



## Effectiveness of The Riliv Mindfulness App on Anxiety Among Hypertensive Patients: A Quasi-Experimental Study

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### Abstract

*Hypertension affects both physical and psychological health, including increasing anxiety, which can further worsen patients' conditions. The Riliv application offers a practical solution for managing anxiety independently and effectively. The purpose of this study was to determine the effect of implementing the Riliv mindfulness application on anxiety levels in hypertensive patients. This study employed a quantitative approach with a pretest–posttest control group design using a quasi-experimental method. The sample was selected through purposive sampling and consisted of 30 respondents, divided into 15 respondents in the intervention group and 15 respondents in the control group. The intervention was conducted over a period of 10 days with 10 sessions using the Riliv mindfulness application. Anxiety levels were measured using the Hamilton Anxiety Rating Scale (HARS) as the primary instrument. Data analysis was performed using paired t-test and independent t-test. The results showed that in the intervention group, the mean anxiety score decreased from 18.27 to 15.73 ( $p < 0.001$ ). While the control group showed an increase in the mean anxiety score from 18.27 to 18.67 ( $p = 0.189$ ). The independent t-test results indicated a statistically significant difference in anxiety levels between the intervention group and the control group, with a p-value of 0.005 ( $p < 0.05$ ). The Riliv mindfulness app significantly reduced anxiety scores in hypertensive patients after 10 days of intervention.*

## INTRODUCTION

Hypertension is a major global health problem, as it affects millions of people worldwide and contributes to an increased risk of heart disease, stroke, and other serious health complications. According to the World Health Organization (WHO), an estimated 1.28 billion adults aged 30–79 years worldwide were living with hypertension in 2023 (World Health Organization, 2023). Based on the Riskesdas (2018), the prevalence of hypertension in Indonesia was 34.1%. In Central Java, the estimated number of individuals aged >15 years with hypertension in 2023 reached 8,554,672, accounting for 38.2% of the total population aged >15 years (Dinas Kesehatan Provinsi Jawa Tengah, 2023). In Kudus Regency, the estimated number of

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individuals aged >15 years with hypertension in 2023 was 232,914, representing 26.8% of the total population in the same age group. Furthermore, in 2023, Kaliwungu Public Health Center recorded the second-highest number of hypertension cases after Dawe Public Health Center, with an estimated 18,521 individuals aged  $\geq 15$  years diagnosed with hypertension (Dinas Kesehatan Kabupaten Kudus, 2023).

Hypertension does not only affect physical health but can also have a significant impact on mental health. Stress, anxiety and depression in hypertensive patients may worsen their overall health condition (Kementrian Kesehatan Indonesia, 2024). Anxiety in hypertensive patients needs to be managed properly because it can lead to various adverse effects. A study conducted by Akbar et al. (2022) reported several strategies used to reduce anxiety among patients undergoing treatment for chronic illnesses such as hypertension and kidney failure in hospitals. The study found that patients applied several anxiety management techniques, including deep breathing practiced by 36 patients (59%), muscle relaxation by 12 patients (19.7%), physical exercise by 2 patients (3.3%), meditation by 31 patients (50.8%), mental imagery by 4 patients (6.6%), and positive thinking by 44 patients (72.1%). The findings indicate that most patients used positive thinking and meditation techniques as ways to manage their anxiety. One of the non-pharmacological techniques that falls within the categories of positive thinking and meditation is mindfulness.

Mindfulness is a non-pharmacological technique that focuses on full awareness of the present moment without judgment or excessive emotional reactions. In the context of anxiety, mindfulness can be highly beneficial as it helps individuals manage their thoughts and feelings in a calmer and more controlled manner (Sanjiwani et al., 2023). A study by Zhang et al. (2024) showed that mindfulness meditation reduced anxiety by 17.8%. In the digital era, mindfulness can be practiced through smartphone applications that provide integrated mindfulness meditation programs guided by trained mindfulness practitioners. The use of digital applications is considered effective because it uses technology that is already widely used by the public, especially smartphones. Riliv is one such mindfulness application that is practical, user-friendly, flexible in terms of time and place of use (Waney et al., 2020).

The results of a preliminary study conducted by the researchers through a community health post (posyandu) in Kedungdowo Village on February 8, 2025, indicated the presence of anxiety among hypertensive patients. Initial data were collected using the Hamilton Anxiety Rating Scale (HARS) from eight hypertensive patients. The findings revealed that three patients experienced severe anxiety with a mean score of 29, two patients experienced moderate anxiety with a mean score of 22, and three patients experienced mild anxiety with a mean score of 19. Interviews with the respondents revealed that their anxiety was mainly caused by psychological burdens and concerns about their illness, which they believed could affect their blood pressure. Based on these findings, there is a need for an effective intervention to address anxiety among hypertensive patients in the working area of Kaliwungu Public Health Center.

Based on the background explained above, this study aimed to examine whether the Riliv mindfulness app reduces anxiety among hypertensive patients compared with usual care.

## **MATERIALS AND METHODS**

This study used a quantitative approach with a quasi-experimental method. The study applied a pretest–posttest control group design. This design was selected because it allows researchers to measure changes before and after the intervention, provides a comparison group, reduces research bias, and is more feasible for field studies that have limitations in randomization.

This research was conducted in September 2025 at the Prolanis program in Karangampel Village, Kaliwungu Subdistrict, Kudus Regency. The sample was selected using purposive sampling. The population of this study consisted of 36 hypertensive patients in the Prolanis program at Karangampel. Anxiety screening was then conducted to select eligible respondents. The inclusion criteria in this study were respondents diagnosed with hypertension and regularly taking antihypertensive medication, willing to participate from the beginning until the end of the intervention, and experiencing anxiety based on the screening results. Meanwhile, the exclusion criteria included hypertensive patients who misuse drugs or alcohol, patients with hypertensive emergencies and patients with hearing impairments.

A total of 30 respondents met the criteria and were included as the study sample, consisting of 15 respondents in the intervention group and 15 respondents in the control group. The use of a small sample size in each group was due to the limited population available at the research site. A minimum sample size of 12 participants per group is considered acceptable as a guideline; therefore, the sample size of 15 respondents in each group in this study is still within an acceptable range.

The intervention was conducted in 10 sessions over 10 consecutive days. Each day, one session was carried out in the morning, with a duration of 7–10 minutes per session. The intervention group received the same mindfulness intervention in the form of audio content available on the Riliv application. The audio content consisted of guided mindfulness exercises, including breathing techniques, relaxation, and awareness practices delivered in a structured manner. On the first day, during the Prolanis meeting, respondents were provided with an explanation of the study. Those who agreed to participate were asked to sign an informed consent form. Subsequently, the respondents' anxiety levels were measured using the Indonesian version of the Hamilton Anxiety Rating Scale (HARS) questionnaire. The instrument demonstrated acceptable validity, with Pearson correlation coefficients ranging from 0.529 to 0.727, and reliability with a Cronbach's alpha value of 0.756 (Ramdan, 2018). The researcher administered the instrument by asking each question in the HARS systematically according to the order of the items. Participants in the intervention group were then given instructions on how to use the mindfulness application Riliv. The intervention group was monitored through a WhatsApp group for 10 days. During this period, the researcher reminded participants through the WhatsApp group to perform the mindfulness intervention using the Riliv application at home. After the 10 day intervention period, participants in the intervention group were gathered for the posttest assessment using the Hamilton Anxiety Rating Scale (HARS) as the final evaluation. Participants were also asked to provide screenshots from the Riliv application as evidence that they had completed all 10 intervention sessions.

To ensure participants' adherence to the mindfulness intervention using the Riliv application, the researcher provided initial education regarding the purpose, benefits, and procedures for using the application. In addition, the researcher conducted daily monitoring through the WhatsApp group and reviewed the application usage history as an evaluation tool for adherence. Meanwhile, the control group received no intervention during the study period.

Data analysis included descriptive analysis of respondent characteristics. Bivariate analysis was conducted using the Shapiro–Wilk test for normality, homogeneity testing, paired t-test, independent t-test and analysis of score changes to test the research hypotheses. This study received ethical approval from the Health Research Ethics Committee of Universitas Muhammadiyah Kudus, with approval Number : 450/Z-7/KEPK/UMKU/XI/2025.

## RESULT

The study was conducted at the Prolanis program in Karangampel Village, Kaliwungu Subdistrict, Kudus Regency from 1 to 10 September 2025.

Table 1 Respondent Characteristics

Characteristic	Group				p
	Intervention (n=15)		Control (n=15)		
	f	%	f	%	
Age					
41- 50 years	2	(13.3%)	0	(0%)	0.882
51-60 years	3	(20.0%)	7	(46.7%)	
61-70 years	10	(66.7%)	8	(53.3%)	
Gender					
Female	14	(93.3%)	11	(73.3%)	0.327
Male	1	(6.7%)	4	(26.7%)	
Baseline Anxiety	18.27±2.73		18.27±2.73		1.00

Table 1 shows that there were no statistically significant differences between the intervention and control groups in terms of participants' characteristics. The age distribution was not significantly different between the two groups ( $p = 0.882$ ). Similarly, no significant difference was found in gender distribution ( $p = 0.327$ ). In addition, the baseline anxiety scores between the intervention and control groups were comparable, with no significant difference observed ( $p = 1.00$ ). Therefore, both groups were considered homogeneous and comparable at baseline prior to the intervention.

Table 2 Difference Test and Normality Test

Group	Mean	Median	SD	Min	Max	p value	Conclusion
<b>Intervention</b>							
Before	18.27	19.00	2.576	14	23	0.574	Normal
After	15.73	16.00	2.374	11	19	0.577	Normal
<b>Control</b>							
Before	18.27	18.00	2.658	14	23	0.625	Normal
After	18.67	19.00	2.920	14	23	0.381	Normal

Table 2 shows that in the intervention group before the mindfulness intervention, the mean anxiety score was 18.27 with a median of 19.00, a minimum score of 14, and a maximum score of 23. The normality test indicated that the data were normally distributed ( $p > 0.05$ ). After the mindfulness intervention, the mean anxiety score in the intervention group decreased to 15.73 with a median of 16.00, a minimum score of 11, and a maximum score of 19. The normality test also showed that the data remained normally distributed ( $p > 0.05$ ). Meanwhile, in the control group, the anxiety score had a mean of 18.27 with a median of 18.00, a minimum score of 14, and a maximum score of 23, and the data were normally distributed ( $p > 0.05$ ). In the subsequent measurement, the anxiety score in the control group increased, with a mean of 18.67 and a median of 19.00. The minimum score remained 14 and the maximum score remained 23, and the data were also normally distributed ( $p > 0.05$ ).

Tabel 3 Results of Anxiety Comparison Test

Category	n	Mean ± SD	Mean Difference ± SD	95% CI	t	p
Intervention						
Before	15	18.27 ± 2.576	2.533 ± 0.834	2.072 – 2.995	11.767	< 0.001
After	15	15.73 ± 2.374				
Control						
Before	15	18.27 ± 2.658	-0.400 ± 1.121	-1.021 – 0.221	-1.382	0.189
After	15	18.67 ± 2.920				
Anxiety						
Intervention	15	15.73 ± 2.374	-2.933 ± 0.972	(-4.924-0.943)	-3.019	0.005
Control	15	18.67 ± 2.920				

Table 3 shows that in the intervention group, the comparison of pretest and posttest data using the paired t-test revealed a significant difference, with a p-value of  $< 0.001$  ( $p < 0.05$ ). In contrast, in the control group, the paired t-test comparing pretest and posttest data did not show a significant difference, with a p-value of 0.189 ( $p > 0.05$ ). Furthermore, the independent t-test showed a statistically significant difference in posttest anxiety scores between the intervention group and the control group, with a p-value of 0.005 ( $p < 0.05$ ).

## DISCUSSION

### Anxiety Before and After the Intervention in the Control Group and Intervention Group

Based on the results of the study, the control group showed an increase in the mean anxiety score from 18.27 to 18.67. This indicates that the control group experienced a statistical increase in anxiety levels between the pretest and posttest measurements. These results are consistent with a study conducted by Dewi et al. (2024), which showed that the control group without a mindfulness intervention did not experience a reduction in anxiety, with the mean anxiety score increasing from 27.2 before the intervention to 28.13 after the intervention. This indicates that there was no decrease in the average anxiety score in the control group. Similar results were also shown by Babak et al. (2022), who stated that the absence of a mindfulness intervention resulted in minimal changes in anxiety levels.

The results in the control group showed that five participants experienced an increase in anxiety scores. The data suggest that increased anxiety was associated with cardiovascular symptoms. This was supported by questionnaire data, which revealed that five participants in the control group experienced an increase in cardiovascular items, specifically increased heart rate, and six participants experienced increased blood pressure. A previous study by Nurhidayat Ento et al. (2025) showed that 56 respondents (58.3%) who experienced anxiety had abnormal blood pressure.

Several factors may have contributed to the increase in anxiety levels in the control group, one of which is the respondents' age characteristics. The majority of respondents were in the age range of 61–70 years, totaling 8 individuals (53.3%). A study conducted by Raziansyah & Sayuti Muhammad (2022) also found that most respondents who experienced anxiety were aged 60–69 years, with 8 individuals (53.3%). Age is considered an important factor influencing the occurrence of anxiety, as older adults tend to be more sensitive to various situations. In addition, older adults are more vulnerable to emotional disturbances; therefore, increasing age is associated with a higher risk of experiencing anxiety and emotional problems (S. Aulia et al., 2023).

Another factor that influences anxiety is gender. The results of this study showed that the majority of respondents were female, with 11 individuals (73.3%). Similarly, a study conducted by Adelia & Supratman (2023) found that most respondents experiencing anxiety were women, totaling 28 individuals (75.7%). In terms of gender differences, anxiety disorders are reported to occur more frequently in women than in men, as women tend to be more sensitive to feelings of anxiety. Women also tend to perceive life events in greater detail, whereas men tend to view them in a more general or global manner (Ratri, 2024).

In contrast, the intervention group showed a decrease in the mean anxiety score from 18.27 to 15.73. This result is supported by a study conducted by Z. Aulia et al. (2025), which showed that among 20 older adults who participated in a mindfulness intervention, the mean anxiety score decreased from 39.55 to 34.6. After 14 days of mindfulness intervention, a reduction in anxiety levels among older adults was observed, as indicated by an increase in the number of participants with mild anxiety from 13 to 19, a decrease in those with moderate anxiety from 6 to 1, and the absence of participants with severe anxiety, which initially included one participant. Similar results were also described by Fadillah et al. (2025), who showed that anxiety levels in three patients were initially categorized as moderate anxiety before the intervention and decreased to mild anxiety after the intervention.

The results of this study indicate that the intervention group experienced a reduction in anxiety levels. This was supported by questionnaire data showing that 12 participants in the intervention group experienced a decrease in anxiety-related feelings, particularly feelings of worry and fear. These results are consistent with a study conducted by Rohmawati et al. (2020), which showed a reduction in anxiety levels in the intervention group. The study showed an increase in the number of participants who did not experience anxiety from 1 person (3.3%) to 8 people (26.7%), an increase in participants with mild anxiety from 10 people (33.3%) to 20 people (66.7%), and a decrease in participants with moderate anxiety from 19 people (63.3%) to 2 people (6.7%).

Physiological findings may also explain the role of mindfulness in reducing anxiety. Mindfulness can decrease sympathetic nervous system (SNS) activity by helping the body shift from a state of psychological stress to a more relaxed condition. Mindfulness may reduce anxiety symptoms by increasing body awareness, improving emotional regulation, and supporting better blood pressure control (Bubulac et al., 2025). The relaxation response associated with mindfulness is also related to a reduction in the hypothalamic–pituitary–adrenal (HPA) axis response. A decrease in HPA axis activity leads to lower levels of cortisol, adrenaline, and noradrenaline. In a relaxed state, the mind becomes calmer and anxiety levels decrease (Pujiati & Heriyanti, 2022). Furthermore, reduced cortisol levels following mindfulness interventions are associated with a decrease in anxiety symptoms such as restlessness, muscle tension, and excessive worrying. Mindfulness also involves a reduction in physiological responses, including heart rate, muscle tension, and breathing rate (Calderone et al., 2024).

### **Comparison of Anxiety Levels Between the Control Group and Intervention Group**

Based on the results of the study, the control group showed no statistically significant change in anxiety levels before and after the intervention, with a p-value of 0.189 ( $p > 0.05$ ). This result is supported by a meta-analysis conducted by Chen et al. (2024) entitled *Effect of Mindfulness-Based Interventions on People with Prehypertension or Hypertension*, which showed that control groups in various clinical trials did not experience a reduction in anxiety,

and anxiety symptoms even tended to increase when no psychological or relaxation intervention was provided. Similar results were also shown in a study by Kurniawati & Sari (2024) entitled *The Effect of Zikr Meditation on Anxiety, Stress Levels, and Blood Pressure in Hypertensive Patients*, in which the control group showed no meaningful change in anxiety levels.

In contrast, the intervention group showed a statistically significant change in anxiety levels before and after the intervention, with a p-value of  $< 0.001$  ( $p < 0.05$ ). This result is supported by a study conducted by Irawan et al. (2024) entitled *Effectiveness of Mindfulness in Alleviating Hypertension and Anxiety in Adult Patients*, which showed that the intervention group experienced a decrease in the mean anxiety score from 48.5 before the intervention to 28.9 after the intervention ( $p < 0.001$ ), indicating a statistically significant difference between pretest and posttest measurements. Similar results were also shown by Rismawati et al. (2022), who indicated a significant difference in post-intervention anxiety levels ( $p = 0.000$ ;  $p < 0.05$ ), suggesting that mindfulness was effective in reducing anxiety levels among older adults with hypertension in the intervention group.

The study results also indicated a statistically significant difference in anxiety levels between the intervention group and the control group, with a p-value of 0.005 ( $p < 0.05$ ). These results highlighted different outcomes between the two groups. The control group did not experience a significant change in anxiety levels because they were not provided with anxiety management strategies. In contrast, the intervention group, which received mindfulness intervention, experienced a reduction in anxiety levels. This is consistent with a study conducted by Safavi et al. (2025), which showed a statistically significant difference between the intervention group and the control group ( $p < 0.001$ ). According to Shen et al. (2023), mindfulness encourages individuals to focus on the present moment, become aware of sensations and emotions inside and outside the body, and approach these experiences with an open, nonjudgmental, and accepting attitude. When practiced regularly, mindfulness helps the body become more relaxed, reduces nervous system activity associated with anxiety, and promotes a calmer mental state. This is particularly beneficial for hypertensive patients who often experience physical symptoms such as palpitations or muscle tension, which may further increase anxiety.

Based on the study data, mindfulness showed an effect in reducing anxiety levels. This is consistent with a systematic review by Calderone et al. (2024) entitled *Neurobiological Changes Induced by Mindfulness and Meditation: A Systematic Review*, which stated that mindfulness and meditation consistently improve emotional regulation and brain structure, reduce anxiety, and enhance stress resilience. In addition, the results of this study are consistent with a study by Orosa-Duarte et al. (2021) entitled *Mindfulness-Based Mobile App Reduces Anxiety and Increases Self-Compassion in Healthcare Students: A Randomized Controlled Trial*. The study showed that the use of a mindfulness mobile application for four weeks significantly reduced anxiety compared to the control group and increased self-compassion. This supports the conclusion that mobile-based mindfulness interventions can be a method for reducing anxiety because they are flexible, easily accessible, and allow regular practice without time or location constraints.

This study indicates that the use of mobile-based mindfulness applications can support patients in practicing relaxation techniques independently, thereby improving psychological well-being and self-management among hypertensive patients. This study has limitations in the use of a WhatsApp group as a monitoring medium. This platform was selected to accommodate the respondents' conditions and the limitations encountered in the field. However, this approach

may allow variations in participants' levels of adherence that could not be fully controlled directly by the researchers.

## CONCLUSION

This study concludes that the Riliv mindfulness application showed positive outcomes in reducing anxiety among hypertensive patients. The mean anxiety score in the intervention group decreased from 18.27 before the intervention to 15.73 after the intervention, with a p-value of  $< 0.001$ , indicating a statistically significant difference. In contrast, in the control group, the mean anxiety score increased from 18.27 before the intervention to 18.67 after the intervention, with a p-value of 0.189, indicating no statistically significant difference. A statistically significant difference in anxiety levels was also observed between the intervention group and the control group, with a p-value of 0.005 ( $p < 0.05$ ).

This study found that the Riliv mindfulness app significantly reduced anxiety scores among hypertensive patients in the intervention group after 10 days. Further studies with larger samples, longer follow-up and stronger allocation procedures are needed.

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