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Impact of Specific Training on Selected Speed, Explosive Power and Muscular Strength Parameters among College Men Handball Players

[1]Mr.K. Narayana prabhu, [2]Dr. S. Vijaya Kumari

[1]Research Scholar

[2]Assistant Professor, S.F.R College for Women-Sivakasi.

Abstract: Court handball asks a lot of the body. Over two thirty-minute halves, players keep switching between quick defensive shuffles, sudden sprint breaks, jump throws and hard contact. At the college level, conditioning usually means general endurance running or plain game play, and neither copies these movement patterns closely. This study looked at what an eight-week handball-specific training schedule does to speed, explosive leg power and muscular strength among male intercollegiate players. Thirty men aged 18 to 23 years were recruited from affiliated college teams and split evenly into a specific training group (n = 15) and a control group (n = 15). The control group carried on with its normal daily practice. The experimental group added four 60-minute sessions a week made up of short resisted sprints, multi-directional plyometric hops, medicine ball throws and court-specific strength drills. Before and after the eight weeks, speed was measured with the 30-meter dash, explosive power with the standing broad jump, and muscular strength endurance with push-ups and bent-knee sit-ups. Analysis of covariance (ANCOVA) showed significant gains ($p < .05$) on every variable for the experimental group relative to the control group: 30-meter sprint time fell by 4.38%, standing broad jump distance grew by 6.64%, and push-up count rose by 17.82%. Building structured, movement-specific conditioning into regular college practice is a practical way to improve the physical output that matters in matches.

Keywords: team handball, specific conditioning, acceleration speed, explosive power, muscular strength, collegiate athletes

1. Introduction

Team handball is played on a 40-by-20-meter indoor court, and the switch between attack and defense is so fast that nobody gets a real chance to rest. Time-motion studies of competitive matches put the distance covered at roughly four to five kilometers per game, but most possessions are decided by short bursts of two to four seconds, not by steady jogging (Michalsik et al., 2015). An attacker driving at the six-meter line has to get past a defender, take off from one or both feet over a raised block, and throw at speeds above 20 meters per second. A moment later the same player is sprinting back to form a 6-0 defensive wall and taking body checks from opposing pivots.

These actions repeat dozens of times in each half, so modern handball leans on three connected physical qualities: linear and change-of-direction speed, explosive power in the lower limbs, and functional muscular strength (Wagner et al., 2014). Speed decides whether a wing beats the defense on a fast break or shuts a shooting lane before a backcourt thrower is set. Explosive power sets how high a player rises for a jump shot, and so how clear an angle the shooter gets over outstretched hands. Trunk and upper-body strength steadies the shoulder girdle during throws and lets defenders hold their ground in one-on-one contact without picking up two-minute suspensions.

College coaches usually work around tight academic timetables, limited weight-room access and short preparation windows before tournaments. Under those limits, conditioning tends to default to generic aerobic running or long scrimmages. (Jasani, D. 2021) Continuous running does build cardiovascular stamina, but it

mainly works slow-twitch motor units and does little to load the stretch-shortening cycle or the high-threshold motor units used in maximal jumps and sprints (Chelly et al., 2010). The principle of specificity says that the body adapts to the mechanical angles, contraction velocities and energy systems it is actually trained under (Bompa & Buzzichelli, 2019). Drills that pair short sprint accelerations, reactive bounding and rotational medicine ball throws come much closer to what happens on court. (Jasani, D. 2020)

Specificity is widely accepted in elite European clubs, yet there is little data on compact, court-based specific programs for college handball players. Many earlier studies used heavy barbell protocols that typical college programs cannot offer, or studied youth academy players, whose maturation differs from that of young adults. This study therefore asked whether an eight-week specific conditioning program built into on-court practice could improve 30-meter sprint speed, standing broad jump distance and muscular strength endurance in college men handball players.

2. Methodology

2.1 Participants and Experimental Design

Thirty male intercollegiate handball players aged 18 to 23 years volunteered for the study. All were active members of their university squad and had played in at least two inter-university or state-level tournaments. None had a history of lower-limb surgery, shoulder instability or acute musculoskeletal injury in the six months before data collection. Before baseline testing, each athlete attended an orientation session covering the training schedule, the tests and the possible physical risks, and gave written informed consent.

A randomized pre-test/post-test control group design was used. After baseline testing, players were ranked by composite physical performance score and randomly assigned to two equal groups of 15: an experimental specific training group (STG; age = 20.40 ± 1.35 years, height = 176.8 ± 5.4 cm, body mass = 71.2 ± 6.1 kg) and a control group (CG; age = 20.13 ± 1.41 years, height = 175.9 ± 5.8 cm, body mass = 70.5 ± 6.4 kg). Both groups kept to their usual technical-tactical handball practice five evenings a week, and participants were asked not to do any outside strength or conditioning work during the eight weeks.

2.2 Testing Procedures and Criterion Measures

All pre- and post-tests took place on an indoor wooden handball court over two consecutive mornings, at a steady temperature of 24–26 °C. Athletes avoided vigorous exercise for 48 hours beforehand and did the same standardized 15-minute warm-up before each session: light jogging, dynamic joint mobility and submaximal acceleration strides.

Speed (30-Meter Dash): Straight-line acceleration and top-end speed were timed over a 30-meter straightaway marked on the court floor. Participants started from a stationary split stance 30 centimeters behind the first line. Two trained timekeepers recorded times on calibrated digital stopwatches accurate to 0.01 seconds, and the mean of their two readings was kept. Each athlete ran two maximal trials with four minutes of passive rest between them, and the faster time was used in the analysis.

Explosive Power (Standing Broad Jump): Horizontal explosive power of the lower body was measured with the standing broad jump. Participants stood with toes behind a marked take-off line and feet shoulder-width apart, swung their arms in a countermovement, and jumped forward as far as they could, landing on both feet at once. Distance was measured in centimeters from the take-off line to the nearest heel contact. Each athlete had three attempts with two minutes of rest in between, and the longest valid jump counted.

Muscular Strength Endurance (Push-Ups and Bent-Knee Sit-Ups): Upper-body pushing endurance was tested with a cadence-controlled push-up test to failure. Participants lowered the chest to within five centimeters of the floor while keeping the torso rigid, and continued until they could not go on or made two form breaks in a row.

Core and abdominal endurance was tested with the one-minute bent-knee sit-up test, counting full repetitions with knees bent at 90 degrees and hands behind the ears.

2.3 Specific Training Protocol

The experimental group did four 60-minute specific conditioning sessions a week (Monday, Tuesday, Thursday and Friday) for eight consecutive weeks, ahead of their regular ball-handling drills. Loading followed a progressive overload model split into two four-week mesocycles. Weeks 1 to 4 focused on movement mechanics, eccentric landing control and basic strength endurance, at moderate volume (3 sets of 8–10 repetitions) with 60–90 seconds of rest between sets. In weeks 5 to 8, movement velocity and intensity went up (4 sets of 6–8 explosive repetitions) with 90–120 seconds of rest, enough for the phosphocreatine system to recover fully.

Table 1 Eight-Week Handball-Specific Conditioning Schedule for the Experimental Group

Training Day	Primary Focus	Specific Exercises & Court Drills	Volume & Intensity
Monday	Linear & Reactive Speed	10 m & 20 m sprint starts from defensive stance; partner-resisted harness sprints; zig-zag cone shuffles with ball catch	Weeks 1–4: 3 sets × 4 reps Weeks 5–8: 4 sets × 5 reps (95–100% effort)
Tuesday	Lower-Body Explosive Power	Double-leg hurdle hops; single-leg lateral bounds; depth jumps into simulated jump-shot take-off	Weeks 1–4: 3 sets × 8 reps Weeks 5–8: 4 sets × 6 reps (Maximal reactive contact)
Thursday	Upper-Body & Core Strength	Overhead & rotational 3 kg medicine ball slams; plyometric clap push-ups; V-ups & Russian twists with ball	Weeks 1–4: 3 sets × 10 reps Weeks 5–8: 4 sets × 8 reps (Explosive concentric phase)
Friday	Integrated Court Conditioning	Fast-break 15 m sprint + jump throw; 6-0 defensive slide-and-block repeats; partner grappling push-outs	Weeks 1–4: 3 rounds × 45 s Weeks 5–8: 4 rounds × 40 s (1:2 work-to-rest ratio)

Note. Each session opened with a 10-minute dynamic warm-up and closed with 8 minutes of static stretching and breathing recovery. During these periods the control group did standard skill drills and scrimmages.

2.4 Statistical Analysis

Data were analyzed in SPSS (Version 26.0). Descriptive statistics are reported as means and standard deviations (M ± SD). Paired-samples t-tests assessed within-group change from pre-test to post-test. To adjust for small

baseline differences between the groups, a one-way Analysis of Covariance (ANCOVA) was run on post-test scores with pre-test values as the covariate. Effect sizes were calculated as partial eta-squared (ηp^2) and read as small (0.01), moderate (0.06) or large (0.14). The significance level was set at $\alpha = .05$.

3. Results

All 30 participants finished the eight weeks without injury. Attendance was 96.8% in the experimental group and 95.4% in the control group. Independent t-tests showed no significant baseline differences between the groups on any physical measure ($p > .05$).

Table 2 Pre-Test and Post-Test Descriptive Statistics and Within-Group Comparisons

Variable	Group	Pre-Test (M ± SD)	Post-Test (M ± SD)	Mean Diff.	% Change	t-value
30 m Sprint (s)	Experimental (n = 15)	4.34 ± 0.16	4.15 ± 0.14	-0.19	-4.38%	9.42*
	Control (n = 15)	4.36 ± 0.17	4.33 ± 0.16	-0.03	-0.69%	1.61
Standing Broad Jump (cm)	Experimental (n = 15)	218.40 ± 9.85	232.90 ± 9.12	+14.50	+6.64%	11.18*
	Control (n = 15)	216.90 ± 10.20	218.80 ± 9.95	+1.90	+0.88%	1.74
Push-Ups (reps)	Experimental (n = 15)	28.40 ± 3.92	33.46 ± 3.64	+5.06	+17.82%	10.65*
	Control (n = 15)	27.93 ± 4.10	28.60 ± 3.88	+0.67	+2.40%	1.48
Bent-Knee Sit-Ups (reps/min)	Experimental (n = 15)	36.20 ± 4.15	42.13 ± 3.80	+5.93	+16.38%	12.04*
	Control (n = 15)	35.80 ± 4.30	36.53 ± 4.05	+0.73	+2.04%	1.59

Note. For the 30 m sprint, negative values indicate faster completion times. *Statistically significant within-group difference at $p < .001$. As Table 2 shows, the specific training group improved on every measure after eight weeks. Their 30-meter sprint time dropped from 4.34 ± 0.16 s to 4.15 ± 0.14 s ($t = 9.42$, $p < .001$), while the control group barely changed, going from 4.36 ± 0.17 s to 4.33 ± 0.16 s ($t = 1.61$, $p = .130$). Standing broad jump in the experimental group rose by 14.50 cm ($t = 11.18$, $p < .001$), against a non-significant 1.90 cm gain in the control group ($t = 1.74$, $p = .104$). Push-up repetitions in the experimental group increased by 17.82% and sit-up counts by 16.38%, whereas control players showed little change.

Table 3 Analysis of Covariance (ANCOVA) Comparing Adjusted Post-Test Means Between Groups

Variable	Adjusted Post-Test Mean (STG)	Adjusted Post-Test Mean (CG)	F (1, 27)	p-value	Partial ηp²
30 m Sprint (s)	4.16	4.32	44.82	< .001*	0.624
Standing Broad Jump (cm)	232.24	219.46	58.19	< .001*	0.683
Push-Ups (reps)	33.25	28.81	49.64	< .001*	0.648
Bent-Knee Sit-Ups (reps/min)	41.96	36.70	63.40	< .001*	0.701

Note. STG = Specific Training Group; CG = Control Group. Covariates appearing in the model were evaluated at baseline mean values. *Significant between-group difference at $p < .001$.

The ANCOVA results (Table 3) show that the differences between the experimental and control groups stayed highly significant after adjusting for pre-test scores. Group effects were significant for 30-meter sprint speed, $F(1, 27) = 44.82$, $p < .001$, $\eta p^2 = 0.624$; standing broad jump, $F(1, 27) = 58.19$, $p < .001$, $\eta p^2 = 0.683$; push-ups, $F(1, 27) = 49.64$, $p < .001$, $\eta p^2 = 0.648$; and bent-knee sit-ups, $F(1, 27) = 63.40$, $p < .001$, $\eta p^2 = 0.701$. Every partial eta-squared value was above 0.60, which points to large practical effects.

4. Discussion

The main finding is that an eight-week handball-specific program clearly improved linear sprint speed, horizontal explosive power, and trunk and upper-body muscular strength endurance in college male players, while routine skill practice alone produced no meaningful physical gains. Technical drills and scrimmages remain essential for tactical coordination, but these results suggest they do not provide the high-intensity mechanical overload needed to drive neuromuscular adaptation in trained college players.

The 4.38% drop in 30-meter sprint time is in line with Hermassi et al. (2019), who reported significant gains in 15-meter and 30-meter sprint velocity after eight weeks of combined sprint and plyometric conditioning in male handball players. The short resisted accelerations and defensive-stance starts in this program targeted the first 0–15 meters, where producing horizontal ground reaction force matters most. Practicing explosive first steps from sport-specific postures probably raised motor unit firing frequency and shortened ground contact times during maximal sprinting.

The 14.50 cm gain in standing broad jump is consistent with Chelly et al. (2010) and Chaabene et al. (2019), who documented clear jump improvements after short plyometric interventions. Hurdle hops, lateral bounds and depth jumps into simulated shooting take-offs train the stretch-shortening cycle by shortening the amortization phase between eccentric landing and concentric push-off. In a match, greater horizontal and vertical impulse lets backcourt shooters rise higher over blocks and lets wingers cover more distance through the air into the goal area before releasing the ball.

The improvements in push-ups (+17.82%) and bent-knee sit-ups (+16.38%) point to the value of combining medicine ball throws, plyometric push-ups and rotational trunk drills. A fast handball throw depends on a kinetic chain that carries ground reaction forces up through a braced core into rapid internal rotation and extension of the throwing arm (Wagner et al., 2014). College players also take repeated collisions along the six-

meter line. Local muscular endurance in the front trunk, chest and triceps helps hold throwing mechanics and defensive posture in the last minutes of close matches, when fatigue usually erodes technique.

Some limitations should be kept in mind. First, throwing velocity and on-court agility with dribbling were not measured directly, and either would have tied the results more closely to match performance. Second, the study ran for eight weeks in the pre-competitive phase; tracking players across a full university season is needed to learn how to taper volume so that gains hold without overreaching. Even so, the protocol needed only cones, hurdles and medicine balls, which makes it realistic for college coaches without a dedicated strength facility.

5. Conclusion

An eight-week, four-day-per-week handball-specific conditioning program added to regular practice significantly improved 30-meter sprint speed, standing broad jump power, and upper-body and core muscular strength endurance in college men handball players. Technical practice alone did not produce comparable neuromuscular gains over the same period. Coaches should work short resisted sprints, multi-directional plyometrics and explosive medicine ball drills into their weekly microcycles to prepare players for the physical demands of competitive matches.

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