

The effect of rhythmic exercise on balance performance in children with mental retardation

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Abstract

This study aims to demonstrate the effect of rhythmic exercise on improving static balance in children with mental retardation. The study employed a quantitative method with a pretest-posttest control group design. A total of 12 children with mental retardation, aged 10-12 years, participated in the study. Subjects were randomly divided into two groups: the control group (CG, n=6) and the rhythmic exercise group (RE, n=6). The rhythmic exercise intervention was conducted with a duration of 20-30 minutes per session, at a light to moderate intensity, three times a week for four weeks. Static balance was measured using the Stork Balance Stand Test, conducted pre-exercise and post-exercise. Data analysis techniques included the paired sample t-test with a significance level of 5%. The results showed the average static balance in the CG and RE between pre-exercise and post-exercise (12.89 ± 1.74 vs 13.16 ± 2.05 seconds, $p \geq 0.05$), and (13.24 ± 1.39 vs 21.03 ± 1.62 seconds, $p \leq 0.001$). The findings indicate that the rhythmic exercise intervention conducted over four weeks was effective in improving static balance in children with mental retardation.

Keywords: Children With Special Needs; Static Balance; Mental Retardation; Rhythmic Exercise

1. Introduction

In the context of special education and rehabilitation therapy, balance plays a critical role as the foundation for the development of motor skills and executive functions in children with mental retardation. Optimal balance is not only essential for the execution of complex motor tasks but also contributes to the enhancement of social participation capacity and individual independence (Horvat, Ray, & Croce, 2005). Recent studies have shown that interventions such as physical therapy, virtual reality, and rhythm-based exercises can provide significant benefits in improving balance in individuals with neurological disorders, including those with mental retardation (Alashram et al., 2020). Adi et al. (2023) demonstrated that core strengthening exercise therapy with pelvic Proprioceptive Neuromuscular Facilitation (PNF) can improve balance in post-stroke hemiparesis patients. This study offers a new perspective on the potential of similar interventions in improving balance in children with mental retardation. Therefore, research that delves into interventions that can improve balance performance in this population has significant value, not only in a clinical context but also in social and emotional empowerment.

Rhythmic exercise, defined as physical activity that combines elements of music and coordinated movement, has shown potential as an effective therapeutic medium. Previous studies have indicated that rhythmic exercise can facilitate neuromuscular synchronization and enhance cognitive abilities related to planning and executing movements (Taghi Pour Javan, 2011; Zolghadr, 2019). However, there is debate in the literature regarding the extent to which rhythmic exercise is effective. Some studies have found that rhythmic exercise can improve attention and motor skills in children

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with mental retardation, while other studies show mixed results, with some interventions failing to improve dynamic and static balance (Klavina & Jekabsone, 2008; Dana et al., 2022).

This research is designed to fill that knowledge gap by investigating the impact of rhythmic exercise on the performance of static and dynamic balance in children with mental retardation. Based on the study by Arya Gilang Permana et al. (2022), which found that balance board technology can improve postural stability in children through exercises that support muscle performance and complex sensory system coordination. Through a rigorous empirical approach, this study will test the hypothesis that rhythmic exercise can provide significant improvements in balance performance compared to conventional intervention methods. The research methodology is designed to adopt standardized and psychometrically validated balance measurement instruments, along with an experimental design that allows for variable control and systematic hypothesis testing.

The main goal of this study is to explore and empirically prove that rhythmic exercise can provide a significant improvement in static balance in children with mental retardation. It is hoped that the results of this study will make a meaningful contribution to pedagogical and therapeutic practices, as well as pioneer the development of more innovative and effective intervention programs. Thus, this research aims not only to enrich the academic literature but also to offer practical solutions that can be relied upon to improve the quality of life of children with mental retardation.

2. Material and methods

This study employed a quantitative method with a pretest-posttest control group design. A total of 12 children with mental retardation, aged 10-12 years, were involved in this research. Subject selection was done using consecutive sampling technique, while the division of subjects into groups was done randomly. Subjects were randomly divided into two groups: the control group (CG, n=6), and the rhythmic exercise group (RE, n=6). Before participating, all subjects were informed about the research and parents or guardians provided informed consent before starting the intervention program. All procedures in this study received approval from the Health Research Ethics Committee, Faculty of Medicine, Universitas Brawijaya with number: 260/EC/KEPK-S1/09/2019.

The rhythmic exercise intervention was conducted with a duration of 20-30 minutes per session, light to moderate intensity, frequency 3 times a week for 4 weeks. Static balance measurement used the Stork Balance Stand Test conducted pre-exercise and post-exercise (Rahman et al., 2017). The static balance measurement ratings include: (1) Excellent (≥ 50 seconds), (2) Good (40-50 seconds), (3) Average (25-39 seconds), (4) Fair (10-24 seconds), and (5) Poor (≤ 10 seconds) (Rahman et al., 2017).

Data analysis techniques used descriptive tests, normality tests with the Shapiro–Wilk test, difference tests with paired sample t-tests and independent sample t-tests. Meanwhile, effect size evaluation using Cohen's d and Cohen's classified effect sizes as small ($d = 0.2$), medium ($d = 0.5$), and large ($d \geq 0.8$) (Wiriawan et al., 2024). All statistical analyses were performed with SPSS version 21. Data were declared to have a significant difference if $p \leq 0.05$.

3. Results

The results of the static balance analysis between pre-exercise and post-exercise for each group are presented in Figure 1. Meanwhile, Figure 2 presents the data from the analysis of the differences in static balance between the control group (CG) and the rhythmic exercise group (RE) in the observations pre-exercise, post-exercise, delta (pre – post), and change from pre.

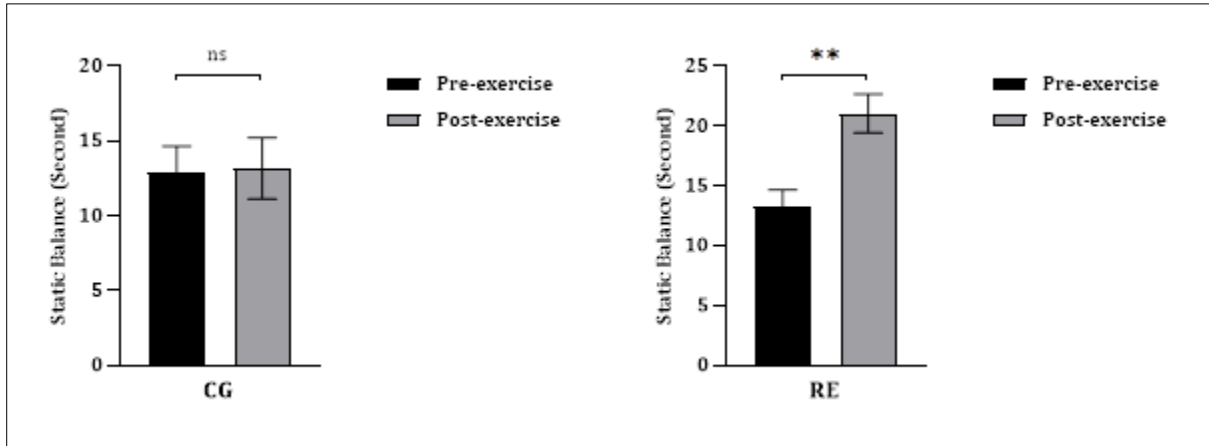


Figure 1 Results of the static balance analysis between pre-exercise and post-exercise in both groups

Description: (**) Significantly different from pre-exercise in RE ($p < 0.001$). (ns) Not significantly different from pre-exercise in CG ($p \geq 0.05$). the p-Value obtained with paired sample t-test.

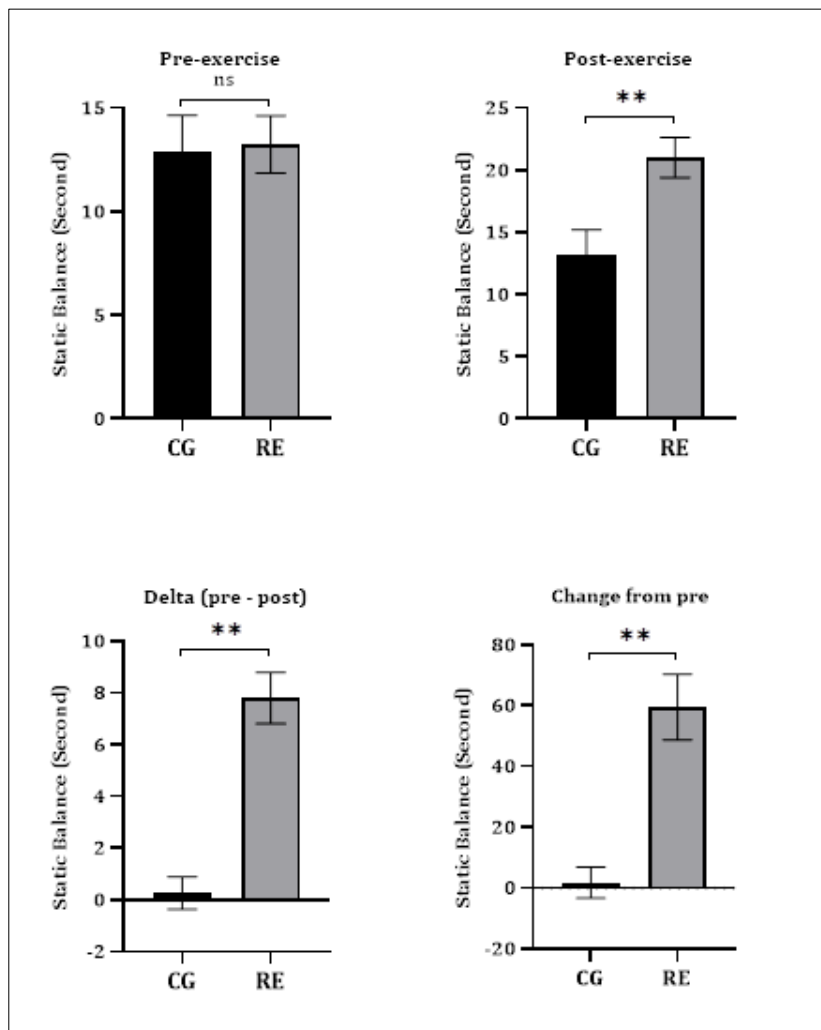


Figure 2 Differences in static balance pre-, post-, delta, and change from pre-exercise in both groups

Description: (**) Significantly different from CG ($p \leq 0.001$). (ns) Not significantly different from CG ($p \geq 0.05$). p-Value obtained with independent sample t-test.

4. Discussion

This study aims to determine the effect of rhythmic exercise on the balance level in children with intellectual disabilities. Our results indicate that a four-week intervention of rhythmic body movement has a positive effect in improving balance in children with intellectual disabilities. These results provide evidence supporting the use of rhythmic exercise as part of a therapeutic program to enhance motor skills in this population, which is a strong point of this study. Improved balance is an important indicator for independence and social participation of children with intellectual disabilities, and this improvement can have a long-term impact on their quality of life (Zhao et al., 2024). These results are consistent with those by Xu et al. (2020), who stated that a combination of rhythmic movements can foster a sense of balance in children; children acquire dynamic balance through dynamic shifting.

Balance is an important aspect of motor development and can affect a child's ability to participate in daily and social activities. Children with intellectual disabilities often have difficulties with balance and coordination, which can limit their independence (Andželina Wolan-Nieroda et al., 2023). Therefore, interventions that can improve balance are very important and have significant value in the context of special education and rehabilitation therapy. A case study by Adi et al. (2023) shows the effectiveness of core strengthening exercise therapy with pelvic PNF in improving balance in post-stroke hemiparesis patients, which can provide valuable insights for similar interventions in children with intellectual disabilities.

The rhythmic body movement intervention implemented in this study involves structured and rhythmic movements, which not only help in improving balance but can also facilitate neuromuscular synchronization and enhance cognitive abilities. This exercise can be performed with or without music and can be tailored to meet the individual needs of the child, demonstrating the flexibility and adaptability of the intervention method (Yang et al., 2022).

The effectiveness of this intervention can be attributed to several factors. Rhythmic movements can help in strengthening the muscles required for balance (Esteban-García et al., 2021), while these exercises can also increase proprioceptive awareness, which is the body's awareness of position and movement. Enjoyable and engaging rhythmic exercises also increase the motivation and participation of children in therapy, which is a key aspect of a rigorous empirical approach (Chan et al., 2022).

Although the results are promising, this study has several limitations that need to be considered. The limited duration of the intervention to four weeks may not be sufficient to assess the long-term effects of the exercises. The small sample size may limit the ability to generalize the results to a broader population. Individual variability in the level of intellectual disability may affect individual responses to the intervention. Without a strong control group, it is difficult to determine whether the improvement in balance is exclusively caused by the rhythmic body movement intervention or other factors. It is important to note that further research is needed to explore the optimal duration of intervention, exercise frequency, and the most effective combination of specific movements. Additionally, further research can help understand how this intervention can be adapted for children with various levels of intellectual disability and other special needs.

5. Conclusion

Based on the research results, it is concluded that the rhythmic body movement intervention conducted over 4 weeks has been proven effective in improving the balance of children with mental retardation. Based on the research results, it is recommended that rhythmic exercise intervention can be an alternative therapy in improving the static balance of children with mental retardation.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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