determination theory (SDT; Ryan & Deci, 2017) to develop and test basic psychological need-satisfying (i.e. autonomy, competence, and relatedness) activities (e.g. try to undertake some activities to help fulfill basic psychological needs, try to do something that makes you feel like you can help someone, and try to make a meaningful choice about what matters to you) to enhance the satisfaction of basic psychological needs, motivation toward activities, and subjective vitality, and reduce stress.

Basic Psychological Needs

SDT is a macro-theory of motivation and well-being, whose propositions have received empirical support in many countries (Deci & Ryan, 1985; Ryan & Deci, 2017). Based on SDT, the satisfaction of basic psychological needs for *autonomy* (feeling volition and act with choice), *competence* (feeling effective and capable in doing things and influencing the environment), and *relatedness* (feeling significant and connected to others) are essential nutrients for high quality motivation and well-being. Research has shown that the satisfaction of these basic needs results in positive outcomes, such as engagement in activities, behavior change, and greater performance (Ntoumanis et al., 2020; Ryan, Patrick, Deci, & Williams, 2008). The satisfaction of basic needs would most likely result from need-supportive environments across the lifespan, where people feel that social agents (e.g. teachers, coaches, and managers) support their basic needs (Vansteenkiste & Ryan, 2013). In contrast, when social environments do not create a need-supportive climate or thwart basic needs, it results in need frustration and negative outcomes. That is, need frustration results from need-thwarting or need-indifference environments, and thus, is related to

negative behaviors such as depression and stress, and lower self-esteem (Bhavsar et al., 2019; Mageau et al., 2015; Weinstein & Ryan, 2011).

Basic Psychological Need-Satisfying Activities

According to SDT, social environments, by supporting versus thwarting these basic needs, affects people's well-being versus ill-being, respectively (Ryan & Deci, 2017). In stressful situations like the current COVID-19 pandemic, officials should provide a clear rationale, information, and altruistic choice for citizens to participate voluntarily in programs recommended by health organisations (e.g. physical distancing) and for understanding the situation (Brooks et al., 2020). However, in this difficult time, officials themselves and their nations are unprepared to deal with unforeseen situations, and thus people may feel frustration and suffer from the stressor at the subsequent cost to their well-being (Brooks et al., 2020; Wang et al., 2020). Therefore, an important question is how can people create the conditions to satisfy their basic needs and motivate themselves, and subsequently cope with their stress during this difficult time of uncertainty? To do this, we tested an exploratory and easy to implement intervention to encourage individuals to satisfy their basic psychological needs through various activities (Weinstein, Khabbaz, & Legate, 2016) with samples from Iran. Moreover, the aim of providing activities was to encourage individuals to create a self-support climate for themselves to seek out activities to satisfy their basic psychological needs.

Based on SDT, the satisfaction of basic needs results in being intrinsically motivated toward the activities and greater well-being (Ryan & Deci, 2017). Rather than receiving support from social agents, anyone can help themselves by thinking about how to get their needs satisfied. To do this, one can develop relationships with others, focus on learning how to do things that one thinks are important for oneself, and take responsibility for oneself (Deci & Flaste, 1995; Ryan & Deci, 2017; Weinstein et al., 2016). When people feel that their behaviors are truly chosen by themselves, feel a sense of autonomy, believe that their behaviors will lead to something desirable and feel effective in doing that, they feel a sense of competence, and volitionally engage in relationships, and giving and receiving support from others, they feel a sense of relatedness (Ryan & Deci, 2017).

Motivational Self-Regulations

Based on SDT, when people feel that their basic needs are satisfied, they experience greater well-being and decreased ill-being, and this relation mediates motivational self-regulation (Ryan & Deci, 2017). Within SDT, motivational self-regulation is described as a continuum that spans from amotivation (lack of any motivation and control), to controlled self-regulation (evading a feeling of pride

and guilt, and avoiding external punishment and requests) to autonomous self-regulation (personally value the activity, fully self-endorsed, and act based on interests and preferences). Research has shown that need-supportive environments are related to the experience of need satisfaction and autonomous self-regulation, and on the contrary, need-thwarting environments are related to the experience of need frustration and controlled self-regulation and amotivation. Moreover, generally, autonomously regulating behaviors are associated with positive outcomes, such as greater performance, persistence at activities, and well-being, whereas, controlling behaviors and amotivation are associated with less well-being and higher psychological distress (e.g. Ntoumanis et al., 2020).

The Present Study

In the current study, along with the experience of basic needs and motivations, we aimed to examine the two outcome variables of subjective vitality and perceived stress. Subjective vitality refers to the feeling of being alert and vital, and having energy (Ryan & Frederick, 1997) that has been widely used as a measure of psychological well-being and being fully functioning (e.g. Behzadnia & Ryan, 2018). Perceived stress, generally, refers to a combination of a stressor, stress reactivity, and the interaction between them, which is concerned with the perceptions of the stressful events and the degree to which events and conditions in one's life are appraised as stressful (Greenberg, 2012). Recent research has also found that stress is an important driver of behavior during the COVID-19 pandemic (Vindegaard & Benros, 2020).

In this study, we investigated the effects of an easy to implement psychosocial intervention to encourage individuals to carry out need-satisfying activities during the COVID-19 stressful situation. This intervention is nonclinical in nature, but it offers a framework in which people can do activities to satisfy their basic needs even when they are not receiving support from others in a stressful situation. That is, we provided some need-satisfying activities for participants in the experimental condition, and we asked them to be creative in doing these activities. It was designed to help people to satisfy and rediscover their basic needs in order to autonomously motivate them toward daily activities, increase vitality, and reduce stress during the difficult times of uncertainty in the spreading COVID-19 outbreak. Moreover, we aimed to help the individuals learn how to satisfy their basic psychological needs in a way that is achievable for them (Weinstein et al., 2016) while they must stay at home. That is, the interventions were small acts to enhance the experience of satisfying basic needs that is also achievable by them during social distancing restrictions at home. We, therefore, hypothesised that participants in the experimental condition (basic psychological need-satisfying activities intervention) would increase their experience of basic need satisfaction (H1a), autonomous self-regulation (H1b), and subjective vitality (H1c) more than would participants in the no-intervention control condition.

We also hypothesised that participants in the experimental condition would decrease their experience of need frustration (H2a), controlled self-regulation (H2b), amotivation (H2c), and perceived stress (H2d) more than would participants in the no-intervention control condition.

METHOD

Participants and Procedures

Two hundred and fifty-five participants (212 female and 43 male), age range 18–46 years old (M_{age} = 23.98, SD = 5.22) took part in this research during the final days of March 2020, during the COVID-19 crisis in North-Western Iran. Participants were mostly university students and were recruited through their teachers, most of them were single (78.82%), and lived with their parents or spouse (98.00%).

One week before the beginning of the intervention, we contacted six teachers to ask for students or people around them to attend the study, and then created two groups in a WhatsApp mobile application to participate in the 10-day long study (one group created for all participants of the experimental condition and one group created for all participants of the control condition). Then, 255 of the participants who were eligible and agreed to attend the study were allocated to the conditions (experimental condition, n = 126, control condition, n = 129). These six teachers were first randomly allocated to either the experimental or control condition by the researchers (authors). Then, the students of the teachers who were allocated to the experimental condition had to be part of the experimental condition, and the students of the teachers who were allocated to the control condition had to be part of the control condition (see Figure 1). That means that we tried to deliver the intervention only to the participants in the experimental condition. Participants in both conditions were informed that the study aimed to assess their psychological states during the COVID-19 time in general. Participants were asked to provide a consent form to take part in the study, and they were assured about the anonymity and confidentiality of their responses. The inclusion criterion was being 18 years old or above, and the exclusion criteria were having psychological symptoms (i.e. previously diagnosed with a psychological illness such as depression or psychotic disorders[1]), being infected with the COVID-19, and a background in attending basic psychological needs activity programs (such as the one that we applied to this study). The Regional Research Ethics Committee of the University of Tabriz approved the study protocol (IR.TABRIZU.REC.1399.014).

[1] Participants were asked to respond whether they had previously been diagnosed with a psychological illness or not.

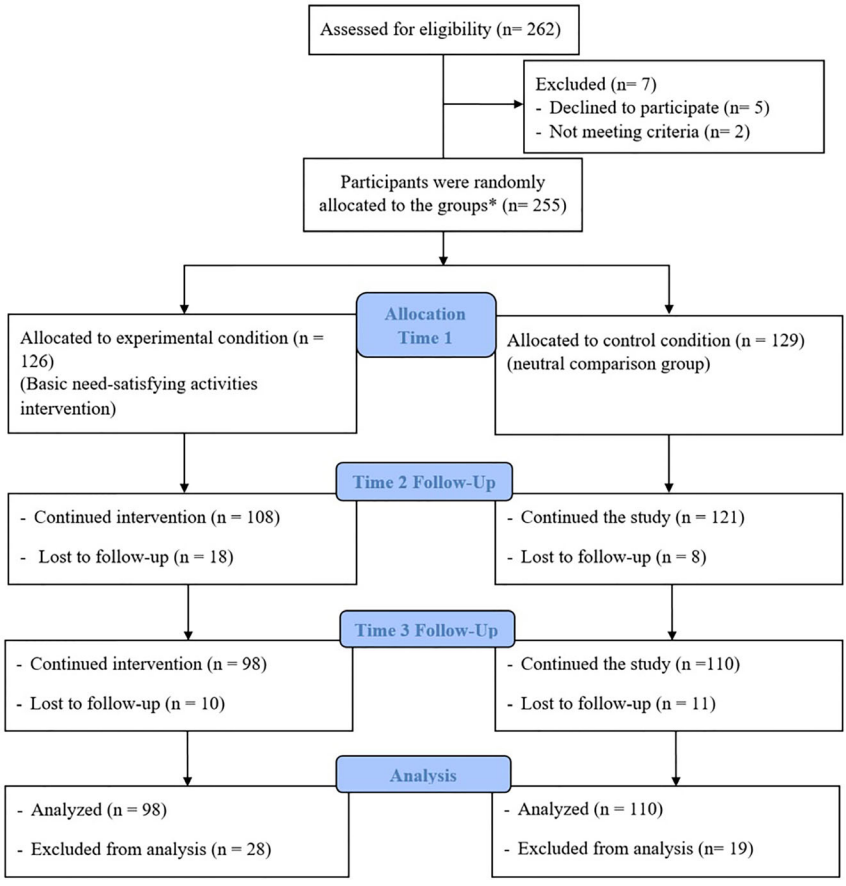

FIGURE 1. Participants flowchart. * Teachers of the participants were randomly allocated to groups.

Participants completed the study questionnaires over all three waves of data collection. At Time 1 (the beginning of the study, *Pretest*), 255 participants completed all the questionnaires (need satisfaction and frustration, motivational self-regulation, subjective vitality, perceived stress, physical activity behaviors, and demographic information). At Time 2 (5 days after the first day, *Mid-test*), 229 participants completed the questionnaires (subjective vitality and perceived stress), while 26 did not. The Time 2 dropout participants did not differ in autonomous and controlled self-regulation, but they scored higher on Time 1 need frustration, amotivation, and stress, and scored lower on Time 1 need satisfaction, subjective vitality, and physical activity behaviors. At Time 3 (10 days

after the first day, *Posttest*), 208 participants completed all the questionnaires (need satisfaction and frustration, motivational self-regulation, subjective vitality, and perceived stress), while 21 of the Time 2 remaining participants did not. The Time 3 dropout participants did not differ from the remaining participants in the experimental condition on autonomous and controlled self-regulation and physical activity behaviors, but did score higher on Time 1 need frustration, amotivation, and perceived stress, and did score lower on Time 1 need satisfaction and subjective vitality. The Time 3 dropout participants also differed from the remaining participants in the experimental condition at Time 2, they scored higher on perceived stress, and lower on subjective vitality. The dropout analyses were conducted through MANOVAs to examine the mean differences in study variables between dropout and persistent participants (see File S1). Thus, the final sample of 208 participants represented a retention rate of 81.57 per cent (255/208). This final sample consisted of 181 (87.02%) females and 27 (12.98%) males, and 98 (47.12%) in the experimental condition and 110 (52.88%) in the control condition. All participants were asked to complete online surveys designed in Google Docs and delivered via WhatsApp groups. Also, all questions were required to be answered by participants before they submitted the surveys; thus, there were no missing values.

Basic Psychological Need-Satisfying Activities Intervention

Based on SDT (Ryan & Deci, 2017; Weinstein et al., 2016), ten suggested activities were provided for participants in the experimental condition (intervention), and they were instructed to follow the activities each morning. That is, we sent one activity each morning to the participants in the experimental condition (Table 1). Participants were provided with some options on how to do the activities each day, including volitionally doing the activities, choosing different activities based on their interests or preferences that were also based on the main theme of that day, doing the activities with family members (if possible), feeling free to do the activity whenever they preferred during the day, and they were provided with some examples of activities to achieve their tasks. If they had any questions regarding the activities, they could ask the Research Assistant (RA). We also provided a general suggestion regarding health recommendations provided by WHO (e.g. washing hands). Participants in the control condition were only asked to complete online surveys three times as did the participants in the intervention condition.

Manipulation Checks

We assessed the fidelity of the need-satisfy activities intervention in two ways. First, participants were asked to complete a survey regarding doing daily

TABLE 1
Instructions for Basic Psychological Need-Satisfying Activities Intervention

Day	Intervention
Day 1 (Autonomy, competence, relatedness)	Today, try to do something that you have done before that has been a challenge for you, but something that you feel you can do it successfully (e.g. doing a specific exercise, or making a special dish or cake). To do this, first try to do it yourself, create the conditions for those around you (e.g. family members and your friends) to be able to do this, and then encourage and support them to do it
Day 2 (Autonomy, relatedness)	Today, try to do something that makes you feel that you can help someone (e.g. teaching someone an important task even if a simple thing). To do this, try to feel responsible for teaching it today, and encourage and support those around you (or even yourself), teach it to others, and try to create the conditions for your family members (or your friends) to make the effort and perform it
Day 3 (Relatedness)	Today, do something that makes you feel good in connection with nature, and take inspiration from it to do your daily activities (such as making a pot or flower at home, or arranging pots). To do this, try to make a good connection with nature, and encourage/support those around you (e.g. family members or friends) to do so; meanwhile, try to be less in touch with artificial things like television and your mobile
Day 4 (Autonomy, relatedness)	Today, try to use positive dialogue with others, so that you speak positively about your feelings and thoughts (e.g. using words like "How good it is that you are here", or appreciating others). To fulfill this, try to use only positive words in your daily interaction with others, and encourage/support those around you to do so; in the meantime, try not to think about negative events and dialogue, nor judge them
Day 5 (Autonomy, competence, relatedness)	Today, try to make a meaningful choice about what matters to you, even if it is a very small thing (e.g. the decision to attain a goal like a healthy lifestyle or learning a foreign language, or make a plan or a framework for your work). To do this, try both to make meaningful choices for yourself, and to encourage/support those around you. Try to create the conditions to fulfill it for those around you (e.g. family members and friends)
Day 6 (Competence)	Today, try to come up with creative work or ideas for the first time. Let yourself enjoy and be surprised with the result (e.g. making something or a device with your extras at home, or any other creative stuff). To fulfill this, both do it yourself and encourage/support those around you to do so. Try to create a condition for those around you (e.g. family members and friends) to perform it well
Day 7 (Autonomy, competence, relatedness)	Today, try to do a joyful exercise with family members. At the same time, smile during the exercise. Don't think about anything other than the exercise and just smiling and think about your breathing. Try to encourage/support those around you, regardless of whether they perform the exercise well or poorly. If you are alone at home, try to do this online by creating a group via social media applications, such as Skype or WhatsApp

TABLE 1 *(CONTINUED)*

Day	Intervention
Day 8 (Competence, relatedness)	Try to share an experience or an event with others that has directed your life, and made it meaningful. Share your compelling experiences with others so they may be useful and positive for them too
Day 9 (Autonomy, competence, relatedness)	Today, try to do your favorite personal activities, things that you would like to do, but remember to be active and transfer your positive energy to the people around you, and in the meantime try to focus on your daily activities (e.g. studying, jobs, doing exercises, or helping your family members)
Day 10 (Autonomy, competence, relatedness)	Today, try to write a paragraph (or how much you want) about your emotions, thoughts, and experiences during these 10 days and share it with ones you love or whomever you think that it can be useful to in such days. Always keep in your mind that: one of the greatest and most beautiful feelings in the world is to be compassionate and kind. There is always time to live well, so you can just start it and remind others to do it as well. Determine the best things in your life by yourself, and finally try to be the best within yourself

activities each day, which included (1) "Have you done the activities yesterday?" (short answer "*yes*" or "*no*"), (2) "Have you felt that the activity was useful for you?" (range from 1 *not useful*, to 5 *useful*), and (3) "What are your opinions about the activities? You can provide some feedback if you like." Second, participants reported their experiences of need satisfaction and need frustration at two times, at the beginning of the program (*pretest*) and at the end of the program (*posttest*).

Measures

Demographic Information. To better assess the relations between variables and the influence of need-satisfying activities on the study variables, we collected some demographic information on age, gender, marital status, living status, education level, and socioeconomic status. Socioeconomic status was assessed through the MacArthur Scale of Subjective Social Status (Adler, Epel, Castellazzo, & Ickovics, 2000), that assesses individual socioeconomic status through a numbered stepladder image. We asked participants to choose the step where they were located in their social community in terms of income, education, and occupation, rangeing from 1 (*lowest level*) to 10 (*highest level*).

Experience of Basic Psychological Needs. Participants responded to the 12-item shortened version (Behzadnia, Adachi, Deci, & Mohammadzadeh, 2018) of the Basic Psychological Need Satisfaction and Need Frustration Scale

(BPNSNFS; Chen et al., 2015). Each need was assessed with four items, of which two tapped into the satisfaction of basic needs and two items tapped into the frustration of basic needs. Sample items included, "I felt a sense of choice and freedom in the things I undertook" (autonomy satisfaction), "I felt confident that I could do things well" (competence satisfaction), "I experienced a warm feeling with the people I spent time with" (relatedness satisfaction), "Most of the things I did felt like 'I had to'" (autonomy frustration), "I felt insecure about my abilities" (competence frustration), and "I had the impression that people I spent time with disliked me" (relatedness frustration). For the present study, the stem of the BPNSNF was slightly adjusted to "During my daily activities. . .". We measured a composite score of need satisfaction and need frustration by averaging the sum of the three needs. Participants rated responses on a scale ranging from 1 (*not at all true*) to 7 (*completely true*). The shortened version of the BPNSNF had been translated and validated in Iranian samples by Behzadnia et al. (2018). The results of the internal structure of the BPNSNF were examined through Confirmatory Factor Analysis (CFA). In the current study, with two higher-order factors of need satisfaction and need frustration, the model fitted the data reasonably well, $\chi^2 = (51)\ 123.54$; $p < .001$; RMSEA = .075; RMSEA 90% CI = .058 to .092; CFI = .95; SRMR = .05. All items were above .52, $p < .001$.

Motivational Self-Regulation. Participants' types of motivational self-regulation were assessed through the Perceived Locus of Causality (PLC; Ryan & Connell, 1989) that Waterschoot, Vermote, Soenens, and Vansteenkiste (in progress) adapted to a specific activity. For the present study, we added items to assess amotivation (Goudas, Biddle, & Fox, 1994), and we slightly reworded some items to better reflect the current crisis (COVID-19), by adding the stem "When you are performing your activities during this crisis time of the novel coronavirus, how you try to motivate yourself?" Autonomous self-regulation was assessed by five items (e.g. "Discovering something small in my daily activities that is interesting for me"), controlled self-regulation was assessed by four items (e.g. "Thinking I will feel bad if I cannot bring my daily work to a close"), and amotivation was assessed by three items (e.g. "I used to have good reasons for doing my daily work, but now I am asking myself if I should continue doing it"). Participants responded on a scale ranging from 1 (*not at all true*) to 7 (*very true*). The original version of the PLC has been translated and validated in Iranian samples by Behzadnia, Ahmadi, and Amani (2017). The internal structure of this scale through the CFA with the proposed three higher-order factors of autonomous self-regulation, controlled self-regulation, and amotivation yielded a good fit to data, $\chi^2 = (49)\ 96.97$; $p < .001$; RMSEA = .06; RMSEA 90% CI = .04 to .08; CFI = .96; SRMR = .06. All items were above .40, $p < .001$.

Subjective Vitality. Participants' subjective vitality was assessed by the recommended five-item version of the Subjective Vitality Scale (SVS; Ryan & Frederick, 1997). Participants were asked, "To what degree do you typically feel each of the following. . .?" The sample items include "I Feel alive and vital." Participants responded on a scale ranging from 1 (*not at all true*) to 7 (*very much true*). This five-item version of the SVS had been previously used among Iranian samples (Behzadnia & Ryan, 2018). The internal structure of the SVS through CFA yielded a good fit to data, $\chi^2 = (4)\ 8.23$; $p = .08$; RMSEA = .065; RMSEA 90% CI = .00 to .13; CFI = 1.00; SRMR = .02. All items were above .60, $p < .001$.

Perceived Stress. To measure participants' perceived stress, we used six negative items (i.e. negative stress) from the original Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983) that has been validated in several cultures, such as Iranian samples (Safaei & Shokri, 2014). Participants were asked, "During recent days, how much did you feel each of the following. . .?" The sample items include "Unable to control the important things in my life". Participants responded on a scale ranging from 1 (*never*) to 7 (*very often*). The internal structure of the scale through CFA yielded a satisfactory fit to the data, $\chi^2 = (7)$ 19.70; $p = .006$; RMSEA = .085; RMSEA 90% CI = .04 to .13; CFI = .98; SRMR = .04. All items were above .46, $p < .001$.

Physical Activity Behaviors. Through a brief two-question physical activity assessment tool we evaluated participants' physical activity behaviors (Marshall, Smith, Bauman, & Kaur, 2005). Questions included: "How many times a week, do you usually do 20 min of vigorous physical activity that makes you sweat or puff and pant?", and "How many times a week, do you usually do 30 min of moderate physical activity or walking that increases your heart rate or makes you breath harder than normal?" The score shows sufficiently (score ≥ 4) or insufficiently (score $0 - 3$) active participants. In the present study, we aimed to control for participants' physical activity behaviors because previous research, generally, has shown that physical activity behaviors related to both outcome variables evaluated in this study—that is, positively related to vitality (e.g. Ju, 2017) and negatively related to perceived stress (e.g. McKenzie et al., 2012).

Data Analysis

To assess the effects of the need-satisfying activities on participants' experience of need satisfaction and need frustration, we conducted a pair of 2 (experimental and control conditions) $\times$ 2 (time of assessment) repeated measures ANCOVAs (one for the experience of need satisfaction and one for the experience of need frustration). In these analyses, experimental and control conditions served as the between-group independent variable and the times of assessment were the

repeated within-group independent variables. The same processes in analysing participants' experience of need satisfaction and need frustration were used to test participants' motivational self-regulation. To assess the effects of the need-satisfying activities on participants' well-being (subjective vitality) and ill-being (perceived stress), we conducted a pair of 2 (experimental and control conditions) × 3 (time of assessment) repeated measures ANCOVAs (one for subjective vitality and one for perceived stress).

As recommended by Li, Stuart, and Allison (2015), missing values were handled through the multiple imputation method. To prevent multiple testing problems and the inflation of Type I error in the pairwise comparisons, we used the Bonferroni post-hoc corrected *t*-test and an alpha of $p = .007$ (family-wise error rate $\alpha = .05/7 = .007$). The comparisons along with 95% confidence intervals (CI) for differences were reported. Mean scores adjusted for the covariates are shown in Figure 2 based on two conditions and time of assessment. The three covariates were gender, physical activity behaviors, and SES. Before testing the hypotheses, power analysis for two-condition repeated measures analysis was computed using G*Power version 3.1.9.2 (Faul, Erdfelder, Buchner, & Lang, 2014). Using $p = .05$ (power = .95) and an expected medium effect size (Cohen's *d*) of $d = .40$ among a set of seven variables (plus the 3 statistical controls) determined that the minimal sample size would be 157. Because our sample size was $N = 255$ (at Time 1), we determined that we had sufficient statistical power to test our hypotheses.

RESULTS

Based on the recommendation of Tabachnick and Fidell (2013), the univariate distributions of the study variables were examined, and they were normality distributed (Skewness and Kurtosis > 2). Table 2 presents the participants' demographic information at baseline (Time 1). Table 3 presents the descriptive statistics and internal consistency of the variables employed in the study in three waves, as well as the results of inter-correlations among the experimental condition and the major study variables.

Preliminary analyses showed that age was not related to the study variables. The results showed that socioeconomic status (SES, *Mean* = 5.49, *SD* = 1.59) and physical activity behaviors (*Mean* = 1.77, *SD* = 1.29) were related to most of the study variables. Next, we conducted a MANOVA to examine the mean differences for gender, marital status (single or married), education level (high school graduate, undergraduate, master, or PhD), and physical activity behaviors. Because of the unequal sample sizes on participants' gender (female = 83.14%), marital status (single = 78.82%), and education levels (undergraduate = 79.61%), the assumptions of equality of variances were checked through Levene's test. The results showed that there were differences between males and females, $F(18, 178) = 2.21$, $p = .004$, $\eta_p^2 = .18$. Females reported higher

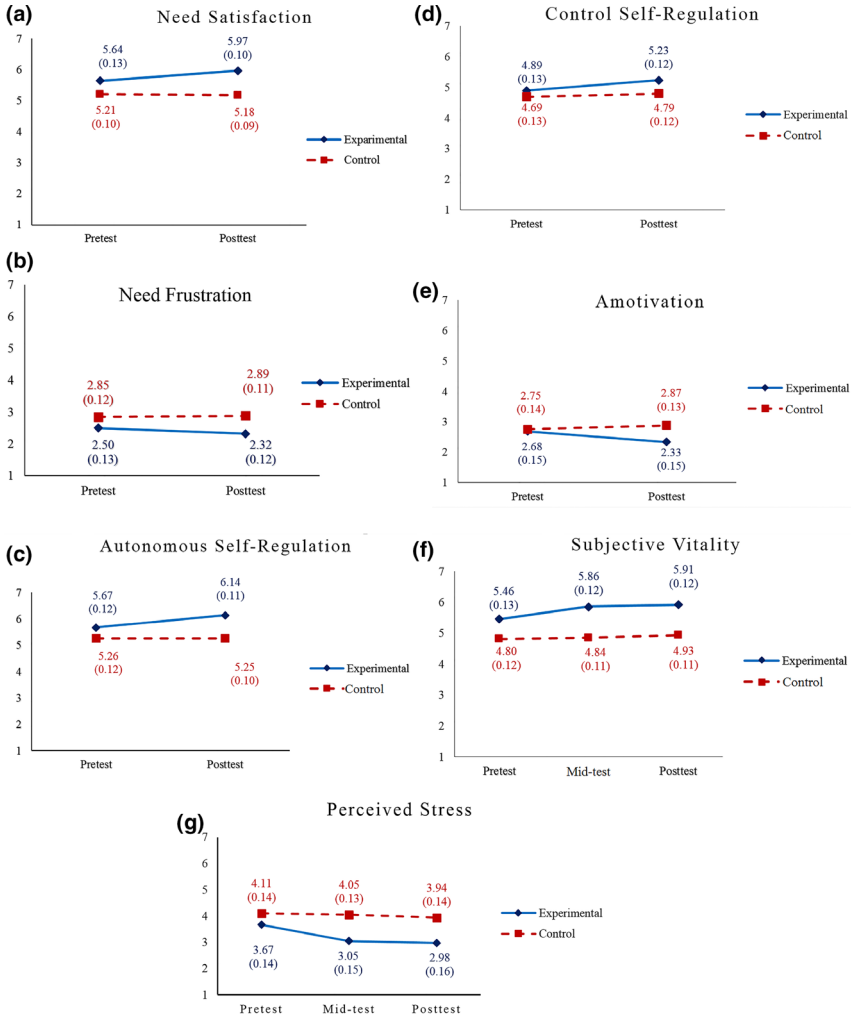

FIGURE 2. Participants' experience of basic needs (a, b), motivational self-regulation (c, d, e), subjective vitality (f), and perceived stress (g). *Note.* Numbers within parentheses are standard errors.

controlled self-regulation at *pretest*, $F(1, 196) = 5.49$, $p = .02$, $\eta_p^2 = .03$, compared to males. Further, females were lower on stress, $F(1, 196) = 3.97$, $p = .048$, $\eta_p^2 = .02$, and need frustration at *posttest*, $F(1, 196) = 6.41$, $p = .012$, $\eta_p^2 = .03$, than males. The results also showed that participants were not different based on their marital status, $F(18, 178) = .76$, $p = .7$, $\eta_p^2 = .07$, and

TABLE 2
Demographic Characteristics of Participants at Baseline

	Experimental condition (n = 126)	Control condition (n = 129)	Total sample (n = 255)
Age, year ($M \pm SD$)	23.53 ± 5.05	24.42 ± 5.36	23.98 ± 5.22
Gender (Female, *n* (%))	107 (84.92%)	105 (81.40%)	212 (83.14%)
Marital (Single, *n* (%))	104 (82.54%)	97 (75.19%)	201 (78.82%)
SES ($M \pm SD$)	5.63 ± 1.60	5.34 ± 1.57	5.49 ± 1.59
Education (*n* (%))			
High school graduate	1 (.79)	1 (.78)	2 (.78%)
Collage degree	104 (82.54%)	99 (76.74%)	203 (79.61%)
Master degree	16 (12.70%)	20 (15.50%)	36 (14.12%)
PhD	5 (3.97%)	9 (6.98%)	14 (5.49%)
Physical activity behaviors, *M*	1.81	1.73	1.77

Note: SES = Socioeconomic status.

education level, $F(18, 178) = 1.24$, $p = .12$, $\eta_p^2 = .11$, on the study variables. Given these results, we included gender, physical activity behaviors, and SES as covariates in the main analyses.

Participants' Experience of Need Satisfaction and Need Frustration (Manipulation Check)

For *participants' experience of need satisfaction*, as expected, the interaction of time × condition, $F(1, 203) = 7.72$, $p = .006$, $\eta_p^2 = .04$, the main effect for time, $F(1, 203) = 8.95$, $p = .003$, $\eta_p^2 = .04$, and the main effect for condition $F(1, 203) = 20.85$, $p = .001$, $\eta_p^2 = .09$, were significant. As illustrated in Figure 2(a), the experience of need satisfaction increased significantly for the participants in the experimental condition from Time 1 (*pretest*) to Time 3 (*posttest*) ($p = .001$, $d = .30$, 95% CI [0.12, 0.46]), whereas it remained unchanged for the participants in the control condition from *pretest* to *posttest*. Moreover, the two conditions did not differ at *pretest*, but participants in the experimental condition showed significantly higher need satisfaction than participants in the control condition at *posttest* ($p < .001$, $d = .78$, 95% CI [0.50, 1.07]).

For *participants' experience of need frustration*, the main effect for time, $F(1, 203) = 5.11$, $p = .025$, $\eta_p^2 = .03$, and the main effect for condition, $F(1, 203) = 9.21$, $p = .003$, $\eta_p^2 = .04$, were significant, but the main effect for interaction of time × condition was not significant. As illustrated in Figure 2(b), the experience of need frustration decreased for the participants in the experimental condition from *pretest* to *posttest*, but it was not significant, whereas it remained unchanged for the participants in the control condition from *pretest* to *posttest*. Moreover, the two conditions did not differ at *pretest*, but participants in the

TABLE 3
Descriptive Statistics, Internal Consistency, and Correlations among Experimental Condition and the Study Variables in Three Waves

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Experimental condition	–																	
	Time 1																		
2	Need satisfaction	−.10	*.87*																
3	Need frustration	.10	−.57	*.85*															
4	Autonomous SR	−.11	.48	−.27	*.85*														
5	Controlled SR	−.07	.41	−.19	.43	*.73*													
6	Amotivation	.02	−.37	.50	−.20	−.20	*.72*												
7	Vitality	−.10	.70	−.52	.54	.42	−.44	*.90*											
8	Stress	.09	−.37	.64	−.19	−.09	.45	−.47	*.86*										
	Time 2																		
9	Vitality	−.38	.48	−.34	.53	.35	−.30	.66	−.29	*.92*									
10	Stress	.36	−.31	.37	−.18	−.07	.26	−.38	.50	−.48	*.89*								
	Time 3																		
11	Need satisfaction	−.37	.66	−.53	.36	.26	−.21	.57	−.34	.58	−.36	*.88*							
12	Need frustration	.27	−.49	.66	−.26	−.16	.39	−.47	.43	−.39	.46	−.66	*.86*						
13	Autonomous SR	−.39	.40	−.30	.52	.33	−.16	.48	−.19	.67	−.25	.61	−.45	*.90*					
14	Controlled SR	−.18	.34	−.26	.42	.61	−.21	.45	−.15	.51	−.13	.44	−.31	.58	*.73*				
15	Amotivation	.21	−.39	.39	−.24	−.19	.42	−.41	.32	−.38	.34	−.52	.60	−.42	−.36	*.74*			

TABLE 3 *(CONTINUED)*

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
16	Vitality		−.39	.50	−.42	.45	.36	−.26	.66	−.33	.70	−.37	.71	−.58	.71	.57	−.55	*.91*		
17	Stress		.28	−.38	.48	−.20	−.15	.31	−.45	.60	−.38	.72	−.54	.63	−.32	−.21	.55	−.55	*.92*	
18	Physical activity		−.03	.26	−.19	.16	.15	−.14	.30	−.14	.19	−.01	.12	−.07	.08	.16	−.09	.15	−.02	*.75*
19	SES		−.09	.34	−.26	.16	.22	−.23	.31	−.28	.23	.20	.21	−.22	.05	.15	−.09	.21	−.20	.06
	Descriptive statistics																			
	Experimental condition	*M*	5.44	2.70	5.53	4.89	2.83	5.09	3.93	5.79	3.09	6.00	2.27	6.14	5.23	2.30	5.90	3.03	–	
		SD	1.24	1.40	1.28	1.32	1.63	1.53	1.40	1.06	1.37	0.85	1.09	0.83	1.10	1.38	1.00	1.52	–	
	Control condition	*M*	5.19	2.98	5.27	4.69	2.89	4.79	4.20	4.79	4.17	5.15	2.94	5.25	4.79	2.88	4.90	3.91	–	
		SD	1.51	1.31	1.26	1.43	1.47	1.42	1.51	1.35	1.41	1.15	1.25	1.25	1.32	1.14	1.35	1.47	–	

Note: Autonomous SR, autonomous self-regulation. Controlled SR, controlled self-regulation. SES, socioeconomic status. Values equal to and above .14 are significant at $p < .05$, values above .18 are significant at $p < .01$, and values above .22 are significant at $p < .001$. Italic values are Cronbach's alpha.

experimental condition showed significantly lesser need frustration than participants in the control condition at *posttest* ($p < .001$, $d = .49$, 95% CI [−0.90, −0.26]).

In addition, the next way to assess the fidelity of the intervention showed that participants in the experimental condition reported that, generally, they actively participated in the activities at a level of more than 91 per cent, and they reported that the activities were useful for them. They also noted some positive opinions, such as "It was really good for me" and "I would like to continue activities even after the program ends" (the details are presented in File S2).

Participants' Motivational Self-Regulation

For *participants' autonomous self-regulation*, the interaction of time × condition, $F(1, 203) = 8.54$, $p = .004$, $\eta_p^2 = .04$, and the main effect for condition, $F(1, 203) = 21.64$, $p < .001$, $\eta_p^2 = .10$, were significant, but the main effect for time was not significant. As illustrated in Figure 2(c), autonomous self-regulation increased significantly for the participants in the experimental condition from *pretest* to *posttest* ($p < .001$, $d = .43$, 95% CI [0.24, 0.63]), whereas it remained unchanged for the participants in the control condition from *pretest* to *posttest*. Moreover, the two conditions did not differ at *pretest*, but participants in the experimental condition showed significantly higher autonomous self-regulation than participants in the control condition at *posttest* ($p < .001$, $d = .85$, 95% CI [0.58, 1.19]).

For *participants' controlled self-regulation*, none of the main effect for the interaction of time × condition, $F(1, 203) = 2.58$, $p = .11$, $\eta_p^2 = .01$, the main effect for time, $F(1, 203) = .09$, $p = .7$, $\eta_p^2 = .00$, and the main effect for condition, $F(1, 203) = 2.47$, $p = .12$, $\eta_p^2 = .01$, were significant (Figure 2(d)). Therefore, based on these non-significant results, and to reduce Type 1 error, we could not analysis changes over time, and compare the means of controlled self-regulation between the two conditions.

For *participants' amotivation*, the interaction of time × condition was significant, $F(1, 203) = 4.80$, $p = .03$, $\eta_p^2 = .02$. The main effect for condition was marginally significant, $F(1, 203) = 3.30$, $p = .071$, $\eta_p^2 = .02$, but the main effect for time was not significant. As illustrated in Figure 2(e), amotivation decreased for the participants in the experimental condition from *pretest* to *posttest* ($p = .042$, $d = .29$, 95% CI [−0.64, −0.01]), but it was not significant based on the Bonferroni correction ($p < .007$), whereas it remained unchanged for the participants in the control condition from *pretest* to *posttest*. Moreover, the two conditions did not differ at *pretest*, but participants in the experimental condition showed significantly lesser amotivation than participants in the control condition at *posttest* ($p = .006$, $d = .40$, 95% CI [−0.92, −0.16]).

Participants' Well-Being and Ill-Being

For *participants' subjective vitality*, the interaction of time × condition, $F(2, 202) = 4.71$, $p = .009$, $\eta_p^2 = .02$, and the main effect for condition was significant, $F(1, 203) = 31.54$, $p < .001$, $\eta_p^2 = .13$, but the main effect for time was not significant. As illustrated in Figure 2(f), subjective vitality increased significantly for the participants in the experimental condition from Time 1 (*pretest*) to Time 2 (*mid-test*) ($p = .006$, $d = .31$, 95% CI [0.08, 0.64]), and from Time 1 (*pretest*) to Time 3 (*posttest*) ($p < .001$, $d = .36$, 95% CI [0.16, 0.67]), but remained unchanged from *mid-test* to *posttest*, whereas it remained unchanged for the participants in the control condition from *pretest* to *mid-test*, from *mid-test* to *posttest*, and from *pretest* to *posttest*. Moreover, the two conditions did not differ at *pretest*, but participants in the experimental condition showed significantly higher subjective vitality than participants in the control condition at *mid-test* ($p < .001$, $d = .75$, 95% CI [0.60, 1.23]), and at *posttest* ($p < .001$, $d = .77$, 95% CI [0.59, 1.24]).

For *participants' perceived stress*, the interaction of time × condition, $F(2, 202) = 7.34$, $p = .001$, $\eta_p^2 = .04$, the main effect for time, $F(2, 202) = 5.48$, $p = .005$, $\eta_p^2 = .03$, and the main effect for condition, $F(1, 203) = 14.32$, $p < .001$, $\eta_p^2 = .07$, were significant. As illustrated in Figure 2(g), perceived stress decreased significantly from *pretest* to *mid-test* ($p = .006$, $d = .45$, 95% CI [−0.96, −0.28]), and from *pretest* to *posttest* ($p < .001$, $d = .48$, 95% CI [−1.03, −0.34]), but it remained unchanged from *mid-test* to *posttest*, whereas it remained unchanged for the participants in the control condition from *pretest* to *mid-test*, from *mid-test* to *posttest*, and from *pretest* to *posttest*. Moreover, the two conditions did not differ at *pretest*, but participants in the experimental condition showed significantly lesser perceived stress than participants in the control condition at *mid-test* ($p < .001$, $d = .73$, 95% CI [−1.38, −0.65]), and at *posttest* ($p < .001$, $d = .53$, 95% CI [−1.21, −0.38]).

DISCUSSION

Helping people learn how to satisfy their basic psychological needs represents a key element in coping with and managing stress and maintaining their vitality in stressful situations. In this research, we aimed to use activities that facilitate the experience of need satisfaction and implement an intervention fulfilling this objective, in accord with SDT recommendations (Ryan & Deci, 2017). With this objective in mind, we pursued two goals during the stressful situation of the novel coronavirus outbreak spreading. First, we hypothesised the effectiveness of a basic psychological need-satisfying activities intervention to increase the experience of need satisfaction, autonomous self-regulation, and subjective vitality of the participants in the experimental condition relative to the participants in the no-intervention control condition. Second, we hypothesised that participants

in the experimental condition would decrease their experience of need frustration, controlled self-regulation, amotivation, and perceived stress compared with the participants in the control condition. Consistent with expectations, generally, the effects of the activities to satisfy basic needs were successful. The results showed that participants in the experimental condition displayed significantly higher need satisfaction and lesser need frustration than participants in the control condition. These results are consistent with the SDT proposition (Ryan & Deci, 2017)—that is, activities that create a climate to fulfill basic needs for autonomy, competence, and relatedness result in positive outcomes in two ways; first, they can result in the experience of need satisfaction and, second, they can prevent or decrease the experience of need frustration. We found that the satisfaction of basic needs is essential for greater well-being, and reduces stress, in a stressful situation. Thus, the activities that help individuals to satisfy their basic needs not only decrease the experience of need frustration and psychological distress (Weinstein et al., 2016), but also help them experience need satisfaction and greater well-being.

The results showed that autonomous self-regulation increased from pretest to posttest in the experimental condition. Participants in the experimental condition also reported higher autonomous self-regulation relative to participants in the control condition. The interpretation is, generally, the effect of need-satisfying activities or even a self-support approach to satisfy basic needs was similar to previous research that has found that support from social agents (e.g. teachers and managers) positively affects people's autonomous regulation and positive outcomes (e.g. Behzadnia, Mohammadzadeh, & Ahmadi, 2019; Slemp, Kern, Patrick, & Ryan, 2018). In other words, when individuals feel that they could choose an activity and freely make decisions about it, feel effective in doing that, and help others in doing the activities, they enjoy the activity and place importance on doing that activity, and thus, they experience greater vitality. It is also worth noting that autonomous reasons for doing activities would prevent people from negative affect and stress, even during social distancing. If people freely choose to be alone, they can feel relaxed and reduce stress (Nguyen, Ryan, & Deci, 2018). It means that people can still experience vitality and reduce stress when they are alone and during social distance restrictions if they actively choose what to do. Thus, autonomously regulating behaviors would be associated with greater vitality and lesser stress during social distancing.

The results also showed that, unexpectedly, controlled self-regulation did not change among participants. Previous research in the area of physical activity found that controlled regulation neither changed the results from need-supportive interventions nor was related to positive outcomes (Aelterman et al., 2012; Behzadnia et al., 2019). In the current study, we asked participants to do some activities each day, and this might be interpreted by participants as an external voice or suggestion, so that they may have pushed themselves to do things based on the activities that were provided for them. They may have seen the activities either as an

external contingency to be included in the group or as a way to experience greater vitality and lesser stress. So that may be why controlled self-regulation has remained unchanged among participants, as well as being related positively to their subjective vitality and related negatively to stress at the posttest.

Moreover, during enforced social isolation, participants may have experienced the frustration of their basic needs, and to combat this, they may have found the activities interesting and important. For example, they might have forced themselves to do some hard work, such as waking up early in the morning to follow and do things in a way that was suggsted for them in the group. By doing this, they actually could control themselves to thrive to get those goals. However, this finding needs to be replicated in future research, through longitudinal research or a long-term intervention design.

Participants in the experimental condition also reported that their amotivation decreased from pretest to posttest (marginally), and it was lower than the participants in the control condition at posttest. This is in line with SDT's notion that the experience of need satisfaction is associated with a decrease in amotivation (Ryan & Deci, 2017), suggesting that need-satisfying activities effectively reduce individuals' amotivation. Thus, these findings represent an effective approach to individuals' motivational regulation, as they increased autonomous motivation, and decreased amotivation.

We believe that the most important contribution of the current study is that need-satisfying activities increased subjective vitality and decreased perceived stress. These results suggest that need-satisfying activities are important for people during difficult times, and specifically during the current novel coronavirus outbreak. In this study, we assessed subjective vitality because it has some important implications; first, when one feels energised and vitality in doing an activity, one is most likely persist at that activity (Deci & Ryan, 2008), second, higher subjective vitality relates to healthier physiological and immunological functioning of the human body (Ryan & Deci, 2008), and third, the more the subjective vitality, the less is the experience psychological distress and higher resilience in coping with stress (Ryan & Deci, 2008). Perceived stress was also assessed with the same level of importance. That is, research has shown that higher stress may have major influences upon both psychological and physical well-being, for example, higher stress decreases immunological functioning (Greenberg, 2012).

Practical Implications and Study Limitations

The current research suggests that need-satisfying activities help individuals' needs get fulfilled, become autonomously motivated toward daily activities, and experience greater well-being, and cope with stress. Psychologists or mental health professionals could encourage their clients or patients to use these need-satisfying activities to cope with and reduce stress and enhance their subjective

vitality. That is, while people during the current difficult time of the novel coronavirus outbreak need to stay at home or maintain social distancing even after the government loosens the restrictions, they can still strive to get their basic needs fulfilled, and doing so will help them to experience greater well-being and reduce stress. This intervention provides an opportunity for psychologists or clinicians and mental health professionals to even deliver it to those infected by the novel coronavirus who may suffer from psychological distress, and so it might help them back to their normal life, although this needs future consideration. Moreover, these need-satisfying activities may help individuals to be self-orientated to support themselves to satisfy their basic needs during difficult times. When people have learned how to do the activities that help them satisfy their basic needs, these activities may also enhance their awareness in choosing and doing activities. So, future research could examine how need-satisfying activities contribute to their awareness or mindfulness. It is also important to examine the relations of this approach to well-being and ill-being through the structural equation modeling or growth curve models. In this study, we could not examine the relations through this approach because of the relatively small sample size for it. Because of the rapidly spreading novel coronavirus, we preferred to not wait for a long time for more participants to attend the study.

It is also important to note that we tried to provide the intervention only to the participants in the experimental condition. To control that participants in the no-intervention control condition have not engaged in need-satisfying activities outside the study, we asked them to report their need satisfaction and need frustration; and their experience of need satisfaction was less than for participants in the experimental condition.

The current study is among the first to apply a motivational approach through need-satisfying activities during the difficult time of the novel coronavirus. The findings show some support for the link between basic needs, motivational self-regulation, and well-being. This study highlighted an encouraging approach in this stressful situation. The rapidly growing novel coronavirus pandemic makes people psychologically vulnerable and fearful in all regions. Thus, these promising results can help people to engage in their activities and energise them to find ways to thrive.

Besides, as the results of correlations have shown, age was not related to the study variables, so we can generalise these findings to all ages, especially the age range from 18 to 46 years old, and rely on this intervention to enhance vitality and reduce stress. However, while we tried to ensure and maximise the generalisability of this intervention and we sampled individuals from the whole age range, the majority of participants were student and female, and they were a self-selected sample. Therefore, we must cautious in generalising these findings to the broader population. It would be good to replicate these findings with samples from different age ranges, for example among school students, an older population, or employees as well as investigate less educated samples to test the

effectiveness of this intervention. It would also be interesting to test the applicability and generalisability of this intervention among different cultures.

CONCLUSION

In the current study, we took an SDT-based approach to test activities to satisfy basic psychological needs during the novel coronavirus spreading outbreak among an Iranian sample. By doing so, individuals could experience greater vitality and cope with and reduce stress. Overall, our hypotheses received support, as the results showed that this intervention positively increased the experience of need satisfaction, autonomous self-regulation, and subjective vitality, whereas it decreased the experience of need frustration, amotivation, and perceived stress.

COMPETING INTERESTS

The authors declare no competing interests.

AUTHOR CONTRIBUTIONS

The corresponding author (BB) came up with the idea for the paper, and invited the co-author to collaborate, acquire the data, analysed the data, and wrote and edited the manuscript.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

File S1 Comparison between dropout and persistent participants on the study variables.

File S2 Participants' reports about the activities.