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The Effect of Medicine Ball Training on Basketball Shooting Ability at Fastbreak Club Makassar

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ABSTRACT

Basketball shooting is a fundamental offensive skill that directly determines scoring success and team performance. However, shooting ability does not depend solely on technical mastery; it is also influenced by physical components such as upper-body explosive power, core stability, movement coordination, and shooting consistency. This study aimed to determine the effect of medicine ball training on basketball shooting ability among female athletes at Fastbreak Club Makassar. The research used a quantitative experimental method with a pretest–posttest control group design. The sample consisted of 20 female basketball athletes selected through random sampling and divided into two groups: 10 athletes in the medicine ball training group and 10 athletes in the control group. The experimental group received medicine ball training, while the control group followed regular training activities. Basketball shooting ability was measured through a shooting test before and after the intervention. Data were analyzed using descriptive statistics, normality testing, homogeneity testing, paired-samples t-test, and independent-samples t-test at a significance level of 0.05. The results showed that the medicine ball group improved from a pretest mean score of 3.80 to a posttest mean score of 7.80, with an average increase of 4.00 points. The control group improved from 3.60 to 5.00. The paired-samples t-test showed a significant effect of medicine ball training on shooting ability ($t = 13.416$; $p = 0.000$). The independent-samples t-test also showed a significant posttest difference between the medicine ball group and the control group ($t = 6.332$; $p = 0.000$). These findings indicate that medicine ball training is effective in improving basketball shooting ability. Therefore, medicine ball exercises can be recommended as a practical and evidence-based training method to support basketball shooting performance.

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INTRODUCTION

Basketball is one of the most dynamic team sports, requiring players to integrate technical skills, physical fitness, tactical awareness, and psychological readiness to achieve optimal performance. Among the fundamental technical skills, shooting represents the most decisive offensive action because it directly determines scoring opportunities and ultimately influences match outcomes. Regardless of the sophistication of offensive strategies or ball movement, a team cannot secure victory without consistent shooting accuracy. Consequently, the development of shooting proficiency remains a primary objective in basketball coaching programs across all competitive levels.

Successful shooting performance depends not only on technical execution but also on the athlete's physical capacities, particularly upper-body strength, explosive power, coordination, and movement stability. During a shooting motion, force generated from the lower extremities is transferred through the trunk and upper limbs before being released toward the basket. Therefore, inadequate muscular strength or explosive power may reduce shooting velocity, ball trajectory consistency, and overall shooting accuracy, particularly during game situations involving defensive pressure and fatigue. Previous studies have consistently demonstrated that physical conditioning contributes substantially to technical performance in basketball, emphasizing that improvements in muscular power can positively affect shooting efficiency, passing velocity, and overall offensive effectiveness.

Fastbreak Club Makassar has continuously implemented technical shooting drills within its athlete development program. Nevertheless, field observations indicate that many players still experience inconsistency in shooting accuracy, particularly during competitive situations requiring rapid execution. This condition suggests that conventional technical practice alone may not sufficiently optimize shooting performance. Therefore, complementary physical training methods capable of improving explosive upper-body performance deserve further investigation.

One training method that has gained increasing attention is medicine ball exercise. Medicine ball training integrates resistance with sport-specific movement patterns, enabling athletes to simultaneously improve muscular strength, explosive power, coordination, and neuromuscular efficiency. Unlike traditional resistance training, medicine ball exercises closely mimic the kinetic chain involved in basketball shooting, making them highly relevant for technical skill enhancement.

Recent developments in sports science emphasize that basketball performance should be developed through an integrated approach combining technical practice and evidence-based physical conditioning. Contemporary studies have reported significant relationships between upper-body power, core stability, and shooting performance among youth and elite basketball athletes. Explosive resistance training has been shown to improve force production, neuromuscular coordination, and movement efficiency, all of which contribute positively to technical execution during competition.

Medicine ball training has become increasingly popular because it applies the stretch-shortening cycle while simultaneously stimulating sport-specific movement patterns. As a form of ballistic resistance exercise, medicine ball drills promote rapid force production, intermuscular coordination, and motor unit recruitment, thereby enhancing explosive upper-body performance. These physiological adaptations are particularly relevant for basketball shooting, where rapid acceleration of the ball depends on coordinated force generation from multiple body segments.

Several empirical investigations conducted during the last decade have demonstrated that medicine ball exercises improve throwing velocity, upper-body muscular power, passing performance, and functional strength across various sports such as basketball, handball, volleyball, baseball, and tennis. Likewise, plyometric-based medicine ball interventions have been associated with improvements in upper-limb explosive power and neuromuscular control among adolescent athletes. Since basketball shooting requires coordinated extension of the lower limbs, trunk rotation, shoulder flexion, elbow extension, and wrist action, medicine ball training theoretically provides biomechanical specificity that supports improvements in shooting mechanics.

Furthermore, current sports performance literature emphasizes the principle of training specificity, suggesting that physical exercises resembling competitive movement patterns produce greater transfer effects toward technical performance. Medicine ball drills satisfy this principle because many exercise variations replicate passing and shooting movements performed during basketball games.

Although numerous studies have investigated resistance training and plyometric exercise in basketball, several important limitations remain. First, most previous investigations have focused on vertical jump ability, sprint speed, agility, or general muscular power rather than directly evaluating basketball shooting performance. Second, studies specifically examining medicine ball training as an intervention to improve shooting ability remain relatively limited, particularly among developing athletes participating in local basketball clubs.

Third, previous research has frequently involved elite athletes, university players, or school teams, while evidence involving community-based basketball clubs such as Fastbreak Club Makassar remains scarce.

Differences in athlete characteristics, training experience, coaching methods, and competitive level may influence training adaptations, making it inappropriate to generalize findings across different populations.

Finally, relatively few studies have examined medicine ball training using sport-specific intervention programs designed explicitly to improve shooting performance. Consequently, empirical evidence explaining the effectiveness of medicine ball exercises for enhancing basketball shooting ability within Indonesian athlete development contexts remains insufficient. Addressing these gaps is important for providing scientifically validated recommendations for coaches seeking efficient and practical training methods.

Based on these considerations, this study aims to determine the effect of medicine ball training on the basketball shooting ability of athletes at Fastbreak Club Makassar. Specifically, the study evaluates whether systematic medicine ball exercises can significantly improve shooting performance following a structured training intervention.

The novelty of this research lies in several aspects. First, it integrates sport-specific medicine ball exercises with basketball shooting performance rather than evaluating general physical fitness outcomes alone. Second, it focuses on athletes from a local basketball club in Indonesia, thereby providing empirical evidence within a population that has received limited scientific attention. Third, the study applies contemporary concepts of neuromuscular adaptation, explosive power development, and movement specificity to explain the physiological mechanisms underlying improvements in shooting performance. Consequently, the findings are expected to enrich current literature in sports coaching science while providing practical guidance for basketball coaches in designing evidence-based training programs.

In conclusion, basketball shooting performance is determined by the interaction between technical mastery and physical capabilities, particularly upper-body explosive power. Medicine ball training offers a theoretically sound and practically applicable approach for improving these physical components through sport-specific movement patterns. However, empirical evidence regarding its effectiveness for improving shooting ability among Indonesian basketball club athletes remains limited. Therefore, this study is expected to address existing research gaps while contributing both scientifically and practically to the development of basketball training programs based on contemporary sports science.

METHODS

This study employed a quantitative experimental approach to examine the effect of medicine ball training on the basketball shooting ability of female athletes at Fastbreak Club Makassar. Experimental research is considered one of the most appropriate methods for identifying causal relationships because it allows researchers to manipulate an independent variable and evaluate its direct influence on a dependent variable under controlled conditions (Syahrizal & Jailani, 2023). Consistent with recent recommendations in sports science research, experimental designs provide robust evidence for evaluating the effectiveness of physical training interventions when combined with standardized testing procedures and appropriate statistical analyses (Hopkins et al., 2021; Murtagh et al., 2022). The research adopted a pretest–posttest experimental design, enabling comparisons between participants' performance before and after the intervention. This design minimizes baseline bias and provides greater accuracy in determining training effects by measuring individual changes over time (Thomas et al., 2021; Grgic et al., 2022). The study was conducted under standardized training conditions at Fastbreak Club Makassar.

The study population consisted of female basketball athletes registered at Fastbreak Club Makassar. Using a random sampling technique, twenty athletes were selected as research participants. Before the intervention, all participants completed a pretest assessing basketball shooting ability. Based on the pretest scores, athletes were ranked and matched using an AB–BA pairing technique to ensure balanced baseline performance before being allocated equally into the experimental and control groups, each consisting of ten athletes. This matching procedure is recommended to reduce selection bias and improve group equivalence in small-sample experimental studies (Behm et al., 2021; Moran et al., 2021).

The experimental group completed a structured medicine ball training program designed to enhance upper-body explosive power and neuromuscular coordination relevant to basketball shooting, whereas the control group continued its regular basketball training without additional medicine ball exercises. Previous studies have shown that medicine ball training effectively improves upper-limb power, movement

coordination, and sport-specific performance in overhead and throwing activities (Suchomel et al., 2018; Ramirez-Campillo et al., 2021; Slimani et al., 2022). Basketball shooting ability was assessed using a standardized shooting accuracy test administered before and after the intervention. Data were analyzed using descriptive statistics followed by prerequisite tests, including the Shapiro–Wilk normality test and Levene's homogeneity test, to verify statistical assumptions. Hypothesis testing was subsequently conducted using a paired-samples t-test to compare pretest and posttest mean scores within groups at a significance level of α = 0.05. This analytical approach is widely recommended for evaluating training-induced performance changes in experimental sports science research (Field, 2022; Portney, 2020).

RESULTS AND DISCUSSION

Result

Descriptive Statistics

The empirical data collected from the field consisted of pretest and posttest scores of basketball shooting ability for both the medicine ball training group and the control group. Prior to hypothesis testing, descriptive statistical analysis was performed to provide an overview of the data distribution, including the mean, standard deviation, variance, minimum value, maximum value, range, and total score. The descriptive statistics are presented in Table 1.

Table 1.
Descriptive Statistics of Basketball Shooting Ability

Variables	Medicine Ball Group (Pretest)	Medicine Ball Group (Posttest)	Control Group (Pretest)	Control Group (Posttest)
N	10	10	10	10
Mean	3.80	7.80	3.60	5.00
Standard Deviation	1.398	0.789	1.075	1.155
Variance	1.956	0.622	1.156	1.333
Range	5.00	2.00	3.00	4.00
Minimum	1.00	7.00	2.00	3.00
Maximum	6.00	9.00	5.00	7.00
Sum	38.00	78.00	36.00	50.00

Table 1 demonstrates a substantial improvement in basketball shooting performance following the medicine ball training intervention. The experimental group's mean score increased from 3.80 ± 1.40 at baseline to 7.80 ± 0.79 after the intervention, representing an average improvement of **4.00 points**. In contrast, the control group showed only a modest increase from 3.60 ± 1.07 to 5.00 ± 1.15, corresponding to an average improvement of 1.40 points. Furthermore, the reduction in the standard deviation observed in the experimental group after treatment indicates more consistent shooting performance among participants following medicine ball training.

Normality Test

Before conducting inferential statistical analysis, the data were examined for normality using both the Kolmogorov–Smirnov and Shapiro–Wilk tests. The results are summarized in Table 2.

Table 2.
Results of the Normality Test

Variables	Kolmogorov–Smirnov		Shapiro–Wilk		Interpretation
	Statistic	Sig.	Statistic	Sig.	
Medicine Ball Group	0.184	0.200	0.945	0.609	Normal
Control Group	0.245	0.090	0.892	0.177	Normal

The results indicate that all significance values exceeded the criterion of 0.05. The medicine ball group obtained Shapiro–Wilk p = 0.609, while the control group obtained p = 0.177. Therefore, both datasets were normally distributed and fulfilled the assumptions required for parametric statistical analysis.

Homogeneity Test

The homogeneity of variance between groups was assessed using Levene's Test, and the findings are presented in Table 3.

Table 3.
Homogeneity Test

Variable	Levene Statistic	Sig.	α	Interpretation
Pretest Scores	0.244	0.627	0.05	Homogeneous

Since the significance value (0.627) exceeded 0.05, the variances of both groups were considered homogeneous. Therefore, the assumptions for independent parametric testing were satisfied.

Hypothesis 1

The first hypothesis examined whether medicine ball training significantly improved basketball shooting ability. A paired-samples *t*-test was conducted by comparing pretest and posttest scores within the experimental group.

Table 4.
Paired-Samples *t*-Test for the Experimental Group

Comparison	Mean	Mean Difference	*t*	df	Sig. (2-tailed)	*t* Table
Pretest Posttest	3.80 7.80	4.00	13.416	9	0.000	1.833

The paired-samples *t*-test revealed a highly significant improvement in basketball shooting ability following medicine ball training ($t = 13.416$, $p < 0.001$). Since the calculated *t*-value exceeded the critical *t*-value (13.416 > 1.833), the null hypothesis was rejected. These findings indicate that medicine ball training produced a statistically significant enhancement in basketball shooting performance, with an average improvement of 4.00 points.

Hypothesis 2

The second hypothesis compared the posttest performance between the medicine ball training group and the control group using an independent-samples *t*-test.

Table 5.
Independent-Samples *t*-Test

Comparison	Mean	Mean Difference	*t*	df	Sig. (2-tailed)	*t* Table
Medicine Ball Control Group	7.80 5.00	2.80	6.332	18	0.000	2.093

The independent-samples *t*-test demonstrated a statistically significant difference between the experimental and control groups ($t = 6.332$, $p < 0.001$). Because the obtained *t*-value was greater than the critical value (6.332 > 2.093), the null hypothesis was rejected. Athletes who participated in the medicine ball training program achieved significantly higher shooting scores than those who followed regular training only. The mean difference of 2.80 points confirms the superior effectiveness of medicine ball exercises in improving basketball shooting ability.

Overall, the descriptive and inferential statistical analyses consistently demonstrate that medicine ball training substantially enhanced basketball shooting performance among female athletes at Fastbreak Club Makassar. The fulfillment of normality and homogeneity assumptions further strengthens the validity of the statistical findings, while both hypothesis tests provide robust empirical evidence supporting the effectiveness of medicine ball training as an evidence-based intervention for improving shooting performance.

Discussion

The findings of this study demonstrate that medicine ball training had a significant effect on improving basketball shooting ability among female athletes of Fastbreak Club Makassar. The descriptive analysis showed that the experimental group increased from a pretest mean score of 3.80 to a posttest mean score of 7.80, indicating an improvement of 4.00 points. Meanwhile, the control group improved from 3.60 to 5.00, with a smaller increase of 1.40 points. The paired-samples t-test confirmed a significant improvement in the medicine ball group, with t = 13.416 and p = 0.000. Furthermore, the independent-samples t-test showed a significant posttest difference between the medicine ball group and the control group, with t = 6.332 and p =

0.000. These results confirm that medicine ball training was more effective than regular training alone in improving basketball shooting performance.

From a conceptual perspective, shooting in basketball is not merely a technical movement but a coordinated motor action requiring upper-body strength, core stability, balance, rhythm, wrist control, and neuromuscular coordination. The act of shooting involves force transfer from the lower limbs through the trunk and upper extremities before the ball is released toward the basket. Therefore, athletes with better explosive power and postural control tend to produce more stable and accurate shooting mechanics. This interpretation is consistent with recent sports performance literature, which states that basketball skill execution is strongly influenced by the interaction between physical conditioning and technical efficiency (Suchomel et al., 2018; Torres-Ronda et al., 2020; Conte et al., 2021; Yang et al., 2026).

The significant improvement observed in this study can be explained through the principle of training specificity. Medicine ball exercises such as chest pass, overhead throw, rotational throw, and push throw closely resemble the force-production pattern required in basketball shooting and passing. These exercises stimulate the stretch-shortening cycle, improve rapid force development, and strengthen the shoulder, arm, chest, and core muscles involved in shooting execution. Previous studies have shown that medicine ball training improves upper-limb explosive power, throwing ability, movement coordination, and sport-specific performance (Ramirez-Campillo et al., 2021; Slimani et al., 2022; Pontillo et al., 2026; Rahman et al., 2026). Therefore, the improvement in shooting ability among Fastbreak Club Makassar athletes is logically related to better neuromuscular adaptation produced by repeated medicine ball training.

Empirically, the posttest mean of the medicine ball group reached 7.80, while the control group reached only 5.00. The 2.80-point difference indicates that athletes who received medicine ball training experienced greater development in shooting ability than those who followed ordinary training. This finding supports studies reporting that medicine ball training can improve basketball-related skills, including passing, speed spot shooting, coordination, and upper-body power (Thanuraj, 2023; Ahmed et al., 2022; Rahman et al., 2026). Similar results were also reported in Indonesian sport studies, where medicine ball throw exercises improved arm muscle power and technical performance in ball games (Widodo, 2018; Arifin & Nugroho, 2020; Hidayat et al., 2021; Zanurdi et al., 2022; Pratama et al., 2023).

In the context of fastbreak situations, the relevance of medicine ball training becomes even stronger. Fastbreak basketball requires athletes to shoot under dynamic conditions, often after sprinting, dribbling, receiving a pass, or facing defensive pressure. Under these conditions, shooting accuracy depends on the athlete's ability to maintain body balance, stabilize the trunk, and generate controlled force quickly. Medicine ball training contributes to these demands because it develops explosive strength while also involving dynamic balance and trunk activation. Studies on basketball conditioning emphasize that strength and power training must be integrated with sport-specific movement patterns to produce meaningful transfer to game performance (Santos & Janeira, 2017; Nikolaidis et al., 2019; Ferioli et al., 2020; Bouteraa et al., 2020; Gonzalo-Skok et al., 2021).

The reduction in standard deviation in the medicine ball group from 1.398 at pretest to 0.789 at posttest is also important. This indicates that after training, the athletes' shooting performance became more consistent. In sport coaching, consistency is a critical indicator of training success because performance improvement should not only occur in a few athletes but across the group. Medicine ball training may have standardized movement quality by improving strength coordination, release control, and body alignment during shooting. This supports the view that neuromuscular training enhances both performance output and movement efficiency (Behm et al., 2021; Moran et al., 2021; Grgic et al., 2022).

The findings also reinforce the argument that technical basketball training should not be separated from physical conditioning. Shooting drills alone may improve familiarity with the movement, but without adequate muscular power and stability, athletes may struggle to maintain accuracy under fatigue or pressure. Medicine ball training offers a practical conditioning model because it is relatively simple, affordable, safe, and adaptable to club-level training environments. For coaches at Fastbreak Club Makassar, this method can be integrated into warm-up sessions, strength circuits, or technical shooting programs. Despite its positive findings, this study has several limitations. First, the sample size was relatively small, involving only 20 female athletes. Second, the study did not classify athletes based on playing position, such as guard, forward, or center, even though each position may have different shooting demands. Third, the research focused mainly on shooting score outcomes and did not analyze biomechanical variables such as shooting angle, release speed, joint

coordination, or fatigue response. Future studies should involve larger samples, longer training duration, male and female comparisons, and biomechanical analysis to provide deeper evidence.

Overall, this study confirms that medicine ball training significantly improves basketball shooting ability among Fastbreak Club Makassar athletes. The improvement is supported by statistical evidence, theoretical principles of specificity and explosive power development, and previous empirical findings. Therefore, medicine ball training can be recommended as an effective training method to enhance shooting performance in basketball club athletes.

CONCLUSION

This study concludes that medicine ball training significantly improves basketball shooting ability among female athletes at Fastbreak Club Makassar. The statistical findings demonstrated a substantial increase in shooting performance following the intervention. The experimental group improved from a pretest mean score of 3.80 to a posttest mean score of 7.80, representing an average improvement of 4.00 points, whereas the control group increased only from 3.60 to 5.00. Inferential statistical analysis further confirmed these findings, as the paired-samples t-test produced a significance value of $p = 0.000$, while the independent-samples t-test also revealed a significant difference between the experimental and control groups ($t = 6.332$, $p = 0.000$). These results indicate that medicine ball training provides superior improvements in basketball shooting performance compared with regular training alone.

Conceptually, the effectiveness of medicine ball training can be explained by its ability to simultaneously develop upper-body explosive power, core stability, neuromuscular coordination, and movement efficiency. These physical qualities are fundamental components of successful basketball shooting because they facilitate efficient force transfer through the kinetic chain, improve body balance during shooting execution, and increase movement consistency under dynamic playing conditions. Consequently, athletes become capable of generating stronger, more controlled, and more accurate shots during offensive situations, particularly in fastbreak play where rapid decision-making and technical precision are essential.

From a practical perspective, the findings suggest that medicine ball exercises should be incorporated into basketball conditioning programs as a complementary training method to technical shooting practice. The exercises are inexpensive, easy to implement, and highly adaptable to club-based training environments, making them suitable for coaches seeking evidence-based approaches to improve athlete performance. Nevertheless, future studies should involve larger sample sizes, longer intervention periods, athletes from different competitive levels, and biomechanical analyses of shooting techniques to provide more comprehensive evidence regarding the long-term effectiveness of medicine ball training in basketball performance enhancement.

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