Abstract

Background: Traditional throwing performance training primarily focuses on upper extremity and core strengthening, often overlooking the foundational role of hip adductor muscles in the kinetic chain. Hip adductors contribute to pelvic stabilization, rotational control, and power transfer during throwing motions, yet their specific impact on throwing performance in amateur athletes remains largely unexplored.

Objective: To evaluate the effects of a structured hip adductor strengthening program using the Copenhagen Adduction exercise on throwing performance parameters (velocity, distance, accuracy) and bilateral hip adductor strength in amateur throwers.

Methods: A quasi-experimental study was conducted over 16 weeks with 45 amateur throwers (ages 18-24) from Brainware University, Kolkata. The intervention consisted of a 6-week progressive Copenhagen Adduction exercise program (2-3 sessions/week), preceded by 4 weeks of baseline measurements and followed by 6 weeks of post-intervention assessment. Outcome measures included bilateral hip adductor strength (handheld dynamometer)[15], throwing distance (measuring tape), throwing velocity (velocity gun), and throwing accuracy (spatial deviation assessment) using a standardized 1-kg exercise ball. Statistical analysis employed paired t-tests with significance set at $p < 0.05$.

Results: All participants completed the intervention with 100% retention rate. Statistically significant improvements were observed across all parameters: right hip adductor strength ($p = 4.48 \times 10^{-17}$), left hip adductor strength ($p = 5.18 \times 10^{-17}$), throwing distance ($p = 5.68 \times 10^{-20}$), throwing accuracy ($p = 3.50 \times 10^{-11}$), and throwing velocity ($p = 3.89 \times 10^{-18}$). The bilateral strength gains were nearly identical, indicating balanced muscular development. Throwing distance showed the strongest statistical improvement, suggesting enhanced force transmission through the kinetic chain.

Conclusions: The Copenhagen Adduction exercise significantly enhances multiple dimensions of throwing performance in amateur athletes within six weeks. The concurrent improvements in strength, distance, accuracy, and velocity validate the critical role of hip adductors in kinetic chain efficiency during throwing movements[13]. These findings provide evidence- based justification for integrating hip adductor strengthening into throwing-specific training programs, offering a practical, equipment-minimal intervention suitable for amateur athletic populations.

Clinical Relevance: This study establishes hip adductor strengthening as a foundational component of throwing performance enhancement, with implications for athletic training, injury prevention, and sports performance optimization across rotational sports.

Keywords: Hip adductor strengthening, Copenhagen Adduction exercise, throwing performance, amateur athletes, kinetic chain, sports biomechanics, pelvic stability, rotational power, athletic training, sports performance enhancement.

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