Research Paper

Effect of Using Wii Balance Board on Functional Balance of Children With Ataxic Cerebral Palsy

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Objective Ataxic cerebral palsy accounts for 5%-10% of the population with cerebral palsy. This palsy is characterized by poor balance and coordination, clumsiness, and involuntary tremor. As a result, balance training is one of the essential parts of the rehabilitation programs for children with ataxic cerebral palsy. Wii Balance Board (WBB) is an efficient tool for balance training in children with different physical problems, including cerebral palsy. This study aims to assess the effect of WBB-based balance training on functional balance and the persistence of its effect two months after the intervention in children with ataxic cerebral palsy.

Materials & Method This is a single-case study with a pre-test, post-test and follow-up design conducted on 3 children (2 girls and 1 boy) with ataxic cerebral palsy (Mean±SD age=10.56±1.09 years). They were classified at levels I and II of the gross motor function classification system. They received conventional occupational therapy three sessions per week, each for 45 minutes in the baseline and follow-up phases. In the intervention phase, each session consisted of 25 minutes of routine rehabilitation followed by 20 minutes of WBB-based balance training for 3 months (12 hours). The changes were evaluated by the Pediatric Balance Scale (PBS) and Timed Up And Go (TUG) test, three times in the baseline phase, three times in the intervention phase (at the end of 12th, 24th, and 36th sessions), and two times in the follow-up phase (one and two months after the intervention). Assessments were done by a pediatric occupational therapist who was unaware of the study process. Finally, the results were analyzed using the Percentage of Nonoverlapping Data (PND), 2 Standard Deviations (2SD), Hedges’s g, and the visual analysis method.

Results The results of the PBS and TUG test showed the improvement of functional balance in all children in the intervention phase and maintained in the follow-up phase. The PND of PBS and TUG test results was 100% for all children, indicating that balance training by the WBB improved functional balance in the intervention and follow-up phases compared to the baseline. Hedges’ g value for all participants was more than 0.8, indicating a significant difference between the baseline and follow-up phases. The 2SD results showed a significant increase in the PBS score and a significant reduction in the TUG test duration in all children. Furthermore, the visual analysis revealed a significant improvement in the functional balance of all children in the intervention phase and the stability of these changes in the follow-up phase.

Conclusion Balance training by the WBB is an effective method for improving the functional balance of children with ataxic cerebral palsy. Further studies are needed using a larger sample size to confirm its effectiveness.

ABSTRACT

Keywords: Cerebral palsy, Functional balance, Ataxic cerebral palsy, Virtual reality, Wii balance board

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Extended Abstract

Introduction

Ataxic cerebral palsy, which accounts for 5%–10% of the patients with cerebral palsy [1], is caused by damage to the cerebellum and is characterized by balance and coordination problems. Involuntary tremor, clumsiness, and poor instability in the proximal joints are other signs of this disease [2]. Therefore, teaching balance skills is an integral part of the rehabilitation program for these patients. So far, various interventions have been employed in postural control and balance abilities for children with ataxic cerebral palsy. The most widely-used interventions are neurodevelopmental treatment, reactive balance training, treadmill training, and visual feedback training [3]. Rehabilitation of children with cerebral palsy is often challenging for therapists due to their insufficient motivation to receive rehabilitation interventions and lack of careful progress monitoring. Therefore, the tool of choice for the rehabilitation of these children should be fun and increase their motivation to receive rehabilitation.

The use of Virtual Reality (VR) is more fun for children than conventional exercises, and their motivation to participate in a VR-based rehabilitation program is far greater than in a conventional training program [4]. The Wii Balance Board (WBB) is a portable and accessible tool for VR-based balance training. The studies on the effectiveness of WBB in balance training of children with cerebral palsy have shown that the use of this device has a much greater impact on increasing the balance of these children compared to conventional balance training due to the presence of visual feedback, more motivation and recording the amount of change quantitatively [5]. This device can also make intervention easier for occupational therapists and reduce physical pressure [6, 7]. Various studies have proved the effectiveness of WBB on balance indicators in people with different physical problems, such as acquired brain injury, developmental coordination disorder, Down syndrome, and spastic and dyskinetic cerebral palsy [8-12]. WBB can improve static and dynamic balance [5, 13-15] and independence in performing activities of daily living in children with spastic and dyskinetic cerebral palsy [5]. However, there is very little and or unreliable scientific evidence on the effects of WBB in people with ataxic cerebral palsy. The study of the long-term effects of WBB requires further research [8]. Therefore, this study aims to assess the effectiveness of WBB and the persistence of its impact in children with ataxic cerebral palsy.

Materials and Methods

This research is a preliminary study (single-case study) with a pre-test, post-test and follow-up design conducted from April to December 2019 on 3 children with ataxic cerebral palsy (Mean±SD age= 10.56±1.09 years) who were selected using a purposive sampling method. The inclusion criteria included the diagnosis of ataxic cerebral palsy, being at level 1 or 2 of motor function based on the Gross Motor Function Classification System (GMFCS), no history of fractures, and lower extremity surgery during the past six months, according to the family report, adequate cognitive ability to participate in WBB-based activities (ability to attend school or score above 70 in the Sparkle test). After explaining the research process and intervention method to the parents of children, their written informed consent was obtained. All three children received routine occupational therapy three sessions per week throughout the study. The duration of sessions in the baseline and follow-up phases was 45 minutes. In the intervention phase, the duration of sessions was 25 minutes, followed by balance training by the WBB for 12 weeks, three times a week, each session for 20 minutes (12 hours).

WBB is a device connected to a far-enough monitor. The results of displacement of the Center of Pressure (CoP) on the WBB were displaced in the monitor. During the intervention process, the child tried to control the CoP displacement by using visual feedback information. The child performs dynamic balance exercises by changing the center of gravity in different directions and static balance exercises by maintaining the center of gravity at a fixed point. The therapist also monitored the intervention process and provided progressive balance training by giving verbal feedback when needed and coordinating the difficulty of each exercise with each participant’s balance abilities.

The outcome of the intervention was measured by Pediatric Balance Scale (PBS) and Timed Up and Go (TUG) test three times in the baseline phase (before the intervention), three times in the intervention phase (at the end of 12th, 24th, and 36th sessions) and two times in follow-up phase (one and two months after the intervention). It should be noted that all assessments were performed by an occupational therapist unaware of the study process.

Results

Results of PBS and TUG test in the baseline, intervention, and follow-up phases are presented in Table 1. Findings from visual analysis of graphs for all three subjects (Figures 1 and 2) showed that balance training by WBB in the intervention and follow-up phases improved their func-
tional balance compared to the baseline. The Percentage of Nonoverlapping Data (PND) in both tests was 100% for all children. The Hedge’s g value for all children was above 0.8, indicating a significant difference between the baseline and follow-up results (Table 2). According to the 2SD (2 standard deviations) method, the results of PBS in the intervention and follow-up phases were greater than the sum of the mean and twice the standard deviation of its results in the baseline, indicating a significant improvement in PBS score in all three children. The results of the TUG test in the intervention and follow-up phases were less than twice the standard deviation of the test result in the baseline, indicating a significant reduction in the duration of the TUG test in all three children (Table 3).

Discussion and Conclusion

The purpose of this pilot study was to investigate the effect of balance training with WBB on the functional balance of 3 children with ataxic cerebral palsy and also to evaluate the stability of the effect one and two months after the intervention. The functional balance variable was measured by PBS and the TUG test. The results showed significant changes in the functional balance of children during the intervention period and the persistence of these effects up to two

![Figure 1. Comparing Pediatric Balance Scale Results](image1)

![Figure 2. Comparing Timed Up and Go Test Results](image2)
These results are consistent with studies on the impact of WBB on balance indicators in different types of cerebral palsy [8]. For example, the results of Tarakcy et al. [5, 14] and Gatica et al. [13] on the effectiveness of using WBB in teaching balance to children with spastic and dyskinetic cerebral palsy suggested an efficient method for teaching balance to children with spastic and dyskinetic cerebral palsy. Another study by Silva et al. on a child with ataxic cerebral palsy also showed promising results.

### Table 1. Comparing the Results of PBS (Pediatric Balance Scale) and TUG (Timed Up and Go) Test

| Variable | Participant | Baseline 1 | Baseline 2 | Baseline 3 | Intervention 1 | Intervention 2 | Intervention 2 | Follow-up 1 | Follow-up 2 |
|----------|-------------|------------|------------|------------|----------------|----------------|----------------|-------------|-------------|
| PBS      | 1           | 36         | 36         | 37         | 39             | 40             | 41             | 41          | 41          |
|          | 2           | 33         | 34         | 34         | 36             | 37             | 37             | 37          | 36          |
|          | 3           | 39         | 39         | 40         | 42             | 43             | 44             | 44          | 44          |
| TUG      | 1           | 11.52      | 11.23      | 11.66      | 10.49          | 9.99           | 9.26           | 9.28        | 9.32        |
|          | 2           | 14.90      | 14.79      | 14.60      | 14.19          | 13.84          | 13.32          | 13.55       | 42.13       |
|          | 3           | 12.20      | 12.18      | 12.32      | 11.31          | 11.03          | 10.47          | 10.72       | 10.90       |

PBS: Pediatric Balance Scale; TUG: Timed Up and Go.

### Table 2. Results of PND (Percentage of Nonoverlapping Data) and Hedges’ g

| Participant | A-B PND above | B-A1 Hedges’s g | A-A1 PND above | B-A1 Hedges’s g | A-A1 PND below | B-A1 Hedges’s g | A-A1 PND below | B-A1 Hedges’s g |
|-------------|---------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|----------------|
| PBS         | 1             | 3.257           | 0.886          | 6.651           | 1.636          | 0.886           | 6.651          | 1.636          |
| TUG         | 1             | 2.676           | 0.878          | 8.732           | 2.367          | 0.400           | 8.405          | 2.367          |
|             | 2             | 3.242           | 0.256          | 8.835           |                |                 |                |                |

PBS: Pediatric Balance Scale; TUG: Timed Up and Go.

### Table 3. The Mean, Mean-2SD, and Mean+2SD Results in the Baseline

| Variable | Participant | 2SD – Mean | Mean | 2SD + Mean |
|----------|-------------|------------|------|------------|
| PBS      | 1           | 35.31      | 36.67| 37.82      |
|          | 2           | 32.51      | 33.67| 34.82      |
|          | 3           | 38.18      | 39.33| 40.49      |
| TUG      | 1           | 11.03      | 11.47| 11.91      |
|          | 2           | 14.50      | 14.73| 14.97      |
|          | 3           | 11.99      | 12.20| 12.42      |

PBS: Pediatric Balance Scale; TUG: Timed Up and Go.
cerebral palsy showed that using WBB in combination with kinesiotherapy interventions improved balance in this child [16]. Therefore, balance training by WBB can effectively improve balance in different types of cerebral palsy.

A study conducted by Gatica et al. on four children with spastic cerebral palsy showed that six weeks of WBB-based balance training intervention consisted of three 25-min sessions per week (7.5 hours) significantly improved children’s functional balance based on the TUG test results, but it did not affect the static balance of children based on One-Leg Stance Test (OLST) results [17]. Another study by Tarakcy et al. on 12 children with spastic cerebral palsy and three children with dyskinetic cerebral palsy found that 12 weeks of balance training by the WBB, 2 sessions of 40 minutes per week (16 hours) significantly improved the static balance of participants according to the OLST test [14]. The discrepancy in the results of two different studies can be attributed to the different duration of balance training interventions. Since the base of support of a person in the OLST test is smaller than in functional balance tests such as the TUG test, its implementation requires higher levels of balance indicators [14]. Therefore, more time is needed to improve a person’s performance in the OLST test. Hence, we suggested that in future studies, the effects of intervention by WBB on the static balance of children with ataxic cerebral palsy be investigated at appropriate durations.

The results of PBS in our study showed that child No. 2 with GMFCS level 2 showed no progress in the last four weeks of the intervention phase. We even witnessed the reduction of PBS score in this child between the first and second months of follow-up. However, children No. 1 and No. 3, both with GMFCS level 1, not only progressed throughout the intervention phase but also maintained their progress for up to two months after the intervention. Therefore, the effect of balance training by WBB on children with ataxic cerebral palsy and GMFCS level 1 may be more significant and more lasting than its effect on children with ataxic cerebral palsy and GMFCS level 2. It should be noted that these differences were not observed in the results of the TUG test. Further documented studies in this field can provide more information.

Based on the observations during the research process, the motivation of the children to receive interventions in the initial sessions was much higher and gradually decreased during the implementation process. This finding indicates the limited number and visual aspects of the exercises. Although exercises by WBB are more motivating and fun for children than conventional occupational therapy exercises, for longer use of such tools, it is better to consider the greater variety and more attractive graphics for them. According to the parents of children, the WBB-based balance training also improved their ability and independence in some of their daily activities, including games that require gross motor function and bathing tasks. Tarakci et al. also found that balance training by the WBB can increase the independence of children with cerebral palsy in their daily activities [5]. Therefore, it is recommended that the effect of WBB-based interventions on the ability to perform daily living activities in children with ataxic cerebral palsy be examined more comprehensively in future studies. Some of the limitations and disadvantages of the present study were the preliminary nature of the study, the impossibility of generalizing the results to all children with ataxic cerebral palsy, the relatively high cost of the device, the impossibility of providing the device for all rehabilitation centers, and the small number of samples.

Balance training by the WBB can effectively improve the functional balance of children with ataxic cerebral palsy. These results can be used as a basis for conducting clinical trial studies with an appropriate sample size to evaluate the effects of this technique on children with ataxic cerebral palsy.

Ethical Considerations

Compliance with ethical guidelines

All ethical principles are considered in this article. The participants were informed about the purpose of the research and its implementation stages. They were also assured about the confidentiality of their information. They were free to leave the study whenever they wished, and if desired, the research results would be available to them.

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Authors’ contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declared no conflict of interest.
بررسی تأثیر استفاده از صف مهارتی کودکان با فلج مغزی نوع آتاکسیک بر تعادل عملکردی کودکان با فلج مغزی نوع WBB

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مقدمه

فلج مغزی نوع آتاکسیک (WBB) به دلیل بروز تهیه‌گری و نواقص معنی‌داری در واکنش‌های تعادلی در کودکان با فلج مغزی نوع آتاکسیک، در سطح از ۱۰ تا ۵ درصد از جمعیت افراد با فلج مغزی را تشکیل می‌دهد و با نواقص تعادلی و هماهنگی مشخص است. هدف از مطالعه حاضر بررسی تأثیر استفاده از صفحه تعادلی وی‌آتاکسیک بر تعادل عملکردی در کودکان با فلج مغزی نوع آتاکسیک می‌باشد. 

محور مطالعه

کودکان با فلج مغزی نوع آتاکسیک باید در مطالعه‌های فعالیت‌های تعادلی و پیشگیری از ریخته نشان کنند. شکست در توانایی‌های هماهنگی و تعادلی کودکان با فلج مغزی نوع آتاکسیک می‌تواند به پیشرفت نشانگر بهبود تعادل عملکردی کودکان با فلج مغزی نوع آتاکسیک باشد. 

روش بررسی

مطالعه حاضر از نوع پژوهش موردی بوده است و در سه فاز پایه، مداخله و پیگیری اجرا شده است. مورد بررسی نهایی، ۳۶ پسر و دختر با فلج مغزی نوع آتاکسیک، سطح یک یا دو سیستم طبقه‌بندی GMFCS سال در این مطالعه شرکت کردند. 

نتایج حاصل به وسیله مقیاس تعادلی کودکان WBB، دو ماه پس از اتمام مداخلات آموزش تعادل، تعادل عملکردی کودکان با فلج مغزی نوع آتاکسیک بهبود یافت. 

کلیدواژه‌ها: فلج مغزی نوع آتاکسیک، تعادل، واقعیت آتکسیک، WBB, PBS
استخراج فلج مغزی صرف گروهی از اختلالات رشدی و اجتماعی علیه نظر حکمی در مسکن کودکان است که از زیک اختلالات فیزیکی افراد. مطالعات در زمینه اختلالات فیزیکی نشان داده که افرادی با اختلالات فیزیکی نسبت به اندازه و ظرفیت انجام این بویه‌های طیف‌پردازی در عملکرد رشدی متفاوتی نسبت به افرادی با اختلالات فیزیکی نهایی می‌شود. از جمله کودکان با ظرفیت نسبت به اندازه و ظرفیت انجام این بویه‌های طیف‌پردازی در عملکرد رشدی متفاوتی نسبت به افرادی با اختلالات فیزیکی نهایی می‌شود. از جمله کودکان با ظرفیت نسبت به اندازه و ظرفیت انجام این بویه‌های طیف‌پردازی در عملکرد رشدی متفاوتی نسبت به افرادی با اختلالات فیزیکی نهایی می‌شود.
منظره اندازه‌گیری انسجام در انجام وظایف مالک‌گرایی (کوک و مالک‌گرایی) به وسیله WBB به صورت دو مقدار (کوک و مالک‌گرایی) و یک سنجش ابزاری (یک ابزار آموزشی) به وسیله وسیله‌پوشانی (WBB) است. این آزمون شامل سوالات و سوالاتی است که به منظور بررسی انسجام و مستقل بودن کودکان در انجام وظایف مالک‌گرایی طراحی شده است. به‌طور کلی، این آزمون شامل سوالات و سوالاتی است که به منظور بررسی انسجام و مستقل بودن کودکان در انجام وظایف مالک‌گرایی طراحی شده است.

18. Functional tasks
19. Center of Pressure (CoP)
20. Force platform
21. Percentage of Nonoverlapping Data (PND)
22. Two Standard Deviation
مطالعه‌گرانی می‌شناخته‌اند که تأثیر‌گذاری آموزش تعادل به وسیله WBB می‌تواند نتایج مهمی را در فرآیند آموزش کودکان به دست آورد. در ستودهای مطالعه مقدماتی، بررسی گزارش‌های رونمایی با فلج مغزی نوع آتاکسیک و همچنین بررسی میزان تأثیر تغییرات قابل توجه در توان توازن عمومی و عملکرد ایجاد می‌باشد. همچنین در مطالعه مقدماتی حاضر، بررسی تأثیر تغییرات قابل توجه در توان توازن عمومی و عملکرد ایجاد می‌باشد. همچنین در مطالعه مقدماتی حاضر، بررسی تأثیر تغییرات قابل توجه در توان توازن عمومی و عملکرد ایجاد می‌باشد. همچنین در مطالعه مقدماتی حاضر، بررسی تأثیر تغییرات قابل توجه در توان توازن عمومی و عملکرد ایجاد می‌باشد. همچنین در مطالعه مقدماتی حاضر، بررسی تأثیر تغییرات قابل توجه در توان توازن عمومی و عملکرد ایجاد می‌باشد. همچنین در مطالعه مقدماتی حاضر، بررسی تأثیر تغییرات قابل توجه در توان توازن عمومی و عملکرد ایجاد می‌باشد. همچنین در مطالعه مقدماتی حاضر، بررسی تأثیر تغییرات قابل توجه در توان توازن عمومی و عملکرد ایجاد می‌باشد. همچنین در مطالعه مقدماتی حاضر، بررسی تأثیر تغییرات قابل توجه در توان توازن عمومی و عملکرد ایجاد می‌ба
این دو مطالعه، اثرات استفاده از صفحه تعادلی WBB بر تعادل ایستا یا فعالیت کودکان با فلج مغزی، به ویژه آتاکسیک، را بررسی کرده‌اند. در مطالعه اول، برای تعادل ایستا و نشسته، یک صفحه تعادلی فشرفتی مخصوص کودکان با فلج مغزی تهیه کرده و آزمودنی ها در فاز پایه و فاز مداخله با این صفحه تعادلی مطالعه شدند. نتایج نشان داد که این صفحه تعادلی می‌تواند بهبودی عملکرد فرد را در فاز مداخله بهبود بخشید.

در مطالعه دوم، آزمودنی ها در فاز پایه و فاز مداخله با صفحه تعادلی WBB و TUG مطالعه شدند. نتایج نشان داد که استفاده از WBB می‌تواند بهبودی عملکرد فرد را در فاز مداخله بهبود بخشید.

در مطالعه اول، بهبودی عملکرد فرد را در فاز پایه و فاز مداخله با استفاده از صفحه تعادلی WBB می‌تواند بهبودی عملکرد فرد را در فاز مداخله بهبود بخشید.

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در مطالعه اول، بهبودی عملکرد فرد را در فاز پایه و فاز مداخله با استفاده از صفحه تعادلی WBB می‌تواند بهبودی عملکرد فرد را در فاز مداخله بهبود بخشید.

در مطالعه دوم، بهبودی عملکرد فرد را در فاز پایه و فاز مداخله با استفاده از صفحه تعادلی WBB می‌تواند بهبودی عملکرد فرد را در فاز مداخله بهبود بخشید.
بر اساس مشاهدات محقق در طول روند تحقیق، میزان انگیزه شرکت کنندگان برای دریافت مداخلات در اولین جلسات مداخله بیشتر بود و طی روند اجرا به تدریج کاهش یافت. این حقيقة جانا از حدود بین تعداد و نسبت به کودکانی که تمرینات مورد استفاده است، پس از انجام این نگاه و در نظر گرفته شده است. هرچند تمرینات به وسیله کاردرمانی رایج برای کودکان انگیزه بخش تر و سرگرم کننده تر است، اما برای استفاده طولانی مدت از این گونه ابزار بهتر است تنوع بالاتر و گرافیک جذاب تری برای آنها در نظر گرفته شود. بر اساس گزارش والدین شرکت کنندگان، تمرینات آموزش تعادل به وسیله WBB سبب بهبود توانایی و افزایش استقلال این کودکان در برخی فعالیت‌های روزمره زندگیشان از جمله بازی‌های نیازمند به عملکرد حرکتی شدید و وظایف مربوط به حمام کردن نیز شده است. تاراکسی و همکاران نیز طی مطالعه ارائه دادند که آموزش تعادل می‌تواند سبب افزایش استقلال کودکان با فلج WBB باشد. بنابراین پیشنهاد می‌شود تأثیر مداخلات به وسیله WBB بر توانایی انجام فعالیت‌های روزمره کودکان با فلج مغزی نوع آتاکسی که در مطالعات آتی به صورت جامع تر مورد بررسی قرار گیرد.

نتیجه‌گیری

نتایج مطالعه مقدماتی حاضر نشان می‌دهد آموزش تعادل به وسیله WBB می‌تواند روشی مؤثر در بهبود تعادل عملکردی کودکان با فلج مغزی نوع آتاکسی باشد. این نتایج می‌تواند زمینه‌ساز انجام مطالعات ارتقاء‌یافته بیشتری با حجم نمونه بزرگ‌تر باشد.

مشکلات اخلاقی

ملاحظات اخلاقی

پیروی از اصول اخلاقی برخی از این مقاله رعایت شده است. شرکت WBB می‌تواند سبب افتتاح استعداد کودکان با فلج مغزی نوع آتاکسی باشد. این نتایج می‌تواند زمینه‌ساز انجام مطالعات کارآزمایی بالینی با حجم نمونه مناسب بر WBB در زمینه بررسی تأثیرات آموزش تعادل به وسیله WBB بر تعادل عملکردی کودکان با فلج مغزی نوع آتاکسی باشد. این مطالعات می‌تواند به ماهیت مقدماتی بودن مطالعه و نبود امکان تعمیم بخشی نتایج به تمام کودکان با فلج مغزی نوع آتاکسی، هزینه نسبتاً بالای دستگاه و نبود امکان تهیه دستگاه برای همه مراکز توانبخشی و تعداد کم مراجعین با تشخیص فلج مغزی نوع آتاکسی اشاره کرد.

جدول گ. نتایج Hedge's g و PND– 2SD و 2SD میانگین برای مقایسه فاز پایه A-A1 و A-B

| متغیر | شرکت کننده | Hedges's g | PNDabove | Hedges's g | PNDabove | Hedges's g | PNDabove |
|-------|--------------|------------|-----------|------------|-----------|------------|-----------|
| PBS   | 1            | 35         | 1         | 35         | 1         | 35         | 1         |
| PBS   | 2            | 32         | 1         | 32         | 1         | 32         | 1         |
| PBS   | 3            | 38         | 1         | 38         | 1         | 38         | 1         |
| PBS   | 4            | 37         | 1         | 37         | 1         | 37         | 1         |
| TUG   | 5            | 11         | 1         | 11         | 1         | 11         | 1         |
| TUG   | 6            | 14         | 1         | 14         | 1         | 14         | 1         |
| TUG   | 7            | 11         | 1         | 11         | 1         | 11         | 1         |

جدول گ. نتایج میانگین + 2SD و -2SD

| متغیر | شرکت کننده | میانگین + 2SD | -2SD | میانگین -2SD | + 2SD |
|-------|--------------|---------------|------|---------------|-------|
| PBS   | 1            | 35            | 1    | 35            | 1     |
| PBS   | 2            | 32            | 1    | 32            | 1     |
| PBS   | 3            | 38            | 1    | 38            | 1     |
| PBS   | 4            | 37            | 1    | 37            | 1     |
| TUG   | 5            | 11            | 1    | 11            | 1     |
| TUG   | 6            | 14            | 1    | 14            | 1     |
| TUG   | 7            | 11            | 1    | 11            | 1     |
کنندگان اجازه داشتند هر زمان که مایل بودند از پژوهش خارج شوند. همچنین همه شرکت کنندگان در جریان روند پژوهش بودند. اطلاعات آن‌ها محرمانه نگه داشته شد.

حامی مالی

این تحقیق هیچ‌گونه کمک مالی از سازمان‌های تأمین مالی در بخش‌های عمومی، تجاری یا غیرانتفاعی دریافت نکرد.

مشارکت‌نوبنیست‌ها

تمام نوبنیست‌ها در طراحی، اجرا و نگارش همه پژوهش‌های پژوهش حاضر مشارکت داشتند.

تظاهر منافع

بنابر اظهار نوبنیست‌ها این مقاله تعارض منافع ندارد.
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