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Effect of Dead Bug Exercises on Dynamic Balance and Agility Among Adolescent Badminton Players at the End of Four Weeks – An Experimental Study

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ABSTRACT

Introduction: Badminton is one of the most popular racquet sports in the world. The game of badminton is characterized by repetitive actions of short resting time with high speed and intensity. Therefore, badminton players require good balance and agility during rapid postural actions around the court. Badminton is a dynamic equilibrium process that involves loss of balance in the air to restore balance after landing. Thus, players need body coordination and dynamic balance. Dynamic balance is a crucial fitness component to prevent lower limb injuries that can result because of poor balance. Agility is the ability to move and change the direction and position of the body quickly and effectively while under control. Dead bug is a bodyweight exercise that targets the abdominal muscles and increases core strength. The dead bug is one such isometric exercise that challenges the anterior core of an athlete from the supine position, targeting the rectus abdominis and external obliques in particular.
Methods: This pre-post experimental study aimed to assess the impact of a specific exercise intervention on dynamic balance and agility in badminton players aged 18-25 years. A total of 30 badminton players were selected using purposive sampling. The inclusion criteria required participants to be between the ages of 18 and 25, actively training in badminton, and willing to participate in the study. Group A (experimental group) received a structured exercise intervention, while Group B (control group) continued with their regular fitness badminton training. Dynamic balance was assessed using the Star Excursion Balance Test (SEBT). Agility was measured using the Illinois Agility Test (IAT).
Results: For the SEBT, Group A (experimental) demonstrated a mean pre-intervention score of 6.23 (SD = 5.25), which significantly improved post-intervention with a t-value of -6.51 and a p-value of <0.001, indicating significant enhancement in dynamic balance. In contrast, Group B (control) showed a mean pre-intervention score of 1.50 (SD = 4.98), with a post-intervention t-value of -1.65 and a p-value of 0.11, showing no significant improvement
Conclusion: The structured four-week intervention, conducted three times per week, led to substantial improvements in the SEBT and IAT scores among the experimental group compared to the control group. These findings highlight the efficacy of Dead Bug exercises in strengthening core muscles, which play a critical role in maintaining lumbopelvic stability and improving athletic performance.

Keywords: Dead bug exercises, dynamic balance, agility, badminton, athletes

INTRODUCTION

Badminton is one of the most popular racquet sports in the world. The game of badminton is characterized by repetitive actions of short resting time with high speed and intensity.[1]

The speed of badminton smashes can be as high as 30m/s. In addition, badminton players must react to moving shuttlecock and adjust their body position rapidly and continuously throughout the game. Therefore, badminton players require good balance and agility during rapid postural actions around the court. Tiwari et al. found that agility was associated with performance during a badminton game. [2]

Boesenet et al. (2011) demonstrated that repeated rapid forward lungs during the badminton match create high-stress loads on the Achilles and patellar tendon in the dominant leg. Kimura et al. (2014) observed that weak trunk flexion strength increased knee valgus moment during single-leg landing after an overhead stroke in badminton players. [1]

Balance is the ability to maintain a base of support with minimal movement actions and dynamic performance of motor tasks while maintaining a stable position.

The word balance is associated with terms such as stability and postural control. [3]

Badminton is a dynamic equilibrium process that involves loss of balance in the air to restore balance after landing. Thus, players need body coordination and dynamic balance. Dynamic balance is a crucial fitness component to prevent lower limb injuries that can result because of poor balance. [4]

Agility is the ability to move and change the direction and position of the body quickly and effectively while under control. It requires quick reflexes, coordination, balance, speed, and correct response to the changing situation. [5]

Agility training is thought to be a re-enforcement of motor programming through neuromuscular conditioning and neural adaptation of muscle spindles, golgi-tendon organs, and joint proprioceptors. [5]

Dead bug is a bodyweight exercise that targets the abdominal muscles and increases core strength. The dead bug is one such isometric exercise that challenges the anterior core of an athlete from the supine position, targeting the rectus abdominis and external obliques in particular. [6]

Specifically intended to target the core muscles with the intent of enhancing spinal stability, the transfer of torque (i.e., muscle force that causes joint movement), and angular velocity (i.e., speed of joint movement) from the lower to the upper extremities.

Dead bug exercises increase your core strength. Unlike other core exercises like sit-ups, dead bugs target deeper core muscles like the transverse abdominis, pelvic floor, and erector spinae muscle group. Dead bug exercises can improve your coordination. By activating your stabilisation muscles throughout the full range of motion, the dead bug can improve mobility and coordination in your lower back, core, arms, and legs. Practice dead bugs as a warm-up for sprinting, jumping or swimming exercises. [7,8]

The core can be described as a muscular corset with the abdominals in the front, paraspinal and gluteals in the back, the diaphragm as the roof, and the pelvic floor and hip girdle musculature as the bottom. The CST may help to improve dynamic balance and muscle coordination between lower and upper extremities, as well as reduce injury risk and muscle imbalances. [9-13] It is believed that core strength improves postural control, and postural control improves balance. Balance interventions with athletes have improved measures of athletic performance, including agility.

MATERIALS & METHODS

This pre-post experimental study aimed to assess the impact of a specific exercise intervention on dynamic balance and agility in badminton players aged 18-25 years. The study was conducted over a period of six months at various badminton training centers in and around Pune. A total of 30

badminton players were selected using purposive sampling. The inclusion criteria required participants to be between the ages of 18 and 25, actively training in badminton, and willing to participate in the study. Participants were excluded if they had any lower limb injuries or conditions that could affect balance or agility. The PES Modern College of Physiotherapy Ethics Committee approved the study. The importance and procedures of the study were explained to all participants, and informed consent was obtained prior to their involvement.

Participants were randomly assigned to two groups using an even and odd number method. Group A (experimental group) received a structured exercise intervention, while Group B (control group) continued with their regular fitness badminton training. The exercise intervention for Group A involved Dead Bug exercises conducted three days a week for four weeks, in addition to their regular training. Each session lasted for 15 minutes and was conducted on alternate days, resulting in a total of 12 sessions.

The Dead Bug exercise sessions began with participants in a supine position, arms extended above the shoulders, and legs lifted with hips and knees at 90 degrees. The lumbopelvic region was maintained in a neutral position throughout the exercise. A resistance band placed under the lumbar spine provided feedback to ensure the maintenance of the neutral position. Participants performed the exercise by slowly extending the right leg and pulling the contralateral arm towards the ear, then returning to the starting position, alternating sides with each repetition. The exercise was performed in a controlled manner, with emphasis on maintaining a neutral spine and proper breathing. The protocol included different levels of difficulty (beginner, intermediate, advanced) with increasing repetitions and sets.

Group B participants continued their regular fitness training, which included warm-up exercises such as arm, leg, and torso stretches, high elbow stretches, posterior shoulder stretches, bridging, jogging, and knee bending exercises. Cool-down exercises involved brisk walking or jogging, breathing exercises, and stretches to aid recovery and prevent soreness.

Dynamic balance was assessed using the Star Excursion Balance Test (SEBT). Participants performed the SEBT by standing on one leg at the center of a grid with eight lines extending at 45-degree increments. They reached with the opposite leg along each line, touching the farthest point possible while maintaining balance. The reach distance was measured from the center to the touch point, and trials were repeated if balance was compromised. The SEBT provided reach distances in eight directions: anterolateral, anterior, anteromedial, medial, posteromedial, posterior, posterolateral, and lateral.

Agility was measured using the Illinois Agility Test (IAT). Participants started in a prone position and, upon the command, sprinted and manoeuvred around cones placed in a specific pattern, completing the course as quickly as possible. The test was performed three times, with a 3-5 minute rest period between trials. The best time or the average time of the three trials was recorded.

Pre-intervention and post-intervention assessments were conducted for both SEBT and IAT. Data were collected and analysed using appropriate statistical methods to compare the outcomes between the experimental and control groups. The significance level was set at $p < 0.05$.

Figure 1: Subjects performing star excursion Test

Figure 2: Subject performing bracing

Figure 3: Subject performing supine dead bug exercise

Figure 4: Subject performing bracing with feet on floor

Data Analysis and Result

The study included 30 badminton players aged 18-25 years, with a mean age of the population being (mean age value to be filled in). The effect of Dead Bug exercises on dynamic balance and agility was analysed by assessing pre and post values using the SEBT and IAT respectively. The intervention was conducted three days a week for four weeks. Data collected were

statistically analysed using Microsoft Excel and GraphPad software. The paired t-test was utilized to determine the difference between pre- and post-intervention values. Various statistical measures, including mean, standard deviation (SD), and test of significance, were employed to analyse the data, with results deemed statistically significant if the p-value was less than 0.001. Data were represented in both tabular and graphical formats, including a pie chart illustrating the age distribution among participants.

For the SEBT, Group A (experimental) demonstrated a mean pre-intervention score of 6.23 (SD = 5.25), which significantly improved post-intervention with a t-value of -6.51 and a p-value of <0.001, indicating significant enhancement in dynamic balance. In contrast, Group B (control) showed a mean pre-intervention score of 1.50 (SD = 4.98), with a post-intervention t-value of -1.65 and a p-value of 0.11, showing no significant improvement. The bar graph comparing pre and post mean SEBT scores for both groups illustrated these results, with blue bars representing pre-intervention scores and orange bars representing post-intervention scores.

For the IAT, Group A showed a mean pre-intervention score of 16.79 (SD = 0.86), which significantly improved post-intervention with a t-value of -75.57 and a p-value of <0.001, indicating a substantial increase in agility. Similarly, Group B displayed a mean pre-intervention score of 17.62 (SD = 1.51), with a post-intervention t-value of -45.25 and a p-value of <0.001, also indicating significant improvement. These results were depicted in a bar graph, with blue bars representing pre-intervention scores and orange bars representing post-intervention scores.

Overall, the SEBT values in Group A showed significant improvements in all eight directions (anterolateral, anterior, anteromedial, medial, posteromedial, posterior, posterolateral, and lateral) with p-values <0.001, demonstrating the efficacy of Dead Bug exercises in enhancing dynamic balance. In Group B, SEBT values showed no significant improvement (p-value <0.1 in all directions), indicating that regular fitness training alone was less effective. For the IAT, both groups showed significant improvements (p-values <0.001); however, Group A demonstrated a greater mean improvement in dynamic balance post-protocol, while Group B showed less improvement in agility compared to Group A. These findings suggest that the Dead Bug exercise regimen significantly enhances both dynamic balance and agility in adolescent badminton players, outperforming regular fitness training alone in improving these specific physical attributes

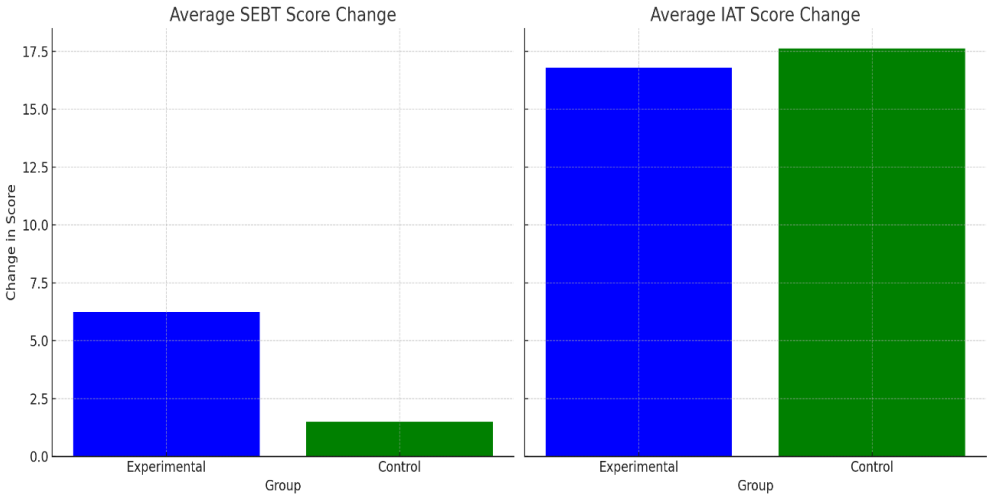

Figure 5: Comparison of pre- and post-intervention outcome measure values for average SEBT score change and IAT score

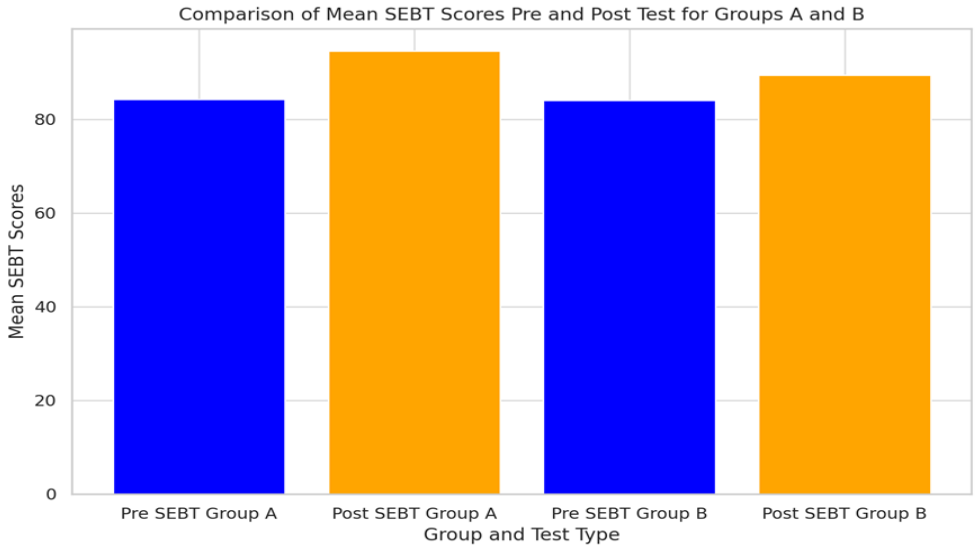

Figure 6: Comparison of mean SEBT scores pre and post-test for groups A and B

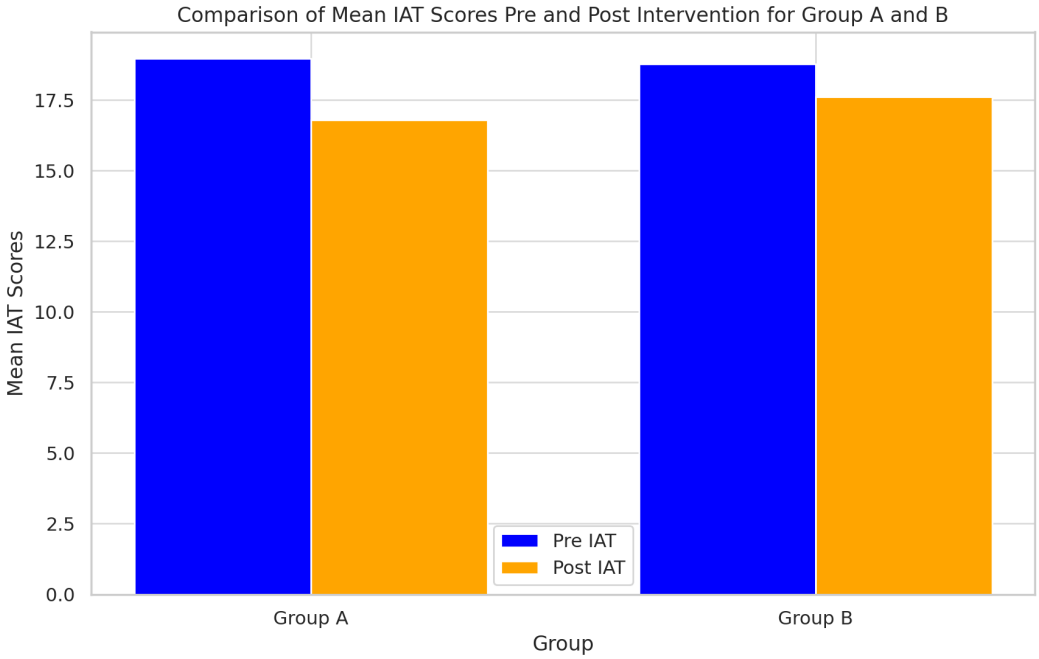

Figure 7: Comparison of mean IAT Scores Pre and post-test for Group A and B

DISCUSSION

This study aimed to investigate the effects of Dead Bug exercises on dynamic balance and agility among adolescent badminton players aged 18-25 years. The findings reveal significant improvements in both dynamic balance and agility following a structured four-week intervention, demonstrating the efficacy of Dead Bug exercises in enhancing these physical attributes.

The inclusion of 30 participants, comprising both male and female subjects within the specified age range, ensured a diverse sample representative of the target population. The statistical analysis using paired t-tests showed statistically significant increases in dynamic balance and agility post-intervention, underscoring the effectiveness of the Dead Bug exercise protocol.

The results align with previous studies on core stabilization exercises. Sandrey et al. (2013) observed significant gains in SEBT scores following a similar core stabilization training program among high school track

and field athletes. Although their study lacked a control group, the outcomes support the notion that targeted core exercises can improve balance capabilities across various directions. [14]

Contrary findings by Ozmen and Aydogmus (2016), who assessed core stabilization training in adolescent badminton players, noted significant increases in SEBT scores and core endurance but no significant change in agility. [6] Our study extends these findings by demonstrating improvements in both dynamic balance and agility, suggesting a broader impact of Dead Bug exercises on overall physical performance in badminton.

The mechanism behind the efficacy of Dead Bug exercises lies in their ability to enhance core strength and stability. By targeting the rectus abdominis and external obliques from a supine position, these exercises promote lumbopelvic stability critical for maintaining balance during dynamic movements. This stability translates into improved motor control and efficiency, essential for athletes engaged in sports requiring rapid changes in direction and agility.

Regular practice of Dead Bug exercises not only strengthens the abdominal muscles but also enhances spinal stability, contributing to injury prevention and improved performance. The observed improvements in dynamic balance in our study highlight the functional benefits of integrating core-specific exercises into training regimens for adolescent athletes.

In conclusion, the findings support the incorporation of Dead Bug exercises as a valuable component of training programs aimed at enhancing dynamic balance and agility in adolescent badminton players. Future research could explore longer intervention durations, larger sample sizes, and additional measures of athletic performance to further elucidate the broader impact of core stabilization exercises in sports training and injury prevention strategies.

CONCLUSION

This study demonstrates that Dead Bug exercises significantly enhance dynamic balance and agility in adolescent badminton players aged 18-25 years. The structured four-week intervention, conducted three times per week, led to substantial improvements in the SEBT and IAT scores among the experimental group compared to the control group. These findings highlight the efficacy of Dead Bug exercises in strengthening core muscles, which play a critical role in maintaining lumbopelvic stability and improving athletic performance. Incorporating such exercises into regular training regimens can be beneficial for athletes seeking to improve their dynamic balance and agility. Future research with larger sample sizes and extended intervention durations could further validate these results and explore additional benefits of core stabilization exercises in sports performance and injury prevention.

Declaration by Authors

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