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# Effectiveness of physical exercise models R.A. game based on long jump for the 13 - 15 year olds

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## Abstract

Conventional training models that only focus on repetitive techniques without variety, such as static exercises or monotonous drilling, are often considered inefficient for the 13-15-year-old age group. This approach tends to be boring, lacks motivational aspects, and does not fully develop all-around motor skills as the game-based R.A. model does. This research aims to see how effective the game-based Resistance and Aerobic training (R.A.) physical training model is in the long jump for the 13-15-year-old age group, which has been developed previously. This study used a quantitative approach with a pre-experimental design (one-group pretest-posttest) to measure the model's effectiveness. The sample consisted of 60 students aged 13-15 years old who were purposively selected. The test instruments used in this research were the physical test of running 30 meters, jumping three times, dynamic balance test, and flexibility. The analysis test uses statistics (t-test) to evaluate the effectiveness of the model. The results showed a significant increase between the pretest and posttest results. These results prove that the R.A. model is more effective than the monotonous conventional method in improving physical abilities and long jump technique. This game-based approach also positively impacted overall motor skill development, making it an innovative and relevant training alternative for the 13-15 age group. These findings make an important contribution to the development of sports training methods, particularly the long jump.

**Keywords:** Resistance and aerobic training, long jump, athletes, games.

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**Authors contribution:** a – Preparing concepts; b – Formulating methods; c – Conducting research; d – Processing results; e – Interpretation and conclusions; f - Editing the final version.

## INTRODUCTION

Conventional training in the sport of long jump, which only focuses on repetition of techniques such as rejecting or stepping movements without variation, is often considered less efficient for the 13-15-year-old age group. This approach tends to be monotonous, thus demotivating

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students and less than optimal in developing motor skills and explosive power needed in the long jump (Setiawan & Hutomo, 2020). In addition, these static exercises often do not involve elements of play or interaction that are appropriate to the developmental needs of children at that age, so the results are not as effective as more creative and fun models (Permana et al., 2022). In contrast, game-based training models such as Resistance and Aerobic training (R.A.) can increase emotional and physical engagement, directly impacting long jump technique and performance. Thus, innovations in physical education learning methods are needed to increase training effectiveness, especially in athletic branches such as the long jump.

Prior research has introduced various physical training approaches, each designed for unique goals and demographics. Kirkham-King et al. (2017) examined physical training approaches to enhance teenage physical fitness. Their research underscores the need for age-appropriate training programs that correspond with teenagers' physiological and psychological requirements. This study highlights that organized physical training in adolescence improves physical health and cultivates enduring habits of physical activity. Such approaches prevent sedentary behaviors and encourage active lives by focusing on critical developmental phases. This discovery is especially significant in light of contemporary issues like excessive screen usage and diminished outdoor activities among young people.

Focusing on a specific population, Sammoud et al. (2021) concentrated on a particular demographic and created a psychologically oriented physical training model designed to enhance physical fitness in the elderly. The research elucidates the significance of psychological well-being in preserving physical health in older persons. This strategy integrates physical activities with techniques to enhance motivation, self-efficacy, and mental health, catering to the distinct requirements of the elderly population. This research demonstrates the twin advantages of

these therapies in improving physical capacity and reducing age-related mental health losses, hence enhancing overall quality of life in later years.

From a perspective, Zulkarnain et al. (2021) examined a physical training strategy to improve punch velocity, muscular strength, and arm power in pencak silat practitioners. This study offers significant insights into the specific requirements of martial artists, especially in enhancing critical performance metrics like explosive force and quickness. The study highlights the importance of sport-specific training programs that correspond with the biomechanical requirements of the sport. This is essential for athletes competing at elite levels because incremental improvements in strength and speed can substantially impact performance results.

Traditional games have been recognized as useful instruments for skill enhancement in physical education. Traditional games such as Daniyantara et al. (2023) employed traditional games to enhance long jump instruction. The research demonstrates that incorporating culturally pertinent and stimulating activities into training might enhance skill acquisition, especially for younger learners. Conventional games improve motor skills and foster a pleasurable learning atmosphere, facilitating students' comprehension of the technical elements of the long jump.

Examined long jump instruction through the implementation of play circuits (Ida Zubaida et al., 2021; Ioannides et al., 2020). The study highlights the importance of innovative and participatory pedagogical methods in physical education. The circuit-based methodology improves creativity, fosters active engagement, and enhances student skill retention. Breaking down the long jump into manageable components and incorporating gamification into the educational process improves performance and increases engagement.

Expanding on the concept of gamified learning (Sobarna & Hambali, 2020) examined the use of winning front-and-back games in teaching the long jump, contributing to the concept of gamified learning. The findings suggest that these strategies improve technical execution

and foster a competitive yet collaborative learning environment. The activities facilitate the practice of fundamental motions in an instinctive and enjoyable manner, leading to enhanced proficiency in the long jump technique. Current long jump training methods for the 13-15-year age group generally use traditional approaches such as drilling basic techniques, including repetitive repulsion, hovering, and landing exercises. Although this method is effective for building the basis of technique, this approach is often considered less suitable for adolescents due to its monotonous nature and less involvement of motivational aspects and fun in training (Nur Aeni et al., 2021).

In contrast, game-based physical training methods, such as R.A., are considered more suitable because they create an interactive and fun training atmosphere while integrating the development of physical skills such as strength, speed, and coordination in a natural and non-boring way (Prakoso et al., 2022). This game-based model is also relevant to a child-centered learning approach, where adolescents can participate actively while gradually developing techniques (Widiastuti & Hutumo, 2018). Thus, the R.A. model not only increases training effectiveness but also helps to increase adolescents' motivation and engagement in learning long jump, which is key to successful early childhood coaching.

Apart from that, research has also been carried out on the concept of playing alone, such as Rudiyanto and Hadi (2022). The Influence of Traditional Games on Improving Students' Physical Fitness, Nuriman, et al., (2016) The impact of the traditional Betengan sport on children's agility skills (Nurlaily et al., 2024). The influence of the jumping game on the long jump learning outcomes of the squat style in physical education, sports, and health learning. In addition, research related to the concept of play has also been conducted. Izzullaq et al. (2022) state that the Effect of Traditional Sports Games on Increasing Physical Fitness of Madrasah Aliyah Manbaul Ulum Bungah Gresik Students, Pratiwi & Kristanto (2015) with research on the Effect of Traditional Games on Increasing Students' Physical Fitness, Dadang Prayoga & Hegen Maulana, (2022) which

examines the Effect of Betengtengan Traditional Sports Games on Agility Ability of Children aged 8-9 years and Izzullaq et al. (2022) which discusses the Effect of Jump-Jump Games on Squatting Style Long Jump Learning Outcomes in Physical Education, Sports and Health Learning (Study on Class V Students of Kabuh I Jombang State Elementary School).

However, in this discussion, the research conducted discusses the effectiveness of the game-based R.A. physical training model in the long jump in the 13-15-year age group, which has been previously developed. The R.A. training model was created by a private writer named Rolly Afrinaldi, who specializes in physical training with a game concept for the long jump in the 13-15-year-old age group. This training model has systematically and interestingly impacted training activities (Rolly, 2019). However, the model has yet to be tested further to determine its suitability. Therefore, this needs to be studied to see whether this model is proven to be effective in increasing physical exercise.

## METHOD

This study utilizes a quantitative methodology to objectively assess the efficacy of the Resistance and Aerobic Training (R.A.) model in enhancing long jump performance. The quantitative method was selected to yield measurable and data-driven insights into the effects of the training intervention on physical capability and long jump skills. This approach guarantees that the results are based on actual evidence, facilitating clear comparisons pre-and post-treatment.

This study employs an experimental research method, specifically a pre-experimental design. The one-group pretest-posttest design is employed, which entails gathering data from an identical group of participants before and after the intervention. This methodology enables researchers to isolate and examine the impact of the R.A. game-based physical training model on participants' physical capabilities and long jump methods. The lack of a control group restricts the capacity to compare

outcomes with a non-intervention condition, yet this design is suitable for first investigations focused on assessing treatment effects.

The study sample comprised 60 athletes aged 13 to 15 years, selected according to strict inclusion criteria to ensure uniformity in their fundamental physical capabilities and long jump methods before the intervention. Participants were recruited from local sports training centers, with consent secured from both their guardians and the athletes to adhere to ethical norms. Stratified random sampling was employed to guarantee that the sample accurately represented the population of adolescent athletes. The sample was separated into experimental groups utilizing the Resistance and Aerobic Training (R.A.)-based game approach for a more effective evaluation of the intervention, excluding a control group. The absence of a control group is a restriction; nonetheless, it underscores the practical emphasis of this study on direct application and viability in real-world training contexts.

**Table 1.** Research design in testing model effectiveness

| **Subject** | ***Pres-Test*** | | ***Posttest*** |
|---|---|---|---|
| **R** | **$O_1$** | **P** | **$O_2$** |

Description :

R : Subject

$O_1$ : Result observation (pretest)

P : Treatment

$O_2$ : Result observation (posttest)

The intervention administered to the participants consisted of 6 weeks of R.A. game-based training, occurring at a frequency of 3 sessions weekly. Each session was meticulously organized to incorporate resistance and aerobic workouts into gamified games designed to improve both physical fitness and long jump techniques. The training program was created to sustain participant involvement and guarantee progressive overload, which is essential for enhancing athletic performance. Certified coaches and sports scientists supervised the training sessions to ensure uniformity in the administration of the intervention.

The study employed verified and standardized measuring procedures to evaluate long jump skills and associated physical capabilities. The tests encompassed:

1) A 30-meter sprint test to assess running speed is essential for producing horizontal velocity in the long jump approach.
2) A triple jump assessment to evaluate explosive strength and coordination, reflecting the takeoff and flight stages of the long jump.
3) A dynamic balance assessment utilizing the Modified Bass Test of Dynamic Balance evaluated participants' capacity to sustain stability during dynamic movements—a crucial element of proficient long jump performance.
4) A flexibility assessment utilizing the Sit and Reach technique evaluated the suppleness of the lower back and hamstring muscles, both crucial for attaining ideal takeoff angles.

Incorporating these measurement instruments to thoroughly evaluate the athlete's physical capabilities and long jump skills yields a complete comprehension of the training intervention's effects.

Data analysis involved statistical examination of pretest and posttest results by paired sample t-tests to assess the significance of changes in the measured variables. This statistical test was selected to compare means within the same group pre-and post-intervention. Effect size calculations were performed to ascertain the extent of the training intervention's impact, enhancing comprehension of the practical significance of the results. Descriptive statistics, such as means and standard deviations, encapsulated the data, providing a succinct snapshot of the individuals' performance variations.

The research procedure of the R.A. game-based physical training method was carried out with an experimental approach using a pretest-posttest control group design. The research sample consisted of students aged 13-15 years who were selected by purposive sampling based on a homogeneous basic ability level. The sample was divided into two groups:

an experimental group using the R.A. method and a control group using the conventional method. The treatment was given for 6 weeks, with a training frequency of 3 times per week, where each session lasted about 60-90 minutes, including warm-up, core (R.A. game-based exercises), and cool-down. The steps taken in this trial include (1) determining the research subject group, (2) carrying out the pretest, (3) trying the model that has been developed, (4) carrying out the posttest, (5) looking for the average score of the pretest and posttest and compare the two; (6) look for the difference between the two averages using statistical methods (t-test) to determine whether there is a significant influence from using a formula model to process data as a whole subject using the t-test procedure and using the SPSS 20 application. This study used measurement tests for long jump skills, such as running 30 meters, jumping three times, dynamic balance test using the Modified Bass Test of Dynamic Balance, and flexibility using Sit and Reach.

## RESULT

Based on the results of the analysis using SPSS version 20, it was found that the average obtained before being given the game-based physical training model treatment for the long jump athletics branch at the student level was 11.85, and the average result after being given the game-based physical training model treatment was 12.9667. In athletics, the long jump for students is 12.9667. This can be seen based on the output results in the table below.

**Table 2.** Data on pretest and posttest results

| | | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | pretest | 11.8500 | 60 | 1.19071 | .15372 |
| | posttest | 12.9667 | 60 | 1.17843 | .15213 |

Furthermore, the table below also explains that the correlation between these 2 variables is 0.878, which means they have a fairly strong and positive relationship. After that, it can be seen that the significant value in the paired samples correlations table from the results obtained shows a significant level of 0.00, which means it has a significant value


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10 (3) 2024 | 486-502

obtained with a significant level of 0.05. Based on the analysis, the correlation value of 0.878 indicates a fairly strong and positive relationship between the two variables, which means that an increase in one variable is closely related to an increase in the other variable. In addition, the significant value of 0.00 in the paired samples correlations table is smaller than the significant level of 0.05, so it can be concluded that the relationship between the two variables is statistically significant. Thus, the R.A. Game-Based Physical Training model is proven effective and significantly improves long jump ability in the 13-15-year age group. From the above results, a diagram can be drawn according to the data above as follows:

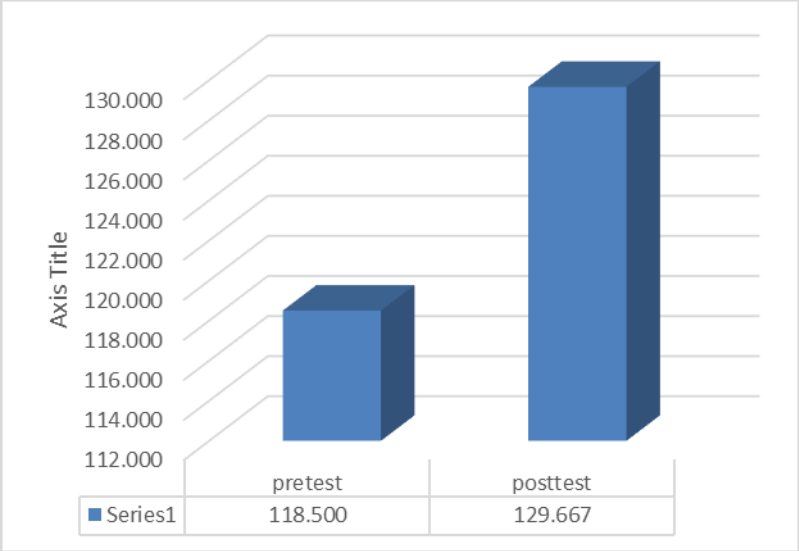


**Figure 1.** Mean results of pretest and posttest data

**Table 3.** Correlation data of pretest and posttest results

| | | N | Correlation | Sig. |
|---|---|---|---|---|
| Pair 1 | pretest & posttest | 60 | .878 | .000 |

The correlation analysis shows a strong and positive relationship between the two variables studied based on the data found with a sample size of n = 60, a correlation value of 0.878, and a significance level (Sig.) of 0.000. The correlation value of 0.878 indicates that changes in one variable are closely related to changes in the other variable. In addition, the significance value of 0.000, which is less than the 0.05 significance level, confirms that the relationship is statistically significant and does not

occur by chance. The R.A. Game-Based Physical Training Model significantly influences the measured variables, strengthening the model's validity as an effective training method to improve long jump ability in the 13-15-year-old age group.

Table 4. T-Sample Test

| | | Paired Differences | | | | | T | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference Lower | Upper | | | |
| Pair 1 | preetest - posttest | -1.11667 | .58488 | .07551 | -1.26776 | -.96557 | -14.789 | 59 | .000 |

Furthermore, the df (degree of freedom) value in the paired samples test table is calculated using the formula N - 1, so the result is 60 - 1 = 59. The t-count value obtained is -14.789, showing a significant difference when compared to the t-table, namely -14.485 < 1.669. In addition, the significant value obtained of 0.000 indicates that the physical training model based on the long jump athletic game is effective. Thus, based on the results of data analysis, it can be concluded that the game-based physical training model of Endurance and Aerobic Training (R.A.) is effective in improving physical abilities and long jump techniques at the 13-15-year-old student level.

## DISCUSSION

This study shows that the game-based physical training model of Resistance and Aerobic Training (R.A.) is effective in improving physical abilities and long jump techniques in students aged 13-15 years. This game-based approach provides a variety of fun and interactive exercises, making it more suitable for adolescents than conventional training methods that tend to be monotonous. Previous research also supports these findings, such as that conducted by Rudiyanto & Hadi (2022), which shows that traditional games can improve students' physical fitness, as well as research by (Fauzi et al., 2023), which confirms that game approaches such as jumping are effective in learning the long jump. Thus, the R.A. model can be an innovative alternative in youth sports coaching,

providing a positive impact both physically and psychologically. The long jump material was taken based on the analysis found in the field located in the Karawang district. Over the years, the decline in long jump athletes' achievements has made the basis for taking long jump material the main topic. The results of the field analysis show that many trainers' roles are less competitive in training, their monotonous attitudes and unstructured coaching styles cause athletes' performance to decline.

Leg swing motions are essential for calculating the long jump's distance, particularly during the takeoff preparation phase and the final stride prior to the repulsion. To develop ideal speed, the athlete runs in advance during the prefix phase. The momentum during the repulsion is significantly influenced by the speed attained during the start (Raharjo et al., 2024). The last four steps before the repulsion has reached maximum speed and the speed must be constantly maintained, not reduced. (Rohmansyah & Suharjana, 2015; Suharnoko & Firmansyah, 2018).

In order to prepare for an effective repulsion, the athlete lowers their center of gravity on the final step before the repulsion, also referred to as the "penultimate step." A higher and longer leap is made possible by the proper leg swing action during this phase, which aids in the transition from horizontal to vertical speed (Suharnoko & Firmansyah, 2018). The transfer of energy from horizontal velocity gained by running to vertical velocity takes place in the repulsion stage (Masitah et al., 2022).

The leg not used for repelling is swung rapidly forward and upward during the repulsion phase. This motion helps keep the body balanced while floating in the air and increases the upward thrust. The repulsion technique involves "the thighs and legs being swung freely, straightening the knees, ankle joints, and waist when repelling (Wardana & Liskustyawati, 2017). For the best jumping results, coordination between leg swing, body position, and pace is crucial. An optimal takeoff angle will be achieved by coordinating the leg swing with the repulsion, which will increase the jumping distance. In order to maintain balance and make a

safe landing, athletes must also be mindful of their body movement techniques throughout this hovering phase (Utomo & Agustiyanto, 2017).

Therefore, the efficacy and distance of the long jump are determined by leg swing movements, particularly during the takeoff preparation phase and the final stride prior to the repulsion. Athletes will perform at their peak with training that emphasizes leg muscle strength and coordination. Research on coaching in sports, especially the long jump, has highlighted the importance of a holistic approach that suits the developmental needs of athletes, especially in adolescence. According to (Permana et al., 2022), structured training with attention to the principle of periodization can improve technical and physical abilities gradually. In the long jump branch, the main elements, such as speed, strength, agility, and coordination, are the main focus that must be trained through varied and interesting methods, especially for young age groups. Studies by Fatchurrahman et al. (2019) and Labib Siena Ar Rasyid et al. (2023) mentioned that exercises that incorporate both anaerobic and aerobic components, such as dynamic sports, can greatly increase agility and speed.

In addition, research by Aulia et al. (2022) shows that simple games such as jumping significantly improve the learning outcomes of squatting long jump techniques in elementary school students. Other research, such as that conducted by Widiastuti and Hutumo (2018), highlights that a game-based approach is able to improve students' technical ability and motivation in learning physical education, including in the sport of the long jump. From a coaching perspective, (Đurović et al., 2020) state that the game approach in coaching improves the understanding of tactics and techniques and creates a fun training atmosphere, making it more suitable for young athletes who need high motivation to keep developing.

The findings make an important contribution to the development of physical training methods in sports, particularly the long jump, by introducing a game-based Resistance and Aerobic Training (R.A.) model as an effective approach for the 13-15-year-old age group. The results


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10 (3) 2024 | 486-502

showed that this model not only significantly improved physical abilities and techniques but also created a more fun and interactive training atmosphere, making it relevant for the development of early athletes. These findings can form the basis for further development, such as applying similar models to other sports or exploring game-based training adaptations that integrate technology, such as digital apps or gamification, to increase participant engagement. As such, this research opens up opportunities to create more innovative training approaches that suit the needs of younger generations.

## CONCLUSION

The findings above show that the game-based physical training model of Resistance and Aerobic Training (R.A.) is proven effective in improving physical abilities and long jump techniques in students aged 13-15. This approach provides a fun, interactive training atmosphere and encourages participant motivation, making it more suitable than conventional methods that tend to be monotonous. With correlation values showing a strong positive relationship between this training model and physical skill improvement outcomes, these findings confirm that a game-based approach provides significant benefits in the context of sports learning.

Research confirms the need to integrate game-based methods into physical education coaching and learning programs, particularly for the sport of the long jump. This approach helps improve physical performance and technique and creates a more meaningful experience for learners, especially in adolescence. In addition, the results of this study guide coaches and educators in prioritizing a holistic approach, which includes the physical, mental, and emotional development of learners. The contribution of these findings includes the development of innovative training models for the development of young athletes, especially in the sport of long jump. Physical education coaches and teachers can utilize the Resistance and Aerobic Training (R.A.) model to optimize learning outcomes while increasing students' active participation in sports activities.

The findings also open up opportunities for further development, such as the application of similar models in other sports, which can help create a more competitive and vibrant generation of young athletes.

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