The Effectiveness of Weight Training in Improving Students' Physical Fitness for Badminton

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ABSTRACT

Badminton is a popular sport in Malaysian society. It has a high-intensity match play and important variability in physiological demands. These factors emphasise the importance of both anaerobic and aerobic training while playing badminton. Despite this, primary school students normally undergo more aerobic training rather than anaerobic training, especially weight training with dumbbells. This study aims to explore how weight training can improve performance in badminton. **Objectives**: This research is to study the effects of weight training incorporated with muscle endurance, cardiovascular as well as speed on badminton players. **Methods**: This research uses a quantitative approach to test the effectiveness of weight training. This research is one example of experimental research. By employing statistical tools such as descriptive data and T-test, the study will analyse all these statistical data to determine the impact of weight training on various aspects of physical fitness. **Results:** During the 6-week intervention, significant improvements were observed in the experimental group across all four tests, while the control group showed significant improvement only in agility. For muscle endurance, the experimental group achieved higher significance ($p < 0.001$) and mean improvement (0.8) than the control group ($p = 0.096$, mean = 0.5). Cardiovascular endurance, measured by the beep test, has improved more in the experimental group (mean = 0.46, $p < 0.001$) compared to the control group (mean = 0.26, $p = 0.007$). Agility improvements show a significant improvement in both groups, with the experimental group showing a larger mean improvement (4.1s) and effect size ($d = 1.449$). For speed, neither group showed significant improvement, although the experimental group had a slightly larger mean difference (0.7s). These findings suggest the weight training potential to enhance badminton-specific fitness attributes, particularly in agility and endurance. **Conclusion:** This study highlights the effectiveness of incorporating weight training into badminton training for primary school students. These findings underscore the value of weight training in enhancing badminton-specific fitness, particularly agility and endurance, and suggest further exploration of its long-term benefits.

Keywords: weight training, muscular endurance, cardiovascular endurance, speed, agility, badminton, primary students

INTRODUCTION

Badminton is a very popular sport in Malaysia, but primary school students often focus solely on aerobic training and not anaerobic exercises like weight training with dumbbells. This is concerning because badminton demands a combination of both aerobic and anaerobic fitness due to its high-intensity nature and the varying physiological demands of the game.

In order to examine various exercises that can improve students' performance in badminton, various methods and approaches have been determined to achieve this goal. Furthermore, the determination of training methods that can improve students' performance in badminton also has implications for school administrators and teachers. This research also determines the training methods that can improve students' performance in badminton and also has a positive impact on teachers. However, this research has a few limitations. This research only involves multiple badminton players in school. The sample of research consists of the school representatives which are the students who only acquire basic skills and they are only involved badminton players with the age from 9 to 12 years old.

In fact, there are many previous studies related to weight training and physical fitness that have been carried out. Zhan (2023) found out that weight gain can improve training efficiency and optimize the competitive level of table tennis players. 16 professional table tennis players have participated in this research and the experimental group received additional weightlifting training using 30% maximal strength based on the existing training.

Liu & Liu (2023) has also found that the addition of 10% weight training showed statistical benefits to explosive strength training, and improved the indicators of explosive strength in athletes. They also found significant improvements in the wrist joint speed and final velocity for the experimental group compared to the control group in their weight training for badminton athletes for 8 weeks training. This may be a reference for the effectiveness of improving the power of the athletes in different sports.

Furthermore, Plyometric Training (PT) is training which focuses on power. Deng et al. (2024） stated that skill-related physical fitness is important for sports performance, particularly in badminton, which involves dynamic movements and quick reflexes. His findings showed that PT improved power, agility, speed, and balance, but not reaction time in badminton players. His finding is supported by another research by another research by Fu et al. (2021). More importantly, PT has a high similarity with weight training and can act as the reference for this research.

In addition, the other studies which related to anaerobic training like high-intensity interval training (HIIT) showed positive results too. Ko & Lee (2021) found that HIIT significantly improved anaerobic ability, fatigue recovery, and muscle function compared to moderate continuous training (MCT) among the adolescent badminton players. This has proven the effectiveness of aerobic training.

The previous studies have proven the effectiveness of many anaerobic training like HITT, PT in different sports. Normally, the training will be carried out for 8 to 12 weeks or above. Despite this, the different period of training may be the gap for the previous research and the coming studies. The age and level of training of the sample may affect the impact of weight training in badminton too. The limited research of weight training in badminton with the period of 6 weeks has brought to the execution of this research.

This research has shown its potential and importance to obtain results regarding weight training among primary school students. Weight training is carried out in order to investigate its effect on physical fitness. The weight training is hoped to improve students' speed, agility, muscular endurance and cardiovascular endurance which are highly related in badminton performance. This study is unique due to its focus on weight training in primary school students and its 6 weeks short training duration. The six-week period was chosen considering the limited preparation time available to primary school students, making it a more practical option for integration into their schedules. This research is to study the effects of weight training incorporated with muscle endurance, cardiovascular as well as speed on badminton players.

METHOD

Participants

Population in this research refers to the badminton players in School Y in Kota Tinggi, Johor. Badminton players in the school refers to the members of the badminton club in School Y. Hence, the population for this research is 28 people. The total number of badminton players in this school is about 28 people. Meanwhile, the number of participants involved in this research study is 20 individuals. The study participants consist of 10 males and 10 females. All the samples consist of students from the age 10 to 12 years old.

Study Design

This study employed an experimental design after the discussion was made. Experimental Designs have been chosen for a few reasons. Firstly, experimental designs are more suitable to this topic that need to be experimented due to its establishing causality. In this context, this research aims to investigate the impact of weight training on the physical fitness of badminton players. These aspects include speed, agility, muscular endurance, and cardiovascular endurance.

Experimental research allows researchers to investigate relationships between the variables by manipulating one variable while keeping the other variable constant. This is extremely important to enable researchers to systematically study how changes in the manipulated variable affect the outcome. This also enhances the study of the internal validity by minimizing other outside factors. This will ultimately lead to a more convincing argument about the effectiveness of weight training for improving physical fitness in student badminton players.

This research also involves manipulating one independent variable which is weight training, in order to observe its effects on a dependent variable, physical fitness. Random assignment of participants to different groups helps control for confounding variables. Examples include pre-test and post-test of control group design, factorial design, and randomized controlled trials.

A randomized controlled trial (RCT) is a study where patients from a target population are randomly put into either a treatment group or a control group. They then followed at specific intervals to gather data on outcomes. The control group usually receives a standard treatment for comparison. The samples of the research were chosen randomly by using the randomized controlled trial method. They were chosen from the badminton representative in the school and put into the control and experimental group. However, gender is considered in order to make the experiment more reliable and valid. Both control and experimental groups are set with 5 males and 5 females. They were then put into 2 different groups randomly.

Intervention Assessment

The objective of intervention is to improve students' physical fitness and follow by bringing a positive impact in badminton performance. The period of intervention is conducted for 6 weeks continuously. The experimental group had undergone weight training twice a week. The total content of training is fixed along the intervention. The intervention involved training for the whole body. (refer to Figure 1 & Figure 2).

Parts of Body	Exercises	Set & Repetition	Main muscle Groups Involve
Upper body	Hammer Curl	1kg x 8 times (2 repetition)	• Biceps brachii • Forearm muscles
	Tricep Extension	1kg x 8 times (2 repetition)	• Triceps brachii
	Shoulder Press	1kg x 8 times (2 repetition)	• Deltoids • Triceps brachii • Upper trapezius
Lower body	Reverse Lunge	1kg x 8 times (2 repetition)	• Quadriceps • Hamstrings • Glutes • Calves • Core muscles
	Jump Squat	1kg x 8 times (2 repetition)	• Quads Hamstrings • Glutes • Calves • Core • Hip flexors
	Goblet Squart	1kg x 8 times (2 repetition)	• Quads • Core • Hamstrings • Glutes • Calves
Core	Russian Twist	1kg x 8 times (2 repetition)	• Obliques • Rectus abdominis
Total Body	Farmer Walk	1kg x 8 times (2 repetition)	**Upper Body** • Forearms • Trapezius • Biceps • Deltoids **Lower Body** • Quadriceps • Hamstrings • Glutes • Calves **Core** • Obliques • Transverse abdominis

Figure 1: Relationship between Exercise and Muscle Groups Involve

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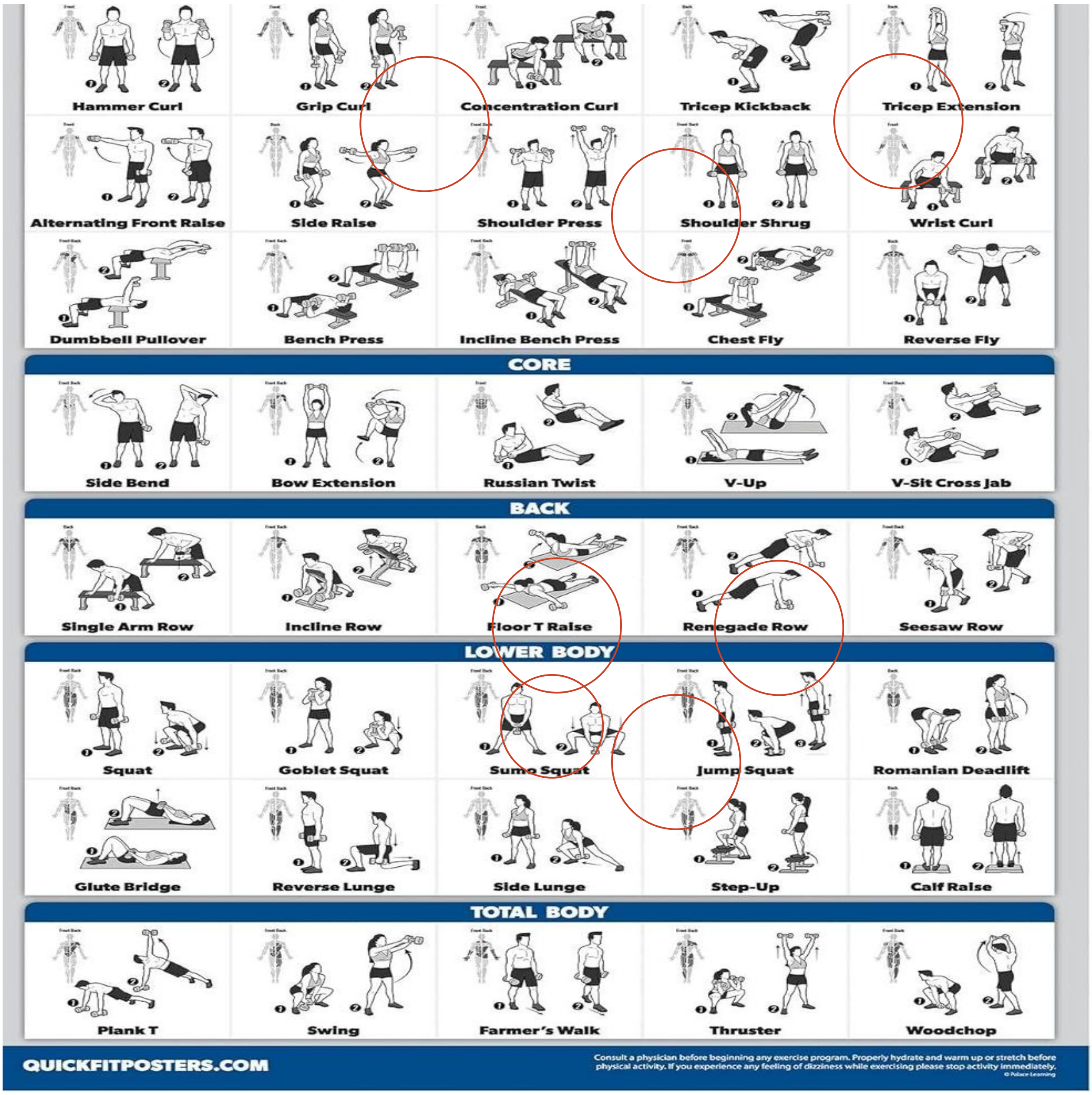

Figure 2: 8 Dumbbell exercises in this research.

The experimental group followed a structured weight training protocol, weight training with a fixed load for six weeks using dumbbells. Participants performed two sessions per week over six weeks. Each session consisted of eight exercises with dumbbell weights set at 1kg. Each exercise consists of 2 sets included 8 repetitions, with a rest interval of 60 seconds between sets to ensure adequate recovery. Participants were monitored to maintain proper form and avoid injury. Detailed protocols, including exercise diagrams and progression tables, are available in Supplementary Materials (Appendix 1).

Physical Fitness Test

The sequence of assessment was conducted for pre and post intervention assessment. In other words, all the assessment will be conducted before the weight training is applied and after the 6^{th} week of training is started. Participants underwent that push up, beep test, badminton agility test and the 5 m Repeat Sprint Test (5 m-RST) m that includes measurements of muscle endurance, cardiovascular endurance, agility and speed. Muscle endurance is measured by push up. The more push-ups a participant can complete represent the higher their muscle endurance. Similarly, cardiovascular endurance is measured by a beep test. Reaching a higher stage represents the higher level of participants' cardiovascular endurance. On the other hand, agility is measured by a special test called badminton-agility test. Lastly, the speed is measured by the 5 m Repeat Sprint Test (5 m-RST) m.

There is always a time interval between the four tests to ensure students have enough time of recovery. However, all the tests are carried out on the same day to ensure the body condition of the sample remains the same. All the participants underwent the process of assessment as below (refer Figure3)

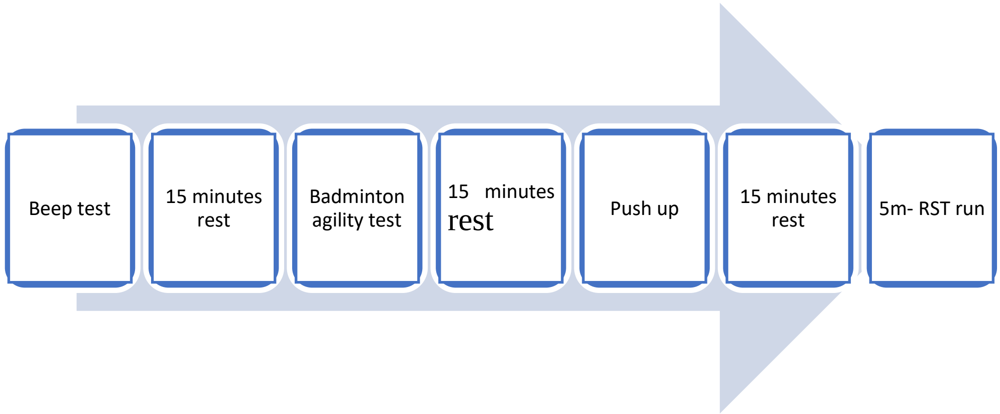

Figure 3: Protocol of assessment

Push up

Muscular endurance is tested by using push ups. There is a test done by Romain & Mahar (2001). A table by FITNESSGRAM Standards The FITNESSGRAM®, a comprehensive fitness assessment battery for youth developed by The Cooper Institute is used. FITNESSGRAM includes a suite of health-related fitness tests that assess cardiovascular fitness, muscular strength, endurance, flexibility, and body composition. Its standards are criterion-referenced, emphasizing health-promoting fitness levels rather than population averages. Push up is a bodyweight exercise that targets the chest, shoulders, and triceps. They can be modified to be easier or harder. Although push ups can modify its difficulties by changing the position, its difficulties should be maintained from the pretest to the post test. The samples should get on their hands and knees, with their arms positioned a little wider than shoulder width. Then, extend the feet backward and straighten the body. When they are doing the push up, make sure they keep the body straight and elbows slightly tucked in, lower the chest to the floor by bending elbows. Exhale as they reverse the motion and push their body back up to the starting position. The samples should try to do a complete push up as much push up as they can. The samples" performance is based on maximum number of repetitions in 1 minute. The participants must complete the push in a proper way.

Beep test

The Beep Test, developed by Professor Luc A. Leger, is a fitness test used to estimate a person's aerobic capacity (VO_2max).(Prime Motion Group, 2024). VO_2max measures how well your body uses oxygen during exercise, a key factor for endurance in sports like badminton and swimming。

The procedure of preparing a beep test is simple. Before the test starts, the researcher has to make sure that all the samples are clear with the beep test rules thoroughly. The researcher can advise the samples to be as efficient and economical with the technique and energy consumption during the test as possible. Correct running technique, timing, foot placement and turning technique are all elements that will improve their performance. These moves are to make sure they perform their best performance in the test. The researcher also needs to prepare cones to mark each end and make sure the testing area with a flat, non-slip surface with no obstructions. In this test, the other samples who are not tested in that round can be the people who help the researcher to make sure the tested participants follow the rules. The recommended protocol will be each participant supervised by a person.

Badminton Agility Test

Agility is the ability to rapidly change body direction, accelerate, or decelerate. It is influenced by balance, strength, coordination, and skill level. Agility can be improved by first developing an adequate base of strength and conditioning that is appropriate for the difficulty level of the athlete. (Prelaz, 2013). The Badminton-specific movement agility test can be carried out by following the procedures. Samples stood in the middle of the badminton court without a racket. They started the test by moving quickly side-to-side across the court, touching shuttlecocks placed on the sidelines. Then, they moved around the court corners, touching shuttlecocks at each corner. Samples ran around the four corners of the court 16 times, following a specific order. They had to touch a shuttlecock at each corner. They had to follow badminton-specific movements and use their dominant hand for both moving and hitting the shuttlecocks. Edmizal & Soniawan (2020) developed a badminton-specific agility test using movements like forward, side-to-side, and backward motions on a badminton court. The test was performed on 100 participants, and its validity was compared to the Shuttle Run Test. The new test showed good validity (0.78) and reliability (0.79), indicating it effectively measures badminton-related agility and provides consistent results. This test is more suitable for badminton as it replicates the sport's movements. Frederick et al. (2015) introduced a badminton-specific movement agility testing system to compare pre-planned (sequential) and specific (random) movement agility. The results showed that the badminton-specific test was more effective in measuring a player's agility on the court.

The 5 m Repeat Sprint Test (5 m-RST) m

The 5 m multiple shuttles repeat sprint test (5 m-RST) was adapted from the Welsh Rugby Union shuttle run test by the Sport Science Institute of South Africa. (Boddington, 2001) The test consists of six 30 second repeat sprint bouts, interspersed by 35 second rest periods. The 5m-RST assesses an athlete's ability to maintain high-intensity performance over repeated short sprints. It's designed for sports with frequent bursts of intense activity, like rugby, hockey, and basketball. The procedure is simple. Six markers were placed every 5 meters for a total distance of 25 meters before the test started. Samples start at the first marker. On a signal, they sprinted to the second marker, touched it, returned to the first, touched it, then sprinted to the third marker, back to the first, and so on for 30 seconds. They rested for 35 seconds and repeated this 6 times. The total distance covered in all 6 rounds was measured. All samples ran back and forth between the starting point and markers at 5, 10, and 20 meters. When the 30 seconds were over, the researcher noted the participant's position.

Statistical Analysis

After the data is collected, the statistical tool, SPSS (Version 27.0,) is used to analyse the data. The tests such as descriptive data and T-test are used. Descriptive statistics are performed to analyse statistical data from the research findings. According to Kang & Lim (2015), descriptive statistics aim to determine the mean, standard deviation, median, mode, frequency, and percentage. The T-test can be used to compare the level of motivation between two different periods. In this case, a Paired Samples T-Test is typically used to measure the same group of subjects twice over two periods, pre and post intervention is implemented to compare changes in players' physical fitness The differences between pre- and post-tests of the groups analysed with Paired t-tests (2-tailed). Statistical significance was set at $p \leq 0.05$. Effect sizes were interpreted as small (0.2 – 0.49), medium (0.50–0.79), and large (≥0.8) for more complete analysis. Despite this, the normality test is run in order to justify the normality of the data as the pre terms before the t-test is tested. The data were tested for normality using the Shapiro-Wilk test as the sample is less than 50 (N=20). All variables were normally distributed ($p > 0.05$).

RESULTS

During the 6-week intervention period, no injuries were ported, and all participants fully completed the study. There are mostly significant improvements in all the four tests for the experimental group while the control group only show significant improvement in the agility test. The tests were run with a 95% confidence interval level.

Variable	Group	Pre-Test Mean	Post-Test Mean	Mean Difference (pre-post)	95% Confidence Interval	t-value	Cohen's Standardizer （d）	Sig(2 tailed)
Push up （Muscle endurance ）	Experimental group	11.6	12.4	-0.8	（-1.102, -0.498）	-6	0.422	<0.001
	Control group	8.1	8.6	-0.5	（-1.108, 0.108）	-1.86	0.85	0.096

Beep test(Cardiovascular endurance)	Experimental group	6.49	6.95	-0.46	(-0.5957, -0.3243)	-7.67	0.1897	<0.001
	Control group	5.43	5.69	-0.26	(-0.4293, -0.907)	-3.47	0.2366	0.007
Badminton Agility Test（Agility training）	Experimental group	50.5	46.6	4.1	（3.063, 5.137）	8.947	1.449	<0.001
	Control group	55.4	53.5	1.9	（1.274, 2.526）	6.862	0.876	<0.001
The 5 m Repeat Sprint Test((5 m-RST) m（Speed training）	Experimental group	25.9	25.2	0.7	（0.354, 1.046）	4.583	0.483	0.001
	Control group	28.5	28.3	0.2	（-0.457, 0.857）	0.688	0.919	0.509

Table 1 : Descriptive Statistics and Paired T-Test Results for Pre-Test and Post-Test Scores Across Experimental and Control Groups

Muscle endurance

The muscle endurance level of samples are tested by push up. By referring to Table 1, both groups show improvement in terms of mean. The experimental group improved by 0.8 while the control group improved by 0.5 in means. The interesting parts are experimental group shows higher significant level (p<0.001) higher mean difference (0.8) but with lower Cohen's Standardizer (d=0.422) compared with the control group with the result of lower significant level (p>0.001), lower mean difference,0.5 but with lower Cohen's Standardizer (d=0.8). The t value of the experimental group (t= 6.000) is higher than the control group(t=1.861).

Cardiovascular endurance

The cardiovascular endurance level of samples is tested by beep test. Both groups show improvement after the intervention was applied. Despite this, the experimental group shows higher improvement by 0.46 compared to the control group with the improvement by 0.26.(refer to Table 1) The experimental group also shows higher significant levels (p<0.001) compared to the control group with the significant level of p>0.00. Nevertheless, the control group showed slightly higher Cohen's Standardizer (d=0.2366) compared to the experimental group(d=0.1897). The t value of the experimental group (t=7.667) is higher than the control group(t=3.474).

Agility training

Both experimental group and control group show improvement in terms of agility which is tested by the badminton agility test. By referring to Table 1, Both improved significantly (p>0.001) in agility. However, the experimental group has a higher mean difference (4.1 s) and Cohen's Standardizer(d=1.449) compared to the control group which has the lower mean difference (1.9s) and Cohen's Standardizer(d=0.876). The t value of the experimental group (t=7.667) is higher than the control group(t=3.474).

Speed training

Both groups didn’t improve significantly in speed after 6 weeks of intervention. By referring to Table 1, both groups showed low significance levels: the experimental group (p = 0.001) and the control group (p > 0.01). Nevertheless, both groups show a slightly improvement in result. The experimental group has a bigger mean difference (0.7s) than the control group (0.2s). On the other hand, the control group showed slightly higher Cohen's Standardizer (d=0.919) compared to the experimental group(d=0.483). The t value of the experimental group (t=4.583) is higher than the control group(t=0.688).

DISCUSSIONS

By referring to the result in Table 1, the weight training has brought the positive result towards the experimental group. This can be proven by showing the sig level of push up, beep test and agility test with the P <0.001 and 0.001 for 5 m-RST m test. There is strong evidence that there is an effect in the group. At the same time, we can reject the null hypothesis. Despite this, there are a few things that can be highlighted in this research.

Firstly, there are improvements in both groups although the control group didn't undergo any intervention. The improvement of the control group is less significant which can be proven by the p value. The control group does not show statistical significance ($p = 0.096$), suggesting that weight training had a greater impact than standard training in muscle endurance. Not only that, the improvement of results of the control group is lesser than the experimental group in all the four tests which indicate 4 different aspects of physical fitness namely muscle endurance, cardiovascular endurance, agility and speed. For instance, the experimental group has a slightly larger effect size (Cohen's d = 0.1897) than the control group (Cohen's d = 0.2366), indicating the experimental training is slightly more effective in cardiovascular endurance.

Both experimental and control groups show a significant level (P< 0.001 in the badminton agility test). In other words, both the groups have shown improvement in the agility test before and after the weight training were applied. This means that the improvements in the agility test might not be highly related to weight training. In fact, both groups were actually undergoing the training of footwork throughout the 6-week intervention. It helps the players to improve their agility on the court. Despite this, the experimental group still shows bigger improvement in agility by the mean of 4.1 s compared to the control group with the improvement of 1.9s. In short, the training of footwork plays an important role in improving the agility and speed of badminton players.

For the test in the 5m Repeat Sprint Test, the experimental group shows a non-significant improvement ($p = 0.001$) with a moderate effect size (Cohen's d = 0.483). Likewise, while the control group's results are not statistically significant ($p = 0.509$), indicating limited effectiveness of the standard training for speed improvement. This result may due to a few reasons. One possible explanation is the specificity of the training program. Weight training has proven its effectiveness towards muscle strength and endurance, may not directly translate to improvements in sprint performance over short distances (Young et.al, 2001). Speed development often requires high-velocity plyometric exercises or sprint-specific drills, which were not the primary focus of this intervention. More importantly, neuromuscular fatigue could have played a role in limiting improvements. The training load, combined with regular badminton practice, may have led to accumulated fatigue, reducing the players' ability to generate peak acceleration during the 5m-RST test (Collins et al., 2018). Especially the 5m-RST test was conducted as the last test after all the three tests that may had caused the sample to feel tired.

These improvements in physical fitness have proven its importance in the actual performance in the real game of badminton. Ma (2024) stated in her research that the previous study has proven a strong core also helps maintain good posture, reduce the risk of injury, and increase overall body control. Many studies have shown the positive effects of core strength training on athletic performance. Research has shown that athletes who incorporate core strengthening exercises into their training regimens experience improvements in stability, agility, and strength. While core strength plays a vital role in improving muscular endurance, agility, and speed, and indirectly contributes to better cardiovascular fitness.

Dimas (2017) found that agility is one of the important components in badminton. Agility is needed to maintain balance when performing maneuvers quickly and accurately. Agility in badminton is associated with the ability of the athlete to move and move around in maintaining the position of the shuttlecock, so there is a need for accuracy and speed of reaction in changing direction. Changing direction quickly requires leg muscle power, which exercises involving rapid jumps are able to stimulate muscle to increase power.

Zhang & Cui (2023) stated that in fast-paced badminton, the lightweight shuttlecock demands powerful backcourt attacks. Smashing the ball is crucial for scoring. Modern badminton emphasizes attacking play, requiring players to reduce reliance on high balls and accelerate the game's rhythm. This not only improves scoring opportunities but also enhances the game's entertainment value. Accurate and strategic smash are essential to create attacking advantages and maximize scoring potential. This is supported by the high speed of players.

At the same time, all the skills must be supported by the high cardiovascular and muscle endurance in order to make sure the badminton players are able to keep their momentum and ability to play all the techniques and react according to the situation on the badminton court.

Undeniably, there are several limitations in this research which can be improved in the future studies. The sample size of 20 people is considered quite small for research. The small sample size may affect the result of the research. This was occurring due to the limitation of equipment and population of research. The number of dumbbells will limit the process of research. The shortage of dumbbells had slowed down the process especially when the players had to wait for other people to finish their training set. The amount of badminton players in school affects the selection of research samples. Although the sample selection process followed the principles of Randomized Controlled Trials (RCT), the research must consider the players' level to align with school-level standards. There are limited school representatives available, which is crucial because weight training is more applicable to school representatives to effectively address the research problem and demonstrate its effectiveness. The process of weight training may not be perfect due to the application of weight training is hard for primary students. Although full guidance was given to every participant of research, especially the experimental group, they still face many difficulties in using the dumbbells as that might be the first time of using the dumbbells. This has caused the effectiveness of weight training to drop due to the improper ways of training. In conjunction with this, the weight of the weight training should remain in the future studies. The overload of weight training may increase the risk of injuries and difficulties of maintaining the correct position of training, Injuries and wrong position of the training may affect the result of research critically.

Here are a few suggestions for the previous studies. The investigation of weight training among badminton representatives in primary students is still very limited. Thus, the conduction of this type of research with a few adjustments should be continued. Firstly, the increasing sample size to at least 50. The increasing sample will bring a stronger power of research as well as lower the standard error of research. Not only that, but more dumbbells are also needed in order to make sure the research is conducted more effectively. The longer periods of weight training may show a more significant improvement and how far weight training plays the role in improving the physical fitness of badminton players with the age of 10-12 years old.

CONCLUSION

To our knowledge, this is the first study to investigate the effects of a 6-week weight training program among primary school badminton players. The results highlighted positive effects on badminton-specific fitness, particularly in agility and endurance. These findings suggest that structured weight training can be an effective effect on badminton training programs for primary school badminton players. In conjunction with that, future research should explore the long-term benefits, impacts on injury prevention, and its broader applicability across different contexts by involving larger sample size. This study adds to the growing body of evidence on the role of anaerobic training, weight training in enhancing youth sports performance, especially badminton.

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APPENDIX

Parts of Body	Exercise	Dumbbell Weight (kg)	Repetitions and Sets	Rest Interval (s) between sets	Frequency (Days/Week)	Note
Upper body	Hammer Curl	1 kg	8 repetitions (2 sets)	60 seconds	2 sessions per week	Finish all the exercises for upper body and rest for extra 60 seconds
	Triceps Extension	1 kg	8 repetitions (2 sets)	60 seconds	2 sessions per week	
	Shoulder Press	1 kg	8 repetitions (2 sets)	60 seconds	2 sessions per week	
Lower body	Reverse Lunge	1 kg	8 repetitions (2 sets)	60 seconds	2 sessions per week	Finish all the exercises for lower body and rest for extra 60 seconds
	Jump Squat	1 kg	8 repetitions (2 sets)	60 seconds	2 sessions per week	

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	Goblet Squart	1 kg	8 repetitions (2 sets)	60 seconds	2 sessions per week	
Core	Russian Twist	1 kg	8 repetitions (2 sets)	60 seconds	2 sessions per week	Finish Russian Twist for core and rest for extra 60 seconds
Total Body	Farmer Walk	1 kg	8 repetitions (2 sets)	60 seconds	2 sessions per week	Finish the Farmer Walk for Total body as the last exercise.

Appendix 1: Exercise Protocols Diagram.