Research Paper

Effects of a Mindfulness-based Education Program on Mindfulness, Emotional Regulation, Interoceptive Awareness, and University-life Adjustment for Korean University Freshmen

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ABSTRACT

Background: University freshmen experience increased stress levels, and women, in particular, experience more stress and anxiety. Maintaining mindfulness through mindfulness programs may contribute to a successful university experience. This study aims to determine the effects of a mindfulness-based education program on mindfulness, emotional regulation, interoceptive awareness, and university-life adjustment among Korean university freshmen.

Methods: This study was a single-group pre-test-post-test design and a clinical trial (No. KCT0008309) registered with the clinical research information service of South Korea. This study was conducted with 46 female university freshmen using a volunteer sampling approach in Korea from March 2023 to June 2023. The mindfulness-based education program was conducted in 12 sessions, 1 day per week, for 12 weeks. Standard questionnaires were used, including the Kentucky inventory of mindfulness skills, positive affect, and negative affect schedule, multidimensional assessment of interoceptive awareness, and college life adjustment scale. A paired-sample t-test was used for statistical analysis using IBM SPSS software, version 29.

Results: Only attention related to mindfulness had a significant difference before and after the intervention (P=0.013). Interoceptive awareness sub-items, including accept (P=0.022), return to the body (P<0.001), and trusting (P=0.035) showed significant increases following the intervention. The interpersonal relationships required during university-life adjustment also revealed a significant improvement (P=0.025). However, no significant changes were observed in the emotional regulation variables after the intervention.

Conclusion: These results suggest that implementing a mindfulness program can effectively improve self-awareness and mutual acceptance skills among female university freshmen. This can help them establish strong social connections with their peers and professors. Therefore, we suggest incorporating a mindfulness program into university curricula to support adjustment to university life among female university freshmen experiencing various forms of stress.

Keywords: Emotional regulation, Awareness, Mindfulness, Social adjustment

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Introduction

University life is a challenging period for students because it requires effort in a variety of fields, such as integration into academic and social life at a university [1]. University students are challenged by various kinds of stressors from study tasks to role changes, interpersonal relationships, and employment [2]. If this pressure is not resolved in time, emotional suppression can easily lead to psychological problems. Consequently, these negative emotions may affect students' physical health, academic performance, learning efficiency, and lifestyle and exacerbate problems related to their psychological well-being [2, 3]. Evidence indicates a higher prevalence of psychological health problems in higher education institutions, and the prevalence rate continues to rise [4]. University freshmen face an increased level of stress. Students transitioning from high school to university are often excited about a new stage in their lives; however, they must face challenging situations and high expectations that can put them at risk of psychological health problems and may exacerbate existing problems [5]. Puthran et al. [6] pointed out that the rate of depression among medical freshmen students was the highest at 33.5%. Bewick et al. [7] noted that students faced higher levels of strain during the first semester of their first year compared to the pre-university stage. Kim [8] found that academic, future, and interpersonal problems negatively affected freshmen's social adjustment to university life. She suggested that this adjustment was influenced by various forms of stress during their university experience.

In terms of gender differences in psychological distress, women suffer more from stress and anxiety [4, 9]. Women and men respond differently to stress due to differences in sensitivity; women may experience greater sadness and anxiety because they are more vulnerable to stress [10]. They are more likely to struggle with internalizing disorders, such as depression and anxiety, while men are more likely to suffer from externalizing disorders, such as substance and alcohol abuse and internet addiction [11, 12]. Gao et al. [9] demonstrated that female students had significantly higher anxiety scores in the first and second grades compared to their male counterparts. Anxiety is positively correlated not only with introversion but also with body image, drinking habits, and academic performance [9].

Previous studies have demonstrated that few students experiencing stress-related psychological problems receive treatment [13]. Downs and Eisenberg [13] reported that suicidal college students had barriers to seeking treatment, including a preference for dealing with stress alone, the acceptance that stress was normal in university, not considering their needs as serious, and not having time for treatment. Students with psychological problems revealed poorer relationships with other students or faculty professors, lower academic achievement, and lower levels of participation in academic life or activities [14, 15].

A mindfulness-based education program is commonly used to cope with stress by improving mental and physical stability and self-regulation in university [16]. Most mindfulness-based interventions, including body scans, yoga, and other meditation elements, encourage interoceptive awareness resulting from a shift away from thinking about body sensations to an immediate feeling of body sensations [17, 18]. Interoceptive awareness is supposed to be a core component of many mindfulness practices. In other words, mindfulness inspires insight into the relationship between mind and body, encouraging interoceptive awareness. Both mindfulness and interoceptive awareness are closely intertwined yet distinct constructs and appear to be independently connected with enhanced psychological well-being [19]. Previous studies on mindfulness-induced neuroplasticity effects demonstrated that the interoceptive network spanned various brain regions, including the insular and cingulate cortexes, inferior frontal gyrus, and sensorimotor cortex [2, 20, 21]. The interoceptive network is modulated by mindfulness intervention, implicated in all bodily, emotional, and subjective feelings, and plays a central role in attention, intention, and other cognitive functions [20]. Kabat-Zinn [22] suggested that focusing attention meditation, such as breathing meditation on internal sensations encourages non-judgmental, moment-to-moment awareness that penetrates daily life.

The need for a mindfulness-based education program is highlighted by the increasing incidence and prevalence of psychological health problems among university students [23]. Numerous previous studies have focused on the beneficial effects of mindfulness-based education programs on mindfulness status and psychological symptoms, such as perceived stress, anxiety, and depression in college or university students [24, 25]. Additionally, several examiners suggested that maintaining mindfulness through mindfulness programs may contribute to successful university experiences [21, 26]. Lee et al. [26] also found a negative correlation between daily life stress and university life adjustment among university students. As mentioned, women suffer more from psychological health problems due to differences in

their psychological aspects and responses to stress. Several researchers have suggested that mindfulness plays a crucial role in facilitating the adjustment of university students [21, 26]. Mindfulness promotes emotional well-being by reducing stress and anxiety while improving self-awareness, concentration, and academic performance. Additionally, mindfulness helps build social connections, equipping students with the necessary skills and mindset to navigate and thrive during university life. However, among female university freshmen suffering from various stressful situations, it is unclear how a mindfulness-based education program specifically affects a student's adjustment to university life through positive changes in mindfulness, emotional regulation, and interoceptive awareness. Therefore, this study investigates the effects of a 12-week, mindfulness-based education program on mindfulness, emotional regulation, interoceptive awareness, and university-life adjustment among female university freshmen. We proposed the following four hypotheses:

1. The mindfulness of Korean female university freshmen changes when a mindfulness-based educational program is applied.

2. The emotional regulation of Korean female university freshmen changes when a mindfulness-based educational program is applied.

3. The interoceptive awareness of Korean female university freshmen changes when a mindfulness-based educational program including body scans, breathing meditation, and yoga meditation is applied.

4. The university-life adjustment of Korean female university freshmen changes when a mindfulness-based educational program is applied.

Methods

Research design

This study was quantitative quasi-experimental with a single-group pre-test-post-test design.

Subjects

This study was conducted at the Kwangju Women's University in Gwangju, South Korea. Forty-six university freshmen voluntarily participated in the study through recruitment announcements. The inclusion criteria included first-year university students and willing to participate in the study. Furthermore, the exclusion criteria included students of physical therapy and nursing field related to the authors' affiliations. The sample size was determined using G*Power software,version 3.1.9.4; Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Ger-many) [27] and derived from the insertion of the α (two-tailed) (0.05), effect size d (0.80), and power β (0.80) and ultimately calculated as 52 subjects for the paired t-test. This study collected data from 906 Korean University freshmen who volunteered to participate. Considering the dropout of subjects, data were collected from 59 subjects in the pre-test; however, due to bias in responses, many blanks, and non-participation in the post-test, 46 subjects were finally analyzed.

Intervention

The mindfulness-based education program for university freshmen was developed by the Korean University Mindfulness Education Committee and implemented in a liberal arts class at Korean University. This intervention was performed for twelve sessions, 50 min/day, and one day per week by three expert professors on the mindfulness education committee. To maintain internal consistency among the professors, a delivery training program was conducted before the start of the intervention, and meetings were held periodically during the intervention period. The learning objectives of the program were as follows. First, learners should be able to explain the mind, mindfulness, and mindfulness-based education. Second, learners are aware of the effects of meditation and writing gratitude notes. Third, learners can practice meditation in their daily lives. Fourth, learners should be able to develop attitudes of acknowledging and accepting others as they are. These four learning objectives were applied in all twelve sessions. Table 1 presents the contents of this program.

Measurements

Kentucky inventory of mindfulness skills (KIMS)

KIMS scale, developed by Baer et al. [28] is typically used to assess basic mindfulness. The Korean version of the KIMS (K-KIMS) was modified and validated by Kim [29] and used to evaluate the psychological characteristics of mindfulness that can be naturally acquired in daily life. The K-KIMS has 37 items, including attention, description, focused behavior, and non-judgmental acceptance, according to a four-item subscale. Each item is measured on a 5-point Likert scale. The four subscales of the K-KIMS for university students showed Cronbach's α=0.84 in a previous study [29] and α=0.60 in this study, indicating good internal consistency.

Table 1. The contents of the mindfulness-based education program

Time*	Theme	Contents**
1	Living in the present	- Mindfulness stretching - Focus on the senses - Raisin meditation
2	Gratitude	- Effect of gratitude - Gratitude and brain changes - Writing the gratitude note and its effect
3	Focused meditation	- Mindfulness and meditation trends - Focused meditation and practice
4	Observation meditation	- Four elements of the human experience - Observation meditation and practice
5	The concept and effect of mindfulness	- The tale of two wolves - The definition and benefits of mindfulness - Psychological stage of mindfulness - Practice of walking meditation
6	Body scan	- Mindfulness for beginners - Body scan - Mindfulness plans in daily life
7	Yogic meditation	- Yoga-based meditation
8	Understanding emotions	- Emotion exploration using a mood meter - Emotional mindfulness - Learning about the freedom from taking responsibility for your emotions - Dealing with emotions
9	Self-understanding	- Find your strengths - Present and share experiences that have demonstrated your strengths
10	Communication of mind	- List examples of activities that make you happy - Paying attention to others, including good communication
11	Empathy	- Stress survey (simple psychological) - Understanding stress symptoms - Practice of the empathy
12	Understanding and sharing	- Two dimensions of well-being: Meaning and happiness - Writing miracle questions - Finding the meaning of life through wishes that you thought were difficult to achieve

*Per session, **Activity sharing was performed in all the sessions while writing gratitude notes as a home practice.

Positive affect and negative affect schedule (PANAS)

PANAS, a scale developed by Watson et al. [30], is one of the most widely used scales for measuring mood and emotion. Lee et al. revised and validated the Korean version of the PANAS (K-PANAS) [31] and changes in mood or emotion over the past week were measured. The K-PANAS comprises 20 items, including nine items for positive affect (PA) and eleven items for negative affect (NA). The K-PANAS is a valid and reliable measurement because it has sufficient construct validity PA: r=-0.14–0.61/negative affect: r=0.59–0.70) and internal consistency (Cronbach's α=0.84) in university students [31] and 0.82 in this study.

Multidimensional assessment of interoceptive awareness (MAIA)

MAIA scale, a self-reported questionnaire developed by Mehling et al. [32], is a self-report questionnaire to measure interoceptive awareness. Gim et al. translated and validated the Korean version of the MAIA (K-MAIA) [33]. The K-MAIA was used in this study to assess changes in body awareness through mindful-

ness meditation, emphasizing attention and awareness of bodily interoception. It consists of 32 items with six factors, noticing, accepting, attention regulation, mind-body connection awareness, return to body, and trusting. Each item is measured on a 7-point Likert scale. The K-MAIA has excellent reliability with a high internal consistency of 0.94, and sufficient validity compared with the private body-consciousness subscale (each factor score: r=0.14, 0.63; total score, r=0.52) in healthy adults [33]. In this study, the internal consistency (Cronbach's α) was 0.86.

College life adjustment scale (CLAS)

CLAS, developed and validated by Jeong and Park [34], was used to assess adjustment to university life. This scale comprises 19 items across five factors, interpersonal relationships, academic activities, career preparation, personal psychology, and social experiences. Each item is rated on a 5-point Likert scale. Previous studies for the scale's reliability reported Cronbach's α reliability coefficients of 0.88 [35], indicating high reliability. In this study, the internal consistency (Cronbach's α) was 0.88.

Statistical analysis

Descriptive statistics are presented as Mean±SD. The assumption of a normal distribution of the variables was checked using the Shapiro-Wilk test. A paired-sample t-test was used to analyze differences in mindfulness K-KIMS, emotional regulation K-PANAS, interoceptive awareness K-MAIA, and university life adjustment CLAS before and after the intervention. All statistical analyses were performed using IBM SPSS software, version 29; IBM Corp., Armonk, NY, USA). The level of significance was set at 0.05.

Results

Study participants

Table 2 presents the characteristics of the participants. The Mean±SD of age were 20.28±0.81 years. Thirteen students (28.3%) studied in the field of beauty sciences. Regarding religion, non-religiosity was the most common at 33 students (71.8%). Most of the 34 participants had no experience of participating in mindfulness programs (73.9%), 27 students (58.7%) had experience in meditation, and 19(41.3%) had no experience. Most participants had no problems with their current life, as recognized by the 39 participants (84.8%) (Table 2).

Changes in mindfulness

Table 3 presents the changes in mindfulness resulting from the mindfulness-based education program. Only attention showed a significant difference among the four K-KIMS subscales (t=-2.58, P=0.013) after the intervention. No significant differences were observed in skills (t=0.19, P=0.241), focused behavior (t=0.49, P=0.685), and non-judgmental acceptance (t=0.81, P=0.423) between pre and post-tests. The K-KIMS score also revealed no statistically significant differences (t=-0.48, P=0.635) following the intervention (Table 3).

Changes in emotional regulation

Table 3 presents the changes in emotional regulation related to the mindfulness-based education program. Positive (t=-1.19, P=0.242) and negative (t=-1.86, P=0.070) affectivity showed no statistically significant differences between the pre and post-tests. The K-PANAS score also showed no significant change (t=-1.95, P=0.058) after the intervention (Table 3).

Changes in interoceptive awareness

Table 4 presents the changes in interceptive awareness after the intervention. In the six-subitem scale, accept (t=-2.38, P=0.022), return to body (t=-4.54, P<0.001), and trusting (t=-2.18, P=0.035) significantly increased after the intervention. However, noticing (t=-1.55, P=0.128), attention regulation (t=-1.10, P=0.279), and mind-body connection awareness (t=-1.77, P=0.083) increased, but the differences were not statistically significant. Finally, the K-MAIA score showed a significant difference (t=-3.29, P=0.002) between the pre and post-tests (Table 4).

Changes in university life adjustment

Table 4 presents the changes in university life adjustment according to the mindfulness-based education program. Among the five CLAS sub-items, only interpersonal relationships revealed a significant difference (t=-2.32, P=0.025) after the mindfulness-based education program. No significant differences were observed in academic activities (t=-1.00, P=0.323), career preparation (t=-0.61, P=0.544), personal psychology (t=0.48, P=0.634), or social experience (t=1.27, P=0.209) between the pre and post-tests. Additionally, the CLAS score showed no statistically significant difference (t=-0.67, P=0.507) after the intervention (Table 4).

Table 2. Characteristics of university freshman females (n=46)

Variables	Categories	No. (%)
Major	Beauty science	13(28.3)
	Police administration	10(21.7)
	Speech-language pathology	10(21.7)
	Autonomous major*	1(2.2)
	Airline service	10(21.7)
	Social welfare	2(4.4)
Religion	No religion	33(71.8)
	Christian	7(15.2)
	Catholicism	3(6.5)
	Buddhism	3(6.5)
Experience of participating in a mindfulness program	Yes	12(26.1)
	No	34(73.9)
Experience of meditation	Yes	27(58.7)
	No	19(41.3)
Current problem	Physical problems	2(4.3)
	Psychological problems	1(2.2)
	Both physical and psychological problems	2(4.3)
	Others	1(2.2)
	Without any problem	39(84.8)
	No response	1(2.2)

Variable	Mean±SD
Age (y)	20.28±0.81

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*Autonomous major, this major is a freshman year course, and students who choose this major can decide on a specific major in their sophomore year.

Discussion

This study was conducted to investigate the effects of a 12-week, mindfulness-based education program concerning mindfulness, emotional regulation, interoceptive awareness, and university-life adjustment among Korean female university students. This discussion focuses on the research results of four research hypotheses proposed.

First, we hypothesized that changes in mindfulness skills would occur after 12 weeks of intervention with a mindfulness-based education program. However, hypothesis 1 was not supported, and no significant difference was observed in the students' mindfulness skills [29] in recognizing and accepting their own experiences before and after the intervention. This result is consistent with the results obtained in the study [24], which found that the mindfulness program's intervention among freshmen showed no significant differences in intraper-

Table 3. Comparison of the K-KIMS, K-PANAS data between the pre and post-tests

Variables	Mean±SD		t	P
	Pre-test	Post-test		
Attention	3.19±0.64	3.45±0.65	-2.58	0.013*
Skills	3.85±0.55	3.76±0.66	0.19	0.241
Focused behavior	3.36±0.55	3.32±0.65	0.49	0.685
Non-judgmental acceptance	3.12±0.55	3.03±0.70	0.81	0.423
Total score	3.34±0.26	3.37±0.43	-0.48	0.635
Positive affect	1.59±0.73	1.72±0.84	-1.19	0.242
Negative affect	0.76±0.60	1.00±0.71	-1.86	0.070
Total score	1.13±0.49	1.32±0.62	-1.95	0.058

*Statistically significant at P<0.05.

sonal (mindfulness, self-compassion) perception. MacLean et al. [24] conducted a pilot study of a three-year mindfulness curriculum in undergraduate medical education in Canadian medical students. They suggest that this curriculum did not affect the overall levels of mindfulness, empathy, resilience, or stress scores, but students who actively applied its principles reported significantly higher levels of mindfulness, empathy, and resilience, as well as a trend toward lower perceived stress scores [24]. This difference may have been influenced by the duration of the application of the mindfulness-based program and participant characteristics.

Table 4. Comparison of the K-MAIA and CLAS data between the pre and post-tests

Variables	Mean±SD		t	P
	Pre-test	Post-test		
Noticing	3.91±0.91	4.14±0.96	-1.55	0.128
Accept	2.48±1.15	2.88±1.20	-2.38	0.022*
Attention regulation	3.50±0.87	3.68±0.89	-1.10	0.279
Mind-body connection awareness	4.07±0.86	4.37±0.98	-1.77	0.083
Return to body	3.08±0.91	3.75±0.96	-4.54	<0.001*
Trusting	3.90±1.17	4.28±1.05	-2.18	0.035*
Total score	3.49±0.56	3.85±0.69	-3.29	0.002*
Interpersonal relationships	3.01±0.77	3.30±0.83	-2.32	0.025*
Academic activities	3.83±0.55	3.93±0.70	-1.00	0.323
Career preparation	3.11±0.86	3.20±0.98	-0.61	0.544
Personal psychology	4.11±0.62	4.06±0.75	0.48	0.634
Social experiences	3.36±0.78	3.15±1.09	1.27	0.209
Total score	3.49±0.51	3.55±0.67	-0.67	0.507

*Statistically significant at P<0.05.

Considering the details of the changes in the sub-items of mindfulness, no significant difference was observed in skill, focused behavior, and non-judgmental acceptance after the mindfulness-based education program's intervention; however, attention has significantly improved. This is consistent with the research results that mindfulness is related to attention regulation and concentration ability [36]. This result means that physical sensations are sufficiently concrete for individuals to notice, while thoughts and emotions are more difficult to grasp and require more time and effort because they are neither tangible nor felt by their objects' nature [2].

The first year of university in Korea is a time when students finish their secondary education curriculum and start a new higher-education curriculum [2], experiencing considerable stress, such as academic achievement pressure, sleep disorders, interpersonal difficulties, and lack of coping skills [5, 8]. Previous studies have reported that mindfulness-based education programs have a positive impact on depression, anxiety, stress reduction [2], life satisfaction [37], interpersonal relationships [38], coping strategies [8], sleep disorders, and alcohol problems [37]. We found that mindfulness, which is positively correlated with university freshmen's psychosocial variables, showed a significant difference in attention [24, 25], which partially supported the positive effect of the applied program. Therefore, mindfulness-based education programs should be applied continuously rather than on a short-term or one-time basis during freshman year, when students must adapt to rapid changes. Future studies should diversify the application period for the mindfulness-based education program and conduct comparative studies.

Second, we hypothesized that a 12-week, mindfulness-based educational program would increase an individual's ability to regulate their emotions. However, hypothesis 2 was not confirmed, and no significant difference was observed between positive and negative emotional control before and after the intervention. The participants showed very low differences in positive and negative emotions before and after the program. This result differed from the results of the previous studies [28, 29] in which mindfulness-based interventions were effective in increasing positive emotions and reducing negative emotions. Emotional regulation is the ability to suppress impulsive and inappropriate behaviors by understanding, being aware of, and accepting emotions [39]. Emotional regulation shows bipolarity between PA and NA in individualistic cultures, while PA and NA are independent in collectivistic cultures [40]. A study that verified the reliability and validity of K-PANAS [31] pointed out that word-meaning delivery can vary due to cultural differences. The emotional regulation scale item "alert" is defined as "a state of alertness that is ready to respond to some stimulus"; however, according to the Korean dictionary, "nimble" means "fast and quick in action", which makes it difficult to deliver the appropriate meaning. Additionally, Koreans tend to avoid expressing negative emotions [31]. Future follow-up research should conduct repeated studies using tools that can validly measure emotional regulation for Korean university students from a cultural perspective.

Third, interoceptive awareness significantly increased after the 12-week, mindfulness-based education program's intervention, thus supporting hypothesis 3. These results are consistent with the results of several studies [19, 33] and are significant because mindfulness-based education programs enable self-regulation by focusing on one's physical condition through interoceptive awareness. Paying attention to bodily sensations naturally relaxes the body and clears the mind, leading to positive effects, such as adequate physical activity, sleep quality, and rest [37]. The higher the interoceptive awareness, which is the body's subtle sensation and feeling, the more likely it is to control one's life, and one must know what one feels to know why one feels that way [41].

Considering the details of sub-items of interoceptive awareness, no significant difference was observed in sensory awareness (noticing), attention regulation, and mind-body connection awareness. The sub-items of mindfulness showed a change in attention focusing, which pays attention to what is currently being experienced; however, no difference was observed in attention regulation. These results suggest that mindfulness-based education programs need continuous education and time to reach the stage of attention regulation, which can control and maintain attention to bodily sensations. Acceptance, return to the body, and trust, which are sub-items of interoceptive awareness, were greatly improved. According to previous studies [32, 33], mindfulness-based programs increased mindfulness skills, such as not worrying, attention regulation, body listening, and interoceptive awareness levels [42]. The authors also found a positive correlation between mindfulness and interoceptive awareness. In other words, increasing mindfulness levels through a mindfulness-based program can increase interoceptive awareness [33]. Experts have explained that body awareness is an essential element in perform mindfulness-based interventions such as body scans, breathing meditation, yogic meditation, and walking meditation during rest or movement. As the ability to pay attention to body sensations increases, people con-

sciously and intentionally pay attention to positive sensations, which can increase their perceptions of positive body sensations [32]. In addition, from the mind-body monistic perspective that the mind and body are not two different things but are interrelated, as explained in Spinoza's mind-body identity theory [43], physical changes should also be made to have a positive impact on university students' psychosocial aspects. Therefore, the results of this study are meaningful in that the mindfulness-based education program induced changes in interoceptive awareness for freshmen in university education.

Finally, we hypothesized that university-life adaptability would improve after the 12-week mindfulness-based education program; however, hypothesis 4 was not confirmed. Previous studies have shown that mindfulness programs have significant effects on university-life adjustment [44], student-life satisfaction [37], physiological stress [16, 37, 38], and mental health (depression, anxiety, etc.) [2, 25, 37], which differs from the results of this study. These results indicate that the scores for career preparation outside the school for job preparation in the university-life adjustment tool were low. Thus, survey questions, such as "I am preparing to obtain a certificate that will help me," and "I use my study time efficiently to prepare for employment" were inappropriate (freshmen in their first semester). This result suggests the need to use more valid tools that match the characteristics of university freshmen.

Considering the sub-items of university-life adjustment in detail, interpersonal relationships were greatly improved, consistent with previous research [38]. It is significant that meditation, sharing one's experience through small groups, and writing gratitude notes, which were conducted during the operation of the mindfulness-based education program in this study, helped improve interpersonal relationships. Baker and Siryk [45] considered college-life adjustment as adapting to academic life related to academics and social life, such as interpersonal relationships or extracurricular activities within college, appropriately coping with psychological stress, and having a general attachment, affection, or bonding with college or students. Mindfulness reduces critical and negative thoughts about oneself and others, enhances understanding and empathy, and strengthens one's ability to cope with conflict or stress in interpersonal relationships [38]. Students with high levels of mindfulness are less likely to experience the negative effects of mental health problems on university life adjustment and more likely to experience positive emotions [26, 46]. The mindfulness-based program indirectly affects university-life adjustment through the effects on students' mental health and positive emotions.

Our study identified significant results regarding mindfulness, emotional regulation, interoceptive awareness, and adjustment to university life after the intervention. However, our study has major limitations: [1] It focused on the psychological characteristics of Korean female university students along with rapid changes in the social and educational environments of the Republic of Korea. Regarding university-life adjustment, our results are difficult to generalize due to social or cultural differences between countries. Further studies are needed to investigate the effects of mindfulness-based interventions on university-life adjustment in other countries or in large sample sizes equally allocated by gender; [2] This study used a single-group pre-test-post-test design without a control group. To confirm the efficacy of mindfulness-based interventions, further double-blind randomized trials are required to compare the long-term effects between the intervention and control groups. Additionally, a follow-up study is needed to determine the continuity of the effects of the mindfulness program in the groups; [3] the emotion-regulation tool used in this study was adapted from a foreign tool and had limitations in reflecting Korea's cultural characteristics. Therefore, appropriate tools should be developed; [4] the university-life adjustment tool used in this study contained some inappropriate questions for university freshmen. More valid tools that suit the subjects' characteristics are needed. Despite these limitations, improvements in attention, interoceptive awareness, and interpersonal relationships following the application of a mindfulness-based education program to female university freshmen support the program's effectiveness in promoting positive university-life adjustment.

Conclusion

This study was conducted to investigate the effects of a mindfulness-based educational program on mindfulness, emotional regulation, interoceptive awareness, and university-life adjustment among female university freshmen. The results revealed that the mindfulness-based education program resulted in significant differences in attention, interoceptive awareness, acceptance, sensory return, trust, and interpersonal relationships, which are necessary for adjusting to university life. This shows that implementing a mindfulness program can effectively improve self-awareness and mutual acceptance skills in female university freshmen. This can help them establish strong social connections with their peers and professors. Thus, we recommend incorporating a mindfulness program into university curricula to support university life adjustment among female university freshmen experiencing various forms of stress.

Ethical Considerations

Compliance with ethical guidelines

The research was conducted by the Declaration of Helsinki and approved by the Institutional Review Board of Kwangju Women's University (Code: 1041465-202302-HR-001-01, 02.01.2023). We received informed consent from all study subjects for voluntary participation before participating in this study.

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Authors' contributions

Conceptualization, methodology, investigation, data curation, writing review and editing: All authors; Formal analysis: Mijung Kim and Mijung Jung; Writing original draft: Namgi Lee and Mijung Jung.

Conflict of interest

The authors declared no conflict of interest.

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References

[1] Yilmaz ND, Sahin H, Nazli A. International medical students' adaptation to university life in Turkey. International Journal of Medical Education. 2020; 11:62. [DOI:10.5116/ijme.5e47.d7de]

[2] Kim SY, Suh H, Oh W, Daheim J. Daily change patterns in mindfulness and psychological health: A pilot intervention. Journal of Clinical Psychology. 2021; 77(3):496-515. [DOI:10.1002/jclp.23043]

[3] Holland D. College student stress and mental health: Examination of stigmatic views on mental health counseling. Michigan Sociological Review. 2016; 30:16-43. [Link]

[4] Eisenberg D, Gollust SE, Golberstein E, Hefner JL. Prevalence and correlates of depression, anxiety, and suicidality among university students. American Journal of Orthopsychiatry. 2007; 77(4):534–42. [DOI:10.1037/0002-9432.77.4.534]

[5] Guo Q, Huang YQ, Liu ZR, Wang H. Psychological symptoms and associated risk factors in Chinese freshmen: A three-year follow-up study. Chinese Medical Journal. 2013; 126:3499-504. [Link]

[6] Puthran R, Zhang MW, Tam WW, Ho RC. Prevalence of depression amongst medical students: A meta-analysis. Medical Education in Review. 2016; 50(4):456-68. [DOI:10.1111/medu.12962]

[7] Bewick B, Koutsopoulou G, Miles J, Slaa E, Barkham M. Changes in undergraduate students' psychological well-being as they progress through university. Studies in Higher Education. 2010; 35(6):633-45. [DOI:10.1080/03075070903216643]

[8] Kim SK. [Life stress in freshman and adjustment to college (Korean)]. Korean Journal of Youth Studies. 2003; 10:215-237. [Link]

[9] Gao W, Ping S, Liu X. Gender differences in depression, anxiety, and stress among college students: A longitudinal study from China. Journal of Affective Disorders. 2020; 263:292-300. [DOI:10.1016/j.jad.2019.11.121]

[10] Chaplin TM, Hong K, Bergquist K, Sinha R. Gender differences in response to emotional stress: An assessment across subjective, behavioral, and physiological domains and relations to alcohol craving. Alcoholism: Clinical and Experimental Research. 2008; 32(7):1242-50. [DOI:10.1111/j.1530-0277.2008.00679.x]

[11] Vu HM, Tran TT, Vu GT, Nguyen CT, Nguyen CM, Vu LG, et al. Alcohol use disorder among patients suffered from road collisions in a Vietnamese delta Province. International Journal of Environmental Research and Public Health. 2019; 16(13):2423. [DOI:10.3390/ijerph16132423]

[12] Zhang MW, Lim RB, Lee C, Ho RC. Prevalence of internet addiction in medical students: A meta-analysis. Acad Psychiatry. 2018; 42:88-93. [DOI:10.1007/s40596-017-0794-1]

[13] Downs MF, Eisenberg D. Help seeking and treatment use among suicidal college students. Journal of American College Health. 2012; 60(2):104-14. [DOI:10.1080/07448481.2011.619611]

[14] Keyes CL, Eisenberg D, Perry GS, Dube SR, Kroenke K, Dhingra SS. The relationship of level of positive mental health with current mental disorders in predicting suicidal behavior and academic impairment in college students. Journal of American College Health. 2012; 60(2):126-33. [DOI:10.1080/07448481.2011.608393]

[15] Salzer MS. A comparative study of campus experiences of college students with mental illnesses versus a general college sample. Journal of American College Health. 2012; 60(1):1-7. [PMID]

[16] Marais GA, Lantheaume S, Fiault R, Shankland R. Mindfulness-based programs improve psychological flexibility, mental health, well-being, and time management in academics. European Journal of Investigation in Health, Psychology and Education. 2020; 10(4):1035-50. [DOI:10.3390/ejihpe10040073]

[17] Farb N, Daubenmier J, Price CJ, Gard T, Kerr C, Dunn BD, et al. Interoception, contemplative practice, and health. Frontiers in Psychology. 2015; 6:763. [DOI:10.3389/fpsyg.2015.00763]

[18] Mehling WE, Chesney MA, Metzler TJ, Goldstein LA, Maguen S, Geronimo C, et al. A 12-week integrative exercise program improves self-reported mindfulness and interoceptive awareness in war veterans with posttraumatic stress symptoms.Journal of Clinical Psychology. 2018; 74(4):554-65. [DOI:10.1002/jclp.22549]

[19] Hanley AW, Mehling WE, Garland EL. Holding the body in mind: Interoceptive awareness, dispositional mindfulness and psychological well-being. Journal of Psychosomatic Research. 2017; 99:13-20. [DOI:10.1016/j.jpsychores.2017.05.014]

[20] Craig AD. How do you feel-now? The anterior insula and human awareness. Nature Reviews Neuroscience. 2009; 10:19-30. [DOI:10.1038/nrn2555]

[21] Jung M, Lee M. The effect of a mindfulness-based education program on brain waves and the autonomic nervous system in university students. Healthcare. 2021; 9(11):1606. [DOI:10.3390/healthcare9111606]

[22] Kabat-Zinn J. Mindfulness-based interventions in context: Past, present, and future. Clinical Psychology: Science and Practice. 2003; 10(2):144-56. [DOI:10.1093/clipsy.bpg016Cit]

[23] Auerbach RP, Alonso J, Axinn WG, Cuijpers P, Ebert DD, Green JG, et al. Mental disorders among college students in the World Health Organization world mental health surveys. Psychological Medicine. 2016; 46(14):2955-70. [DOI:10.1017/S0033291716001665]

[24] MacLean H, Braschi E, Archibald D, Sanchez-Campos M, Jebanesan D, Koszycki D, et al. A pilot study of a longitudinal mindfulness curriculum in undergraduate medical education. Canadian Medical Education Journal. 2020; 11(4):e5-18. [DOI:10.36834/cmej.56726]

[25] Lemay V, Hoolahan J, Buchanan A. Impact of a yoga and meditation intervention on students' stress and anxiety levels. American Journal of Pharmaceutical Education. 2019; 83(5):747-52. [DOI:10.5688/ajpe7001]

[26] Lee YW, Lee YJ. A study of the relationships between daily life stress, self-efficacy and university student life adjustment. Journal of Korean Academy of Nursing. 2005; 35(4):664-71. [DOI:10.4040/jkan.2005.35.4.664]

[27] Faul F, Erdfelder E, Lang AG, Buchner A. G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behavior Research Methods. 2007; 39:175-91. [DOI:10.3758/BF03193146]

[28] Baer RA, Smith GT, Allen KB. Assessment of mindfulness by self-report: The Kentucky inventory of mindfulness skills. Assessment. 2004; 11(3):191-206. [DOI:10.1177/1073191104268029]

[29] Kim J-M. [A validation study of Korean version of Kentucky inventory of mindfulness skills (Korean)]. Korean Journal of Clinical Psychology. 2006; 25:1123-1139. [Link]

[30] Watson D, Clark LA, Tellegen A. Development and validation of brief measures of positive and negative affect: The PANAS scales. Journal of Personality and Social Psychology. 54(6):1063–70. [DOI:10.1037/0022-3514.54.6.1063]

[31] Lee H-h, Kim E-J, Lee M-k. [A validation study of Korea positive and negative affect schedule: The PANAS scales (Korean)]. Korean Journal of Clinical Psychology. 2003; 22(4):935-46. [Link]

[32] Mehling WE, Price C, Daubenmier JJ, Acree M, Bartmess E, Stewart A. The multidimensional assessment of interoceptive awareness (MAIA). PLoS One. 2012; 7(11):e48230. [DOI:10.1371/journal.pone.0048230]

[33] Gim WS, Sim KL, Cho OK. Korean multidimensional assessment of interoceptive awareness (K-MAIA): Development and validation. Korean Journal of Stress Researc. 2016; 24(3):177-92. [DOI:10.17547/kjsr.2016.24.3.177]

[34] Jeong E, Park Y. Development and validation of the college adjustment scale. Korean J Educ Method Stud. 2009; 21:69-92. [Link]

[35] Jung SY. A comparative study of college adjustment and life stress of nursing students by grades. Industrial Convergence Research. 2019; 17(4):139-46. [DOI:10.22678/JIC.2019.17.4.139]

[36] Karremans JC, Papies EK. Mindfulness in social psychology. London: Routledge; 2017. [DOI:10.4324/9781315627700]

[37] Dvořáková K, Kishida M, Li J, Elavsky S, Broderick PC, Agrusti MR, et al. Promoting healthy transition to college through mindfulness training with first-year college students: Pilot randomized controlled trial. Journal of American College Health. 2017; 65(4):259-67. [DOI:10.1080/07448481.2017.1278605]

[38] Kim J, Kim N. [The effects of university student's adult attachment on interpersonal relationship ability: Mediating effects of mindfulness and mattering (Korean)]. Korean Association For Learner-Centered Curriculum and Instruction. 2019; 19:529-51. [Link]

[39] Gratz KL, Roemer, L. Multidimensional assessment of emotion regulation and dysregulation: Development, factor structure, and initial validation of the difficulties in emotion regulation scale. Journal of Psychopathology and Behavioral Assessment. 2004; 26:41-54. [DOI:10.1023/B:JOBA.0000007455.08539.94]

[40] Bagozzi RP, Wong N, Yi Y. The role of culture and gender in the relationship between positive and negative affect. Cognition & Emotion. 1999; 13(6):641-72. [DOI:10.1080/026999399379023]

[41] Van der Kolk BA. Running for your life: The anatomy of survival. the body keeps the score: brain, Mind, and body in the healing of trauma. London: Penguin Books; 2015:51-73. [Link]

[42] Shahar B, Britton WB, Sbarra DA, Figueredo AJ, Bootzin RR. Mechanisms of change in mindfulness-based cognitive therapy for depression: Preliminary evidence from a randomized controlled trial. International Journal of Cognitive Therapy. 2010; 3(4):402-18. [DOI:10.1521/ijct.2010.3.4.402]

[43] Hübner K. Representation and mind-body identity in Spinoza's philosophy. Journal of the History of Philosophy. 2022; 60(1):47-77. [DOI:10.1353/hph.2022.0002]

[44] Ramler TR, Tennison LR, Lynch J, Murphy P. Mindfulness and the college transition: The efficacy of an adapted mindfulness-based stress reduction intervention in fostering adjustment among first-year students. Mindfulness 2016; 7:179-88. [DOI:10.1007/s12671-015-0398-3]

[45] Baker RW, Siryk B. Measuring adjustment to college. Journal of Counseling Psychology. 1984; 31(2):179–89. [DOI:10.1037/0022-0167.31.2.179]

[46] Lu F, Xu Y, Yu Y, Peng L, Wu T, Wang T, et al. Moderating effect of mindfulness on the relationships between perceived stress and mental health outcomes among Chinese intensive care nurses. Frontiers in Psychiatry. 2019; 10:260. [DOI:10.3389/fpsyt.2019.00260]