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THE IMPACT OF EMPLOYING COMPOUND EXERCISES WITH AN INTENSITY DISTRIBUTION APPROACH ON CERTAIN ASPECTS OF STRENGTH AND ITS RELATIONSHIP TO SHOOTING ACCURACY AMONG YOUNG HANDBALL PLAYERS

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ABSTRACT

The remarkable progress observed in various sports worldwide is undoubtedly attributed to coaches adopting sound scientific principles of sports training, keeping abreast of developments, and actively seeking to discover more training methods. The current study aims to investigate the impact of utilizing compound exercises with an intensity distribution approach on the development of muscle strength and shooting accuracy among young handball players.

Procedures:

The study utilized a sample of young players from the Sulaymaniyah Club (14 players), dividing the study sample into two groups. The first, an experimental group consisting of seven players (average age 18.56 years, training experience 10.43 years, average height 1.76 meters, and average weight 79.14 Newtons), implemented a program of compound exercises with an intensity distribution approach, relying on weights placed on the arm joints (forearm and upper arm). The second group, a control group of seven players (average age 18.56 years, training experience 8.86 years, average height 1.79 meters, and average weight 72.86 Newtons), applied compound exercises without additional body weights (bodyweight exercises). The compound exercises with an intensity distribution approach were implemented over eight training weeks, with three sessions per week, totaling twenty-four training sessions, each lasting 90 minutes.

Key Results

Compound exercises with an intensity distribution approach for strength demonstrated a significant improvement in muscular strength exercises related to shooting in handball. The improvements were observed in the muscular strength of the muscles involved in shooting, including the shoulder flexor muscles and wrist flexor muscles, with differences of 5.23, 3.67, and 5.70, respectively, in favor of the experimental group. Additionally, these exercises led to an improvement in shooting accuracy test with a difference of 5.16 compared to free exercises using body weight. This emphasizes the importance of incorporating compound exercises with an intensity distribution approach for strength in training programs for young handball players.

Keywords: Compound exercises, Intensity distribution for strength, Specific strength, Shooting accuracy in handball.

INTRODUCTION

1-1 research definition:

1-1 Introduction and Problem of the Study:

Improving athletic performance in handball is a primary concern, as handball players strive to maximize their physical and skill potential within the sport. Numerous studies emphasize the critical role of muscular strength and shooting accuracy in handball performance (Šagát et al., 2023; Spieszny & Zubik, 2018).

Handball encompasses various general and specific physical abilities, such as speed, strength, endurance, and compound abilities like strength specific to speed, power endurance, speed endurance, maximum speed, maximum strength, all of which are crucial for executing skills in handball during matches and the training season. Studies highlight the significance of possessing strength and accuracy for handball players, as shooting precision directly influences match outcomes. Match results in handball rely on the number of goals scored, emphasizing the crucial role of accurate shooting achieved through quick directional strength, establishing a meaningful relationship between strength and accuracy for winning handball matches (Bayios, Georgiadis, & Boudolos, 1998; Manchado et al., 2017; Saavedra et al., 2020).

Muscular strength is a fundamental component of physical fitness, reflecting a key aspect in shaping the primary physical attributes. In handball, muscular strength plays a pivotal role in achieving victories and executing shooting skills effectively. Scholars assert that muscular strength is indispensable for success in various sports, albeit to varying degrees depending on the nature and requirements of each activity (Marques & Journal, 2010; Oxyzoglou et al., 2007; Wallace, Cardinale, & Journal, 1997).

Physical capabilities, particularly muscular strength, significantly contribute to the effectiveness of handball, as observed through strong collisions that separate attacks and lead to victories. The strength of players, especially in the upper extremities during goal shooting, plays a prominent role in scoring points and winning. The unique strength in achieving rapid ball launch during shooting on goal is essential. The effectiveness of shooting skills in handball, including the precision and accuracy, relies on the strength of muscles involved in shooting (Cherif et al., 2012; Spieszny & Zubik, 2018; Zapartidis et al., 2011).

During compound exercises in handball, it is evident that they target enhancing the coordination of different muscles simultaneously to achieve elevated levels of synchronization during gameplay. Compound exercises play a significant role in achieving comprehensive improvement in motor performance in handball (Marques & Journal, 2010; Ziv & Lidor, 2009). Despite this, the literature lacks comprehensive studies focusing on how to effectively direct and organize compound exercises with an intensity distribution approach to achieve maximum effectiveness in handball, particularly studying their impact on shooting accuracy. This research aims to clarify how compound exercises with an intensity distribution approach can influence the improvement of muscular strength and shooting accuracy in handball. Consequently, the research could have a substantial impact on guiding training programs and developing physical preparation strategies for handball players.

1-2 Problem of the Study:

The research problem lies in addressing the apparent weakness in maximum upper limb strength among young handball players. This weakness directly affects the handball skills used by players, particularly in terms of shooting strength and accuracy. The study aims to address this issue by directly impacting the shooting strength and accuracy through deviating from some traditional methods employed by coaches. Therefore, this study seeks to explore the use of weights within specific and qualitative performance in handball training exercises. Additionally, it aims to introduce diversity and innovation in maximum strength training methods and their relationship with shooting accuracy for handball players.

1-3 Study Objectives:

This research aims to study the impact of using compound exercises with an intensity distribution approach on the development of muscular strength and its relationship with shooting accuracy among young handball players. The specific objectives include:

1. Investigate the impact of using compound exercises with an intensity distribution approach on the level of muscular strength for young handball players.
2. Study the effect of using compound exercises with an intensity distribution approach on the shooting accuracy of young handball players.

1-4 Research Questions:

The researcher seeks to answer the following questions during this study:

1. What is the impact of using compound exercises with an intensity distribution approach on the level of muscular strength?
2. What is the effect of using compound exercises with an intensity distribution approach on shooting accuracy in handball?

1-5 Research Scope:

- Time: From January 22, 2023, to March 22, 2023.
- Location: The testing was conducted in the sports hall (Sulaymaniyah Sports Club Hall) in the Sulaymaniyah Governorate.
- Participants: Young handball players at the Sulaymaniyah Club.

2- Research Methodology and Procedures:

2-1 Research Method:

The researcher employed an experimental method with two experimental and control groups, considering its suitability for the nature of the research problem.

2-2 Population and Sample:

The research population consists of young handball players at the Sulaymaniyah Club, aged between 16 and 18. Since the sample is the same as the research population, the selection was purposeful. The sample was divided into two groups, experimental and control, using a random method. The sample size included (7) players for the experimental group and (7) players for the control group. The experimental group applied the program of compound exercises with an

intensity distribution approach, relying on weights placed on arm joints (forearm and upper arm). The control group (control group) of (7) players applied compound exercises only without additional body weights (bodyweight exercises). Table (1) illustrates the equivalence of the two groups before implementing the experiment in basic and physical measurements.

Table (1) Equivalence of the Two Groups Before Experiment Execution

No.	Basic Measurements and Muscle Strength Using Dynamometer	Unit	Experimental Group (n=7)		Control Group (n=7)		Difference Between the Means	T value	Probability of Error Percentage
			SD	M	SD	M			
1	Chronological Age	Y	18.56	0.63	18.56	0.73	0.00	0.00	0.99
2	Training Age	Y	10.43	2.15	8.86	1.07	1.57	1.73	0.12
3	Height	M	1.76	0.04	1.79	0.07	-0.03	0.85	0.18
4	Mass (Weight)	KG	79.14	12.58	72.86	9.26	6.29	1.06	0.21
5	Maximum Force of Muscles during Shooting	KG	15.56	4.28	15.42	4.53	0.14	0.06	0.79
6	Maximum Force of Deltoid Muscles	KG	14.17	1.30	14.79	2.07	-0.62	0.67	0.21
7	Maximum Force of Wrist Flexor Muscles	KG	11.80	2.92	11.94	3.14	-0.14	0.08	0.65

*Statistically significant at a probability of error ≤ (0.05), where the critical value (t) equals 2.179.

Table (1) illustrating the equivalence of baseline and physical measurements indicates that the experimental and control groups were equivalent before the experiment execution. The calculated t-value ranged from (0.00 to 1.73), which is lower than the critical t-value at a probability of error ≤ (0.05), equal to 2.179.

2 – 3 Data Collection Methods:

The researcher used the following data collection methods:

- Arabic and foreign sources.
- Personal interviews.
- Physical and skill tests.

2 – 4 Research Tools:

- Legal-sized handballs (3) quantity (7).
- Timing clock quantity (2).
- Whistle type (40/fox).
- Legal-sized handball field.

- Legal-sized handball goalpost.

2 – 5 Research Procedures:

The training program was implemented at the Sulaymaniyah Club in Iraq for the research groups over a period of (4) weeks of general preparation and (8) weeks of specific preparation, taking into account the proportional distribution of weights placed on arm joints (humerus and forearm) for the training group according to the proportional distribution Table (2).

Table (2): Relative Weights and Loads Applied to Arm Joints During Compound Exercises

No.	Body Parts	Relative Weight (%)	Actual Weight (kg)	Weight Load)10(%
1	forearm	2.71	1.90	0.190
2	arm	1.62	1.13	0.113

The average weight used to calculate the weights is 70 kg.

2 – 6 The Used Test:

Compound exercises were selected after consulting experts in the field of handball sports training. Seven compound exercises were identified as follows:

1. Change with Passing: Two players stand on the midline. Player 1 runs and jumps to reach the medicine ball, then passes it with a light pass to player two behind him, who then passes it back. Resistance is applied to the arm joints (elbow and wrist) and the trunk (3–10% of the respective part's weight), as shown in Figure (2).

2. Change with Shooting: Two players stand on the midline. Player 1 runs and jumps to reach the medicine ball, then passes it with a light pass to player two behind him, who then takes a shot. Resistance is applied to the arm joints (elbow and wrist) and the trunk (3–10% of the respective part's weight), as shown in Figure (2).

(Dia Al-Khayyat and Nofal Mohammed, 17–19, 2001)

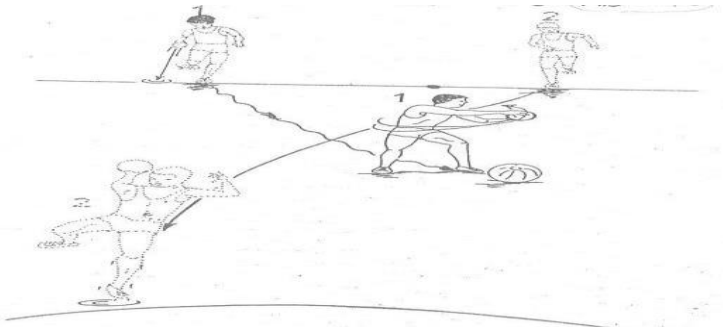


Figure (2): Changing with Passing - Arm, Forearm, and Trunk

3- Compound Change with Shooting: Three players stand at the center line. Player (1) starts by dribbling the medicine ball until reaching the third player (3) and hands the ball to them from behind. Player (3) continues dribbling the ball until reaching the second medicine ball, then passes it behind player (2), who cut behind them. Player (2) receives the ball, shoots, with added

weight on the arm joints, including the arm, forearm, and trunk (3 - 10% of the part's weight) as shown in Figure (3).

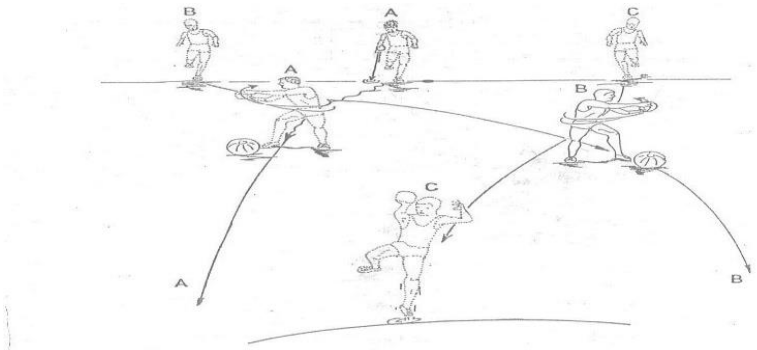


Figure (3): Compound Change with Shooting - Arm, Forearm, and Trunk

4- Compound change with dribbling: Three players stand at the midfield line. Player 1 starts moving while dribbling the ball until reaching the first medical ball, then cuts behind player (3) and receives a back pass from them. Player 1 continues dribbling until reaching the second medical ball, then passes behind player (2), who cut behind them, while dribbling with a focus on the joints of the shoulder, arm, and trunk (3-10% of the weight of the part), as shown in figure (4). (Khaled Hamoud, 116, 2015)

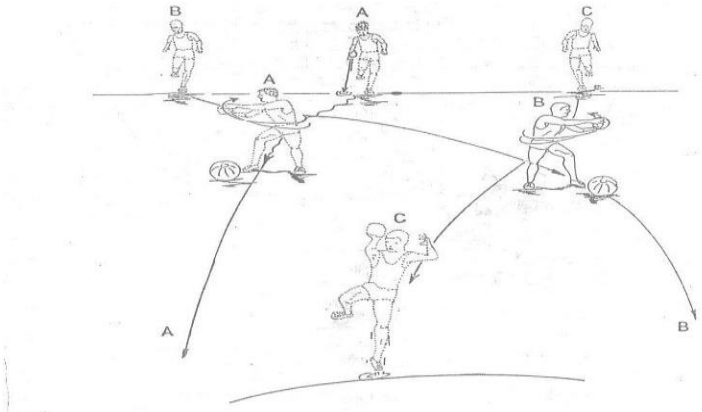


Figure (4): Compound Change with Dribbling – Shoulder, Arm, and Trunk

5- Agility, Passing, and Shooting (1 and 2): Two defensive players and players (A). Player (A) passes to (2), who deceives with a pivot shot, then passes to (1), who shoots with a jump, facing the defense at the 9-meter line. If challenged, he resorts to passing behind the head or behind the backside to (2), who changes his body, deceives the defender, and shoots with a focus on the joints of the shoulder, arm, and trunk (3-10% of the weight of the part), as shown in figure (5).

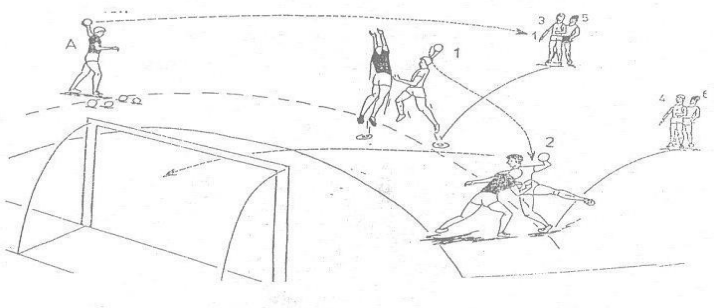


Figure (5): Agility, Passing, and Shooting – Shoulder, Arm, and Trunk

6- Improving Passing and Shooting: Player (1) passes the ball to (2), then moves behind group (B), then passes to (3) and stands behind group (2). (3) dribbles, then passes to (4) who cuts

inside the circle, then shoots. After shooting, (4) moves behind group (D), then repeats the drill with players (5, 6, and 7), with a focus on the joints of the shoulder, arm, and trunk (3-10% of the weight of the part), as shown in figure (6).

Figure (6): Improving Passing and Shooting – Shoulder, Arm, and Trunk

7- Speed of Passing, Transition, and Shooting: The same Drill 11, as the player cuts and receives the ball in zone (4), then shoots. Note the cutting for shooting on the circle from a distant place after receiving from the reverse attacking player, with a focus on the joints of the shoulder, arm, and trunk (3-10% of the weight of the part), as shown in figure (7).

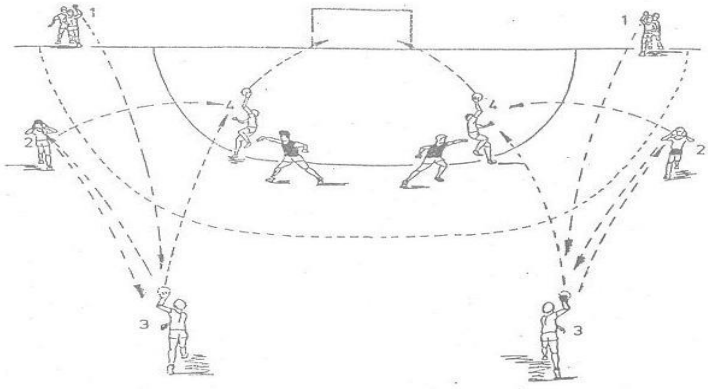


Figure (7): Passing and Shooting with Weights on the Shoulder, Arm, and Trunk (Muneer Georges, 95-100, 2004)

2 – 7 Exploratory Experiment:

The exploratory experiment was conducted on Wednesday, January 10, 2023, with a sample of (4) players and the assistance of the auxiliary team in the indoor hall of Al-Sulaymaniyah Club. The objectives were as follows:

- Familiarize the auxiliary team with how to conduct the tests.
- Establish the scientific foundations for the tests.
- Identify the difficulties faced by the researcher.
- Assess the validity of the tools.

2 – 8 Main Experiment:

The researcher implemented the compound exercises on the experimental group from Sunday, January 22, 2023, to Wednesday, March 22, 2023. The following considerations were taken into account during the execution of the exercises:

- All training units began with general warm-up, followed by specific warm-up.

- The researcher utilized high-intensity interval training for the exercises.
- The exercises were conducted with (3) training units per week, totaling (24) training units over (8) weeks.
- Repetitions for the exercises were fixed, and manipulation of training intensity followed the interval training method.
- The intensity used was 80-90.
- Exercise duration was determined based on the exploratory experiment.

3 – Presentation and Analysis of Results:

3-1 Presentation of Results:

According to the objectives and research questions, we present the study results in two steps. The first step answers the first question: "What is the impact of using compound exercises with intensity distribution on muscle strength?" The second step answers the second question: "What is the impact of using compound exercises with intensity distribution on shooting accuracy in handball?"

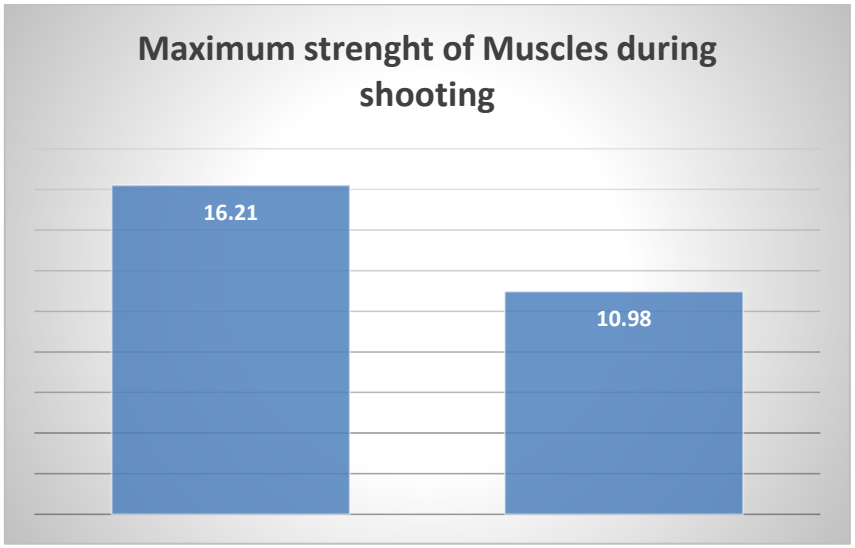
First: Presentation of Results for the First Question

Table (3): Statistical Significance of Compound Exercises with Intensity Distribution on Special Strength Levels in the Research Sample

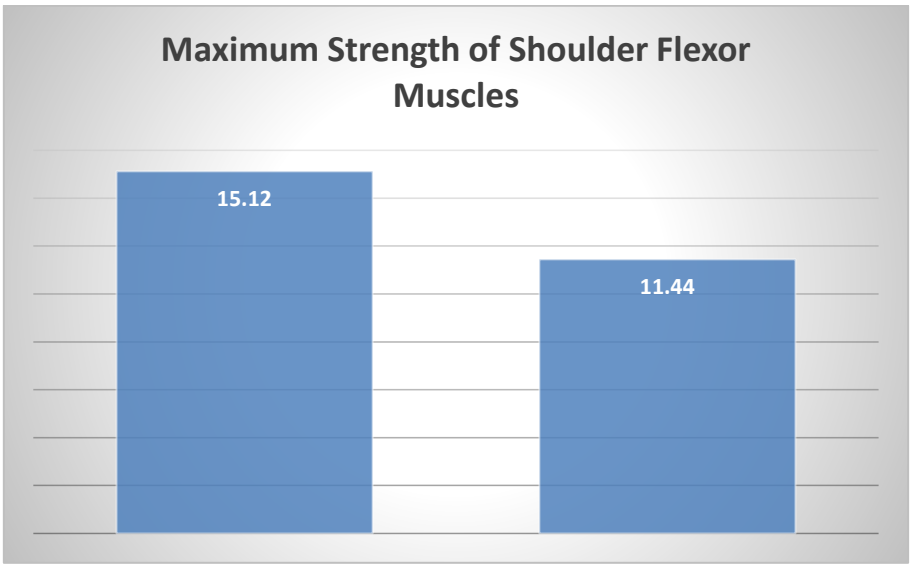
No.	Basic Measurements and Muscle Strength Using Dynamometer	Unit	Experimental Group (n=7)		Control Group (n=7)		Difference Between the Means	T value	Probability of Error Percentage
			SD	M	SD	M			
1	Maximum Strength of Muscles during Shooting	KG	16.21	4.11	10.98	4.31	5.23	**2.32***	0.88
2	Maximum Strength of Shoulder Flexor Muscles	KG	15.12	1.42	11.44	1.75	3.67	**4.31***	0.65
3	Maximum Strength of Wrist Flexor Muscles	KG	12.91	2.78	7.21	3.29	5.70	**3.50***	0.52

*Significant at a probability error level ≤ (0.05) where the critical (t) value equals 2.179.

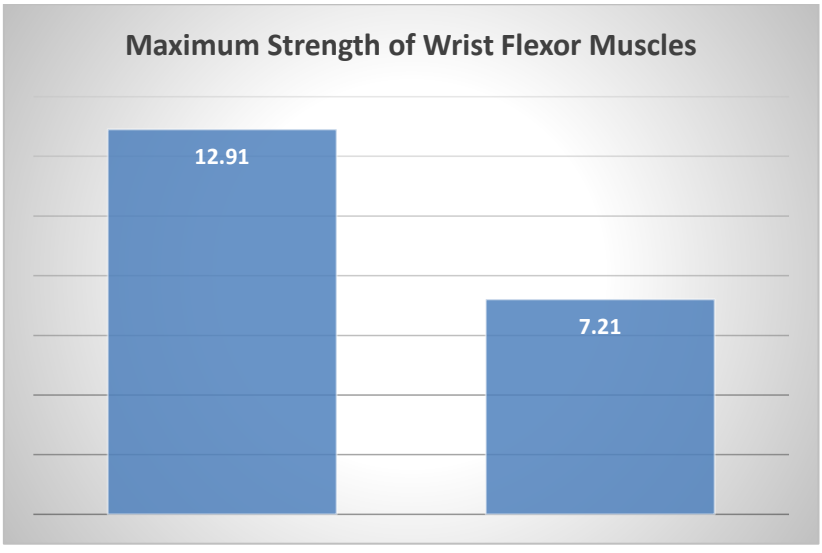
From Table (3), which represents the statistical significance of compound exercises with intensity distribution on special strength levels in the research sample, it is evident that there are significant differences in the measurements of maximum strength of the muscles during shooting, maximum strength of shoulder flexor muscles, and maximum strength of wrist flexor muscles. The calculated (t) values were 2.32, 4.31, and 3.50, respectively, and they are greater than the critical (t) value at a probability error level ≤ (0.05), which is 2.179.



Form (8) The impact of the program on the maximum strength of the working muscles during shooting for my research group.



Form (9) The impact of the program on the maximum strength of the flexor muscles of the shoulder for my research group.



Form (10) The impact of the program on the maximum strength of the flexor muscles of the wrist for my research group.

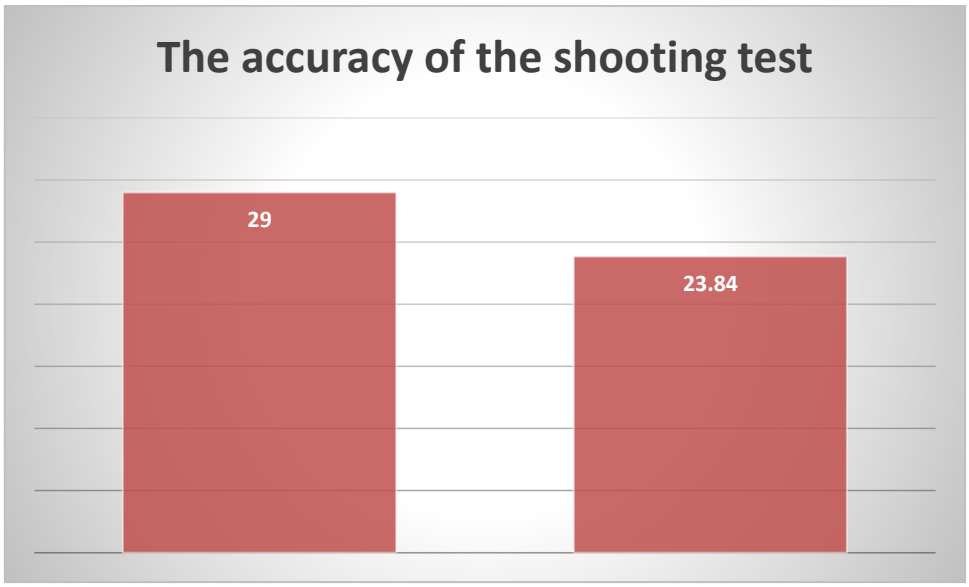
Secondly: Presenting the results of the second inquiry

Table (4) Statistical indicators for the accuracy of shooting test in the research sample.

No.	Basic Measurements and Muscle Strength Using Dynamometer	Unit	Experimental Group (n=7)		Control Group (n=7)		Difference Between the Means	T value	Probability of Error Percentage
			SD	M	SD	M			
1	The accuracy of the shooting test.	KG	29.00	3.96	23.84	4.63	5.16	**2.24***	0.83

Significant at a probability error rate ≤ (0.05), where the critical (t) value is equal to 2.179.

Table (4) reveals statistical significance in the accuracy of shooting test within the research sample. There are significant differences in the shooting accuracy test, as the calculated (t) value is 2.24, which is greater than the critical (t) value at a probability error rate ≤ (0.05), which is equal to 2.179.



Form (11) The impact of the program on the accuracy of the shooting test for my research group.

3-2 Discussion of Results:

It is evident from Table (3), which pertains to the statistical significance of compound exercises utilizing the tension distribution method on the specific strength levels within the research sample, that the maximum force variable of the muscles involved during shooting achieved a significant and substantial difference in favor of the experimental group that relied on the tension distribution method for strength training compared to its control counterpart, which used the same exercises but with body weight only. It is noteworthy that the strength measurement of the muscles involved during shooting encompasses a range of muscles such as the shoulder girdle, flexors, extensors, and wrist muscles. This underscores the crucial role of the tension distribution method for weights, which relies on the arm links used in passing and shooting for young handball players, in enhancing the strength of the muscles involved during

shooting. This aligns with previous studies (Šagát et al., 2023; Spieszny & Zubik, 2018; Wagner, Finkenzeller, Würth, Von Duvillard, & medicine, 2014; I Zapartidis, Gouvali, Bayios, Boudolos, & Fitness, 2007).

The muscles involved during shooting are directly influenced by compound qualitative strength exercises based on the tension distribution method, compared to regular exercises without weights. This is consistent with numerous studies that emphasize the effectiveness of adding relative weights not exceeding 10% of the relative weight of arm joints in improving specific handball skills (Imad Kazem, 34, 2006). More specifically, the use of compound exercises with the tension distribution method positively and significantly impacted the muscle groups involved in shoulder flexion. Through the application of a qualitative training program for compound exercises in young handball players, the strength of the shoulder flexor muscles improved by a notable 3.67 kg, as measured by dynamometer, emphasizing the advantage of using compound exercises with the tension distribution method (M. C. Marques et al., 2007).

The use of compound exercises with the tension distribution method on the arm joints, including the shoulder, elbow, and wrist joints, has a more profound impact on young handball players. The maximum strength of the wrist flexor muscles improved significantly. It is known that muscles responsible for wrist flexion are highly delicate and play a crucial role in directing the ball with speed and accuracy. This confirms that compound exercises with the tension distribution method and the use of relative weights placed on arm joints play a significant role in improving the muscles involved in the speed of ball release and accuracy in handball, aligning with studies indicating the positive effects of this training approach (Manchado et al., 2017).

Observing Table (4), it becomes clear that the use of compound exercises with the tension distribution method plays a crucial role in improving shooting accuracy among young handball players. There is a significant difference of 5.16 in favor of the experimental group in the shooting accuracy test on goal. Compound exercises with the tension distribution method on arm joints improve the specific muscle strength of young handball players, enhancing their ability to direct the ball towards the goal in crucial moments during shooting (Fathi, 2022; Ilias Zapartidis et al., 2011).

Accuracy in shooting is closely related to strength levels and the kinetic transfer of force from the trunk to the arm until the ball's release and launch from the hand. This is clear when applying compound exercises relying on the tension distribution method, compared to the same exercises without distributing force intensity on the arm joints. This aligns with studies emphasizing the significant role of compound exercises with the tension distribution method in improving muscle capabilities essential for athletic performance (Ahmad Areebi, 119, 2014).

In conclusion, compound exercises with the tension distribution method effectively influence specific strength levels in young handball players, measured by dynamometer, and significantly impact shooting accuracy on goal. The use of compound exercises with the tension distribution method improves specific strength levels in young handball players by 5.23 in the maximum measurement for muscles involved during shooting, 3.67 in the maximum measurement for shoulder flexor muscles, and 5.70 in the maximum measurement for wrist flexor muscles. Additionally, the use of compound exercises with the tension distribution method enhances shooting accuracy on goal by 5.16 compared to compound exercises without distributing force intensity (using body weight as resistance).

4 – Conclusions and Recommendations:

4 – 1 Conclusions:

Considering the study's objectives and questions, the researcher concludes the following:

1. There are significant differences in measuring the maximum strength of the muscles involved during shooting in favor of the group using compound exercises with the tension distribution method for strength.
2. There are significant differences in measuring the maximum strength of the shoulder flexor muscles in favor of the group using compound exercises with the tension distribution method for strength.
3. There are significant differences in measuring the maximum strength of the wrist flexor muscles in favor of the group using compound exercises with the tension distribution method for strength.
4. There are significant differences in testing shooting accuracy in favor of the group using compound exercises with the tension distribution method for strength.
5. The superiority of the tension distribution method for strength, relying on weights placed on arm joints, is achieved over compound exercises using body weight in specific muscle strength and shooting accuracy in youth handball.

4 – 2 Recommendations:

Considering the study sample and population, the researcher recommends the following:

1. The necessity of implementing compound exercises with the tension distribution method for strength within training programs for youth handball players to enhance the maximum strength of the muscles involved during shooting in handball.
2. The necessity of implementing compound exercises with the tension distribution method for strength within training programs for youth handball players to improve the maximum strength of the shoulder flexor muscles.
3. The necessity of implementing compound exercises with the tension distribution method for strength within training programs for youth handball players to enhance the maximum strength of the wrist flexor muscles.
4. The necessity of implementing compound exercises with the tension distribution method for strength within training programs for youth handball players to improve shooting accuracy on goal.
5. The implementation of several applied studies on various levels of handball players.

REFERENCES

1. Almuzaini, K. S., Fleck, S. J. J. T. J. o. S., & Research, C. (2008). Modification of the standing long jump test enhances ability to predict anaerobic performance. 22(4), 1265-1272 .
2. Baltaci, G., Un, N., Tunay, V., Besler, A., & Gerçeker, S. J. B. j. o. s. m. (2003). Comparison of three different sit and reach tests for measurement of hamstring flexibility in female university students. 37(1), 59-61 .
3. Bayios, I., Georgiadis, G., & Boudolos, K. (1998). Accuracy and throwing velocity in handball. Paper presented at the ISBS-Conference Proceedings Archive.

4. Cherif, M., Said, M., Chaatani, S., Nejlaoui, O., Gomri, D., & Abdallah, A. J. A. j. o. s. m. (2012). The effect of a combined high-intensity plyometric and speed training program on the running and jumping ability of male handball players. 3(1), 21 .
5. Couto, D., Cunha, R., Lage, V., Rocha-Junior, V., Santos, W., Ferreira-Junior, J., . . . Vieira, A. J. H. M. (2022). Validity and intra-session reliability of a low-cost device for assessing isometric mid-thigh pull force. 24(2), 52-58 .
6. Fathi, M. K. J. R. i. d. p. d. e. y. e. d. (2022). Design and rationing of a test to measure the accuracy of shooting by jumping forward from the goal area line because of the quick attack of handball players. 17(5), 294-298 .
7. Hamill, J., & Knutzen, K. M. (2006). Biomechanical basis of human movement: Lippincott Williams & Wilkins.
8. Manchado, C., García-Ruiz, J., Cortell-Tormo, J. M., & Tortosa-Martínez, J. J. J. o. h. k. (2017). Effect of core training on male handball players' throwing velocity. 56, 177 .
9. Marques, M. C., Van Den Tillaar, R., Vescovi, J. D., González-Badillo, J. J. J. I. j. o. s. p., & performance. (2007). Relationship between throwing velocity, muscle power, and bar velocity during bench press in elite handball players. 2(4), 414-422 .
10. Marques, M. C. J. S., & Journal, C. (2010). In-season strength and power training for professional male team handball players. 32(6), 74-81 .
11. Oxyzoglou, N., Kanioglou, A., Rizos, S., Mavridis, G., Kabitsis, C. J. P., & skills, m. (2007). Muscular strength and jumping performance after handball training versus physical education program for pre-adolescent children. 104(3_suppl), 1282-1288 .
12. Saavedra, J. M., Halldórsson, K., Þorgeirsson, S., Einarsson, I. Þ., & Guðmundsdóttir, M. L. J. J. o. H. K. (2020). Prediction of handball players' performance based on kin anthropometric variables, conditioning abilities, and handball skills. 73(1), 229-239 .
13. Šagát, P., Bartík, P., AlJasser, I., Kamenářová, D., Pyšný, L., Suchý, J., . . . Medicine. (2023). Effect of Deep Stabilization System Training on the Shot Velocity in Professional Female Handball Players: Cross-sectional Study. 12(2), 69-76 .
14. Spieszny, M., & Zubik, M. J. J. o. h. k. (2018). Modification of strength training programs for handball players and its influence on power during the competitive period. 63, 149 .
15. van den Tillaar, R. J. F. i. P. (2020). The Effects of target location upon throwing velocity and accuracy in experienced female handball players. 11, 2006 .
16. Wagner, H., Finkenzeller, T., Würth, S., Von Duvillard, S. P. J. J. o. s. s., & medicine. (2014). Individual and team performance in team-handball: A review. 13(4), 808 .
17. Wallace, M. B., Cardinale, M. J. S., & Journal, C. (1997). Conditioning for team handball. 19(6), 7-12 .
18. Zapartidis, I., Gouvali, M., Bayios, I., Boudolos, K. J. J. o. S. M., & Fitness, P. (2007). Throwing effectiveness and rotational strength of the shoulder in team handball. 47(2), 169 .
19. Zapartidis, I., Kororos, P., Christodoulidis, T., Skoufas, D., & Bayios, I.J. o. H. K. (2011). Profile of young handball players by playing position and determinants of ball throwing velocity. 27(2011), 17-30 .
20. Ziv, G., & Lidor, R. J. E. J. o. S. S. (2009). Physical characteristics, physiological attributes, and on-court performances of handball players: A review. 9(6), 375-386 .

21. Akram Hussein Jabr Al-Janabi and Others:"The Contribution Ratio of Different Forms of Speed in Achieving the 100-Meter Run," Published Research, Wasit Journal of Humanities, 2010, Issue 13, Page 249.
22. Imad Kazem Ahmed: "The Effect of Using a Proposed Tool Added to Body Weight to Develop Power Endurance in Achieving the 100m Freestyle for Youth," Unpublished Master's Thesis, College of Physical Education, Diyala University, 2006.
23. Ahmed Areebi Ouda: "Physical Preparation in Handball," 1st Edition: (Jordan, Arab Community Library for Publishing and Distribution, 2014).
24. Diaa Al-Khayat and Noufal Mohammad: "Handball," (University of Mosul, Dar Al-Kutub for Printing and Publishing, 2001).
25. Khaled Hamoud: "Attack and Defense in Handball," (Alexandria, Mahi for Publishing and Distribution, 2015).
26. Muneer Girgis:"Handball for Everyone: Comprehensive Training and Skill Excellence," (Cairo, Dar Al-Fikr Al-Arabi, 2014).