

CHAPTER IV

RESULTS

The purpose of this study was two fold. The first purpose was to describe the hurdling performance by examining the movement patterns of the trunk and the lead leg during the hurdle step of Thai male sprint hurdlers in terms of their average mean horizontal velocity, takeoff and landing distances, CM parabola path, and joint angles of the trunk and lower extremities. The second purpose was to determine if differences exist in the movement patterns during the hurdle step between high-level and amateur-level hurdlers. The research question was to determine if there were differences between high-level hurdlers and amateur-level hurdlers for mean horizontal velocity, takeoff and landing distances, CM lift, clearance height, horizontal displacement of peak of CM parabola path to the hurdle, maximal trunk flexion, maximal hip flexion, maximal knee extension, time to maximal trunk flexion, time to maximal hip flexion, and time to maximal knee extension.

The characteristics of the participants

The demographic data of the participants are described in Table 3. The high-level hurdlers were older, taller, and heavier than the amateur-level hurdlers ($p = 0.042$, 0.021 and 0.020 , respectively). There was no statistically significant differences between groups for BMI ($p = 0.083$). Additionally, the high-level hurdlers had longer leg length, more experiences, and shorter personal best time records than the amateur-level hurdlers ($p = 0.021$, 0.017 and 0.021 , respectively).

Mean horizontal velocity

The high-level hurdlers' mean horizontal velocity was significantly greater than that of the amateur-level hurdlers ($p = 0.021$), which ranged from 7.21 m/s to 8.23 m/s for high-level and 6.06 m/s to 6.90 m/s for amateur-level (Figure 4).

Takeoff and landing distances

There were no statistically significant differences between groups for takeoff and landing distances (Figure 5). Takeoff distance ranged from 1.96 m to 2.28 m for high-level and 1.95 m to 2.21 m for amateur-level, $p = 0.386$ (Table D1). Landing distance ranged from 1.18 m to 1.63 m for high level and 1.40 m to 2.00 m for amateur-level, $p = 0.149$ (Table D1). When normalized takeoff and landing distances to leg length (% leg length), there were no statistically significant differences between groups. Takeoff distance (% leg length) ranged from 235.15 % to 263.16 % for high-level and 208.03 % to 261.58 % for amateur-level, $p = 0.248$. Landing distance (% leg length) ranged from 177.66 % to 237.57 % for high-level and 126.06 % to 182.13 % for amateur-level, $p = 0.083$.

CM parabola path

Three variables that were used to determine the CM parabola path included CM lift, clearance height, and horizontal displacement of peak of CM parabola path to the hurdle. The graphical representations for CM parabola path of the high-level and the amateur-level hurdlers are presented in Figure 6. The high-level hurdlers had significantly less CM lift than the amateur-level hurdlers ($p = 0.021$), which ranged

from 0.16 m to 0.23 m for high-level and 0.27 m to 0.35 m for amateur-level (Figure 7). There were no statistically significant differences between groups for clearance height and horizontal displacement of peak of CM parabola path to the hurdle (Figures 8 and 9).

Body kinematics of trunk and lead leg

The graphical representations for body kinematics including maximal trunk flexion, maximal hip flexion, and maximal knee extension during hurdle step are presented in Figures 10, 11, and 12, respectively. Two variables of body kinematics were found to be statistically significant differences between the high-level and the amateur-level hurdlers. The high-level hurdlers had significantly less time to maximal hip flexion than the amateur-level hurdlers ($p = 0.020$), which ranged from 0.05 s to 0.09 s for high-level and 0.15 s to 0.19 s for amateur-level (Figure 13). The high-level hurdlers had significantly less time to maximal knee extension than the amateur-level hurdlers ($p = 0.021$), which ranged from 0.33 s to 0.36 s for high level and 0.42 s to 0.50 s for amateur-level (Figure 14).

There were no statistically significant differences found between groups when comparing maximal trunk flexion, maximal hip flexion, maximal knee extension, and time to maximal trunk flexion (Table D3). Although, three out of four amateur-level hurdlers had greater time to maximal trunk flexion than the high-level hurdlers, the group difference in the time to maximal trunk flexion did not reach a significant level ($p = 0.083$) (Figure 15).

Table 3 Mean \pm SD of the demographic data of the participants

Variables	HI	AM	p-value
Age (yr)	24.50 \pm 2.08	20.50 \pm 1.73	0.042*
Height (m)	1.83 \pm 0.05	1.73 \pm 0.03	0.021*
Weight (kg)	75.75 \pm 5.06	64.50 \pm 1.29	0.020*
BMI	22.57 \pm 1.46	21.62 \pm 0.46	0.083
Leg length (m)	0.91 \pm 0.03	0.82 \pm 0.02	0.021*
Experience (yr)	6.25 \pm 0.50	3.25 \pm 1.26	0.017*
Personal best time (s)	14.41 \pm 0.58	22.40 \pm 1.75	0.021*

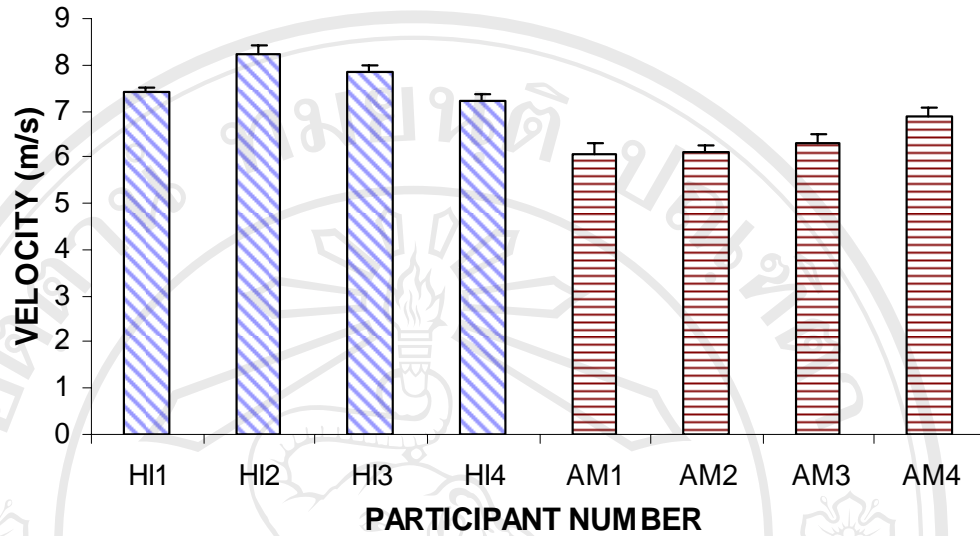


Figure 4 Average mean horizontal velocity of three trials of high-level and amateur-level hurdlers during hurdle step. HI1-4 represents high-level hurdlers. AM1-4 represents amateur-level hurdlers.

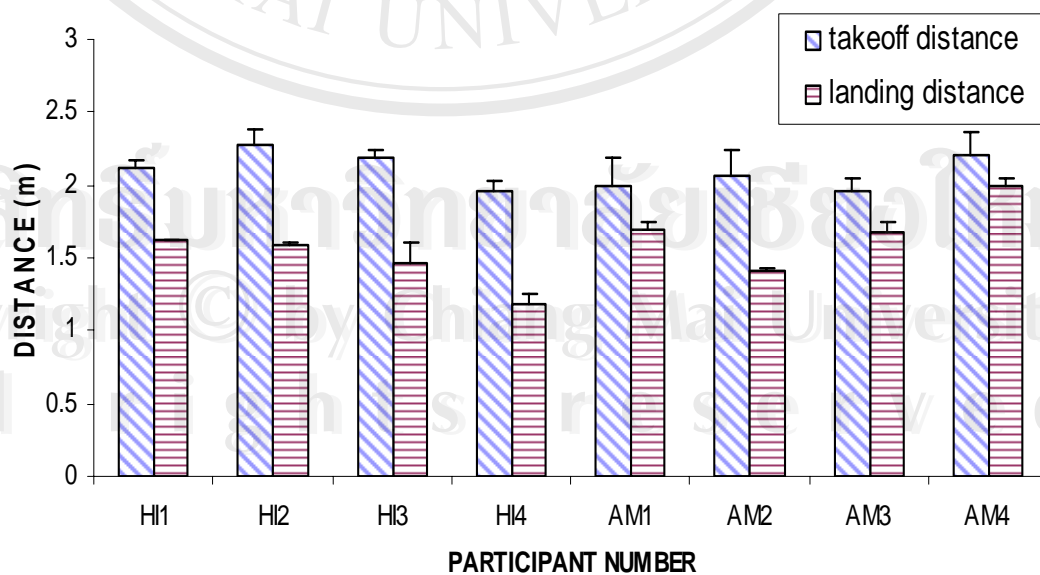


Figure 5 Average takeoff and landing distances of three trials of high-level and amateur-level hurdlers during hurdle step

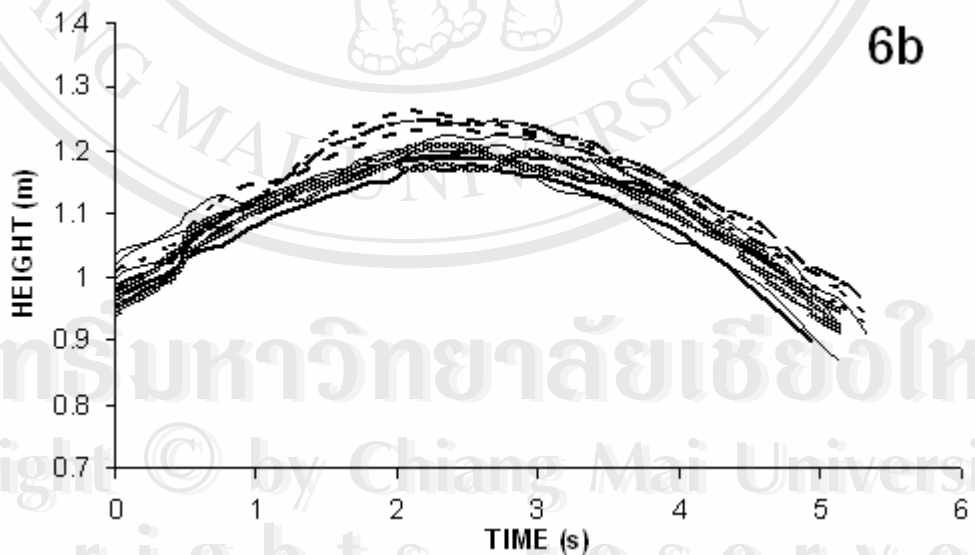
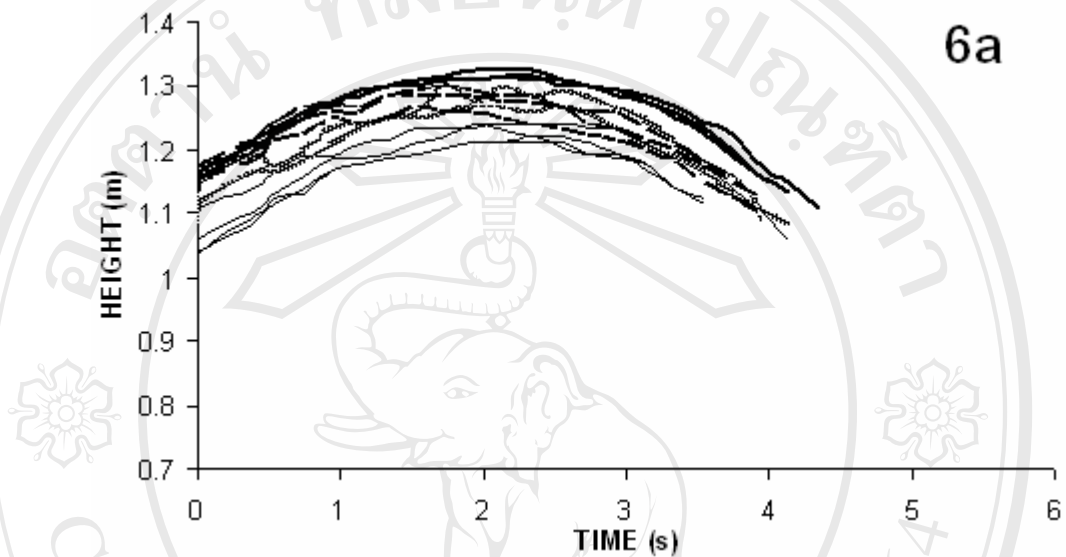


Figure 6 CM parabola path of three trials of high-level (6a), and amateur-level hurdlers (6b) during hurdle step

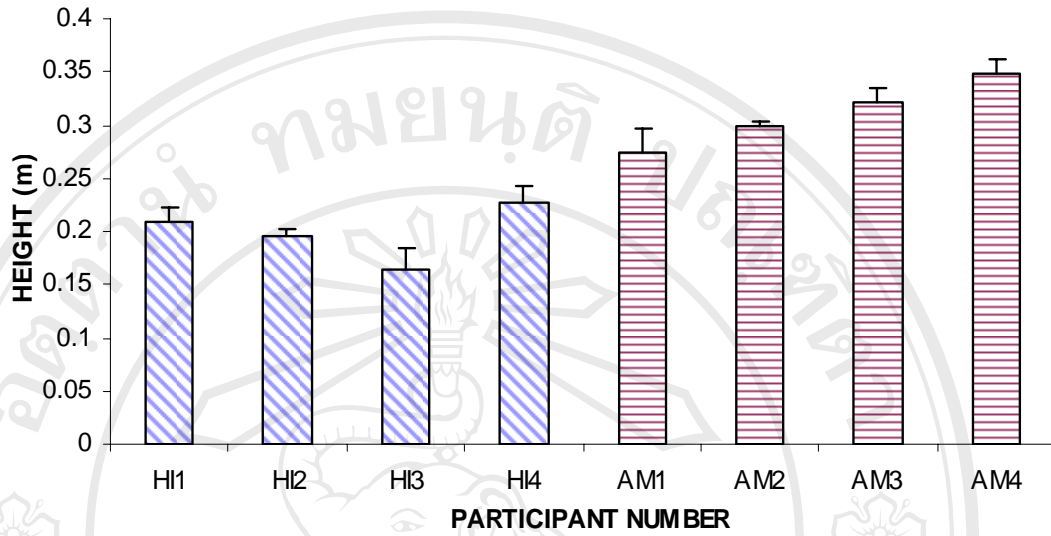


Figure 7 Average CM lift of three trials of high-level and amateur-level hurdlers during hurdle step

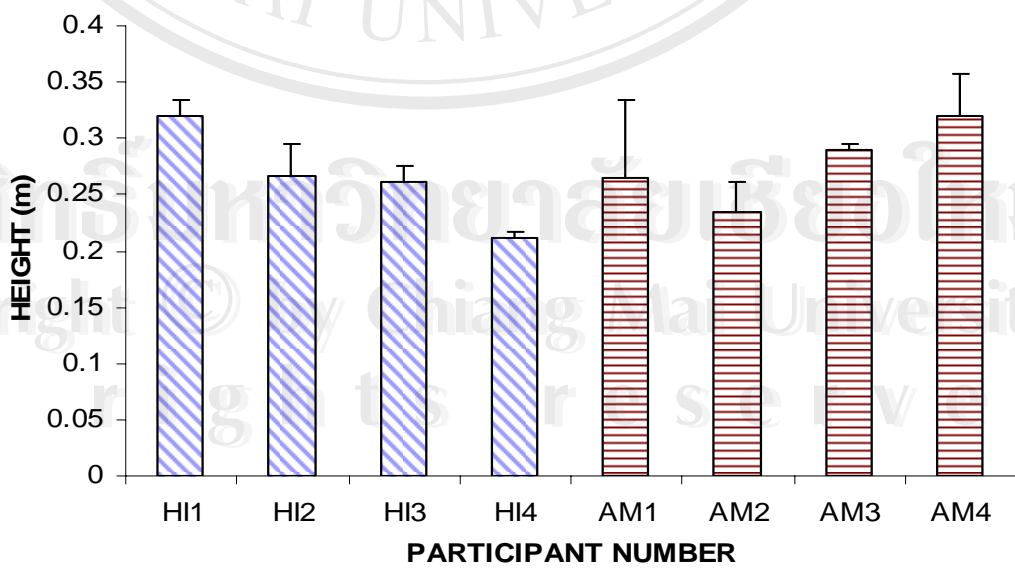


Figure 8 Average clearance height of three trials of high-level and amateur-level hurdlers during hurdle step

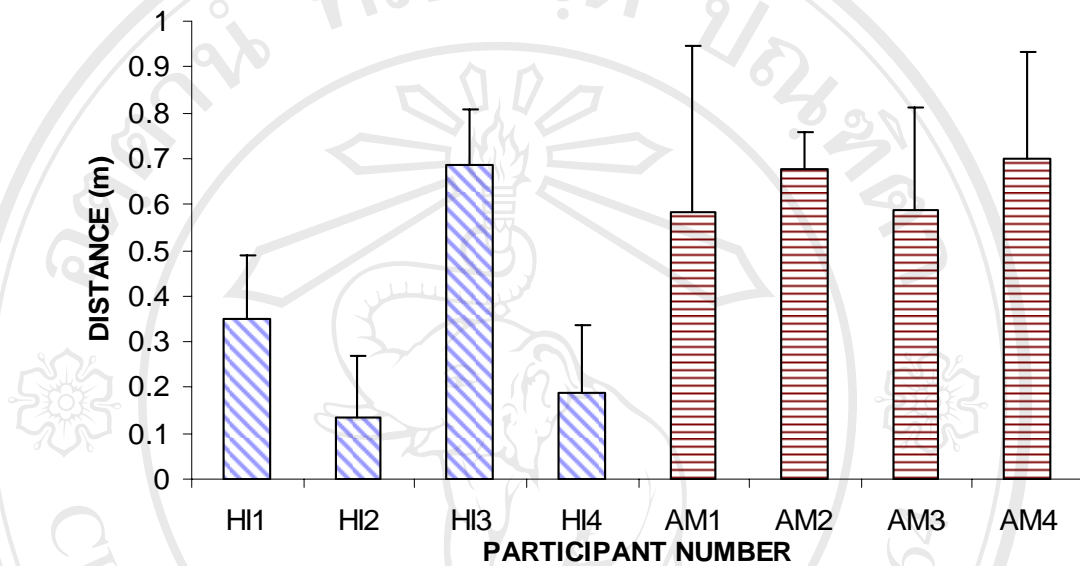


Figure 9 Average horizontal displacement of peak of CM parabola path to the hurdle of three trials of high-level and amateur-level hurdlers during hurdle step

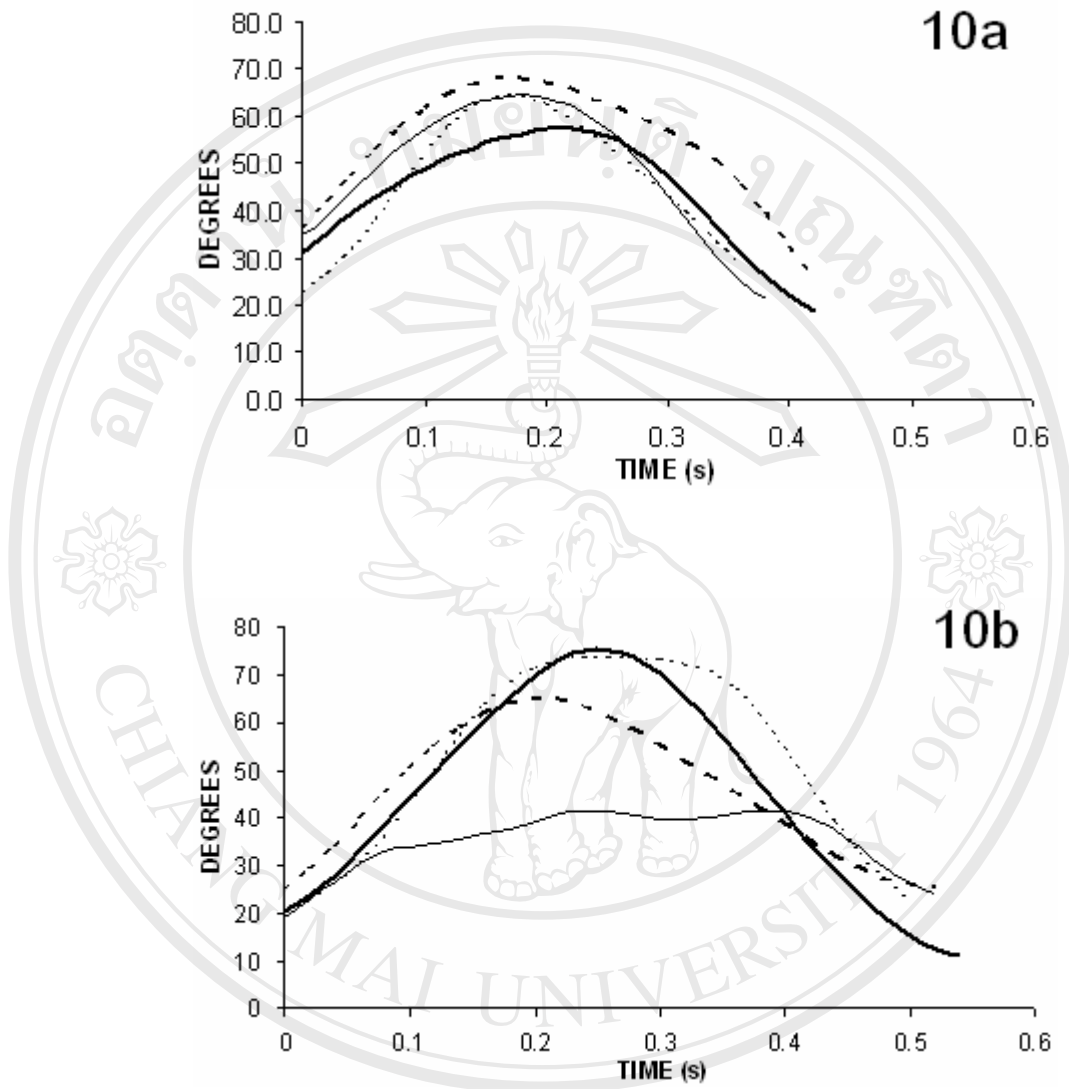


Figure 10 Selected trials showing trunk flexion angle profile of high-level (10a), and amateur-level hurdlers (10b).

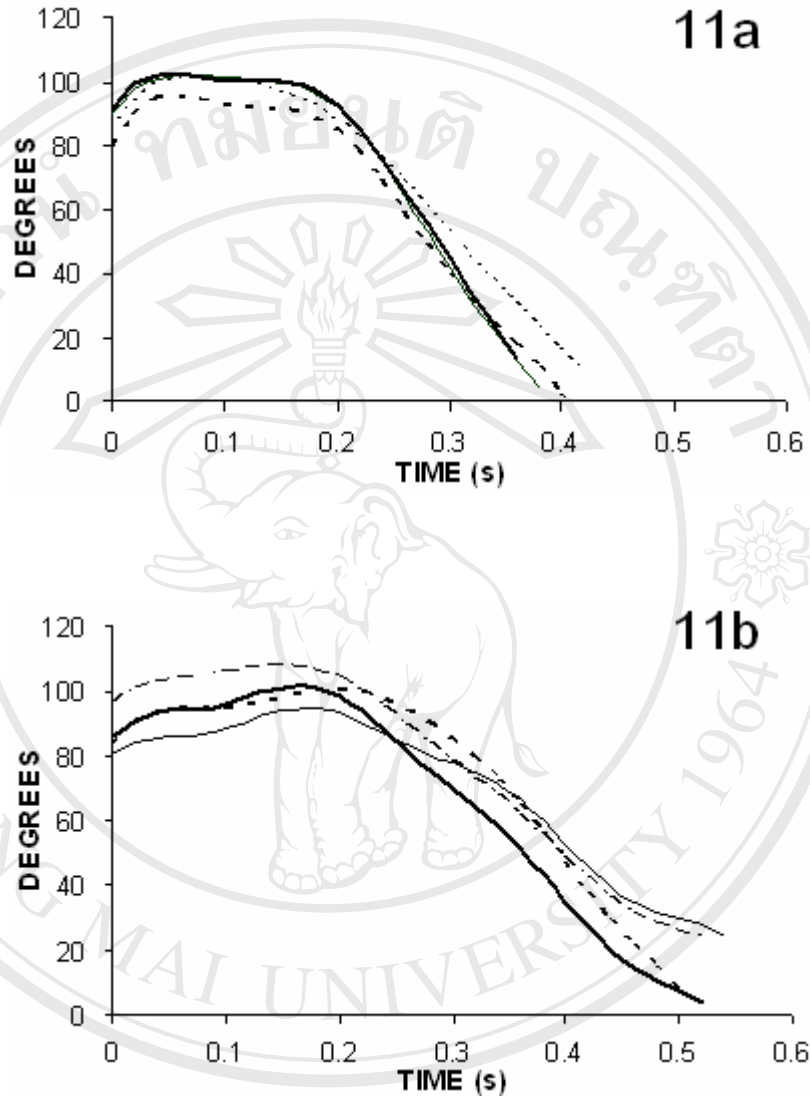


Figure 11 Selected trials showing hip flexion angle profile of high level hurdlers (11a), and amateur level hurdlers (11b).

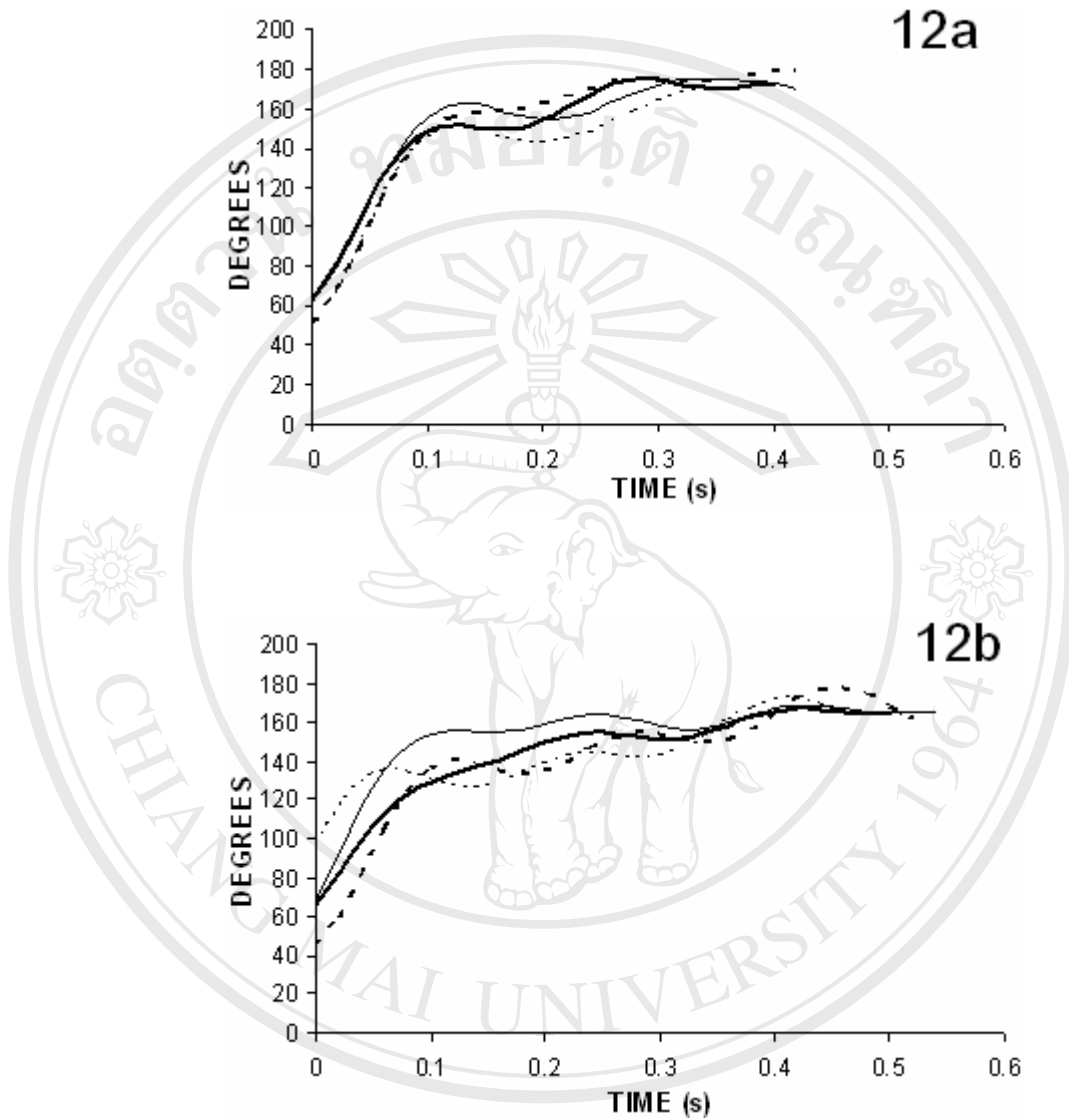


Figure 12 Selected trials showing knee extension angle profile of high-level (12a), and amateur-level hurdlers (12b).

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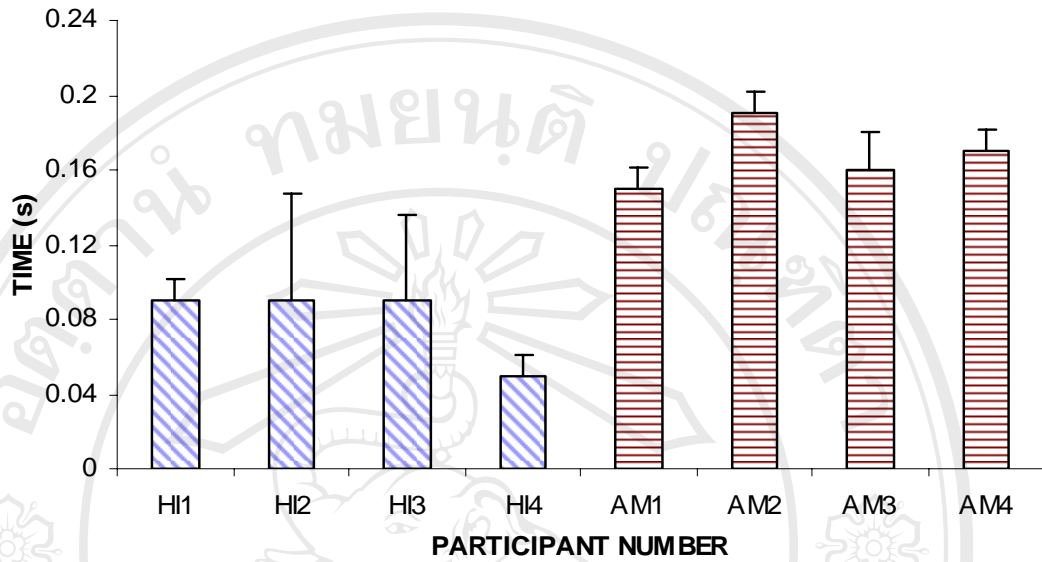


Figure 13 Average time to maximal hip flexion of three trials of high-level and amateur-level hurdlers during hurdle step

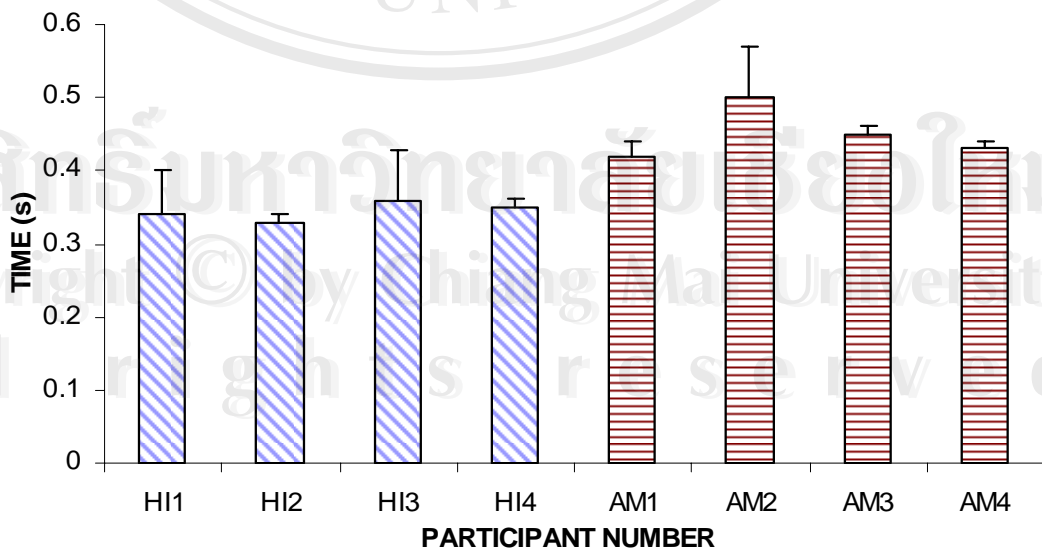


Figure 14 Average time to maximal knee extension of three trials of high-level and amateur-level hurdlers during hurdle step

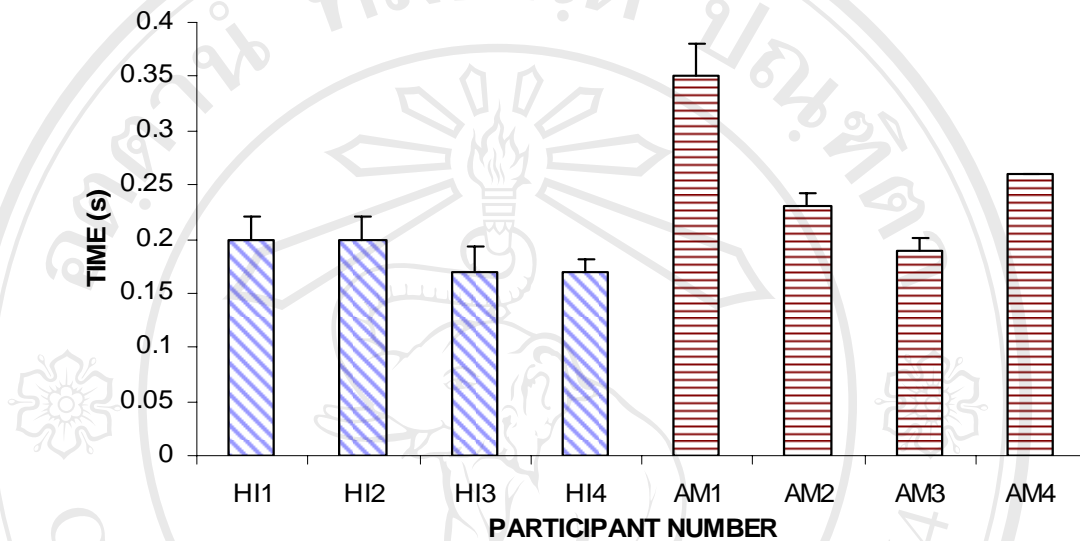


Figure 15 Average time to maximal trunk flexion of three trials of high-level and amateur-level hurdlers during hurdle step