Journal of Coaching and Sports Science
Volume 2, Issue 2, 53-64.
e_ISSN: 2963-1483
https://www.journal.foundae.com/index.php/jcss/index

Special Exercises to Develop Speed Endurance, Passing, and Shooting Skills for Young Handball Players

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Article Info

Article history:
Received: June 11, 2023
Revised: Agustus 4, 2023
Accepted: September 20, 2023

Keywords:
Special exercises;
Speed endurance;
Passing and shooting skills.

Abstract

The research objectives were to prepare special exercises to develop speed endurance for young handball players. The researchers used the experimental method to suit the nature of the research. The researchers identified the junior category players of Al-Qasim Sports Club as the population, which consisted of 22 players. The sample was selected using the simple random technique, and obtained 16 players as the samples. They were divided into two groups: the experimental group, with eight players, and the control group, with eight players. The researchers concluded that the special exercises effectively developed the capacity for speed endurance among the respondents. The development of speed endurance and increasing the players' ability to resist fatigue reflected positively on the players' performance with high efficiency in the basic handball skills tests. The junior handball club players benefitted from the special exercises in developing their speed endurance, as it is one of the fundamental physical characteristics in developing offensive handball skills. The players spent three times a week allocating 20-25 minutes of the final time for the main section of the training unit to develop speed endurance during the particular preparation stage.

To cite this article: Hussein, A. R. A., & Hrebid, N. K. (2023). Special exercises to develop speed endurance, passing, and shooting skills for young handball players. *Journal of Coaching and Sports Science, 2*(2), 53-64. https://doi.org/10.58524/jcss.v2i2.237

INTRODUCTION

Sports training relies heavily on auxiliary sciences, including psychology, biomechanics, and physiology, which have contributed to providing the training side with a lot of data to help it raise the level of technical and physical performance (Chaouachi et al., 2009; Hussein & Shaalan, 2021). The physical attributes are among the essential components of the technical athlete's level, as we cannot develop skillful and tactical performance except by developing these attributes and their interrelationship with the skillful and tactical aspects (Ehlert, 2021; Hrebid et al., 2022). One of the physical attributes that help the success of the sports training process and its continuity is the ability to withstand speed, which helps players to continue performing, maintaining their speed, and resisting fatigue (Lyle & Cushion, 2016; Radhi Abdul Hussein et al., 2022). Speed endurance is one of the important abilities in addition to the other characteristics (Fransson et al., 2018; Havolli et al., 2021; Stamenković et al., 2023). The modern handball game is one of the games that involve high physical exertion. It has great physical requirements, including the importance of maintaining the fast pace of play by the players and the length of the game time and sometimes extra time after the two teams are tied (Mohamed et al., 2022; Popowczak et al., 2021; Vila & Ferragut, 2019). The performance takes the nature of strength, speed, and common abilities between them due to the various offensive and defensive positions along the match duration (Ameer et al., 2023; Pereira et al., 2018). The handball match requires the player to acquire high physical fitness as well as technical skills and mastery (Antohea et al., 2023; Carneiro et al., 2023; Hermassi et al., 2021), which means the importance of developing speed endurance that helps the player to continue performing skills and its various offensive repetitions throughout the match (Hermassi et al., 2020; Radhi Abdul Hussein et al., 2022). Therefore, the research prepared special exercises to develop speed endurance,

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passing performance, and shooting skills in handball. Speed endurance has become necessary for handball players to perform skills throughout the match (Foretic et al., 2022; Nopianto et al., 2021).

Through the experience of the researchers being a player and a coach and watching the course of the youth league matches in handball, which is an important age group that needs good preparation and technical refinement, and its reflection on the preparation of national teams, the researchers noticed a decrease in the level of physical attributes and skillful performance (passing and shooting) from time to time during matches or in their last minutes or in their extra times. The players were in a difficult situation that required them to perform high physical and skillful work in front of a low level of speed tolerance. It negatively affected the implementation of their duties at the required speed, especially the attack, which led to not achieving good results in the match. This problem indicated that the development of speed endurance did not take its wide range in the training programs by the coaches, resulting in the players' low skill, physical, and tactical levels. Consequently, it negatively impacted the team's performance and the match's outcome. Therefore, the researchers decided to study this problem to achieve the goals by developing special exercises to develop speed endurance and its reflection on raising the level of passing and shooting performance for handball players.

There are 21 documents in the studies between 2018 and 2023 with the keywords "handball" and "speed." This data can be seen in Figure 1, presented with the help of a vos viewer. However, research that describes exercises to develop speed endurance, passing, and shooting skills for young handball players, as seen through Scopus data, has not been done by any researchers. The research objectives were to prepare special exercises to develop speed endurance for young handball players and identify the effect of special exercises on developing speed endurance, passing, and shooting performance for handball players. Therefore, the researchers hypothesized that special exercises positively affect speed endurance, passing, and shooting performance in handball players.

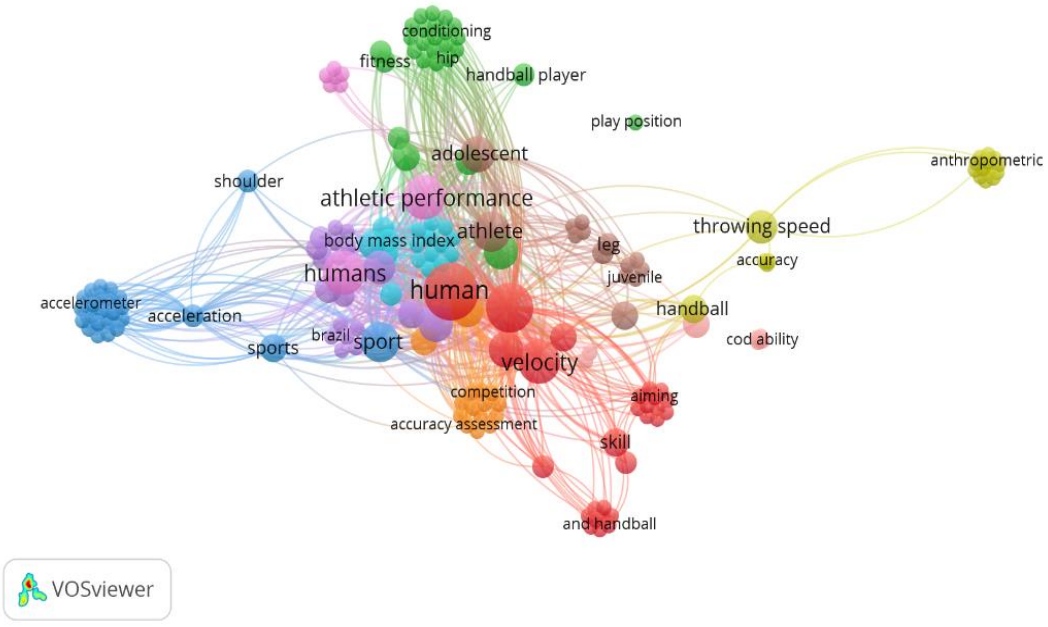

Figure 1. Scopus Data between 2018-2023 with the Keywords “Handball” and “Speed”

METHOD

The researchers used the experimental method to suit the nature of the research (Laura M. O’Dwyer, 2013). The researchers identified the junior category players of Al-Qasim Sports Club as the population, which consisted of 22 players. The sample was selected using the simple random technique, and obtained 16 players as the samples. They were divided into two groups: the experimental group, with eight players, and the control group, with eight players. Data collection methods employed were observation and experimentation, tests, and questionnaires. Tools and devices used in the research were handball court, handballs for juniors (10), measuring tape, two (2)

electronic stopwatches, and a computer (Pentium 4). Field Research Procedures determined the most important forms of passing and shooting skills in handball for juniors. To identify the most important forms of passing and shooting skills in handball for juniors, the two researchers nominated a group of forms placed in a questionnaire form and presented to five experts and specialists. After collecting the forms and emptying the data, the forms were approved: shooting from the center and from the level of the head, shooting from the frontal fall, shooting, high jump, passing the whip from above the head, passing the whip from the level of the head from the fulcrum.

To identify the most important tests of endurance speed, forms of passing, and shooting with handball for young people, the researchers nominated a set of tests developed in a questionnaire form and presented to five experts and specialists. After collecting the forms and emptying the data, the tests with a relative importance of less than 30 and a percentage of 60% were excluded.

Table1. The Relative Importance and Percentage of Speed Endurance Tests, Passing, and Shooting Skills in Handball

N	Format	Relative Importance	Percentage	Test result
1	Shooting by resting from the level of the head on the accuracy squares (50 x 50)	50	100%	✓
2	Shooting from stability from head level on rectangles	26	52%	X
3	Shooting by jumping high on the precision squares (50 x 50)	50	100%	✓
4	Shooting by jumping high on a goal drawn on the wall and divided into five circles	15	30%	X
5	Shooting from the frontal fall on the aiming precision squares (50 x 50)	50	100%	✓
6	Shooting frontal fall on overlapping squares measured in degrees	20	40%	X
7	Whip passing from above the head in a circular shape at a distance of 4 m for 30 seconds	43	86%	✓
8	Whip passing from above the head in the form of a rectangle drawn on the wall for 20 seconds for a distance of 5m	18	36%	X
9	Performing whip passing from the level of the head toward the target 30 m away	28	56%	X
10	Whip passing from the head level on an oval drawn on a wall 30 sec	42	84%	✓
11	Shuttle run test (25 X 8) from a high start	43	86%	✓
12	Running test (5 x 50 m), rest (45) seconds	50	100%	✓

The exploratory experiment was conducted on six junior players in handball, other than the research sample, on (20/1/2023) in the Al-Qasim Youth Forum for the studied tests. The experiment was repeated on the same players on 27/1/2023. The purposes of conducting the exploratory experiment are to:

1- Ensure the validity of the devices and tools used in the research.
2- Determine the level of difficulty of the tests for the research sample.
3- Know the time required to carry out the tests.
4- Know the difficulties the researchers face to avoid them in the future.
5- Extract the scientific bases (reliability and objectivity) for the tests.

Scientific Foundations of the Tests:

Validity of the test: One of the essential qualities that a good test must possess is validity. A test's purpose cannot be served with a low percentage of validity. The researchers gave the test materials to a group of experts and specialists to determine the validity of the tests.

Reliability of the test: To determine the candidate tests' reliability coefficient, the researchers utilized the test and re-test approach, with a seven-day gap between the first and second tests. The researchers calculated the reliability coefficient using the simple correlation coefficient between the outcomes of the first test and the second test. They calculated the significant correlation using (Tr) for the significance. The test was declared significant because the calculated (Tr) values were above the tabular value of (2.77), at the level of significance (0.05), and with a degree of freedom (4). The result indicated that the tests had high reliability, as shown in Table (2).

Objectivity: The test's objectivity indicates that the assessors do not differ in judging something or a specific topic. The researchers employed the correlation coefficient for the objectivity of the tests between the degrees of the first judge to determine the degree of (arbitrators) for the tests. The data also supported the second criterion, which states that all tests are highly objective and significantly significant when the calculated (TR) values are more than the tabular (TR) value of (2.77) at a level of significance (0.05) and a degree of freedom (4).

Table 2. The Coefficient of Reliability and Objectivity of the Tests

N	Tests	Reliability	Sig level	Objectivity	Sig level	Sig type
1	Shooting by resting from the level of the head on the accuracy squares (50 x 50)	0.90	8.04	0.88	7.18	Sig
2	Shooting by jumping high on the precision squares (50 x 50)	0.88	7.18	0.86	6.50	Sig
3	Shooting from the frontal fall on the aiming precision squares (50 x 50)	0.85	6.20	0.82	5.56	Sig
4	Whip passing from above the head in a circular shape at a distance of 4 m for 30 seconds	0.87	6.28	0.84	5.93	Sig
5	Whip passing from the head level on an oval drawn on a wall 30 sec	0.84	5.93	0.89	7.61	Sig
6	Shuttle run test (25 X 8) from a high start	0.87	6.28	0.88	7.18	Sig
7	Running test (5 x 50 m), rest (45) seconds	0.89	7.61	0.90	8.04	Sig

Pretests: The researchers conducted pretests for the research sample on (29/1/2023) at the Al-Qasim Youth Forum before starting the main experiment, with all variables controlled. To verify the equivalence of the two research groups, the researchers relied on the pretest, height, and weight. Furthermore, the researchers applied the non-parametric statistical method (Mann-Whitney) to the pretest results. The value of (Mann-Whitney) calculated was greater than its tabular value of (15) for a sample of size (16) at the level of significance (0.05). This result indicated that the differences between the two groups were insignificant in the test. This result confirmed the equivalence of both groups before conducting the field experiment.

Table 3. The Parity of the Research Groups

Tests	Control Median	Quartile Deviation	Experimental Median	Quartile Deviation	Mann-Whitney calculated value	Sig type
Shuttle run test (25 X 8) from a high start	7.99	0.714	8.11	0.84	35	Non-sig
Running test (5 x 50 m), rest (45) seconds	43.43	1.26	44.15	1.84	32	Non-sig
Shooting by resting from the level of the head on the accuracy squares (50 x 50)	2	2.5	2	0.75	40	Non-sig

Tests	Control Median	Quartile Deviation	Experimental Median	Quartile Deviation	Mann-Whitney calculated value	Sig type
Shooting by jumping high on the precision squares (50 x 50)	2	1.25	2	0.25	28	Non-sig
Shooting from the frontal fall on the aiming precision squares (50 x 50)	2	1.5	2	0.50	35	Non-sig
Whip passing from above the head in a circular shape at a distance of 4 m for 30 seconds	14	1.75	13	1.25	22	Non-sig
Whip passing from the head level on an oval drawn on a wall 30 sec	16	2.50	15	2.75	26	Non-sig

Mann-Whitney tabular value = 15 at the significance level (0.05)

Special Exercises

The researchers applied their training curriculum using the high-intensity interval training method to verify the objectives and hypotheses of the research. Also, the researchers used some sources in preparing their curriculum. In evaluating the curriculum, it also relied on the opinions of experts and specialists in the science of sports training and handball training so that the curriculum is commensurate with the ability of the sample and the available capabilities and tools. The application of the training curriculum continued for eight weeks, at a rate of three training units per week, as Abu Al-Ela Ahmed and Ahmed Nasr Al-Din mention, "speed endurance training is given 2-3 times per week" (Ahmed, Abu El-Ela & Nasr El-Din, Ahmed, 2003, p.198). Thus, the total number of training units is 24, with 20-25 minutes from each training unit devoted to speed endurance and applying the training curriculum prepared by the two researchers. Thus, according to the curriculum, the total number of speed endurance training is (480-600) minutes. The curriculum implementation began on (1/2/2023) and until (31/3/2023). The researchers repeated the same training units during the first, second, third, and fourth weeks. The intensity was increased in the first three weeks and decreased in the fourth week to equal the intensity in the first week, which was a compensation stage. The same training units were repeated during the fifth week. After an intensity increase in the fifth, sixth, and seventh weeks, a decrease in intensity in the eighth week was performed to equal the intensity in the fifth week.

Table 4. The Parity of the Research Groups

The Course Duration	The Number of Weekly Educational Units	The Total Number of Training Units	Trib Unit Time for Speed Endurance	Total Time for Speed Endurance Training
Eight weeks	3	24	20-25 min	480 – 600 min

Data Analysis**.**

After completing the implementation of the training curriculum on the experimental group, posttests were conducted for the two groups (control and experimental) on (3/3/2023). The tests were carried out in conditions similar to the pretests under the direct supervision of the researchers.

RESULTS AND DISCUSSION

Result

This section displays the difference between the pretest and posttest of the control group's passing and shooting skills tests.

Table 5. The Median and Quartile Deviation of the Pretest and posttests, The Calculated Wilcoxon Value, and Its Statistical Significance for the Control Group

Tests	Pretest Median	Quartile Deviation	Posttest Median	Quartile Deviation	Wilcoxon value	Sig value	Sig type
Shuttle run test (25 X 8) from a high start	7.99	0.71	6.10	0.65	3	0.137	Sig
Running test (5 x 50 m), rest (45) seconds	43.43	1.26	40.22	1.29	2.5	0.305	Sig
Shooting by resting from the level of the head on the accuracy squares (50 x 50)	2	2.5	3	2.75	4	0.061	Sig
Shooting by jumping high on the precision squares (50 x 50)	2	1.25	3	1.50	2	0.295	Sig
Shooting from the frontal fall on the aiming precision squares (50 x 50)	2	1.5	2.5	1	2	0.376	Sig
Whip passing from above the head in a circular shape at a distance of 4 m for 30 seconds	14	1.75	17	2.50	2.5	0.177	Sig
Whip passing from the head level on an oval drawn on a wall 30 sec	16	2.50	18	0.75	3	0.461	Sig

The value for the experimental group is displayed in Table 6.

Table 6. The Median and the Quartile Deviation of the Pretest and Posttest, the Calculated Wilcoxon Value, and Its Statistical Significance for the Experimental Group

Tests	Pretest		Posttest		Wilcoxon value	Sig value	Sig type
	Median	quartile deviation	Median	quartile deviation			
Shuttle run test (25 X 8) from a high start	8.11	0.84	4.33	0.37	2	0.317	Sig
Running test (5 x 50 m), rest (45) seconds	44.15	1.84	36.18	1.17	1	0.288	Sig
Shooting by resting from the level of the head on the accuracy squares (50 x 50)	2	0.75	4	1.25	1	0.393	Sig

Tests	Pretest		Posttest		Wilcoxon value	Sig value	Sig type
	Median	quartile deviation	Median	quartile deviation			
Shooting by jumping high on the precision squares (50 x 50)	2	0.25	4	0.75	1.5	0.259	Sig
Shooting from the frontal fall on the aiming precision squares (50 x 50)	2	0.50	4	1.50	3	0.115	Sig
Whip passing from above the head in a circular shape at a distance of 4 m for 30 seconds	13	1.25	19	0.50	2.5	0.219	Sig
Whip passing from the head level on an oval drawn on a wall 30 sec	15	2.75	22	2.25	2	0.180	Sig

Wilcoxon tabular value (5) at the level of significance of 0.05.

Table 7 displays the difference in the posttest of the basic offensive skills tests in handball for the members of the experimental and control groups.

Table 7. The median and the Quartile Deviation of the Posttest and the Mann-Whitney Value (Experimental and Control Group)

Tests	Control		Experimental		Mann-Whitney calculated value	Sig value	Sig type
	Median	Quartile Deviation	Median	Quartile Deviation			
Shuttle run test (25 X 8) from a high start	4.33	0.37	6.10	0.65	6	0.176	Sig
Running test (5 x 50 m), rest (45) seconds	36.18	1.17	40.22	1.29	4	0.183	Sig
Shooting by resting from the level of the head on the accuracy squares (50 x 50)	4	1.25	3	2.75	0	0.612	Sig

Tests	Control		Experimental		Mann-Whitney calculated value	Sig value	Sig type
	Median	Quartile Deviation	Median	Quartile Deviation			
Shooting by jumping high on the precision squares (50 x 50)	4	0.75	3	1.50	1	0.359	Sig
Shooting from the frontal fall on the aiming precision squares (50 x 50)	4	1.50	2.5	1	5	0.619	Sig
Whip passing from above the head in a circular shape at a distance of 4 m for 30 seconds	19	0.50	17	2.50	0	0.157	Sig
Whip passing from the head level on an oval drawn on a wall 30 sec	22	2.25	18	0.75	0	0.517	Sig

The Mann-Whitney tabular value was (15) at the significance level 0.05.

Discussion

Regarding the previous tables (4,5,6), we find a development for the control and experimental groups, but preference is given to the experimental group. The reason for the development of the research sample is due to the exercises prepared by the researchers, as they were suitable for the capacity of the sample and the capabilities of its internal organs, which caused appropriate changes that developed its performance, especially the muscle fibers. The speed falls under the method's direct influence, which increases the sample's ability to withstand the speed. The speed fibers can deliver large amounts of power from a few seconds to a minute" (Díaz-García et al., 2023). This ability increases with the duration of training. Accordingly, the exercises contributed to raising the number of heartbeats to 180 beats through the use of various exercises with high intensity and relatively short periods of rest "Exercises that prepare for speed endurance should raise the heart rate to 180 beats per minute, then this is followed by a positive rest period that brings it down to 120 beats per minute, then the second exercise begins, but if the rest period is long and the heartbeat returns to its normal state, then this type does not develop the players' endurance of speed (Stamenković et al., 2023). Therefore, the curriculum designed to develop the ability of the respondents to resist fatigue through a variety of exercises and the use of appropriate intensity and gradual use was developed because of its direct impact on the functional systems in the body of the athlete (Hornstrup et al., 2019). The circulatory system works to send more blood to the muscles that perform their functions more efficiently and to produce new proteins that contribute to meeting the needs and requirements of exercises that can be performed in the future. All of this will undoubtedly raise the adequacy of the sample members because the organized training that the sample followed according to the special exercises prepared was in a gradual, regular manner, and this regular and gradual increase led to a relatively stable and balanced organic adaptation with the continuation of raising the load and intensity in the curriculum, The organized training on exercises adapts the members and increases their ability to continue playing for a longer period with greater strength and intensity of load (Vala et al., 2022).

It is evident from the presentation above and analysis of the preceding tables that the juniors in both the control and experimental groups have improved their fundamental offensive handball skills. The players' consistency and regularity in training, together with the influence of the coach's regular curriculum, are all factors that the researchers believe contributed significantly to the development of the control group. Regardless of their scientific and practical sources, the experts' opinions differ in that the training program inevitably leads to the development of achievement if it

is built on a scientific basis. In terms of time, space, and training resources, specialized instructors should be utilized (Rafnsson et al., 2021).

The researchers attribute the great development in the experimental group's performance in the tests to the level of its performance increasing due to the use of the exercises the researcher developed in the proposed training curriculum. It emphasized the accuracy exercises for the most important offensive skills, which caused the reduction of time and increased the number of repetitions and the accuracy of performance. The training process has multiple aspects of physical, skill, tactical, psychological, and cognitive preparation (Pityn et al., 2019; Ribeiro et al., 2021; Tee et al., 2018).

Players' possession of high physical attributes helps them in rapid skill development, reflected in the tactical implementation. Thus, the psychological integration of the players through the improvement of their achievement in the experimental group showed in their positive test results. Also, the repetitions in the exercises were appropriate so that they led to the adaptation in the experimental group and a development in their performance level of accuracy in performance. The various exercises in the training curriculum gave a desire and excitement to perform, provided that they are not monotonous in one style and lead to boredom and weakness. The desire to continue performing and training under difficult and multiple requirements imposed by the conditions of different playing situations requires the player to make quick decisions under different requirements. Sports achievements require a measure of muscular uses and decisions. It is imperative to develop physical, skill, and muscular capabilities (Farley et al., 2020; Zanevskyy & Zanevska, 2021).

The process of developing physical fitness must accompany skills development. Training processes develop elements of physical fitness, including speed endurance and motor skills development. The improvement of the time of offensive handball skills depends on other physical elements such as strength, speed, and agility. The development of speed endurance had a positive impact on the development of other physical elements, and the researchers believe that physical exercises improved the level of skillful performance. There is a close correlation between motor skills and the elements of physical fitness that the player acquires in the training process (Kokstejn et al., 2019; Meßler et al., 2018).

CONCLUSION

The research results showed that the special exercises effectively developed the capacity for speed endurance among the respondents. The development of speed endurance and increasing the players' ability to resist fatigue reflected positively on the players' performance with high efficiency in the basic handball skills tests. The players benefitted from special exercises in developing speed endurance, as it is one of the basic physical characteristics in developing offensive handball skills. They trained three times a week by allocating 20-25 minutes of the final time for the main section of the training unit to develop speed endurance during the special preparation stage. Other researchers are expected to prepare other studies and research to develop speed endurance through different training methods and curricula, as it is one of the qualities that help the success and continuity of the sports training process and its impact on the development of other physical characteristics so that this characteristic becomes more effective in raising the physical and skill level of handball players.

AUTHOR CONTRIBUTION STATEMENT

ARAH developed the training program, coordinated the research lab, and collected data. NKH led the writing of the manuscript and participated in data analysis. All authors read and approved the final draft article.

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