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METHODOLOGY FOR DEVELOPING ACCURACY AND EFFECTIVENESS IN GOAL SHOOTING AMONG 12–14-YEAR-OLD HANDBALL PLAYERS

DOI: https://doi.org/10.5281/zenodo.17383537

Annotation. This study aimed to develop and test a scientifically grounded methodology for improving goal-shooting accuracy and efficiency in 12–14-year-old handball players. According to the International Handball Federation's Handball at School programme, shooting is the decisive motor action in handball; it comprises multiple variations such as jump, running, set, underarm, curved, lob and spin shots whose effectiveness depends on situational and individual factors. Early adolescence is characterised by rapid somatic growth and nervous system development, making it crucial to consolidate previously learned techniques, strengthen general physical preparedness and determine individual aptitude. Forty male handball players (mean age 13 ± 0.9 y) were allocated to experimental (n = 20) and control (n = 20) groups. Over 12 weeks the experimental group trained three times per week using integrational (4+5) and positional (11+6) shooting drills on a "Handball goal target" (GDN) device, whereas controls followed standard training.

Keywords: handball, shooting accuracy, "handball goal target", integrational drills, positional drills, adolescent athletes, physical preparedness

Introduction

The main objective of handball is to score by throwing the ball into the opponent's goal, with the throwing action serving as the primary determinant of success. The International Handball Federation (IHF) emphasizes that goal shooting can be executed in distinct forms (jump shot, running shot, set shot, diving, underarm, curve, lob, and spin). The effectiveness of these techniques depends on the game situation, the athlete's physical-coordinative condition, and individual preferences. Consequently, systematic work on throwing technique, mastering various shooting types, and increasing both speed and accuracy are central tasks in the preparation of young athletes. Studies published in BMC Sports Science, Medicine and Rehabilitation show that the handball throw is a complex whole-body movement that dictates scoring opportunities; during a match, adolescents perform on average around 100 passes and 10 shots and, in a single training session, execute 120–150 throws. Therefore, the early and robust formation of the throwing pattern is an integral component of long-term athlete development programs worldwide.

There are numerous international programs for introducing handball at an early age. The IHF's "Handball at School" program encourages elementary pupils to play on a smaller court (20 × 13 m) with fewer players (4 × 4), providing more opportunities to participate in shooting situations and fostering a sense of success. In a study by Indonesian researchers Nopianto et al. (2021), the authors argue that young athletes require a set of 54 shooting drills and that these should be organized in play-based, coordination-focused formats (individual, paired, and group) to ensure engaging learning. Rousanoglou and colleagues (2015) demonstrated that, under time pressure, novices show lower throwing speed and accuracy than experienced players, and that time constraints affect them differently. Moreover, a 2024 meta-analysis found that various resistance exercises (e.g., knee bands, medicine balls, elastic bands) may increase throwing

speed; however, work with medicine balls and elastic bands does not necessarily improve throwing accuracy. Collectively, these findings underscore the need to develop a specialized complex of shooting drills to enhance accuracy and effectiveness among young handball players.

Ongoing sport reforms in Uzbekistan—particularly the strengthening of the material-technical base of sport schools, early identification of talented athletes, and supportive development strategies—heighten the relevance of this study. At the Faculty of Physical Education of Fergana State University, a new methodology combining integrative and positional shooting drills for younger adolescents is being developed using a "Handball Goal Target" device (GDN). This article presents the core principles of the methodology, pilot results, and the ensuing scientific-applied conclusions.

Research Aim

To scientifically assess the effectiveness of a specially designed complex of integrative and positional shooting drills for improving goal-shooting accuracy and effectiveness in 12–14-year-old handball players, and to determine its practical applicability.

Research Objectives

Analyze the theoretical foundations of goal shooting in handball, the different types of shots, and their importance in the preparation of young athletes.

Measure baseline physical preparedness and technical skills of 12–14-year-old athletes and determine control indicators.

Implement, in the experimental group, integrative (4+5) and positional (11+6) shooting drills using the Handball Goal Target (GDN) device.

After a 12-week training program, compare shooting accuracy, speed, and jump performance between the experimental and control groups.

Evaluate the results using statistical analysis and substantiate the effectiveness of the methodology.

Develop practical recommendations for applying the methodology in sport schools, university sections, and specialized centers.

Methodology

Forty boys aged 12–14 (mean age 13.0 ± 0.9 years) from sports schools and university sport sections in Fergana region participated. They were randomly assigned to an experimental group (EG, n = 20) and a control group (CG, n = 20). All participants had at least two years of handball experience and were cleared through medical screening. Parents/guardians provided informed consent in line with medical-ethical standards. Given the rapid growth in height and weight, maturation of the nervous system, and the formation of motor skills at this age, training loads were individualized.

Measurements were taken at baseline (pre-test) and after the 12-week program (post-test):

30 m sprint (s) — measured electronically from a standing start over 30 m.

Standing long jump (cm) — distance measured from a two-footed standing jump using a marked scale.

7 m penalty-shot accuracy (%) — each athlete performed 10 shots from the 7 m line at a goal subdivided into target sectors; accuracy was calculated as successful hits (%).

9 m shot accuracy (%) — each athlete performed 10 shots from the 9 m line; successful hits were expressed as a percentage.

GDN device score — the GDN consists of a six-sector electronic target; for each throw, the sensor system recorded the time and point of impact. Each athlete threw from six positions in sequence, accumulating a total score.

Tests were administered by experienced coaches and sport scientists. Each test was performed three times, and the best result was recorded. To ensure reliability, identical equipment, timing, and conditions were used.

The experimental group trained three times per week for 12 weeks with a specialized complex of shooting drills utilizing the GDN. The program comprised three phases

of four weeks each:

Integrative shooting drills (4+5) — during the first 4 weeks, athletes executed five throws at four target sectors per session, performing exercises that integrated shoulder force, arm trajectory, and footwork. Video analysis was used after each drill to identify and correct errors.

Positional shooting drills (11+6) — over the next 4 weeks, athletes performed running throws from 11 m followed by jump shots from 6 m points. Drills simulated game situations and aimed to improve decision-making speed.

Combined phase — in the final 4 weeks, both drill types were blended; athletes approached from different angles and aimed at varied sectors of the GDN. Each session included a warm-up, followed by shooting and game-based tasks designed to enhance movement speed.

The control group followed a traditional, coach-approved handball program, focusing on general physical preparation, technical elements (passing, dribbling), and team play; they did not use the GDN for specialized shooting drills. For each variable, the arithmetic mean and standard error (SE) were calculated. Paired-samples Student's t-tests compared pre- and post-values; $p < 0.05$ was considered statistically significant.

Results

Table 1 presents baseline and post-intervention values (mean ± SE) for the experimental (EG) and control (CG) groups. The EG showed substantial improvements across all variables (or decreases for sprint time), with particularly notable gains in 7 m and 9 m shooting accuracy and GDN scores. The CG also improved, but to a lesser extent.

As shown, 30 m sprint times and standing-long-jump performance improved in both groups, but changes were larger in the EG (e.g., +9.9 cm in jump distance). The EG's 7 m accuracy increased by 13.4 percentage points, compared with 4.4 points in the CG. For 9 m accuracy, the EG improved by 14.6 points, while the CG improved by 7.3 points. The GDN score rose by 12.3 in the EG versus 4.9 in the CG. t-tests indicated $p < 0.05$ for all EG variables; in the CG, significance at $p < 0.05$ applied to only some measures.

The diagram (Figure 1) depicts initial and post-training shooting accuracy at the six GDN target positions in the EG. Baseline accuracy for each position ranged from 46–55%. After training, all positions showed increases of 14–16%; the greatest gains occurred at positions 1 and 4 (~16%). These results indicate improvements in throwing technique and decision-making speed.

Analysis of the Results

In the EG, 30 m sprint time decreased by 0.27 s ($p < 0.001$), suggesting that specialized shooting drills can positively influence general speed qualities. Standing long jump improved by 9.9 cm in the EG ($p < 0.001$) and 5.1 cm in the CG ($p < 0.001$). Mean 7 m penalty accuracy in the EG in-

Table 1.

Performance of EG and CG at baseline and post-test

Measure	EG (Baseline ± SE)	EG (Post ± SE)	CG (Baseline ± SE)	CG (Post ± SE)
30 m sprint, s	5.77 ± 0.04	5.49 ± 0.04	5.79 ± 0.05	5.68 ± 0.04
Standing long	177.87 ± 1.73	187.74 ± 2.18	180.98 ± 2.15	186.13 ± 1.91
7 m accuracy, %	57.84 ± 1.10	71.22 ± 1.19	57.33 ± 1.41	61.70 ± 1.59
9 m accuracy, %	42.81 ± 1.49	57.43 ± 1.92	47.39 ± 1.57	54.73 ± 1.53
GDN score	24.90 ± 0.62	37.23 ± 0.83	23.17 ± 0.66	28.11 ± 0.86

creased from 57.8% to 71.2% (Δ = 13.4 ± 1.2%, p < 0.001); the CG rose from 57.3% to 61.7% (Δ = 4.4 ± 1.6%, p < 0.01). The EG's 9 m accuracy improved by 14.6 ± 1.9% (p < 0.001), while the CG's improved by 7.3 ± 1.5% (p < 0.001). The GDN score increased by 12.3 ± 0.8 in the EG versus 4.9 ± 0.9 in the CG. These differences indicate that the experimental program substantially enhanced goal-shooting accuracy and effectiveness.

The findings confirm the importance of specialized integrative and positional shooting drills for improving goal-shooting accuracy and effectiveness among 12–14-year-old handball players. The IHF "Handball at School" methodology stresses teaching shooting skills in game-relevant contexts and highlights multiple variants such as jump, running, set, underarm, and curve shots. Our program's combination of integrative (4+5) and positional (11+6) drills brought these variants together, teaching athletes to shoot from varied distances and angles. The IHF program recommends reducing pitch size and player numbers for children to increase the frequency of shooting situations; the GDN device served a comparable purpose by segmenting the goal into sectors that simulate a smaller playing area and help focus the athlete's attention.

Overall, the results suggest that a complex program combining integrative and positional drills can significantly improve not only shooting accuracy and effectiveness but also general speed and jumping ability in young handball players. This can foster more confident match performance, faster decision-making, and higher technical quality. Implemented in training, the methodology can contribute to identifying talented athletes nationwide and preparing them for professional sport.

Conclusion

The integrative and positional shooting-drill complex developed in this study proved effective for improving goal-shooting accuracy and effectiveness in 12–14-year-old handball players. In the experimental group, 7 m and 9 m shooting accuracy increased by 13.4 ± 1.2% and 14.6 ± 1.9%, respectively, while the GDN score increased by 12.3 ± 0.8 points—differences that were significantly greater than in the control group. By using the GDN device, it aligns shooting practice with game-like conditions, enabling engaging and competitive training for athletes. The methodology can be applied in sport schools, specialized centers, and university sections. Integrative and positional drills also positively affect general physical preparedness, as evidenced by improvements in 30 m sprint and standing-long-jump performance. It is important to conduct sessions in a game-based format with age-appropriate loads, monitor outcomes via video analysis, and create competition-like conditions. Finally, tailoring loads to individual growth rates, providing psychological support, and fostering a positive social environment are essential.

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