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The Acute Effect of Plyometric Exercise on Speed and Agility Performance Among Youth Hockey Players

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I. INTRODUCTION

Field hockey demands explosive sprinting and rapid changes of direction, making speed and agility critical performance attributes, especially among youth players. Plyometric training encompassing stretch-shortening cycle movements such as jumps and bounds has been widely recognised for developing explosive power [1]. Post-activation performance enhancement (PAPE) describes a transient neuromuscular state following high-intensity conditioning activity that can potentiate subsequent muscle contractile function, potentially boosting sprint and agility outputs [2]. Alternate-leg bounding (ALB), a horizontal plyometric movement closely mirroring sprinting mechanics, may offer sport-specific advantages over a generalized dynamic warm-up [3]. Despite growing evidence in adult and track-based populations, research on acute plyometric warm-up effects in Malaysian youth hockey players remains scarce. This study examined whether ALB incorporated into a pre-session warm-up significantly improves 10-meter sprint and Illinois Agility Test performance in female youth hockey players.

II. METHODS

A true experimental randomised crossover design was employed. Twenty female youth hockey players aged 14–16 years (M age = 13.8 ± 1.01 yrs; height = 153 ± 4.74 cm; weight = 48.4 ± 6.80 kg) from school/district-level programmes in Malaysia participated. Sample size was determined via G*Power 3.1 a priori analysis ($d_z = 0.76$, $\alpha = 0.05$, power = 0.80; minimum $n = 16$). Each participant completed two randomised sessions: (1) a plyometric warm-up using ALB five bounds per leg; and (2) a standard dynamic hockey warm-up (jogging, high knees, butt kicks, arm circles, leg swings, walking lunges). A 48-hour washout period separated sessions. Performance was assessed immediately post warm-up using the 10 m sprint test (linear acceleration) and the Illinois Agility Test (change-of-direction ability), both timed by the same trained assessor. Normality was assessed via Shapiro–Wilk. Parametric paired-samples t-tests were used for sprint

data ($W = 0.933$, $p = 0.174$); Wilcoxon signed-rank and Mann–Whitney U tests were applied to agility data ($W = 0.841$, $p = 0.004$).

III. RESULTS AND DISCUSSION

Table I presents the within-condition and between-condition performance outcomes.

TABLE I
SPRINT AND AGILITY PERFORMANCE

Test	Plyometric (ALB)	Normal Warm-up
10 m Sprint Pre (s)	2.42 ± 0.23	2.42 ± 0.23
10 m Sprint Post (s)	2.28 ± 0.25	2.45 ± 0.22
Statistic	$t(19) = 1.77$	$t(19) = -0.53$
p-value	0.092	0.603
Illinois Pre (s)	18.5 ± 0.95	18.5 ± 0.95
Illinois Post (s)	18.1 ± 1.13	18.8 ± 0.96
Statistic	$W = 170$	$W = 46.5$
p-value	0.014*	0.030*
Between cond. Illinois	$U = 88.0$, $p = 0.003^*$	

* $p < 0.05$; $\pm$ SD.

The plyometric warm-up did not produce a statistically significant improvement in 10 m sprint performance ($p = 0.092$), supporting the null hypothesis (H_{01}). This aligns with [4], who reported no acute sprint benefit following low-volume plyometric protocols. Short-distance acceleration relies heavily on initial neuromuscular coordination and may require greater plyometric stimulus intensity or volume to elicit PAPE in adolescent athletes. Individual variability in biological maturity and plyometric familiarity among youth players may also reduce the acute response.

Conversely, agility performance improved significantly following ALB ($W = 170$, $p = 0.014$), and the plyometric condition was significantly superior to the normal warm-up between conditions ($U = 88.0$, $p = 0.003$), leading to rejection of H_{02} and H_{04} . The multi-directional demands of the Illinois Agility Test rapid deceleration, re-acceleration, and lateral movement closely parallel the stretch-shortening cycle mechanics activated during

bounding. [5][6], who reported enhanced change-of-direction performance following plyometric priming.

IV. CONCLUSIONS

A single session of alternate-leg bounding as a warm-up significantly improved agility ($p = 0.014$) but did not significantly enhance 10 m sprint performance ($p = 0.092$) among female youth hockey players. These findings support incorporating ALB in pre-competition warm-up routines to optimise immediate agility readiness. Future research should examine optimal plyometric volumes, include male athletes, and explore additional performance variables such as reaction time and repeated sprint ability to broaden generalizability.

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