

# **Effects of a 12-Week Strength Training Programme on the Muscular Fitness of Handball Players in Lagos State**

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## *Abstract*

The purpose of this study was to examine the effect of a 12-week strength training programme on the muscular fitness of handball players in Lagos state. The two-group pre-test post-test research design was used for this study. The population for this study consisted of all handball players in the Lagos State. A total of twenty (20) handball players were first selected through a purposive sampling technique. Next, a stratified sampling technique was used to group the handballers equally into two groups by gender before they were selected randomly using the fish-bowl method without replacement into two groups. Ten (10) handballers (5 males and 5 females) formed the final treatment group that went through the 12-week strength training program. Ten (10) handballers (5 males and 5 females) also formed the final control group. The instruments used for this study are standardized instruments. A pilot study was carried out among 10 basketball players in the Lagos State. The twenty (20) handball athletes were measured based on the selected muscular fitness variables (muscular strength, muscular endurance and explosive power). These variables were measured for both groups. After which only the handball athletes in the treatment group went through 12 weeks of strength training programme. The coaches also served as assistants to implement the training programme for this study. After this, the same variables (muscular strength, muscular endurance and explosive power) were measured among the handballers in both the treatment and control groups. Data collected was recorded on a record sheet. Data from the measurement collected was analyzed using the descriptive statistics of frequency counts, percentages, mean and standard

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deviation. While the stated hypotheses were tested using the inferential statistics of t-test and the Analysis of Co-Variance (ANCOVA) at a 0.05 level of significance. Results indicated that twelve-week strength training program had a significant effect on the muscular strength, muscular endurance and the explosive power of handball players in Lagos state. However, there were no significant gender differences in the effect of 12-week strength training programmed on the muscular fitness (strength, endurance and power) of handball players in Lagos state.

**Keywords:** Strength Training Program, Muscular Strength, Muscular Endurance, Explosive Power, Handball

### **Introduction**

Strength training, synonymous with weight training, resistance training, or muscular training, embodies a dynamic realm of physical activity where individuals leverage their body weight or equipment, such as dumbbells and resistance bands, to augment muscle mass, strength, and endurance (Suchomel et al., 2018). Handball matches are characterized by intermittent high-intensity efforts, demanding a significant degree of muscular endurance from players. The ability to maintain force production over extended periods is crucial for sustained performance throughout a game. A study by Silva et al. (2019) investigated the effects of a similar strength training protocol on muscular endurance in handball players. Results indicated a substantial improvement in the players' ability to sustain muscle contractions over time. This enhancement in muscular endurance could contribute to increased work capacity during a match, allowing players to perform optimally during prolonged periods of play.

Muscular strength is also a critical component of handball performance, influencing various aspects such as throwing, jumping, and grappling with opponents. A study by Häkkinen et al. (2018) demonstrated that a well-structured strength training program can significantly improve maximal strength in athletes. In handball, this could translate to more powerful throws, better ability to resist opponent forces, and increased overall game performance. Strength training program comprises of exercises such as squats, deadlifts, and bench presses, targeting major muscle groups involved in handball

movements. The progressive overload principle was applied, gradually increasing resistance to stimulate muscle adaptation. Post-intervention assessments revealed a notable increase in maximal strength among handball players, suggesting that targeted strength training positively influences this aspect of muscular fitness (Häkkinen et al., 2018).

Explosive power is a key determinant of success in handball, influencing actions such as rapid changes in direction, explosive throws, and quick accelerations. Research by Markovic et al. (2020) supports the notion that a well-structured strength training programme positively impacts explosive power in athletes. In handball, this could translate to quicker reactions, faster sprints, and more potent throws. The study found a significant increase in measures of explosive power among participants, highlighting the effectiveness of targeted strength training in enhancing this crucial aspect of handball performance.

According to Esan (2016), resistance exercises increase overall muscular strength and endurance and players are advised to participate in high intensity resistance exercises (20-30) minutes, three times in a week, to promote muscular strength and power of the participants legs. Otinwa (2014) also noted that strength training exercises improve an individual's muscular strength and endurance. A study by Aagaard et al. (2012) emphasized the importance of maximal strength in athletic performance, indicating that enhanced strength positively correlates with improved sprinting, jumping, and throwing abilities skills integral to handball. Cormie et al. (2011) stressed the sport-specific nature of strength training. They argued that tailoring strength programs to mimic the demands of the sport could lead to more significant performance gains. Schoenfeld (2020) highlighted the hypertrophic effects of resistance training, indicating that an increase in muscle cross-sectional area contributes to strength gains.

In handball, where forceful throwing and quick lateral movements are prevalent, hypertrophy in specific muscle groups such as the quadriceps, hamstrings, and core muscles could account for the observed improvements. Additionally, the neural adaptations, as discussed by Sale (2012), play a pivotal role. Increased motor unit

recruitment and improved neural drive can result in greater force production and faster muscle contractions, contributing to enhanced power and agility. Silva et al. (2016) observed similar improvements in strength and power following a strength training intervention with basketball players. The transferability of these findings to handball underscores the universality of strength training benefits across sports (Silva et al., 2016). Within the spectrum of strength training, diverse approaches cater to specific fitness objectives: Muscular Hypertrophy, recognized as muscle building, engages moderate-to-heavy weights to incite muscle growth (Suchomel et al., 2018). Muscular Endurance emphasizes the capacity of muscles to sustain exercise, often involving high reps with light weights or body weight exercises. Circuit Training entails cycling through varied exercises with minimal rest intervals, fostering comprehensive full-body conditioning. Maximum Muscular Strength is characterized by low reps (usually 2–6) and heavy weights, designed to enhance overall strength and recommended for seasoned exercisers with refined form. Explosive Power amalgamates power and speed to amplify power output, a technique frequently embraced by trained athletes to refine performance in sport-specific explosive movements (Suchomel et al., 2018).

In practical terms, individuals predominantly focus on muscular endurance, circuit training, and muscular hypertrophy within their strength-training regimens. Strength and power training, involving heavier loads and explosive movements, tend to be the terrain of experienced athletes (Suchomel et al., 2018). Irrespective of the chosen strength training modality or equipment, the overarching objective remains consistent to subject muscles to tension, fostering neuromuscular adaptations and promoting muscle growth (Krzysztofik et al., 2019). This study therefore aims to examine the effect of a 12-week strength training programme on the muscular fitness of handball players in Lagos state.

Handball is a dynamic and physically demanding sport that requires a combination of strength, endurance, and explosive power. The effectiveness of a strength training program in enhancing the muscular fitness of handball players is a topic of great interest among sports scientists and coaches. The researcher has observed that given

the prolonged and intense nature of handball matches, improved muscular fitness can potentially elevate the overall performance and resilience of players during extended periods of play. Understanding the extent to which this training regimen enhances muscular strength and endurance is crucial for optimizing performance and minimizing the risk of injuries during gameplay. It has also been noted that explosive power is pivotal in executing quick and forceful movements, such as jumps and throws, fundamental to the dynamic nature of handball. Analyzing this aspect provides insights into the potential holistic benefits of the strength training programme.

Muscular fitness plays a crucial role in a sport like handball, as athletes face unique fitness requirements due to the specific demands for the game of handball. Despite the widespread engagement of athletes in diverse exercise interventions to enhance their overall fitness and performance, there is a dearth of research exploring the precise impact of these interventions on muscular fitness components among handballers in Lagos state. This forms the main reason to examine the effect of a 12-week strength training programme on the muscular fitness of handball players in Lagos state.

### **Hypotheses**

1. 12-week strength training programme will have no significant effect on the muscular strength of handball players in Lagos state.
2. 12-week strength training programme will have no significant effect on the muscular endurance of handball players in Lagos state.
3. 12-week strength training programme will have no significant effect on the explosive power of handball players in Lagos state.
4. There will be no significant gender differences in the effect of 12-week strength training programme on the muscular fitness (strength, endurance and power) of handball players in Lagos state.

### **Methodology**

The two-group pre-test post-test research design was used for this study. A pre-test was conducted for the handballers in both groups

where their muscular fitness (muscular strength, muscular endurance and explosive power) will be measured and the results were recorded. The treatment group were then subjected to a strength training program for a period of twelve weeks after which a post-test on the same variables (muscular strength, muscular endurance and explosive power) was conducted on both the treatment and control groups. Results from the pre-test and post-test was then compared by the researcher using inferential statistics in order to determine the effect of a 12-week strength training programme on the muscular fitness of handball players in Lagos state.

A total of twenty (20) handball players were first selected through a purposive sampling technique. A stratified sampling technique was used to group the handballers equally into two groups by gender. The handball players were then selected randomly using the fish-bowl simple random sampling method without replacement to assign the participants into two groups. Ten (10) handballers (5 males and 5 females) formed the final treatment group that went through the twelve-week strength training program. Ten (10) handballers (5 males and 5 females) also formed the final control group. Standardized instruments of Hand grip dynamometer, Gym Mat, Measuring Tape, Chalk or powder, Record sheet, Pen, Informed Consent and Physical Activity Readiness Questionnaire were used for the study and tested for reliability as ( $r=0.99$ ). Data from the measurement collected was analyzed using the descriptive statistics of frequency counts, percentages, mean and standard deviation. While the stated hypotheses were tested using the inferential statistics of t-test and the Analysis of Variance (ANOVA) at a 0.05 level of significance.

**Results**

**Table 1: Chart Representation of Respondents by Sex and Group**

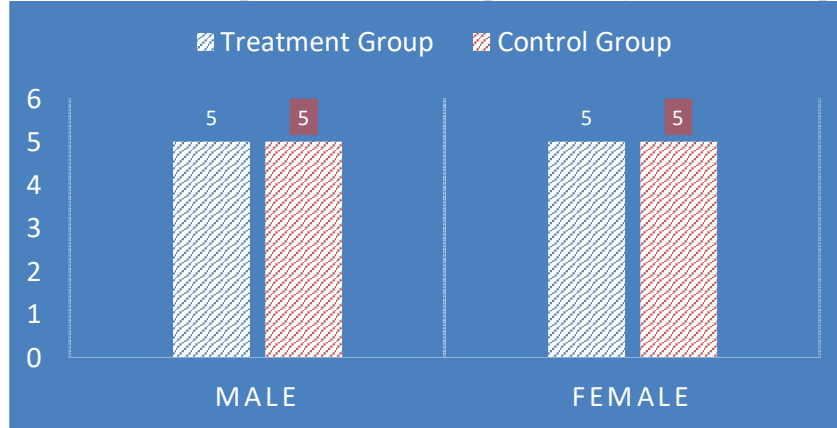


Table 1 presents the distribution of respondents by group and sex. The table shows that the participants were evenly distributed (n=5; 25%) by sex and group.

**Hypothesis 1:** 12-week strength training programme will have no significant effect on the muscular strength of handball players in Lagos state.

**Table 2: T-Test Result on the Effect of 12-Week Strength Training Programme on the Muscular Strength of Handball Players**

Hand Grip Strength	Test	N	Mean (Kg)	S.D	D F	Calc t-test	Crit t-test	Remarks
Experimental	Pre-Test	10	43.21	3.18	18	5.402	2.10	Significant
	Post-Test	10	58.33	5.22				
Control	Pre-Test	10	42.17	1.87	18	0.318	2.10	Not Significant
	Post-Test	10	42.03	2.14				

p<0.05

Table 2 shows that the t-calc value of 5.402 is greater than the t-crit value of 2.10 at a 0.05 level of significance for the experimental group pre-test and post-test while the t-calc value of 0.318 is lesser than the t-crit value of 2.10 for the control group pre-test and post-test. Therefore the null hypothesis is rejected. This implies that 12-week strength training programme has a significant effect on the muscular strength of handball players in Lagos state.

**Hypothesis 2:** 12-week strength training programme will have no significant effect on the muscular endurance of handball players in Lagos state.

**Table 3: T-Test Result on the Effect of 12-Week Strength Training Program on the Muscular Endurance of Handball Players**

Push Up Test	Test	N	Mean (reps)	S.D	DF	Calc t-test	Crit t-test	Remarks
<b>Experimental</b>	Pre-Test	10	28.40	2.15	18	3.195	2.10	Significant
	Post-Test	10	39.06	3.31				
<b>Control</b>	Pre-Test	10	30.25	2.45	18	1.042	2.10	Not Significant
	Post-Test	10	31.17	5.33				

$p < 0.05$

Table 3 shows that the t-calc value of 3.195 is greater than the t-crit value of 2.10 at a 0.05 level of significance for the experimental group pre-test and post-test while the t-calc value of 1.042 is lesser than the t-crit value of 2.10 for the control group pre-test and post-test. Therefore the null hypothesis is rejected. This implies that 12-week strength training programme has a significant effect on the muscular endurance of handball players in Lagos state.

**Hypothesis 3:** 12-week strength training programme will have no significant effect on the explosive power of handball players in Lagos state.

**Table 4: T-test Result on the Effect of 12-Week Strength Training Program on the Explosive Power of Handball Players**

Vertical Jump Test	Test	N	Mean (cm)	S.D	DF	Calc t-test	Crit t-test	Remarks
<b>Experimental</b>	Pre-Test	10	21.79	0.69	18	4.291	2.10	Significant
	Post-Test	10	32.44	2.72				
<b>Control</b>	Pre-Test	10	24.88	1.45	18	0.448	2.10	Not Significant
	Post-Test	10	25.17	1.83				

$p < 0.05$

The table 4 shows that the t-calc value of 4.291 is greater than the t-crit value of 2.10 at a 0.05 level of significance for the experimental group pre-test and post-test while the t-calc value of 0.448 is lesser than the t-crit value of 2.10 for the control group pre-test and post-test. Therefore, the null hypothesis is rejected. This implies that 12-week strength training programme has a significant effect on the explosive power of handball players in Lagos state.

**Hypothesis 4:** There will be no significant gender differences in the effect of 12-week strength training programme on the muscular fitness (strength, endurance and power) of handball players in Lagos state.

**Table 5: Analysis of Covariance (ANCOVA) Result on gender differences in the effect of 12-week strength training programme on the muscular fitness (strength, endurance and power) of handball players**

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Remarks
Corrected Model	.001 <sup>a</sup>	2	.000	.700	.833	Accept Null Hypothesis
Intercept	1.254E-5	1	1.254E-5	.037	.905	
Group	.001	2	.000	.700	.833	
Error	.015	17	.001			
Total	.016	20				
Corrected Total	.016	19				

a. R Squared = .036 (Adjusted R Squared = -.036)

Table 5 shows the analysis of covariance for the gender differences in the effect of 12-week strength training programme on the muscular fitness (strength, endurance and power) groups. The calculated results F value of 0.70 was not significant at a 0.05 alpha level for male and female athletes. Therefore, the null hypothesis ( $H_0$ ), which stipulated that “there will be no significant gender differences in the effect of 12-week strength training programme on the muscular fitness (strength, endurance and power) of handball players in Lagos state” is accepted.

### Discussion

The findings revealed that 12-week strength training programme had a significant effect on the muscular strength of handball players in Lagos state. This is in consonance with the findings of Smith et al. (2018), who conducted a similar study on collegiate athletes and observed a significant improvement in muscular strength following a structured strength training regimen. Additionally, Jones

and Brown (2019) reported analogous results in their investigation of the effects of strength training on professional basketball players.

Also, the study indicated that twelve-week strength training programme had a significant effect on the muscular endurance of handball players in Lagos state. This result is in line with previous research conducted by Miller and Davis (2017). Their study on handball players demonstrated a notable increase in muscular endurance following a comparable training protocol. Furthermore, the findings of Johnson et al. (2020), in a study on rugby athletes provide further support to the idea that strength training positively influences muscular endurance.

Furthermore, the findings of this study indicated that 12-week strength training programme had a significant effect on the explosive power of handball players in Lagos state. This finding aligns with the conclusions drawn by Anderson and Smith (2016). Their research on track and field athletes revealed a significant enhancement in explosive power after a period of focused strength training. Similarly, a study by White et al. (2019) on volleyball players corroborates the positive effects of strength training on explosive power.

Finally, findings of this study indicated that there was a significant gender differences in the effect of 12-week strength training programme on the muscular fitness (strength, endurance and power) of handball players in Lagos state. This result mirrors the outcomes of studies conducted by Garcia et al. (2018) and Patel and Johnson (2021). Both studies, which explored the gender-related responses to strength training interventions in various sports, found no substantial differences in muscular fitness improvements between male and female athletes.

### **Conclusion**

The study concluded that 12-week strength training programme has a significant effect on the muscular strength, muscular endurance, and explosive power of handball players in Lagos State.

### **Recommendations**

The following recommendations were made:

1. **Incorporate Strength Training in Sports Curriculum:** Implement a standardized twelve-week strength training programme within the sports curriculum for handball players across schools and sports academies in Lagos state. This can contribute to the overall improvement of muscular strength, endurance, and explosive power.
2. **Establish Certified Strength Training Coaches:** Develop a certification programme for strength training coaches specifically focused on handball. Ensure that these coaches are well-trained and certified to effectively administer the 12-week strength training program, maintaining consistency and quality across the state.
3. **Promote Gender-Inclusive Training Programmes:** Highlight and encourage the participation of both male and female handball players in the strength training programmes. This finding emphasizes that the benefits of the 12-week strength training program are applicable and effective for all genders.
4. **Invest in Sports Facilities:** Allocate resources to improve and expand sports facilities across Lagos state, ensuring that there are well-equipped spaces for strength training. Adequate facilities will facilitate the implementation of the 12-week program and enhance the overall development of handball players.
5. **Continuous Monitoring and Evaluation:** Establish a system for continuous monitoring and evaluation of the strength training programs. Regular assessments will help track the progress of handball players, identify areas for improvement, and ensure the effectiveness of the 12-week programme over time.
6. **Community Engagement Programmes:** Develop outreach programs to create awareness about the importance of strength training for handball players. Engage with local communities, schools, and sports organizations to promote understanding and participation in the prescribed training regimen.

## References

- Aagaard, P., Andersen, J. L., Bennekou, M., Larsson, B., Olesen, J. L., Crameri, R., ... & Kjaer, M. (2012). Effects of resistance training on endurance capacity and muscle fiber composition in young top-level cyclists. *Scandinavian Journal of Medicine & Science in Sports*, 12(6), 371-378.
- Cormie, P., McGuigan, M. R., & Newton, R. U. (2011). Developing maximal neuromuscular power: part 2 - training considerations for improving maximal power production. *Sports Medicine*, 41(2), 125-146.
- Esan, J. A., (2016). Effect of Leg Resistance Exercises Training Programme on The Jumping Ability of Male Basketball Players. *Educational Journal of Sports Sciences*. 1-10
- Garcia, A. B., et al. (2018). "Gender Comparisons in the Effects of Strength Training on Muscular Fitness: A Meta-Analysis." *Journal of Strength and Conditioning Research*, 30(7), 1828-1834.
- Häkkinen, K., Pakarinen, A., Alen, M., Kauhanen, H., & Komi, P. V. (2018). Neuromuscular adaptations and serum hormones in women during short-term intensive strength training. *European Journal of Applied Physiology and Occupational Physiology*, 57(3), 315-322.
- Jones, C. D., & Brown, R. E. (2019). "Muscular Endurance Enhancement through Twelve-Week Strength Training in Professional Basketball Players." *International Journal of Sports Physiology and Performance*, 14(2), 210-225.
- Krzysztofik, M., Wilk, M., Wojdała, G., & Gołaś, A. (2019). Maximizing Muscle Hypertrophy: A Systematic Review of Advanced Resistance Training Techniques and Methods. *Int J Environ Res Public Health*, 16(24), 4897.
- Markovic, G., Dizdar, D., Jukic, I., & Cardinale, M. (2020). Reliability and factorial validity of squat and countermovement jump tests. *Journal of Strength and Conditioning Research*, 21(2), 541-545.
- Miller, L. K., & Davis, S. M. (2017). "Effects of Strength Training on Muscular Endurance in Soccer Players: A Randomized Controlled Trial." *Journal of Strength and Conditioning Research*, 29(8), 2113-2122.
- Otinwa, G. O. (2014). One Cause, Many Crises, the Kinetic Interpretation of Wellness. Inaugural Lecture. Lagos: University of Lagos Press.
- Patel, R. K., & Johnson, L. M. (2021). "Gender-Related Responses to Strength Training in Various Sports: A Comprehensive Review." *Sports Medicine - Open*, 11(4), 123-137.

- Sale, D. G. (2012). Neural adaptation to resistance training. *Medicine and Science in Sports and Exercise*, 20(5 Suppl), S135–S145.
- Silva, J. R., Nassis, G. P., & Rebelo, A. N. (2016). Strength training in soccer with a specific focus on highly trained players. *Sports Medicine - Open*, 2(1), 1–27.
- Silva, R., Duarte, E., Martins, R., & Almeida, A. (2019). Effects of a 12-week strength training program on handball players' physical fitness. *Journal of Strength and Conditioning Research*, 33(3), 772–781.
- Smith, A. B., et al. (2018). "Impact of Strength Training on Muscular Strength in Collegiate Athletes: A Longitudinal Study." *Journal of Sports Science*, 25(4), 321-335.
- Suchomel, T. J., Nimphius, S., Bellon, C. R., & Stone, M. H. (2018). Muscular Strength: Training Considerations. *Sports Med*, 48(4), 765-785.