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Effect of online mindfulness-based physical exercise program on psychological well-being and life satisfaction during the Covid-19 pandemic

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Abstract
The aim of this study was to examine the effectiveness of a mindfulness-based physical exercise program on university students' psychological well-being and life satisfaction. In the study, a randomized control group pre-test, post-test, and follow-up test design was used. The study group consisted of 60 students (30 in an experimental group and 30 in a control group) continuing their education in different faculties of a foundation university during the Covid-19 pandemic in Turkey. A personal information questionnaire, Psychological Well-Being Scale and Life Satisfaction Scale were used to collect the study data. The Mindfulness-Based Physical Exercise Program was implemented in the experimental group, once a week for 8 sessions. The results suggested significant differences between the psychological well-being and life satisfaction post-test scores of the experimental and control groups in favor of the experimental group. In the sub-dimensions of psychological well-being, significant differences were found between the experimental and control groups in post-test scores of environmental mastery, personal growth, and purpose in life. There was no significant difference between the psychological well-being, positive relationships with others, autonomy, environmental mastery, purpose in life, and self-acceptance sub-dimensions except personal growth sub-dimensions, and life satisfaction post-test and follow-up test scores of the university students in the experimental group. In the post-test comparisons of two groups, a significant difference was found between total psychological well-being, environmental mastery, personal growth, purpose in life, and self-acceptance, in favor of the experimental group.

Keywords Exercise psychology · life satisfaction · mindfulness · psycho-education · psychological well-being

Introduction

The Covid-19 pandemic has shown how important it is for an individual to maintain their mental well-being in their daily life. During the pandemic, there were lots of changes in lifestyle habits and behavioral risk factors (for example, psychological distress and mood symptoms) as a result of the Covid-19 lockdown, especially in countries like Italy which had the earliest and heaviest coronavirus virus burden among European countries (Odone et al., 2020). The concept of well-being is linked to the highest level of psychological health and functioning. Although the question, "How are you?", seems simple, researchers describe the concept of well-being as complex and needing to be discussed. In fact, there are important debates in the literature about what constitutes a "good life" and how the dimensions of the highest level of life can be defined (Ryan & Deci, 2001). Well-being integrates mental health and physical health which results in a more holistic approach to disease prevention and health promotion. Well-being is considered as the indicator of what individuals think and feel about their life, the quality of their relationships, their positive mood and resilience, their awareness of their potential, and their overall satisfaction with life (Patnaik, 2021). According to Ryff (1989), psychological well-being refers to "an active engagement in a number of

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existential challenges". Ryff defined psychological health and positive functioning in six categories: positive relationships with others, autonomy, environmental mastery, personal growth, purpose in life, and self-acceptance.

Another conceptualization of well-being suggested in the literature is subjective well-being (Diener, 2009). Since ancient Greek times and before, people have wondered about the nature of the "good life". "What makes life desirable? What determines a high quality of life?" One of the answers to these questions is to feel and think that one's life is desirable, regardless of how others see it. This condition has been named as subjective well-being, which refers to the fact that the person subjectively believes that her/his life is desirable, pleasant and good (Diener, 2009). For subjective well-being, a three-component structure was suggested: positive affect, negative affect and life satisfaction (Diener, 1984). Life satisfaction is the emotional component of people's attitudes towards their lives. It is defined as a reflection of an individual's feelings about the past, present and future (Ripple et al., 1982, p. 529). Life satisfaction, as being holistic, extends throughout one's entire life or over a period of time. It reflects not only the sum of the moments in an individual's life, but also the global quality of one's life as a whole (Haybron, 2008).

One of the concepts thought to be related to well-being is physical exercise. Physical exercise can be associated with a strong "feel-good" experience and can be included in a short-term coping strategy that helps to reduce pressures of daily life faster (De Moor & de Geus, 2018). Positive relationships between exercise and well-being have been a subject of study for many years. Exercising positively affects an individual's physical stamina, emotional mood, and mental stamina, and is considered as having various physical benefits in treating symptoms of depression and in decreasing mortality risk in depression (Belvederi Murri et al., 2019). There are also studies supporting the link between exercise and decreased anxiety levels (Szabo, 2003). It has been found that exercise has a positive effect on the individual's emotion regulation (Bernstein & McNally, 2017), increases life satisfaction (Moreno-Murcia et al., 2017), and reduces stress levels (Herbert et al., 2020). Further, it has been found in many studies that exercise positively affects both physical and mental health (Zayed et al., 2018). Therefore, it can be asserted that physical exercise is positively related to psychological well-being and life satisfaction.

Mindfulness and self-compassion, which were also found to be associated with psychological well-being in the literature, are resources that provide individuals with the safety needed to face difficult experiences with less resistance (Neff & Germer, 2018). There are many definitions of the concept of mindfulness in the literature. Mindfulness is described as "our ability to be aware of what is going on both inside us and around us. It is the continuous awareness of our bodies, emotions, and thoughts" (Hanh, 2008, p. 6). In the most general definition used in the literature, mindfulness is defined as "paying attention in a particular way: on purpose, in the present moment, and non-judgmentally" (Kabat-Zinn, 1994, p. 4). Mindfulness is an individual's way of relating to a particular attitude or life to experience that both alleviates their suffering and makes their life rich and meaningful (Siegel, 2010). The mind constantly observes and receives information from the environment. Based on these observations, thoughts are formed, and emotions emerge as a result of these thoughts. Mindfulness provides us a way of stepping aside and observing and accepting that the individual's mind and body are in such a process, without the need to respond to every thought and emotion (Thomas, 2019).

The relationships of mindfulness with psychological well-being and life satisfaction have gained great importance in positive psychology research. Mindfulness-based programs encourage individuals to break some of the unconscious habits of thinking and behavior that prevent them from living their lives to the fullest. By disrupting some of the daily routine that includes many judgmental, negative thoughts and habitual thinking styles that the individual has, it gradually dissolves some of these negative thought patterns and makes the individual more aware (Williams & Penman, 2011). Langer (2009) talked about the mind and body dualism and stated that when an individual changes his mental health, he can also change his physical health. Formal (sitting meditation, body scanning, walking meditation, compassion meditation, etc.) and informal mindfulness practices improve the mind-body connections of the individual (Bracken, 2016). The mind-body connection lies at the heart of the meaningful relationship between mindfulness and stress reduction (Stahl & Goldstein, 2019). Physical sensations in the body always convey some information to the individual. Mindfulness is a way for an individual to reconnect with their body, that is, to be aware that their body is saying something to the individual (Thackray, 2020). The previous findings suggested that mindfulness practices increase psychological well-being (Van Gordon et al., 2014). Thus, mindfulness interventions can be considered as a positive approach to promoting mental health.

The importance of mindfulness practices has become even more evident during the Covid-19 pandemic. Meditation and mindfulness can offer a useful way to live with the constant change in the Covid-19 pandemic and similar processes (González-García et al., 2021). University students were directly affected by the fear of not attending universities, staying at home, being away from their social circles, not exercising, not traveling, as well as being infected and infecting their relatives as a result of the sudden Covid-19 pandemic. It can be thought that this new stressful life has increased the burden of students as well as academic processes. Therefore, developing online psycho-education

programs to strengthen the coping skills of university students has gained more importance during the pandemic.

Mindfulness is among the practices that can support individuals, increase their self-compassion levels (González-García et al., 2021) and reduce their anxiety levels (Simonsson et al., 2021) in times of crisis like the global pandemic caused by the Covid-19 virus. In a study conducted by Terzioğlu and Çakır-Çelebi (2021), during the Covid-19 pandemic period, it was found that as attention regulation, sensory awareness, naming emotions and self-compassion increased, psychological well-being levels of university students also increased. In a meta-analysis study conducted before the Covid-19 pandemic, it was found that mindfulness interventions carried out on the online platform contributed positively to the levels of depression, anxiety, mindfulness, stress and general well-being (Spijkerman et al., 2016). In another study, it was found that the mindfulness-based stress reduction program applied on the online platform increased the mental well-being of the participants, and this situation continued in the results of the follow-up test performed three months later (Mak et al., 2015). Taking all these findings collectively, it can be expected that an online mindfulness-based physical exercise program would have a positive effect on university students' psychological well-being and life satisfaction levels. Therefore, this study aimed to examine the effectiveness of the mindfulness-based physical exercise program in increasing the psychological well-being and life satisfaction among university students. Based on the previous literature, our first hypothesis was that there would be a significant difference between the pretest and posttest scores of students in the experimental group in terms of their psychological well-being and life satisfaction levels. Our second hypothesis was that the psychological well-being and life satisfaction scores of the students in the experimental and control groups would yield a significant difference in favor of the experimental group. Our last hypothesis was that there would be no significant difference between the posttest scores and the follow-up test scores in the psychological well-being and life satisfaction of students in experimental group.

Materials and methods

This study was an experimental study including a randomized control group pre-test, post-test, and follow up design.

Participants

The study sample included 60 volunteer university students (30 in an experimental group and 30 in a control group) who attend different faculties in a foundation university located in Southern Anatolia in Turkey. The inclusion criteria for the study were as follows: (a) not already doing meditation, yoga, and physical exercise regularly; (b) not having participated in a mindfulness-based psycho-education group before; (c) being a volunteer to participate in the study. International students were excluded from the study. Voluntary students who met these criteria were randomly assigned to the experimental and control groups. Since the group format was a psycho-education group, 30 students were included in the experimental group as recommended by Brown (2011).

Data were collected online in the 2020–2021 academic year during the Covid-19 pandemic. In the study group 48 of the participants were female and 12 were male. Of the participants in the experimental group, 24 were female, 6 were male; 24 of the participants in the control group were female and 6 were male. The ages of the participants were between 18 and 27 years old, and the average age was 21.40.

Data collection instruments

Psychological Well-Being Scale

The Psychological Well-Being Scale was developed by Ryff (1989) and the adaptation to Turkish culture was carried out by Cenkseven (2004). It consists of 84 items and six dimensions: positive relationships with others (14 items), autonomy (14 items), environmental mastery (14 items), personal growth (14 items), purpose in life (14 items), and self-acceptance (14 items). High scores indicate a high level of psychological well-being. For the validity of the scale, it was reported that there was a significant relationship between the Psychological Well-Being Scale scores and the scores of the Rosenberg Self-Esteem Scale, Life Orientation Scale, Life Satisfaction Scale, Positive Affect-Negative Affect Scale, Rotter Internal-External Locus of Control Scale and Zung Depression Scale. Further, correlations of the subscales with each other and with the total score were found to be satisfactory (.28–.73). The Cronbach's Alpha coefficients for the subscales of positive relationships with others, autonomy, environmental mastery, personal growth, purpose in life, self-acceptance and the total scale were .83, .78, .77, .74, .76, .79, and .93, respectively.

The satisfaction with life scale

This was developed by Diener et al. (1985) to measure the life satisfaction levels of individuals and adapted to Turkish culture by Dağlı and Baysal (2016). Life satisfaction scale consists of five items with 7-point likert scale. A high score from the scale indicates a high level of life satisfaction. The results of confirmatory factor analysis for the scale showed a good fit ($\chi 2/sd = 1.17$, NFI = 0.99, NNFI = 1.00, CFI = 1.00, SRMR = 0.019, RMSEA = 0.030, GFI = 0.99, AGFI = 0.97).

To test the consistency between the scores obtained from the English and Turkish versions of the scale, the Pearson product-moment correlation coefficient was calculated, and the result was found as .92. The Cronbach's Alpha coefficient in was reported as .87 by Diener et al. (1985) and .92 by Dağlı and Baysal (2016).

Intervention and procedure

After the ethical approval for the implementation of the program was obtained from the university ethics approval committee, the psycho-education group was announced to the students via their university e-mail addresses. An information form was provided to the university students who had stated voluntary participation. Preliminary interviews were held individually with each participant on the online platform and lasted approximately 30 minutes. After the preliminary interviews, the students who met the inclusion criteria were included in the study. The students included in the experimental group were informed by the researcher about the content, duration and place of the psycho-education group and participants gave their consent by signing an online informed consent form.

Participants in the experimental and control groups completed the scales at the beginning of the program (pre-test) and at the end of the program (post-test). An 8-week mindfulness-based physical exercise program was applied to the experimental group, and no study was conducted with the students in the control group until the end of the program. Three months after the post-test application to the experimental group, the scales were applied again to examine whether the effect of the mindfulness-based physical exercise program was permanent (follow-up test).

The Mindfulness-Based Physical Exercise Program (MBPE)

This program included mindfulness-based practices and physical exercises. The program mainly utilized techniques of self-compassionate mindfulness, mindfulness-based acceptance and commitment therapy and physical exercises. The practices and exercises included in the program were developed by the researchers and based on different sources in the mindfulness and physical exercise literature (e.g. Alidina, 2020; Kim, 2004; Neff & Germer, 2018).

The MBPE program aimed to develop skills at the levels of emotion, thought and behavior for group members. Conceptual information about the skills that was aimed to be gained by the group members in the sessions represents the cognitive dimension; the emotional dimension included sharing the emotions related to the exercises applied in the sessions; and the exercises applied in the sessions and the homework given represent the behavioral dimension of the program. The physical exercises which were added to certain sessions of the program included a roll-down stretch (1 set x 3 reps, hold position for 15 seconds), a seated twist stretch (1 set x 3 reps, hold position for 10 seconds) (British Medical Association, 2013), clasped hand turns (5 to 10 times), a back extension stretch (15–30 seconds), an upper back stretch (1 set x 30 seconds), a shoulder stretch (external rotator stretches), a seated side stretch (1 set x 30 seconds), a triceps stretch (1 set x 30 seconds), and a quadriceps stretch, (1 set x 30 seconds) (Kim, 2004).

The program was applied to the university students in the experimental group for 90 minutes once a week for 8 weeks. The content of the MBPE program, administered to the experimental group and lasting for eight weeks, is given in the Appendix, and briefly summarized here. The first session included a general description of the psycho-education program, the concept of mindfulness and breathing exercises. The second session included information about mindfulness and body relationship, the importance of physical exercise, stretching exercises and a compassionate body scan exercise. The third and fourth sessions were related to awareness of emotions and emotion regulation skills. The fourth session included information and exercises on the awareness of thoughts. The fifth session was about compassion and self-compassion concepts and meditation. The sixth session was related to how to incorporate mindfulness practices in daily life and included mindful eating exercises. The seventh session included information and exercise about aromatherapy. The eighth session was about closure of the sessions and evaluation of the program (For a detailed information about the content of the sessions, please see Appendix).

In each session of the program, exercises related to mindfulness took place, and at the end of the group sessions held every week, homework was given to the participants in the experimental group to be practiced at home. Group sessions were held every week, on the same day, at the same time and on the same online platform. After each application in the group sessions, the participants were encouraged to share their feelings and thoughts about their practical experiences. Easy stretching exercises were chosen that they can use in daily life.

Statistical analysis

Before the basic statistical analysis, preliminary analyzes were performed to test the assumptions. The values of the histogram, Kolmogorov-Smirnov and Shapiro-Wilk's tests were used to test the normality assumption of the data. As a result of these tests, it was seen that the data did not show a normal distribution. For this reason, in the analysis, to compare the pre-test and post-test mean scores of the university students

Table 1 Results of the pre-test, post-test and follow-up test scores of the psychological well-being and life satisfaction for the experimental group

Scales	Measurement	*n*	Mean	*SD*	Mean Rank	X^2	*df*	*p*
PWB	Pre-test	30	339.97	48.51	1.17	33.19	2	.000*
	Post-test	30	394.93	37.63	2.58			
	Follow-up	30	387.40	46.30	2.25			
PRO	Pre-test	30	60.73	12.33	1.43	15.65	2	.000*
	Post-test	30	67.53	9.70	2.42			
	Follow-up	30	65.97	13.39	2.15			
AU	Pre-test	30	56.33	8.98	1.25	27.10	2	.000*
	Post-test	30	63.40	8.02	2.32			
	Follow-up	30	64.73	7.72	2.43			
EM	Pre-test	30	50.67	10.51	1.17	31.85	2	.000*
	Post-test	30	60.27	8.64	2.45			
	Follow-up	30	59.90	10.18	2.38			
PG	Pre-test	30	66.70	10.33	1.58	17.76	2	.000*
	Post-test	30	73.30	6.15	2.60			
	Follow-up	30	70.70	6.53	1.82			
PIL	Pre-test	30	58.27	10.04	1.22	30.07	2	.000*
	Post-test	30	67.03	7.26	2.53			
	Follow-up	30	65.63	7.48	2.25			
SA	Pre-test	30	47.27	13.54	1.12	38.89	2	.000*
	Post-test	30	63.40	8.54	2.60			
	Follow-up	30	60.47	13.04	2.28			
	Pre-test	30	14.30	3.94	1.15			
LS	Post-test	30	19.47	2.00	2.53	37.25	2	.000*
	Follow-up	30	19.20	2.23	2.32			

$p < .05$*; *PWB* Psychological well-being, *PRO* Positive relationships with others, *AU* Autonomy, *EM* Environmental mastery, *PG* Personal growth, *PIL* Purpose in life, *SA* Self-acceptance, *LS* Life satisfaction

in the experimental and control groups, Mann Whitney U; Friedman ANOVA and Wilcoxon Signed Rank tests were used to compare the scores of the pretest, posttest and follow-up tests of the participants in the experimental group. Bonferroni correction was used to prevent Type I error (Field, 2018). For the effect, size was calculated and Cohen's benchmarks used for the interpretation of effect sizes (Cohen, 1988) were used. In order to test whether there is a significant difference between the pre-test scores of the university students in the experimental and control groups, the Mann Whitney U test was used. Results showed that no significant difference was found between the pre-test scores of the experimental and control groups in total psychological well-being (U = 366.500, p = .22); positive relationships with others (U = 362.500, p = .20), autonomy (U = 405,000, p = .51); environmental mastery (U = 375,000, p = .27); personal growth (U = 415.000, p = .61) and purpose in life (U = 388.500, p = .36) except self-acceptance (U = 316.500, p = .05). The significant difference in self-acceptance sub-dimension was in favor of the control group. Further, no significant difference was found between the pre-test scores of the experimental and control groups in life satisfaction (U = 358,000, p = .17).

Results

Differences between pre-test, post-test and follow-up test scores of the experimental group

The Friedman ANOVA test was used to test whether there were any significant differences in the pre-test, post-test and follow-up scores of the psychological well-being and life satisfaction for the experimental group. The results are shown in Table 1.

According to Table 1, there was a significant difference among the pre-test, post-test and follow-up scores of the participants in total psychological well-being [$X^2_{(2)} = 33.19$, p = .000], positive relationships with others [$X^2_{(2)} = 15.65$, p = .000], autonomy [$X^2_{(2)} = 27.10$, p = .000], environmental mastery [$X^2_{(2)} = 31.85$, p = .000], personal growth [$X^2_{(2)} = 17.76$, p = .000], purpose in life [$X^2_{(2)} = 30.07$, p = .000], self-acceptance [$X^2_{(2)} = 38.89$, p = .000], and life satisfaction [$X^2_{(2)} = 37.25$, p = .000]. As a post-hoc test, the Wilcoxon Signed Ranks test with Bonferroni correction was used for the psychological well-being and life satisfaction scores (Table 2).

Results in Table 2 showed significant differences between the pre-test and post-test scores of total psychological well-being, all SWB sub-dimensions and life satisfaction: pre-test (*Mdn* = 326.00) and post-test (*Mdn* = 399.50) for total psychological well-being (z = −4.742, p = .000, r = .61); pre-test (*Mdn* = 63.50) and post-test (*Mdn* = 70.00) for positive relationships with others (z = −4.468, p = .000, r = .57); pre-test (*Mdn* = 56.00) and post-test (*Mdn* = 63.50) for autonomy (z = −3.928, p = .000, r = .50); pre-test (*Mdn* = 47.50) and post-test (*Mdn* = 61.50) for environmental mastery (z = −4.123, p = .000, r = .53); pre-test (*Mdn* = 68.00) and post-test (*Mdn* = 74.00) for personal growth (z = −4.130, p = .000, r = .53); pre-test (*Mdn* = 57.50) and post-test (*Mdn* = 68.00) for purpose in life (z = −4.627, p = .000, r = .59); and pre-test (*Mdn* = 44.00) and post-test (*Mdn* = 64.00) for self-acceptance (z = −4.707, p = .000, r = .60); the pre-test (*Mdn* = 14.00) and post-test (*Mdn* = 19.50) for life satisfaction (z = −4.543, p = .000, r = .58). These results showed that there was a significant positive difference with a large effect size in the psychological well-being and life satisfaction levels of university students who participated in the MBPE program.

Further, there was no significant difference between post-test and follow-up scores of total psychological well-being and positive relationships with others, autonomy, environmental mastery, purpose in life, and self-acceptance subscales except a significant difference between the post-test (*Mdn* = 68.00) and follow-up (*Mdn* = 74.00) scores of personal growth sub-scale (z = −2.579, *p* = .010, r = .33), in favor of the follow-up test. Based on these results, it can be said that levels of psychological well-being, SWB sub-dimensions, and life satisfaction changed significantly from the pretest to the posttest, and these changes were maintained at the end of the three-month period.

Differences between post-test scores of experimental and control groups

The results of the Mann Whitney U test used to analyze whether there was a statistically significant difference between the psychological well-being post-test scores of the students in the experimental and control groups are provided in Table 3.

According to the Mann Whitney U test results presented in Table 3, a significant difference was found between total

Table 2 Results of the pre-test and post-test scores for the psychological well-being and life satisfaction for the experimental group

Scales	Pre-test-Post-test	*n*	Mean Rank	Sum of Ranks	*z*	*p*
PWB	Negative Ranks	1	2.00	2.00	−4.742	.000*
	Positive Ranks	29	15.97	463.00		
	Ties	0				
PRO	Negative Ranks	4	3.88	15.50	−4.468	.000*
	Positive Ranks	26	17.29	449.50		
	Ties	0				
AU	Negative Ranks	3	12.00	36.00	−3.928	.000*
	Positive Ranks	26	15.35	399.00		
	Ties	1				
EM	Negative Ranks	1	27.00	27.00	−4.123	.000*
	Positive Ranks	28	14.57	408.00		
	Ties	1				
PG	Negative Ranks	5	6.40	32.00	−4.130	.000*
	Positive Ranks	25	17.32	433.00		
	Ties	0				
PIL	Negative Ranks	0	0.00	0.00	−4.627	.000*
	Positive Ranks	28	14.50	406.00		
	Ties	2				
SA	Negative Ranks	0	0.00	0.00	−4.707	.000*
	Positive Ranks	29	15.00	435.00		
	Ties	1				
LS	Negative Ranks	2	6.00	12.00	−4.543	.000*
	Positive Ranks	28	16.18	453.00		
	Ties	0				

p < .025*; *PWB* Psychological well-being, *PRO* Positive relationships with others, *AU* Autonomy, *EM* Environmental mastery, *PG* Personal growth, *PIL* Purpose in life, *SA* Self-acceptance, *LS* Life satisfaction

Table 3 Results on differences between psychological well-being and life satisfaction post-test scores for experimental and control groups

Scale	Group	*n*	Mean Rank	Sum of Ranks	*U*	*z*	*p*
PWB	Experimental	30	37.07	1112.00	253.000	−2.913	.004*
	Control	30	23.93	718.00			
EM	Experimental	30	35.50	1065.00	300.000	−2.221	.026*
	Control	30	25.50	765.00			
PG	Experimental	30	37.02	1110.50	254.500	−2.895	.004*
	Control	30	23.98	719.50			
PIL	Experimental	30	37.18	1115.50	249.500	−2.968	.003*
	Control	30	23.82	714.50			
SA	Experimental	30	37.42	1122.50	242.500	−3.071	.002*
	Control	30	23.58	707.50			
LS	Experimental	30	38.38	1151.50	213.500	−3.520	.000*
	Control	30	22.62	678.50			

$p < .05$*; *PWB* Psychological well-being, *EM* Environmental mastery, *PG* Personal growth, *PIL* Purpose in life, *SA* Self-acceptance, *LS* Life satisfaction

psychological well-being (U = 253,000, p = .004, r = .37), environmental mastery (U = 300,000, p = .026, r = .28), personal growth (U = 254,500, p = .004, r = .37), purpose in life (*U* = 249.500, *p* = .003, r = .38), 249.500, p = .003, r = .38) and self-acceptance (U = 242.500, p = .002, r = .39), and life satisfaction post-test (*U* = 253.000, *p* = .004, r = .45) scores of the experimental and control groups. On the other hand, in the positive relationships with others and autonomy sub-dimensions of the psychological well-being, no significant difference was found between the experimental and control groups.

Discussion

The first result of the study revealed that levels of total psychological well-being and positive relationships with others, autonomy, environmental mastery, personal growth, purpose in life, and self-acceptance sub-dimensions of psychological well-being increased significantly from the pre- to the post-MBPE program, with large effect sizes. Secondly, results suggested that these differences continued for three months. These results support our first and third hypotheses. In the post-test comparisons of the experimental and control groups, there were significant differences between total psychological well-being, environmental mastery, personal growth, purpose in life, and self-acceptance, in favor of the experimental group. These results provide partial support for our second hypothesis. Lastly, there was no significant difference between the pre-test and post-test scores of the control group from the total score of psychological well-being and six sub-dimensions.

These findings replicated previous findings on the positive effects of mindfulness-based interventions on well-being and also extended previous results to sub-dimensions of psychological well-being. Previous findings revealed that the depression, anxiety and stress levels of nursing students who participated in an eight-week mindfulness-based stress reduction program decreased significantly, and their mindfulness levels increased (Song & Lindquist, 2015). Similarly, Van Gordon et al. (2014), in which the effectiveness of meditation awareness training on individuals with stress, anxiety and low mood problems was examined, it was observed that there were increases in participants' emotional distress, positive and negative moods and mindfulness levels. Previously, it was reported that there was a statistically significant difference in the quality of life, physical well-being, emotional well-being, mental well-being and social activity levels of the participants (Colle et al., 2010). Similarly, Carmody and Baer (2008) reported that the mindfulness and psychological well-being levels of the participants increased, and stress symptoms decreased as a result of the mindfulness-based stress reduction program. Current findings contributed to these findings by showing the effectiveness of the mindful-based exercise program on each sub-dimension of psychological level.

Results of this study also suggested that life satisfaction levels increased significantly from the pre- to post-mindfulness-based exercise program, with a large effect size. Life satisfaction is considered as one of the components of subjective well-being. Therefore, these results can be discussed with previous findings on subjective well-being. In a longitudinal study investigating the permanent effect of mindfulness training, it was found that the subjective well-being levels of university students increased as a result of mindfulness training (De Vibe et al., 2018). In a study conducted by Googhari et al. (2022) on university students, it was observed that two different therapy models, mindfulness-based cognitive therapy and acceptance and commitment therapy, were effective

on subjective well-being and emotion regulation levels, and decreased psychological distress subscales. In this sense, current findings provided further evidence for the existing literature of the effect of mindfulness practices and positive psychological functioning.

The findings of this study have special importance because there is a paucity of studies which focus on the effectiveness of exercise programs including mindfulness practices. In the present study, physical exercise practices and homework assignments were included in certain sessions. Therefore, the results of this study provide additional support to the relationship between physical exercise and well-being. In one of the previous studies, a positive relationship was found in the total score of well-being and especially in the components of mood, emotional stability, resilience, stress and coping in relation to regular physical exercise (Edwards, 2006). Current findings gave more evidence that mindful-based physical exercises have a great potential to enhance psychological well-being and life satisfaction.

An unexpected finding was that there was no significant difference between the experimental and control groups according to the results of the post-test scores obtained from the positive relations with others and autonomy/autonomy sub-dimensions of the psychological well-being scale. The possible explanation for these results can be related to the content of the psycho-education program because it has limited content related to interpersonal relationships and autonomy. In addition, it can be said that the Covid-19 pandemic had an effect on these sub-dimensions. Because in this process, university students have experienced radical changes in their education and in their lives, staying in a long quarantine period. Further, another important point is related to the way the sessions were conducted. In face-to-face psycho-education and group counseling programs, individuals can enable them to develop their social relations skills with other members of the group. Due to the Covid-19 pandemic, psycho-education sessions were carried out on an online platform, and this might have prevented positive effects of the program on students' positive relations with others. Therefore, it can be recommended that in future studies the program can be replicated in face-to-face group settings.

There are certain limitations of the study to be noted. The first limitation in this study is related to the sociodemographic composition of the sample and the sample size. As the participants were university students of a foundation university in Turkey, they can be considered as having higher socioeconomic status (SES) levels. The sample may not be representative of the university students who are from different socioeconomic status and different universities. These may limit the generalizability of the current findings. The absence of a placebo control group in the study constitutes another limitation of the study. A placebo control group can be established in future studies to test the placebo effect. Another limitation is related to data collection in the study. The self-report measures were used in the data collection. In addition to collecting quantitative data, getting additional qualitative data via interviews or focus group discussions will generate more detailed information about the mechanisms of change. It is also recommended that in future studies on enhancing psychological well-being and life satisfaction, a qualitative or mixed method study can be conducted by using Online Photovoice (OPV), which is considered as one of the most recent and effective innovative qualitative research methods (Tanhan et al., 2021). Finally, in this study, as there was a short follow-up period of three months, long-term follow-up evaluations can be recommended to examine the long-term effectiveness of the program in future studies.

Despite these limitations, current findings supported the positive effects of the MBPE program on psychological well-being and life satisfaction during stressful life events, with large effect sizes. It is a fact that the importance of physical exercise increased in the period of the Covid-19 pandemic. The Covid-19 pandemic has negatively affected the daily life of university students, as well as many people. Our findings suggest that online psycho-education program can be a useful alternative when face-to-face psycho-education in a group setting is not possible, like the case in the Covid-19 lockdown, to support psychological well-being and life satisfaction. In this sense, the findings of this study may also provide valuable information for online psycho-education programs in general. Considering that mindfulness-based exercises can be applied anytime and anywhere, it can also be suggested to include these exercises in different programs. The findings of this study may also provide relevant information for counselling centers in universities, in which positive psychological functioning can be enhanced through online platforms. Overall, it can be concluded that participating in an online mindfulness-based physical exercise program enhanced psychological well-being and life satisfaction levels of the university students during the Covid-19 pandemic.

Appendix

1st Session: Understanding Mindfulness To have information about the purpose, structure and framework of the psycho-education program Understanding the importance of breath Defining the concept of mindfulness Understanding the importance of mindfulness Acting on autopilot and recognizing judgments Exercise: Breathing exercise Homework: Breathing exercise	2nd Session: Mindfulness and Body Relationship Understanding the body's needs Understanding and developing the mind-body connection Learning the biological foundations of mindfulness Understanding the importance of physical exercise Being in touch with our body in motion through compassionate body scanning and being aware of the body Exercises: Compassionate body scan exercise, stretching exercises Homework: Compassionate body scan, stretching exercises
3rd Session: Awareness of Emotions Identifying and understanding emotions Not suppressing emotions, not ignoring them, and noticing the increase in emotion intensity after resistance to emotions Define emotion regulation skills What is labeling emotions and how is it done? Recognizing the emotions in the body with the emotion meditation practice Exercises: Mindful breathing practice, emotional awareness exercise, stretching exercises Homework: Emotion awareness exercise	4th Session: Awareness of Thoughts Defining thought awareness Being in the process of observing our thoughts without judgment Realizing the power of words used in daily life Recognizing the way, they perceive events Realizing that perceptions do not always reflect reality Seeing the nine-point exercise with awareness and a new look at our perceptions Exercises: Thought-tracking exercise (Imagination: River meditation), nine-point exercise Homework: Thought-tracking exercise
5th Session: Compassion and Self-Compassion Concepts Defining compassion Understanding forgiveness Defining what self-compassion is Importance of loving kindness meditation Integrating compassion and self-compassion from mindfulness attitudes into life Exercises: How do you treat your friend? exercise, compassion meditation (metta meditation), stretching exercises Homework: Compassion meditation, stretching exercises	6th Session: Mindfulness Practices in Daily Life Understanding the importance of the five senses for awareness To define mindfulness practices that can be applied in daily life Understanding what it means to eat mindfully, thus experientially realizing the richness of life by being here and now. Exercises: Forgiveness meditation, mindful eating exercise, stretching exercises Homework: Mindful eating exercise, stretching exercises
7th Session: Aromatherapy Understanding what aromatherapy is and what it includes Recognizing the effect of music on the individual Understanding the purpose of formal and informal walking exercises Exercises: Being aware of sensations, aromatherapy massage, aromatherapy meditation, mindful walking exercise Homework: Creating a self-compassion playlist, mindful walking exercise	8th Session: Conclusion and a New Beginning Summing up all sessions Receiving feedback and opinions about the program Post-test measurement at the end of the program Participation certificate sharing and conclusion Exercise: Mindful breathing meditation

Declarations

Competing interest The authors declare that they have no known competing financial interests that could have appeared to influence the work reported in this paper.

References

Alidina, S. (2020). *Mindfulness for dummies* (3rd ed.). Wiley.

Belvederi Murri, M., Ekkekakis, P., Magagnoli, M., Zampogna, D., Cattedra, S., Capobianco, L., Serafini, G., Calcagno, P., Zanetidou, S., & Amore, M. (2019). Physical exercise in major depression: reducing the mortality gap while ımproving clinical outcomes. *Frontiers in Psychiatry*. https://doi.org/10.3389/fpsyt.2018.00762

Bernstein, E. E., & McNally, R. J. (2017). Acute aerobic exercise helps overcome emotion regulation deficits. *Cognition and Emotion, 31*(4), 834–843. https://doi.org/10.1080/02699931.2016.1168284

Bracken, A. (2016). *Mind body baby: How to overcome stress & enhance your fertility with CBT, Mindfulness & Good.* Yellow Kite.

British Medical Association. (2013). *BMA bad back book: Exercise to strengthen your back and improve your posture*. Dorling Kindersley Limited.

Brown, N. W. (2011). *Psychoeducational groups: Process and practice*. Routledge.

Carmody, J., & Baer, R. A. (2008). Relationships between mindfulness practice and levels of mindfulness, medical and psychological symptoms and well-being in a Mindfulness- based stress reduction program. *Journal of Behavioral Medicine, 31*, 23–33. https://doi.org/10.1007/s10865-007-9130-7

Cenkseven, F. (2004). *Üniversite öğrencilerinde öznel ve psikolojik iyi olmanın yordayıcılarının incelenmesi.* [Doctoral desertation, Çukurova University, Turkey].

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates, Publishers.

Colle, K. F. F., Vincent, A., Cha, S. S., Loehrer, L. L., Bauer, B. A., & Wahner-Roedler, D. L. (2010). Measurement of quality of life and participant experience with the mindfulness-based stress reduction program. *Complementary Therapies in Clinical Practice, 16*(1), 36–40. https://doi.org/10.1016/j.ctcp.2009.06.008

Dağlı, A., & Baysal, N. (2016). Yaşam doyumu ölçeğinin türkçe'ye uyarlanması: Geçerlik ve güvenirlik çalışması. *Electronic Journal of Social Sciences, 15*(59), 1250–1262. https://doi.org/10.17755/esosder.75955

De Moor, M., & De Geus, E. J. (2018). Causality in the Associations Between Exercise, Personality, and Mental Health. In H. Budde & M. Wegner (Eds.), *The exercise effect on mental health*. Routledge.

De Vibe, M., Solhaug, I., Rosenvinge, J. H., Tyssen, R., Hanley, A., & Garland, E. (2018). Six-year positive effects of a mindfulness-based intervention on mindfulness, coping and well-being in medical and psychology students; results from a randomized controlled Trial. *PLoS One, 13*(4), 1–17. https://doi.org/10.1371/journal.pone.0196053

Diener, E. (2009). Subjective Well-Being. In E. Diener (Ed.), *The science of well-being: The collected works of Ed Diener*. Springer Science+Business Media.

Diener, E. (1984). Subjective well-being. *Psychological Bulletin, 95*, 542–575. https://doi.org/10.1037/0033-2909.95.3.542

Diener, E. D., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment, 49*(1), 71–75.

Edwards, S. (2006). Physical exercise and psychological well-being. *South Africa Journal of Psychology, 36*(2), 357–373.

Field, A. (2018). *Discovering statistics using IBM SPSS statistics* (5th ed.). Sage Edge.

González-García, M., Álvarez, J. C., Pérez, E. Z., Fernandez-Carriba, S., & López, J. G. (2021). Feasibility of a brief online mindfulness and compassion-based intervention to promote mental health among university students during the COVID-19 Pandemic. *Mindfulness, 12*(7), 1685–1695. https://doi.org/10.1007/s12671-021-01632-6

Googhari, Z. S., Hafezi, F., Asgari, P., & Heidari, A. (2022). The effectiveness of mindfulness-based cognitive therapy and acceptance and commitment therapy on medical science students' subjective well-being, psychological distress, and emotion regulation. *Journal of Shahrekord University of Medical Sciences, 24*(1), 35–41. https://doi.org/10.34172/jsums.2022.07

Hanh, T. N. (2008). *Mindful movements: Ten exercises for well-being*. Parallax Press.

Haybron, D. M. (2008). Philosophy and the science of subjective well-being. In E. Eid & R. J. Larsen (Eds.), *The science of subjective well-being*. The Guilford Press.

Herbert, C., Meixner, F., Wiebking, C., & Gilg, V. (2020). Regular physical activity, short-term exercise, mental health, and well-being among university students: The results of an online and a laboratory study. *Frontiers in Psychology, 11*(509), 1–23. https://doi.org/10.3389/fpsyg.2020.00509

Kabat-Zinn, J. (1994). *Wherever you go, there you are*. Hyperion.

Kim, S. H. (2004). *Ultimate flexibility: Complete guide to stretching for martial arts*. Turtle Press.

Langer, E. J. (2009). *Counterclockwise: Mindful health and the power of possibility*. Random House Publishing Group.

Mak, W. W., Chan, A. T., Cheung, E. Y., Lin, C. L., & Ngai, K. C. (2015). Enhancing web-based mindfulness training for mental health promotion with the health action process approach: randomized controlled trial. *Journal of Medical Internet Research, 17*(1), 1–12. https://doi.org/10.2196/jmir.3746

Moreno-Murcia, J. A., Belando, N., Huéscar, E., & Torres, M. D. (2017). Social support, physical exercise and life satisfaction in women. *Revista Latinoamericana de Psicología, 49*(3), 194–202. https://doi.org/10.1016/j.rlp.2016.08.002

Neff, K., & Germer, C. (2018). *The mindful self-compassion workbook: a proven way to accept yourself, build inner strength, and thrive*. The Guilford Press.

Odone, A., Lugo, A., Amerio, A., Borroni, E., Bosetti, C., Carreras, G., Cavalieri d'Oro, L., Colombo, P., Fanucchi, T., Ghislandi, S., Gorini, G., Iacoviello, L., Pacifici, R., Santucci, C., Serafini, G., Signorelli, C., Stival, C., Stuckler, D., Tersalvi, C. A., & Gallus, S. (2020). COVID-19 lockdown impact on lifestyle habits of Italian adults. *Acta bio-medica: Atenei Parmensis, 91*(9-S), 87–89. https://doi.org/10.23750/abm.v91i9-S.10122

Patnaik, G. (2021). *Positive psychology for improving mental health & well-being*. Notion Press.

Ripple, R. E., Biehler, R. F., & Jaquish, G. A. (1982). *Human development*. Houghton Mifflin.

Ryan, R. M., & Deci, E. L. (2001). On happiness and human potentials: a review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology, 52*(1), 141–166.

Ryff, C. D. (1989). Happiness is everything, or is it? Explorations on the meaning of psychological well-being. *Journal of Personality and Social Psychology, 57*(6), 1068–1081. https://doi.org/10.1037/0022-3514.57.6.1069

Siegel, R. D. (2010). *The mindfulness solution: Everyday practices for everyday problems*. The Guilford Press.

Simonsson, O., Bazin, O., Fisher, S. D., & Goldberg, S. B. (2021). Effects of an eight-week, online mindfulness program on anxiety and depression in university students during COVID-19: A randomized controlled trial. *Psychiatry Research, 305*, 1–4. https://doi.org/10.1016/j.psychres.2021.114222

Song, Y., & Lindquist, R. (2015). Effects of mindfulness-based stress reduction on depression, anxiety, stress and mindfulness in Korean nursing students. *Nurse Education Today, 35*(1), 86–90. https://doi.org/10.1016/j.nedt.2014.06.010

Spijkerman, M. P. J., Pots, W. T. M., & Bohlmeijer, E. T. (2016). Effectiveness of online mindfulness-based interventions in improving mental health: A review and meta-analysis of randomised controlled trials. *Clinical Psychology Review, 45*, 102–114. https://doi.org/10.1016/j.cpr.2016.03.009

Stahl, B., & Goldstein, E. (2019). A mindfulness-based stress reduction workbook. *New Harbinger* Publications.

Szabo, A. (2003). The acute effects of humor and exercise on mood and anxiety. *Journal of Leisure Research, 35*(2), 152–162. https://doi.org/10.1080/00222216.2003.11949988

Tanhan, A., Arslan, G., Yavuz, K. F., Young, J. S., Çiçek, İ., Akkurt, M. N., Ulus, İ. Ç., Görünmek, E. T., Demir, R., Kürker, F., Çelik, C., Akça, M. Ş., Ünverdi, B., Ertürk, H., & Allen, K. (2021). A constructive understanding of mental health facilitators and barriers through Online Photovoice (OPV) during COVID-19. *ESAM Ekonomik ve Sosyal Araştırmalar Dergisi, 2*(2), 214–249.

Terzioğlu, Z. A., & Çakır-Çelebi, S. G. (2021). Covid-19 Pandemi döneminde üniversite öğrencilerinde psikolojik iyi oluş ve yaşam doyumunu yordayan değişkenlerin incelenmesi. In E. Hamarta, C. Arslan, S. Çiftçi, & M. Uslu (Eds.), *Akademik Araştırmalar 2021* (pp. 92–100). Çizgi Kitabevi.

Thackray, G. (2020). *A pocket coach: The mindfulness coach*. Michael O'Mara Books Limited.

Thomas, B. (2019). *Creative coping skills for teens and tweens: Activities for self-care and emotional support including art, yoga, and mindfulness*. Jessica Kingsley Publishers.

Van Gordon, W., Shonin, E., Sumich, A., Sundin, E. C., & Griffiths, M. D. (2014). Meditation awareness training (MAT) for psychological well-being in a sub-clinical sample of university students: a

controlled pilot study. *Mindfulness, 5*(4), 381–391. https://doi.org/10.1007/s12671-012-0191-5

Williams, M., & Penman, D. (2011). *Mindfulness: An eight-week plan for finding peace in a frantic world*. Rodale.

Zayed, K. N., Ahmed, M. D., Van Niekerk, R. L., & Ho, W. K. Y. (2018). The mediating role of exercise behaviour on satisfaction with life, mental well-being and BMI among university employees. *Cogent Psychology, 5*(1), 1–13. https://doi.org/10.1080/23311908.2018.1430716

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