

Association of Elderly Exercise Participation, Home Exercise Adherence, and Balance in Older Adults

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Abstract

Background: Ageing is associated with progressive declines in musculoskeletal, neurological, and sensory function, leading to impaired balance and an increased risk of falls. Participation in community-based elderly exercise programmes and adherence to prescribed home exercise may help maintain functional balance; however, evidence examining both factors simultaneously remains limited.

Objective: To determine the association between participation in elderly exercise programmes, home exercise adherence, and body balance among community dwelling older adults.

Methods: This analytical cross-sectional study included 30 community dwelling older adults recruited by purposive sampling from the Trisna Asih Integrated Health Post, Semarang, Indonesia. Participation in elderly exercise programmes and home exercise adherence were assessed using a modified Exercise Adherence Rating Scale, while balance was evaluated using the Berg Balance Scale. Spearman's rank correlation was applied because the variables were not normally distributed. Confidence intervals were unavailable in the original dataset.

Results: High participation in elderly exercise programmes was observed in 17 participants (56.7%), and 15 (50.0%) demonstrated high home exercise adherence. Eighteen participants (60.0%) were classified as having a low risk of falls. Elderly exercise participation was strongly associated with body balance ($r = 0.915$, $p < 0.001$), as was home exercise adherence ($r = 0.883$, $p < 0.001$).

Conclusion: Greater participation in elderly exercise programmes and higher adherence to home exercise were significantly associated with better balance among older adults. Integrating supervised community exercise with regular home exercise may support fall prevention and maintenance of functional independence.

Keywords

Aged; Exercise Therapy; Patient Compliance; Postural Balance; Accidental Falls

Introduction

Population ageing has become one of the most important demographic transitions worldwide, creating substantial challenges for healthcare systems because of the increasing prevalence of chronic diseases, disability, and functional decline among older adults. Declining physiological function associated with ageing affects multiple body systems, resulting in reduced mobility, impaired independence, and lower quality of life. Among these age-related changes, impaired postural balance is particularly important because it directly influences an individual's ability to perform daily activities safely and independently. Balance impairment also increases the likelihood of falls, which remain a leading cause of injury, hospitalization, disability, and mortality among older adults. Consequently, maintaining balance has become a major objective of physiotherapy and community based health promotion programmes.^{1,2}

The deterioration of balance in older adults is a multifactorial process involving progressive changes in the musculoskeletal, neurological, and sensory systems. Age related sarcopenia, reduced muscle strength, impaired proprioception, slower neuromuscular responses, decreased joint flexibility, and deterioration of visual and vestibular function collectively compromise postural control.³ These physiological alterations reduce the ability to maintain stability during both static and dynamic activities, thereby increasing susceptibility to falls. Beyond the immediate physical consequences, falls frequently result in fractures, fear of falling, loss of confidence, reduced participation in social activities, institutionalization, and greater healthcare utilization. Therefore, interventions aimed at preserving balance are essential for supporting healthy ageing and maintaining functional independence.^{4,5}

Falls represent a major public health problem worldwide. Approximately one third of adults aged 65 years and older experience at least one fall annually, with the incidence increasing further in more advanced age groups. In Indonesia, falls contribute substantially to morbidity and functional limitations among older adults, highlighting the need for effective prevention strategies that can be implemented at the community level. As the older adult population continues to increase, identifying modifiable factors associated with better balance has become increasingly important for physiotherapists and primary healthcare providers seeking to reduce fall related disability.^{6,7}

Regular physical exercise is widely recognized as one of the most effective non pharmacological interventions for maintaining physical function in older adults. Exercise enhances lower extremity muscle strength, flexibility, coordination, proprioception, and neuromuscular control, all of which contribute to improved postural stability and reduced fall risk.⁸ Community based elderly exercise programmes provide structured opportunities for older adults to engage in supervised physical activity while also promoting social interaction and long term participation. Recent systematic reviews have demonstrated that multicomponent

exercise programmes incorporating balance, strengthening, and functional training significantly improve balance performance and reduce fall incidence among community dwelling older adults.^{8,9,10}

Although supervised exercise programmes provide important clinical benefits, exercise performed only during scheduled sessions may be insufficient to achieve sustained functional improvement. Consequently, home exercise programmes are commonly prescribed to extend therapeutic activity beyond supervised sessions. Regular home exercise increases exercise frequency, reinforces motor learning, and supports long term maintenance of functional capacity. However, the effectiveness of home exercise depends largely on adherence. Older adults with poor adherence may fail to achieve the intended therapeutic benefits despite receiving appropriate exercise prescriptions. Exercise adherence is influenced by numerous behavioural and environmental factors, including motivation, self efficacy, family support, perceived benefits, health literacy, and accessibility of exercise programmes. Therefore, understanding the contribution of home exercise adherence to balance performance has important implications for physiotherapy practice.^{11,12}

Accurate assessment of exercise adherence and balance requires standardized measurement instruments with acceptable psychometric properties.¹³ The Exercise Adherence Rating Scale (EARS) has been widely used to evaluate adherence to prescribed exercise programmes in rehabilitation settings, whereas the Berg Balance Scale (BBS) remains one of the most extensively validated clinical instruments for assessing functional balance and fall risk among older adults. In the present study, a modified version of the EARS was used. However, the original research documentation did not report the cultural adaptation process or psychometric evaluation of the modified instrument. This methodological limitation should be considered when interpreting the findings and addressed in future studies.^{14,15}

Previous studies have shown that participation in elderly exercise programmes is associated with improved balance, while other studies have demonstrated beneficial effects of home exercise adherence on functional mobility and postural stability. Nevertheless, most published investigations have examined these factors separately or have primarily focused on intervention effectiveness rather than evaluating the simultaneous association between participation in supervised community exercise and adherence to home exercise within the same population. Evidence addressing both behavioural factors concurrently remains limited, particularly in Indonesian community based elderly health services. This gap restricts a comprehensive understanding of how supervised and independent exercise behaviours jointly relate to balance outcomes in older adults.^{16,17}

The Trisna Asih Integrated Health Post in Kramas Village, Tembalang District, Semarang City routinely conducts elderly exercise programmes while encouraging participants to continue prescribed exercises independently at home. This setting provides an opportunity to examine whether participation in supervised community exercise and adherence to home exercise are associated with body balance among community dwelling older adults. Therefore, this study aimed to determine the association between participation in elderly exercise programmes, home exercise adherence, and body balance among older adults attending the Trisna Asih Integrated Health Post. It was hypothesized that greater participation in elderly exercise programmes and higher adherence to home exercise would be associated with better balance performance.

Methods

This analytical observational study employed a cross sectional design to examine the association between participation in elderly exercise programmes, home exercise adherence, and body balance among community dwelling older adults. The study was conducted at the Trisna Asih Integrated Health Post (Posyandu Lansia Trisna Asih), Kramas Village, Tembalang District, Semarang City, Indonesia. Data collection was performed during the approved study period after administrative permission had been obtained from the relevant authorities. The study design was selected because it enabled simultaneous assessment of the exposure and outcome variables within the target population without intervention.

The target population consisted of older adults registered at the Trisna Asih Integrated Health Post. Participants were recruited using purposive sampling based on predefined eligibility criteria, resulting in a final sample of 30 participants. According to the original research documentation, no formal sample size calculation or statistical power analysis was performed. Therefore, the final sample represented all eligible participants who met the selection criteria and agreed to participate during the study period. Because no sample size justification was available in the original documents, none has been added in this revision to preserve the integrity of the original study. This limitation should be considered when interpreting the findings and their generalizability.

Eligible participants were older adults registered at the Trisna Asih Integrated Health Post who voluntarily agreed to participate and provided written informed consent before data collection. Participants were also required to communicate effectively and complete all study assessments independently. Individuals who were unable to complete the assessment procedures or who did not satisfy the study eligibility criteria were excluded from the analysis. The original study protocol did not specify detailed exclusion criteria related to cognitive impairment, neurological disease, vestibular disorders, severe musculoskeletal conditions, dependence on walking aids, or other major comorbidities. Consequently, these criteria cannot be added retrospectively because they were not documented in the original research protocol.

The independent variables were participation in elderly exercise programmes and home exercise adherence, whereas body balance served as the dependent variable. Owing to the observational nature of the study, several factors, including age, comorbidities, habitual physical activity, nutritional status, medication use, cognitive function, and functional capacity, could potentially influence balance performance. However, these variables were not analysed as covariates because the original study was designed as a bivariate correlation analysis with a relatively small sample. Therefore, they are acknowledged as potential confounding factors during interpretation rather than variables controlled statistically.

Participation in elderly exercise programmes and home exercise adherence were measured using a modified Exercise Adherence Rating Scale (EARS). The modified instrument consisted of six behavioural items evaluating attendance at elderly exercise sessions, adherence to prescribed exercise movements, exercise intensity, exercise frequency, independent home exercise performance, and allocation of time for home exercise. Each item was scored using a four point Likert scale ranging from 0 (never) to 3 (always), producing a total score between 0 and 18, with higher scores indicating greater adherence. Total scores were categorized as low (<8), moderate (8 to 13), and high (14 to 18). The original EARS is an internationally recognized instrument for evaluating adherence to prescribed exercise programmes.¹⁸ However, the original study did not report the process of cultural adaptation, content validation, construct validation, internal consistency, or reliability testing of the modified six item version used in this study. Accordingly, the psychometric properties of the modified instrument remain unknown and should be established in future investigations.

Body balance was assessed using the Berg Balance Scale (BBS), which is one of the most widely accepted clinical outcome measures for evaluating functional balance and fall risk in older adults. The BBS comprises fourteen functional tasks representing

both static and dynamic balance, with each item scored from 0 to 4 and a maximum total score of 56. Higher scores indicate better balance performance and a lower risk of falls. The BBS has demonstrated excellent validity and reliability in geriatric populations and therefore was considered an appropriate outcome measure for this study.¹³

Data collection began with recording participants' demographic characteristics, including age, sex, and educational level. Participants subsequently completed the modified EARS questionnaire under researcher supervision to ensure complete responses and minimize missing data. Body balance was then evaluated using the standardized BBS assessment during the same session. All measurements were recorded on standardized data collection forms before being entered into the study database. Prior to statistical analysis, the dataset was reviewed for completeness, coding accuracy, and missing values. No missing observations were identified among the 30 participants. The original study documents did not describe a formal procedure for identifying or handling outliers; therefore, no additional information regarding outlier management has been introduced in this revised manuscript.

The overall research procedure is illustrated in Figure 1. The flowchart summarizes participant recruitment, eligibility assessment, informed consent, data collection, statistical analysis, and interpretation of the findings, thereby providing an overview of the methodological sequence used throughout the study.

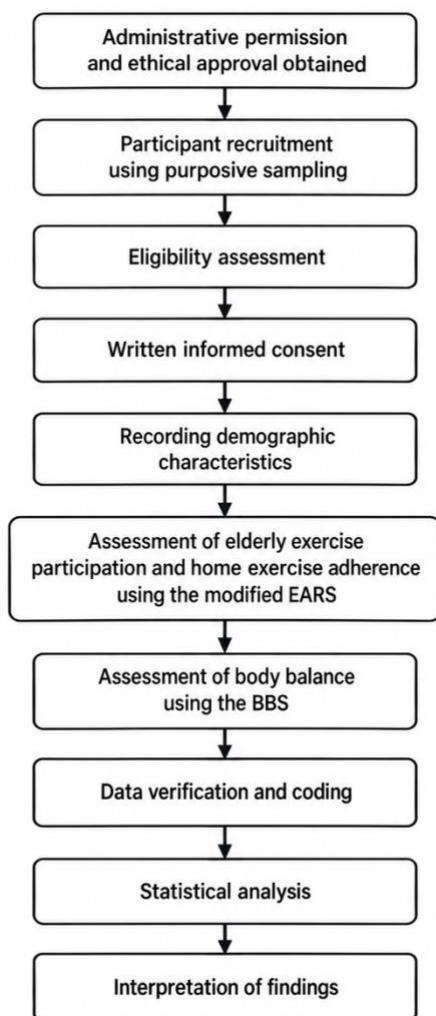


Figure 1. Research Flowchart

The statistical analysis was performed using IBM SPSS Statistics. However, the software version was not reported in the original research documents and therefore should be added by the authors before manuscript submission. Descriptive statistics were used to summarize participant characteristics and study variables as frequencies and percentages. The Shapiro Wilk test was applied to assess data normality because the sample size was fewer than 50 participants.¹⁹ Since all variables demonstrated non normal distributions ($p < 0.05$), Spearman's rank correlation was selected to evaluate the associations between participation in elderly exercise programmes, home exercise adherence, and body balance. Statistical significance was established at $p < 0.05$, and the correlation coefficient was interpreted as the magnitude of association. Confidence intervals for the correlation coefficients were unavailable in the original statistical output and therefore could not be reported in this revised manuscript without access to the raw dataset.

Ethical principles, including voluntary participation, confidentiality, anonymity, and written informed consent, were implemented throughout the study. According to the original research documentation, ethical clearance had been obtained before participant recruitment. However, the name of the ethics committee, ethical approval number, and approval date were not reported in the manuscript or accompanying documents. These details should be added by the authors before journal submission because they cannot be reconstructed without the original ethical approval certificate.

Results

A total of 30 community dwelling older adults participated in this study, and all participants completed the assessments without missing data. The results are presented sequentially according to the study objectives, beginning with participant characteristics, followed by the distribution of elderly exercise participation, home exercise adherence, body balance, assessment of data normality, and correlation analyses. Participant characteristics are presented in Table 1 to describe the demographic profile of the study population.

Table 1. Demographic Characteristics of Participants (n = 30)

Variable	Category	n	%
Age (years)	45–59	9	30.0
	60–69	18	60.0
	≥70	3	10.0
Sex	Female	30	100.0
	Male	0	0.0
Education	Primary school	23	76.7
	Junior high school	1	3.3
	Senior high school	6	20.0

Most participants were aged 60–69 years (60.0%), and all participants were female. Regarding educational attainment, primary school education was the most common level (76.7%), followed by senior high school (20.0%) and junior high school (3.3%). These findings indicate that the study population was relatively homogeneous in terms of sex and educational background. The distribution of participation in elderly exercise programmes is presented in Table 2.

Table 2. Participation in Elderly Exercise Programmes (n = 30)

Participation level	n	%
High	17	56.7
Moderate	9	30.0
Low	4	13.3
Total	30	100.0

More than half of the participants (56.7%) demonstrated high participation in elderly exercise programmes, whereas 30.0% and 13.3% were categorized as having moderate and low participation, respectively. The original statistical output reported a mean participation score of 14.73, with observed scores ranging from 7 to 18. However, the standard deviation was unavailable in the original dataset and therefore could not be reported. Home exercise adherence is summarized in Table 3.

Table 3. Home Exercise Adherence (n = 30)

Adherence level	n	%
High	15	50.0
Moderate	11	36.7
Low	4	13.3
Total	30	100.0

Half of the participants demonstrated high adherence to home exercise (50.0%), whereas 36.7% and 13.3% showed moderate and low adherence, respectively. The mean adherence score was 14.40, with observed values ranging from 7 to 18. Standard deviation was unavailable in the original statistical report. Body balance was evaluated using the Berg Balance Scale (BBS), and the distribution of balance categories is presented in Table 4.

Table 4. Body Balance Classification Based on the Berg Balance Scale (n = 30)

Balance category	n	%
Low fall risk	18	60.0
Moderate fall risk	8	26.7
High fall risk	4	13.3
Total	30	100.0

Most participants (60.0%) were classified as having a low risk of falls, whereas 26.7% and 13.3% were categorized as having moderate and high fall risk, respectively. The original analysis reported a mean Berg Balance Scale score of 45.97, with observed values ranging from 16 to 56. The corresponding standard deviation was unavailable in the original statistical output. The associations between participation in elderly exercise programmes, home exercise adherence, and body balance were analysed using Spearman's rank correlation. The results are presented in Table 5.

Table 5. Spearman's Rank Correlation Between Study Variables

Independent variable	Dependent variable	Spearman's <i>r</i>	<i>p</i> value
Elderly exercise participation	Body balance	0.915	<0.001
Home exercise adherence	Body balance	0.883	<0.001

Participation in elderly exercise programmes demonstrated a statistically significant very strong positive association with body balance ($r = 0.915$, $p < 0.001$). Likewise, home exercise adherence was significantly associated with body balance ($r = 0.883$, $p < 0.001$). These findings indicate that greater participation in supervised elderly exercise programmes and higher adherence to prescribed home exercise were associated with better balance performance among the study participants. Confidence intervals for the correlation coefficients were unavailable because they were not included in the original statistical output.

Discussion

The present study demonstrated that participation in elderly exercise programmes and adherence to home exercise were both significantly associated with body balance among community dwelling older adults. Elderly exercise participation exhibited a very strong positive association with body balance ($r = 0.915$, $p < 0.001$), while home exercise adherence also showed a very strong

positive association ($r = 0.883$, $p < 0.001$). These findings support the study hypothesis and indicate that older adults who participate more consistently in structured community exercise and adhere more closely to prescribed home exercise tend to demonstrate better balance performance. Nevertheless, because this study employed a cross sectional design, these findings should be interpreted as evidence of association rather than causation.

The observed association between participation in elderly exercise programmes and body balance is biologically plausible. Ageing is accompanied by progressive reductions in muscle strength, flexibility, proprioceptive function, reaction time, and neuromuscular coordination, all of which contribute to impaired postural control. Regular participation in structured exercise provides repeated stimulation of the musculoskeletal and neuromotor systems, thereby improving lower extremity strength, sensory integration, movement coordination, and postural stability. Collectively, these physiological adaptations enable older adults to maintain equilibrium more effectively during functional activities and may reduce the likelihood of falls. The findings of the present study therefore support the established role of exercise as an important component of healthy ageing and fall prevention^{1,2}

The present findings are consistent with previous studies reporting that multicomponent exercise programmes improve balance performance and decrease fall risk among community dwelling older adults. Systematic reviews have demonstrated that interventions combining balance training, muscle strengthening, flexibility exercises, and functional task practice produce clinically meaningful improvements in postural stability and mobility. Likewise, current international recommendations advocate structured exercise as a primary non pharmacological strategy for preventing falls because of its effectiveness in maintaining functional independence and reducing disability in older adults. These findings collectively reinforce the importance of implementing structured exercise programmes as part of routine community based physiotherapy services.^{4,5,6}

Home exercise adherence also demonstrated a very strong positive association with body balance, suggesting that exercise behaviour outside supervised sessions contributes substantially to functional outcomes. Home exercise increases the total volume and frequency of therapeutic activity, reinforces motor learning, and facilitates continuous neuromuscular adaptation beyond scheduled community exercise sessions. Consequently, consistent adherence enables older adults to maintain the physiological benefits achieved during supervised exercise while promoting long term improvements in balance and mobility. These findings emphasize that prescribing home exercise alone may be insufficient unless accompanied by strategies that encourage sustained adherence.^{7,8}

Previous investigations have likewise demonstrated that older adults who consistently adhere to prescribed home exercise programmes experience greater improvements in balance, lower extremity strength, gait performance, and functional mobility than individuals with poor adherence.²⁰ However, adherence is a multidimensional behaviour influenced by motivation, self efficacy, family support, perceived benefits, educational level, accessibility of exercise programmes, and professional supervision. Therefore, physiotherapists should not only prescribe appropriate exercises but also implement behavioural strategies that enhance adherence through patient education, regular monitoring, family involvement, and individualized follow up.²¹ Such comprehensive management may optimize rehabilitation outcomes and improve long term functional independence among older adults^{9,10}

An important methodological consideration is the exceptionally high correlation coefficients observed in the present study. Correlation coefficients of 0.915 and 0.883 are considerably larger than those commonly reported in observational studies and therefore warrant careful interpretation. Several factors may explain these findings without necessarily indicating an unusually large biological effect. First, the study population was relatively homogeneous because all participants were female and were recruited from a single community-based elderly health programme. Such homogeneity may reduce variability between participants and consequently increase correlation coefficients. Second, participation in elderly exercise programmes and home exercise adherence were both assessed using self-reported behavioural measures, whereas balance assessment was conducted during the same evaluation period, creating the possibility of common method bias. Third, the relatively small sample size may have produced less stable correlation estimates than would be expected in larger epidemiological studies. Accordingly, these findings should be interpreted cautiously until replicated in larger and more heterogeneous populations.^{11,12}

Several potential confounding factors should also be considered. Variables such as age, chronic diseases, nutritional status, medication use, cognitive function, habitual physical activity, and previous fall history are recognized determinants of balance performance.²² However, these variables were not included in the statistical model because the original study was designed as a simple bivariate correlation analysis. Consequently, residual confounding cannot be excluded, and the observed associations should not be interpreted as independent effects. Future investigations should incorporate larger sample sizes together with multivariable analytical approaches to evaluate the relative contribution of each factor while minimizing confounding bias.¹¹

From a clinical perspective, the findings support the integration of supervised community-based exercise with structured home exercise programmes as complementary components of physiotherapy management. Supervised exercise provides professional guidance, movement correction, motivation, and social interaction, whereas home exercise extends therapeutic activity into daily life and facilitates long term behavioural maintenance. Combining these approaches may improve adherence, sustain physiological adaptation, and ultimately preserve balance and functional independence among older adults. Such integrated programmes may also represent an efficient strategy for strengthening community-based rehabilitation services within primary healthcare settings.¹⁴

Several limitations should be acknowledged when interpreting the present findings. The cross-sectional design precludes conclusions regarding temporal or causal relationships. The relatively small sample recruited from a single community health post limits external validity, while the inclusion of only female participants further restricts generalizability to the broader older adult population. In addition, the modified Exercise Adherence Rating Scale used in this study was not accompanied by evidence regarding cultural adaptation, validity, or reliability, and confidence intervals for the reported correlation coefficients were unavailable in the original statistical output. These methodological limitations should be addressed in future studies through multicentre recruitment, larger sample sizes, longitudinal or experimental designs, formal psychometric evaluation of modified instruments, and more comprehensive statistical reporting.¹⁵

Conclusion

This study demonstrated significant positive associations between participation in elderly exercise programmes, home exercise adherence, and body balance among community dwelling older adults attending the Trisna Asih Integrated Health Post. Older adults who participated more actively in structured elderly exercise programmes and demonstrated higher adherence to prescribed home exercise tended to exhibit better balance performance. Among the two independent variables, participation in elderly exercise programmes showed the strongest association with body balance. These findings support the importance of maintaining

regular participation in supervised community exercise while encouraging consistent home exercise to preserve functional balance in older adults.

Although the findings cannot establish causal relationships because of the cross-sectional design, they provide evidence that exercise participation and adherence are important behavioural factors associated with balance performance in community dwelling older adults. These results may assist physiotherapists and primary healthcare providers in designing comprehensive exercise programmes that combine supervised community exercise with structured home exercise to promote functional independence and support fall prevention in ageing populations. Future studies should include larger and more diverse populations, employ longitudinal or experimental designs, control for potential confounding variables, and report complete psychometric and statistical information to strengthen the methodological quality and generalizability of the evidence.

Study Limitations

Several limitations should be considered when interpreting the findings of this study. First, the cross-sectional design precludes the establishment of temporal or causal relationships between participation in elderly exercise programmes, home exercise adherence, and body balance. Second, the relatively small sample size and recruitment from a single community health post limit the external validity of the findings. Third, all participants were female, thereby restricting the generalizability of the results to broader older adult populations. Fourth, the modified Exercise Adherence Rating Scale used in this study was not accompanied by documentation regarding cultural adaptation, validity, reliability, or other psychometric properties. Finally, several methodological details, including sample size calculation, confidence intervals for the correlation coefficients, standard deviations of descriptive statistics, the statistical software version, and complete ethical approval information, were unavailable in the original research documents and therefore could not be added during manuscript revision without access to the original dataset or supporting records. These limitations should be addressed in future research.

Clinical Implications

The findings of this study have several practical implications for physiotherapy and community-based elderly healthcare services. Physiotherapists should encourage regular participation in supervised elderly exercise programmes while simultaneously promoting adherence to individualized home exercise programmes as complementary strategies for maintaining balance and reducing fall risk.²³ Community health centres and integrated health posts may also strengthen follow up, patient education, family involvement, and adherence monitoring to improve long term participation in prescribed exercise. Integrating supervised exercise with structured home exercise may represent a feasible and cost-effective approach to supporting healthy ageing, preserving functional independence, and reducing the burden of falls among community dwelling older adults.²⁴

Author Contribution

Sonaji: Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Writing Original Draft, Visualization.

Deasy Virka Sari: Conceptualization, Methodology, Supervision, Validation, Writing Review and Editing.

Mianti Nurrisy Sutejo: Methodology, Validation, Supervision, Writing Review and Editing.

Ragil Aidil Fitriasari Addini: Validation, Formal Analysis, Writing Review and Editing.

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Conflict of Interest Statement

The authors declare that there are no conflicts of interest regarding the publication of this article.

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Ethics Statement

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Ethical approval was obtained before participant recruitment. All participants provided written informed consent prior to enrollment in the study. However, the ethics committee name, approval number, and approval date should be added before journal submission because these details are not reported in the manuscript.

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