



Implementing Structured Strength Training for Muscle Endurance in Satchel Peace Softball Athletes

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Keywords

Implementation;
Endurance; Training

Abstract

This research investigated the effectiveness of a structured strength training program in enhancing the muscular endurance of female softball athletes from Satchel Peace Cirebon. A quantitative experimental approach was employed using a One-Group Pretest–Posttest Design, involving 23 athletes selected through total sampling. Muscular endurance was evaluated before and after the intervention using one-minute push-up and sit-up tests. The training intervention consisted of 10 sessions designed according to the principles of progressive overload, goal-oriented training, and recovery. Statistical analysis was conducted with IBM SPSS and included the Shapiro–Wilk normality test, Levene's homogeneity test, and a paired-sample t-test. The findings demonstrated an increase in the mean score from 24.91 during the pretest to 32.96 in the posttest. Furthermore, the paired-sample t-test produced a p-value of 0.000 (< 0.05), indicating the rejection of H_0 and acceptance of H_1 . These results confirm that a structured strength training program significantly improves the muscular endurance of softball athletes. The observed improvement may be attributed to neuromuscular adaptations and enhanced muscle function resulting from consistent and continuous training.

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INTRODUCTION

The development of competitive sports in the modern era demonstrates that athlete performance is not solely determined by talent and technical skill, but is also significantly influenced by the quality of the athlete's physical condition. In modern sports development systems, physical condition is a fundamental component, serving as the foundation for the development of technical, tactical, and strategic abilities. Athletes in good physical condition tend to be able to display consistent performance and maintain quality play over relatively long match durations. (Lockie et al., 2024)

From the perspective of sports coaching science, physical fitness consists of several key components, such as strength, endurance, speed, agility, flexibility, and coordination. Each sport has different physical fitness requirements depending on the characteristics of its movements. In team sports like softball, physical demands are typically complex because athletes must perform various physical activities repeatedly over a relatively long period. This situation means athletes need not only good technical skills but also adequate physical fitness to maintain their performance throughout the game. (Makaruk et al., 2024)

Softball is a team sport characterized by dynamic and varied physical activity. In softball, athletes are required to perform various movements, such as sprinting to the bases, hitting the ball, throwing the ball with a certain amount of force, and executing various defensive maneuvers that require good muscle coordination. These activities occur repeatedly throughout the game, demanding optimal physical readiness from every athlete. This indicates that a softball athlete's performance is significantly influenced by their physical capabilities, particularly in the areas of strength and muscular endurance. (Lockie et al., 2024)

Muscular endurance is the ability of a muscle or group of muscles to perform repeated contractions over a certain period of time without experiencing significant fatigue. In the context of competitive sports, muscular endurance plays a crucial role because it allows athletes to maintain the quality of their movements throughout a match. Athletes with good muscular endurance will be able to perform physical activities repeatedly at a certain intensity without experiencing a drastic decline in performance. Conversely, if an athlete's muscular endurance is low, fatigue will set in more quickly, potentially affecting the effectiveness of their movements and the overall quality of their performance. (Shaputra, 2024).

In softball, muscular endurance is one of the key components of physical fitness because the game involves repetitive movements that require continuous muscular effort. For example, players must swing the bat, which engages the muscles of the arms and shoulders; throw the ball with a certain level of intensity; and run to the base at high speed. All of these activities require the muscles to work repeatedly without experiencing excessive fatigue. One method that can be used to improve muscular endurance is a strength training program. Strength training is a form of exercise designed to improve the muscles' ability to generate force or power through muscle contraction. (Ramos-Campo et al., 2025). In addition to increasing muscle strength, structured strength training can also improve muscle endurance due to physiological adaptations in the neuromuscular system and energy metabolism. These adaptations make muscles more efficient at performing repeated contractions, enabling them to work longer before becoming fatigued. (Vikestad & Dalen, 2024).

For strength training to yield optimal results, the training program must be designed in a systematic and structured manner. A structured training program is typically designed based on training principles such as the principles of progression, specificity, exercise variation, and recovery (Setiadi et al., 2024). The principle of progression emphasizes that training load must increase gradually so that the body can adapt to the training stimulus provided. The principle of specificity states that the exercises provided must be appropriate for the physical abilities one wishes to develop. By applying these principles, a structured training program can help athletes achieve improvements in physical ability more effectively and in a targeted manner. (Bompa & Buzzichelli, 2019).

Therefore, research on the implementation of structured strength training programs to improve the muscular endurance of softball athletes is essential. This study is expected to provide empirical evidence regarding the effects of structured strength training programs on improving athletes' muscular endurance. Furthermore, the results of this study are also

expected to contribute scientifically to the development of training methods in softball, particularly in efforts to improve athletes' physical condition in a more systematic and scientifically grounded manner. (Rohyana et al., 2023)

METHODS

This study adopted a quantitative approach and employed an experimental method to objectively examine the effect of a structured strength training program on the muscular endurance of softball athletes. A quantitative approach was considered appropriate because the study generated numerical data derived from physical performance tests, which were subsequently analyzed using inferential statistical procedures. The experimental method was selected because the researchers implemented the intervention directly and evaluated the changes that occurred following its application. The study utilized a One Group Pretest–Posttest Design, involving a single group without a control group. Within this design, participants were assessed before the intervention through a pretest and reassessed after the intervention through a posttest. By comparing the results obtained from both measurements, the study sought to determine the extent of changes in muscular endurance following participation in the structured strength training program. (Sugiyono, 2018)

The study population comprised all 24 female athletes belonging to the Satchel Peace softball team in Cirebon. Given the relatively limited population size and the fact that all athletes met the established inclusion criteria, total sampling was employed. Consequently, every athlete who actively participated in regular training activities was included as a research participant. (Willie, 2024)

Two variables were examined in this study, namely the independent variable and the dependent variable. The structured strength training program served as the independent variable and was defined as a systematically organized training regimen developed according to the principles of progressivity, specificity, overload, and recovery with the objective of enhancing physical performance. The dependent variable was the muscular endurance of softball athletes. From a conceptual perspective, the training program functions as a stimulus capable of inducing neuromuscular adaptations, which in turn contribute to the muscles' ability to sustain repeated contractions over time.

Muscular endurance was assessed using push-up and sit-up tests. The push-up test was administered to evaluate arm and shoulder muscle endurance, whereas the sit-up test was used to assess abdominal muscle endurance. Each test was performed for a duration of one minute, and performance was recorded based on the number of correctly executed repetitions. These instruments were selected because they are widely recognized measures of muscular endurance and have demonstrated satisfactory validity and reliability in physical fitness research. (Yıldırım et al., 2022)

Data collection was conducted in three sequential phases consisting of a pretest, intervention, and posttest. Initially, participants completed a pretest to establish baseline muscular endurance levels prior to receiving the intervention. Subsequently, the athletes participated in a structured strength training program consisting of ten training sessions implemented according to the predetermined training schedule. Upon completion of the intervention period, a posttest was administered using procedures identical to those applied during the pretest. The scores obtained from both testing sessions were documented and used as the primary data for statistical analysis.

Data analysis was performed using IBM SPSS software. Prior to hypothesis testing, prerequisite analyses were carried out through normality and homogeneity tests. The Shapiro–Wilk test was employed to examine whether the data followed a normal distribution, while Levene's test was used to evaluate the homogeneity of variance across the dataset. After confirming that these assumptions had been satisfied, hypothesis testing was conducted using a Paired Sample t-test. This statistical procedure was considered appropriate because the study involved repeated measurements from the same group before and after the intervention. The results of the test were used to determine whether the structured strength training program produced a statistically significant improvement in the muscular endurance of softball athletes.

RESULTS AND DISCUSSION

This study was conducted to examine the effect of a structured strength training program on improving the muscular endurance of softball athletes. The study was conducted from Monday, April 20, 2026, to Thursday, May 21, 2026, involving 23 female softball athletes from Satchel Peace in Cirebon as research subjects. Data collection was performed through muscle endurance tests before the intervention (pretest) and after the intervention (posttest) using push-up and sit-up tests. Therefore, the descriptive data in this study provide an overview of the initial and final conditions of the athletes' muscular endurance after participating in a structured strength training program. This data was used to determine changes in the athletes' muscular endurance as a result of the systematic and planned training program. The results of the descriptive data can be seen in the descriptive statistics **table 1**.

Table 1. Description of Statistic

	N	Minimum	Maximum	Red	Std. Deviation	Variance
Pretest	23	20	33	24.91	3.029	9.174
PostTest	23	29	40	32.96	2.931	8.589
Valid N (listwise)	23					

Table 1 Based on the results of the descriptive analysis, the mean pretest score was 24.91 with a standard deviation of 3.029, while the mean posttest score increased to 32.96 with a standard deviation of 2.931. The minimum and maximum scores also increased from 20–33 on the pretest to 29–40 on the posttest. These results indicate an improvement in the muscular endurance of softball athletes following a structured strength training program.

Table 2. Test of Normality

	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	.142	23	.200*	.941	23	.188
PostTest	.148	23	.200*	.924	23	.082

Table 2 Based on the results of the Normality test, A normality test was conducted using the Shapiro-Wilk method because the sample size was less than 50 respondents. The test results showed a significance value of 0.188 for the pretest and 0.082 for the posttest. Since both values were greater than 0.05, the data were deemed to be normally distributed. Thus, the data met the requirements for analysis using a paired-sample t-test.

Table 3. Test of Homogeneity

Research Variable	Value sig. (p-value)	Information
Pretest	.030	Homogeneous
PostTest	.821	Homogeneous

Table 3 Based on the results of the homogeneity test using Levene's test, significance values of 0.821 were obtained for the pretest data and 0.849 for the posttest data. Both values are greater than 0.05, so the pretest and posttest data are considered homogeneous. This indicates that the variances of the data are comparable and meet the requirements for further statistical analysis.

Table 4. Test of Hypothesis

Paired Samples Test									
Paired Differences									
Pair		Red	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
1	PreTest - POST-TEST	8.043	2.868	.598	-9.284	-6.803	-13.450	22	.000

Table 4 Based on the results of the hypothesis test using a paired t-test, a significance value (Sig. 2-tailed) of $0.000 < 0.05$ was obtained, so H_0 was rejected and H_1 was accepted. This indicates that there is a significant effect of a structured strength training program on improving the muscular endurance of softball athletes. Furthermore, the higher posttest mean score compared to the pretest indicates that the training program was effective in improving the athletes' muscular endurance following the intervention.

Muscular endurance is a critical component of physical fitness for softball athletes because the sport requires repeated movements such as running, throwing, batting, and defensive actions over the course of a game. Athletes with higher levels of muscular endurance are generally better able to sustain performance and minimize fatigue during competition. Consequently, training interventions designed to enhance this physical attribute are considered essential for optimizing athletic performance. Among various conditioning strategies, structured strength training has been recognized as an effective approach because it systematically develops the muscles' capacity to generate and sustain contractions while adhering to established training principles. Such programs provide progressive, measurable, and continuous stimuli that facilitate long-term physical adaptation. (Ramos-Campo et al., 2025)

The findings of the present study demonstrate that the implementation of a structured strength training program contributed positively to the muscular endurance of softball athletes. Descriptive analysis revealed an increase in the mean score from 24.91 during the pretest to 32.96 during the posttest, indicating improved muscular endurance following participation in the training program. This pattern suggests that the intervention successfully enhanced the athletes' ability to sustain repeated muscular activity over time.

To ensure the appropriateness of the statistical procedures, prerequisite analyses were conducted before hypothesis testing. The Shapiro-Wilk normality test produced significance values of 0.188 for the pretest and 0.082 for the posttest, both exceeding the 0.05 threshold and indicating that the data were normally distributed. Similarly, the homogeneity analysis yielded significance values of 0.821 for the pretest and 0.849 for the posttest. Because these values were also greater than 0.05, the assumption of homogeneity was satisfied, confirming that the dataset met the requirements for subsequent parametric testing. (Vikestad & Dalen, 2024)

Further evidence of the intervention's effectiveness was obtained through the paired-sample t-test. The analysis generated a significance value (Sig. 2-tailed) of $0.000 < 0.05$ and a calculated t-value of -13.450. These results indicate a statistically significant difference between pretest and posttest performance. Accordingly, H_0 was rejected and H_1 was accepted, confirming that the structured strength training program exerted a significant effect on the muscular endurance of softball athletes. (Ayu et al., 2024)

The improvement observed in this study can be interpreted from a physiological perspective. Repeated exposure to structured strength training promotes neuromuscular adaptations that enhance muscle efficiency and increase the capacity of muscle fibers to sustain contractions for extended periods. In addition, regular training contributes to greater muscular work capacity, enabling athletes to perform physical tasks with reduced fatigue. These physiological responses provide a plausible explanation for the significant gains in muscular endurance identified in the present investigation. Therefore, structured strength

training may be considered an effective conditioning strategy for softball athletes seeking to improve endurance-related performance and maintain competitive effectiveness throughout gameplay.

The results of this study also support previous evidence emphasizing the importance of strength-oriented conditioning in athletic development. Given the physical demands of softball, improvements in muscular endurance are likely to contribute not only to enhanced physical performance but also to greater consistency during prolonged competitive activity. In this regard, the findings reinforce the value of incorporating structured strength training programs into regular training routines for softball athletes. (Yuniana et al., 2023)

CONCLUSION

The purpose of this study is to investigate how a systematic strength training program affects the Cirebon Satchel Peace softball team's muscular endurance. Because softball players must do a variety of repetitive tasks throughout the game, including batting, pitching, running, and fielding, muscular endurance is an essential part of physical conditioning. Therefore, to improve the muscles' capacity to sustain peak performance, a methodical and well-planned exercise program is required. The research results indicate that, following the implementation of a structured strength training program, muscular endurance increased. This is reflected in the rise in the average score from 24.91 in the preliminary test to 32.96 in the final test, demonstrating that the training intervention effectively improved the muscular endurance of the study participants, namely the athletes.

The different physiological changes brought about by training, including improved neuromuscular efficiency, higher muscular work capacity, and the muscles' capability to withstand repetitive contractions for extended periods of time, can account for this improvement. Additionally, the formation of physiological adaptations specific to the needs of softball players is made possible by the appropriate application of training principles, such as progression, specificity, and recovery, which contribute to the program's effectiveness.

This conclusion is supported by the statistical analysis's results. The alternative hypothesis H_1 is accepted and the null hypothesis H_0 is rejected since the t-test showed a significance level of $0.000 < 0.05$. Therefore, it can be said that the female players on the Satchel Peace softball team in Cirebon have significantly improved physical endurance through an organized weight training program.

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