



PROPOSED TRAINING APPROACH TO DEVELOP PHYSICAL ABILITIES AND SKILL
OF SHOT STOPPING FREE THROWS FOR HANDBALL GOALKEEPERS

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ABSTRACT

Background. Handball is a team sport that receives special attention due to its popularity and the physical, skill, and psychological capabilities of players to implement the plans required by the game, which arouses the enthusiasm of the spectating audience, especially in winning situations. **Objectives.** The current research aims to develop a training curriculum for handball goalkeepers and to identify the impact of the training curriculum on developing certain physical abilities and blocking free throws. **Method.** The researcher chose the experimental method with a single experimental group design as it is one of the scientific methods that are appropriate for solving the research problem, and it is one of the most efficient means of reaching reliable knowledge . The research sample was chosen intentionally and their number was 13 handball goalkeepers for the junior category participating in the 2023-2024 sports season. The researcher assumed that they were homogeneous as they were from the same age group. **Results.** The results of the study showed that the training method led to the development of some physical abilities among the research sample and that the training method led to the development of the free throw blocking skill among goalkeepers. **Conclusion.** The researcher recommends using the training method under study in training goalkeepers for the junior category in handball and emphasizing the use of physical and motor ability tests periodically to determine the level of these abilities and monitor their development or decline curves.

Keywords; physical abilities, motor abilities, handball skills, free throws in handball



A. INTRODUCTION

Sports science has been very important in helping athletes do better and become great at competitive sports (Wasa et al., 2024; Yudi et al., 2024). Newer training methods are more effective and scientific because they use ideas from biomechanics, physiology, psychology, and motor learning (Bompa & Buzzichelli, 2019). These improvements help athletes and coaches understand movement better, find mistakes, and improve skills more effectively (Rubiyatno et al., 2023). In handball, a dynamic and physically demanding team sport, scientific methodologies are essential for achieving elite performance and preparing athletes to meet the complex physical and tactical demands of the game (Ziv & Lidor, 2009).

In handball, the goalkeeper is very important. The goalie is the last line of defense, and their performance can make or break the game (Nugraha et al., 2024; Wati et al., 2023). This job requires excellent physical fitness, technical accuracy, and strong mental toughness (Šibila, Vuleta, & Pori, 2011). The goalie needs to be able to react quickly to shots from different angles and distances, guess what the other team will do, and stay focused the whole game. As a result, their training must be customized and individualized to develop specific attributes such as agility, explosive strength, coordination, and perceptual awareness (Spudić et al., 2025).

Despite this, many current training programs focus mostly on general conditioning or team-oriented routines, ignoring the specific biomechanical and cognitive needs of goalkeepers (Camacho et al., 2018). Goalkeepers, on the other hand, have to make moves that are considered open skills, which means they have to keep adapting to unexpected situations with the ball and attacking players (Stubbs-Gutierrez & Medina-Porqueres, 2021). To be a good goalkeeper, you need to be physically ready and able to read visual cues, predict where the ball will go, and react quickly when you have to. The difficulty of this task makes training for the goalkeeper one of the hardest parts of getting ready for handball.

Defending against free kicks is especially hard for goalkeepers because the shot is taken from a short distance and there isn't much time to react. In these situations, physical strength alone is not enough; the goalie needs sharp foresight, perfect timing, and good motor coordination to predict where the ball will go and react to it (Wagner et al., 2011). Previous studies have demonstrated that targeted training programs focusing on agility, explosive

lower limb strength, and perceptual-motor skills can significantly improve goalkeeping performance, especially in one-on-one situations such as penalty kicks (Ortega-Becerra et al., 2018). Nevertheless, comprehensive training models that integrate physical and cognitive development for goalkeepers in these specific contexts remain lacking.

This study presents a targeted training program designed to improve the physical attributes and shot-stopping skills of handball goalkeepers, particularly in relation to free throws. The novelty of this study lies in its integration of scientific principles related to motor learning, perceptual awareness, and physical conditioning into a cohesive training framework. This method aims to enhance the physical readiness and decision-making capabilities of goalkeepers, thereby aligning their performance more closely with the actual demands of competition. The goal of this study is to give coaches realistic, evidence-based guidelines for making personalized training plans that will help goalkeepers do better and help the whole team do better.

B. METHOD

Participant

The research sample was chosen intentionally and their number was (13) goalkeepers from Kirkuk handball clubs for the junior category participating in the 2023-2024 sports season. The researcher assumed that they were homogeneous because they were from one age group and participating in one competition and for the same sports season, which makes the differences between them ineffective and thus they are homogeneous.

Research Design

The researcher chose the experimental method with a single experimental group design, as it is one of the most appropriate scientific methods for solving the research problem, and it is one of the most efficient means of arriving at reliable knowledge.

Tests used in the research

1. Vertical jump (Surgent). (2)
2. Broad jump from standing. (1)
3. Nelson test. (3)
4. Forward/downward trunk bend from a long sitting position. (4)

5. Block the goalkeeper's free throw. (5)

Exploratory experiment

conducted the exploratory experiment on 11/17/2023 in the handball hall at the College of Physical Education and Sports Sciences at the University of Kirkuk to identify some of the obstacles that may face the application of the experiment. The sample of the exploratory experiment was from within the original community and specialized in physical and skill ability tests to identify their validity, the time of conducting each test, the validity of the devices and tools, and the test results recording form, in addition to the knowledge of the support team about the mechanism of the tests and their sequence, as well as to identify the measurement of the time of performing each exercise, the validity of the tools used, and the ease of driving them by the support team.

Procedure

Pre-tests: The assistant team conducted physical tests for goalkeepers in the Kirkuk Club hall on 11/24/2023, and at the same time, the skill test for blocking free throws. The test results were recorded in the pre-prepared test form. Training curriculum: The training curriculum for handball goalkeepers for the junior category was designed, as it was presented to the specialized professors, and the training units were presented to the specialized professors as models of those training units. The duration of the training was eight weeks, at a rate of four training units per week, so the number of units became (32) units, the duration of the training unit was from (70 to 90) minutes in all its sections (the preparatory section lasts 15 minutes and includes warm-up and flexibility exercises, the main section lasts 40-50 minutes and includes physical exercises to develop explosive power, motor speed, motor response speed and agility and link them to the skill of blocking the ball, and the final section lasts 5 minutes and includes cool-down exercises). The training phase was the special preparation phase because all the studied variables require high intensity, and the percentage of change in the training load during the month was (1:3), meaning increasing the training load during the first three weeks and reducing it in the fourth week, in addition to using the principle of increasing intensity and reducing training volume. The intensity used for the first month was (85, 87, 90, 85)% and in the second month (92, 95, 97, 92)%. The high-intensity interval training method was used because it was

suitable for the physical abilities under study. Post-tests: The support team administered the tests on 1/10/2024 in the Kirkuk Club Hall, and the test results were recorded on the form prepared for them.

Data Analysis

The data acquired from the investigation were examined utilizing a series of suitable statistical methods to guarantee precise interpretation of the findings. The arithmetic mean was utilized to ascertain the central tendency of the gathered data, whereas the standard deviation was employed to quantify the extent of dispersion and variability within the sample. A paired sample t-test was utilized to analyze the differences between pre- and post-test data within the same group. An independent sample t-test was employed to ascertain significant differences between the experimental and control groups. The Pearson correlation coefficient was utilized to examine the strength and direction of the association between the variables under investigation. Additionally, percentages were computed to delineate and contrast the proportional distribution of the data, so emphasizing performance enhancements. All statistical analyses were performed in accordance with the study's aims to ensure accurate and reliable conclusions.

C. RESULTS AND DISCUSSION

Results

Table 1. means and standard deviations of physical abilities and values T calculated and its significance

Variables	Unit of measurement	Pre-test		Post-test		Calculate d t -value	Significance value	Sig.
		Mean	St.d	Mean	St.d			
Vertical explosive force	cm.	40.50	6.46	50.00	7.39	-3.41	0.04	Sig.
Explosive power horizontal	cm.	208.25	9.00	239.75	10.05	-16.27	0.00	Sig.
Flexibility	cm.	16.25	8.58	22.50	6.56	-5.64	0.01	Sig.
Agility	repetition	7.00	0.82	8.75	0.96	-7.00	0.01	Sig.

Note: Any value in the significance field that is less than 0.05 is considered significant.

Table 1 presents the arithmetic means, standard deviations, calculated t-values, and significance levels for the physical abilities of the goalkeepers in the pre- and post-tests. The findings indicate clear improvements in all physical variables following the implementation

of the training program. The mean value for vertical explosive force increased from 40.50 ± 6.46 cm in the pre-test to 50.00 ± 7.39 cm in the post-test, with a calculated t-value of -3.41 and a significance level of 0.04 , indicating a statistically significant improvement ($p < 0.05$). Similarly, horizontal explosive power showed a notable increase from 208.25 ± 9.00 cm to 239.75 ± 10.05 cm, with a calculated t-value of -16.27 and a significance value of 0.00 , confirming a high level of statistical significance ($p < 0.01$).

In terms of flexibility, the mean improved from 16.25 ± 8.58 cm to 22.50 ± 6.56 cm, with a calculated t-value of -5.64 and a significance level of 0.01 . This indicates that the training program effectively enhanced the players' range of motion and joint flexibility. The agility variable also recorded an increase from 7.00 ± 0.82 repetitions to 8.75 ± 0.96 repetitions, with a calculated t-value of -7.00 and a significance value of 0.01 , demonstrating a significant improvement in the participants' quickness and movement coordination. Overall, all physical ability variables showed statistically significant differences between the pre- and post-tests, indicating that the training approach had a positive effect on developing the goalkeepers' physical performance.

Table 2. Mean and standard deviation values for the goalkeeper's penalty kick save calculated T value and its significance

Variables	Unit of measurement	Pre-test		Post-test		Calculated t-value	Sig. value	Sig.
		Mean	St.d	Mean	St.d			
Goalkeeper free throw stopping test	degree	41.50	1.73	57.25	3.20	12.60	0.01	Sig.

Note: Any value in the significance field that is less than 0.05 is considered significant.

Table 2 shows the mean and standard deviation values for the goalkeepers' free-throw stopping test. The results reveal a substantial improvement in performance, with the mean score increasing from 41.50 ± 1.73 degrees in the pre-test to 57.25 ± 3.20 degrees in the post-test. The calculated t-value of 12.60 and the significance level of 0.01 confirm that the difference was statistically significant ($p < 0.05$). This improvement reflects a marked enhancement in the goalkeepers' ability to anticipate and block penalty throws effectively.

In general, the results demonstrate that the proposed training approach contributed significantly to the development of key physical attributes—explosive strength, flexibility, and agility—which are essential for handball goalkeepers. The improvement in free-throw

blocking performance further indicates that the physical and perceptual-motor components of the training program worked synergistically to enhance overall goalkeeping effectiveness. These findings support the hypothesis that a scientifically structured, specialized training program can meaningfully improve the performance of goalkeepers in terms of both physical readiness and specific skill execution.

Discussion

The Refling activity, which was the seventh meeting, was a very challenging activity because it involved descending from a height using the equipment provided. However, in this activity, students were required to practice courage and self-confidence, as Refling is an activity that trains the adrenaline. In the eighth meeting, students were required to work together toward a common goal in the water tower activity. After the activity, a final test was conducted, yielding the following data: the average pretest score was 86.73, and the average posttest score was 108.23, with an average increase of 21.5. The t-value was 7.447, and the significance level (Sig) was 0.000. Using the formula $\text{Sig} < 0.05$, the data was deemed significant because $\text{Sig} (0.000) < 0.05$.

When reviewing the results of the physical ability tests shown in Table (1) as well as what the results of the T- test for the corresponding samples showed about the presence of a significant difference in favor of the test. Al-Baadi. The researcher attributes this improvement in physical abilities to the quality of the training that was chosen and developed according to scientific foundations within a standardized training curriculum in terms of the components of the training load that were distributed in an organized manner and the duration of training application. This is what was confirmed by both Halson (2014) that the training load is the main means of causing physiological effects in the body, which achieves improved responses, and then adaptation of the body's systems and raising the level, so it is one of the most important factors for the success of the training program and then improving the level.

As for Hughes (2018), he confirms that "training results in an increase in the individual's performance capacity as a result of performing physical exercises for several days, weeks, or months, by adapting the body's systems to the optimal performance of those exercises. The duration necessary to execute physical exercises tailored to various biokinetic factors is

adequate to elicit these modifications, with the majority of alterations stemming from training manifesting during the initial phase of the program, specifically during a timeframe of 6-8 weeks (Haniyyah et al., 2025; Hussein, 2025; Yogi et al., 2023).

When reviewing the training period, we found it to be consistent with what was mentioned in the previous source and the occurrence of this improvement, in addition to the intensity used in carrying out these exercises, which is in accordance with the specificity of each ability, because the abilities used are characterized by high intensity, so high intensity is used and gradually increased when carrying out physical exercises, which also contributes to the emergence of improvement (Bompa & Buzzichelli, 2015). Importance is given to the intensity, volume, and comfort used so that it is appropriate for the level of the individual being trained. We note that the jumping exercises used work to develop explosive power, both vertical and horizontal, and this ability is one of the important requirements in handball, especially for goalkeepers, because their movements and skills involve explosive power in the legs, both upwards and sideways (Suniga et al., 2025). Research reveals that varied jumping exercises play a significant and effective role in developing the explosive power of players' leg muscles (Custodio et al., 2024).

James and Wright also pointed out that explosive power can be increased by influencing highly stimulated units, which increases their susceptibility and thus increases the nervous system's ability to mobilize motor units characterized by high speed (Kruse, 2021). The motor speed exercises included in the training had a significant impact on developing this ability, due to their great importance in the goalkeeper's movements while blocking free throws, as "the player's possession of good motor speed and the ability to implement various simple and complex skills generates a superior ability to perform all other movements and change them according to the playing conditions (Elgueta-Cancino, 2022). This is what the researcher did by strengthening the leg muscles through training curriculum exercises in order to produce the best achievement for the goalkeeper.

Flexibility exercises were also performed by the goalkeepers during the warm-up and rest between repetitions of the various physical exercises in all units, for the various muscles and joints of the body, according to scientific foundations and with appropriate repetitions (Neto et al., 2014). Weights were used in the exercises, which showed significance in the pre- and post-tests. Agility exercises also help the goalkeeper deal with all the situations the body

needs smoothly when blocking balls. This was improved through the training curriculum exercises that were developed, in addition to their relationship to the specific motor performance of the game, as the goalkeeper changes his body positions from stillness to movement and flying to different angles while blocking a free throw. This is what Nikšić, (2020) referred to as "the individual's ability to change his body positions or the speed of changing direction, whether with the whole body or parts of it, and whether on the ground or in the air. Therefore, the physical exercises were mostly similar to the skill performance or the path of the goalkeeper's body or part of it in blocking free throws in different directions and positions.

When reviewing the results of the goalkeeper's free throw blocking test, we find that they have improved, as the post-test results were better than the pre-test results. The researcher attributes this to the fact that the training method used had most of its exercises combining physical fitness and the skill of flying to block the ball. As well as the development of physical abilities, which are considered the basis for the development of skillful performance, as Charles confirms that everything that happens in the game depends on physical fitness, and it is not possible to play at a high level unless the player has excellent fitness (Purba et al., 2024; Suryadi et al., 2024). In addition to what was indicated by both Abod & AlHaddad, (2022); Hussein & Hrebid, (2023); Yanti et al., (2024) about the importance of the relationship between the nervous system and the muscles, the nature of muscle contraction, and the speed of performance angles during skillful performance.

D. CONCLUSION

The findings of this study demonstrate that the suggested training curriculum exerted a distinct and substantial impact on enhancing the physical capabilities of the handball goalkeepers within the research sample. The training program helped build important skills like explosive strength, flexibility, and agility, all of which are very important for improving goalkeeping performance. Moreover, the specialized training method employed in this study resulted in a significant enhancement of the goalkeepers' proficiency in blocking free throws, demonstrating the efficacy of integrating physical, technical, and perceptual-motor components within a systematic training framework. These results underscore the necessity of utilizing scientifically grounded and position-specific training methodologies to improve

the overall efficiency and performance of goalkeepers, especially in scenarios demanding rapid reaction, decision-making, and precise motor execution.

The study's findings suggest that the training methodology formulated in this research should be implemented in the preparation and development of goalkeepers, particularly in the junior handball division. Coaches should also regularly test players' physical and motor skills using standardized tests to keep track of their progress and find areas that need work. Moreover, skill assessments, exemplified by the goalkeeper's free-throw blocking test, ought to be incorporated into the evaluation process to yield a more thorough comprehension of individual performance. Lastly, future research should focus on creating normative data and standard performance benchmarks for the physical and technical skills unique to handball goalkeepers. This information would be useful for coaches, trainers, and researchers in the field.

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F. AUTHOR CONTRIBUTION STATEMENT

Nada Zeed Mahamad is the sole author of this research. She independently designed the study, developed the research instrument, collected and analyzed the data, interpreted the findings, and wrote the manuscript.

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