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STEP ADJUSTMENT IN LONG JUMP APPROACH IN BEGINNER ATHLETES AGED 12-13

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This study examined whether young non-expert long jumpers showed at the long jump approach (LJA) similar pattern of variability in footfall placement across trials as adult expert athletes. The LJA of 51 competition jumps performed by 17 athletes, aged 12-13 years, were analyzed. A stride regulation pattern emerged on the 5th and 4th stride prior to take-off and at a mean distance of 8.7m (males) and 7.2m (females) from take-off board. TBD variability reached a maximum value of 32.1±19.9cm and 37.4±29.9cm and was finally reduced to 10.6±16.1cm and 15.6±14.4cm for males and females respectively. The striding pattern was similar to that reported in the literature for adults. However, beginners were found to be less consistent over the initial phase of the LJA than adult athletes and made more dramatic step length modifications during the final two strides.

KEYWORDS: visual regulation, approach run, long jump.

INTRODUCTION: During target directed locomotion in a track & field setting, stride cannot be uniform and consistent but has to be regulated based on perceptual information in order to achieve satisfactory foot placement and/or negotiate obstacles (Lee, Lishman, & Thomson, 1982). Specifically, in long jump, subtle individual changes (varied level of confidence or fatigue) and external factors (wind speed) between jumps preclude an exact stride replication from one jump to another. The Long Jump Approach (LJA) is a demanding motor skill consisting of spatio-temporal constraints. It requires precise regulation of stride at near maximum running velocity so that foot placement is as close as possible to the front edge of the 20cm takeoff board. To ensure precise foot placement, long jumpers visually regulate their stride pattern during their run-up. Visual regulation of target-directed gait is not a specially trained skill as much as it is a natural means of controlling gait (Berg, Wade, & Greer, 1994). The use of visual regulation has been observed in elite (Bradshaw & Aisbett, 2005; Hay, 1988; Lee et al., 1982), adult long jumpers of various expertise (Montagne, Cornus, Glize, Quaine, & Laurent, 2000), young high school athletes (15-18 years old) (Berg et al., 1994), and non-long jumpers (Scott, Li, & Davids, 1997). Literature reports a very similar pattern of footfall variability (ascending – descending trend of SD of toe-board distance) between elite and “novices” (high school) athletes.
Up today there is limited information regarding the use of visual regulation in young (12-13 years old) non-expert long jumpers. Taking into consideration the cognitive, developmental and physical characteristics of the particular age group, the present study investigated if young beginner long jumpers demonstrate a pattern of stride variability similar to that of adult and higher level of expertise athletes.

METHODS: Seventeen (11 males and 6 females) beginner athletes (aged 12-13 years; mean performance: 4.30m ± 0.58 and 4.05m ± 0.37 for males and females respectively), with less than 3 years experience in a multitasked track & field training program, participated at the study. Recording took place during an official competition. In accordance with the national athletics association’s regulations for that age group, all athletes performed three long jump attempts.
The set up of the experimental procedure was according to the protocols described by most visual regulation studies so far (Berg et al., 1994; Bradshaw & Aisbett, 2005; Hay, 1988; Hay & Koh 1988; Scott et al., 1997). Either side of the runway was marked with white markers placed at 1m intervals lying parallel to the runway’s long axis, in order that the horizontal distance between the toe and take-off board (toe-board distance) be calculated. The approach phase of each long jump was recorded using a high definition digital video camera

(SONY HDR-SR10). The camera was manually panned to allow the whole of each subject's run-up to be recorded. The panning camera was positioned at a distance of 15m from the midline of the runway and elevated at a height of 5m so that the markers on both sides of the runway were visible. In total, 51 run-ups (17 participants x 3 attempts) were analysed.
In order to determine the toe-board distances (TBD) for each foot placement of each athlete's run-up, the videos collected were transferred to a personal computer, and digitized using the APAS 2010 (ARIEL DYNAMICS) software. A five-point model consisting of the toe-point during the support phase and four points - markers which surrounded the foot at ground contact was used. TBD was calculated according to the method described by Chow (1987) and adapted by Hay and Koh (1988). This procedure required the determination of the horizontal distance between the toe and the line between the two closest markers that had been digitized (toe-marker distance). TBD was calculated by adding the toe-marker distance and the marker-takeoff board distance. The validity of the procedure for calculating the toe-board distance was assessed by recording running shoes placed at known distances along the runway. The TBD of the running shoe was then calculated using the same method as described above. The comparison of the actual shoe distance with the digitized one showed an error of ± 1 cm which was considered acceptable for the purposes of the study (Berg et al., 1994; Berg & Mark, 2005; Hay, 1988). Descriptive statistics were used in order to calculate the mean and SD of TBD at each support phase across trials. The distribution of step length adjustment was calculated according to the formula proposed by Hay (1988).

RESULTS: As shown in figure 1, both males and females demonstrated an initial ascending variability of foot placement followed by a descending one as they approached the takeoff board. The onset of visual regulation was identified as the point at which the maximum SD in footfall position occurred. For males, the mean SD of TBD reached a maximum value of 32.12cm (± 19.86cm) on the 6^{th} support phase (i.e. 5^{th} stride from the board) and at a mean distance of 8.70m (± 67.10cm) from the takeoff board. Females demonstrated a maximum SD of TBD of 37.43cm (± 29.93cm) on the 5^{th} support phase (i.e. 4^{th} stride from the board) and at a mean distance of 7.21m (± 65.76cm) from the takeoff board. Following that point, a descending trend of footfall variability was recorded for the remaining strides and the mean SD of TBD across trials was finally reduced to 10.60cm (± 16.06cm) and 15.59cm (± 14.40cm) for males and females respectively. In male athletes, 66.14% of the total step length adjustment occurred over the final two steps of the LJA (36.97% and 29.17% for the last and penultimate step respectively). On the other hand, in females 60.42% of the total step length adjustment occurred on the final step and only 19.33% on the penultimate one.

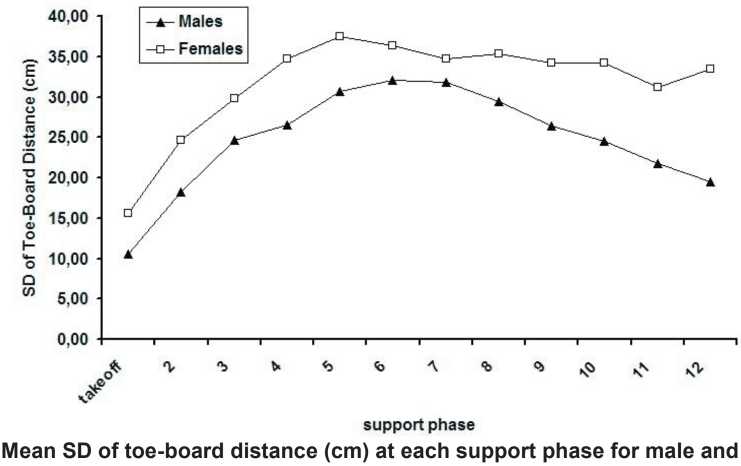

Figure 1: Mean SD of toe-board distance (cm) at each support phase for male and female long jumpers.

DISCUSSION: The results of the present study revealed that young, male and female beginner athletes exhibited a pattern of footfall variability similar to that of older non-expert (Berg et al., 1994) and elite athletes (Hay, 1988; Lee et al., 1982), suggesting the use of visual regulation. Visual control emerged on the 5th and 4th stride and at a distance of 8.70m and 7.21m from the takeoff board for males and females respectively. The stride where regulation was initiated was similar to that of expert athletes. However, this appeared to be a function of the number of steps remaining rather than the absolute distance, which differed considerably (10.73m and 8.42m for elite men and women respectively). Furthermore, both male and female beginners exhibited a mean maximum SD of TBD of 32.12cm and 29.93cm, respectively. These values were higher than those recorded for high school athletes (0.29m; Berg et al., 1994) and those reported for elite long jumpers (0.14m-0.30m; Hay, 1988). The higher values indicate that beginner athletes were less consistent over the initial phase of the LJA than were older and more skilled athletes. This is probably due to limited task-specific training and lack of experience (Berg et al., 1994), something that could also explain the “unequal” distribution of step length adjustment over the final steps of the LJA (Hay, 1988). The current results show that beginners made more dramatic step length modifications during the final two strides. The latter may have negatively affected their performances by means of poor takeoff accuracy (large last stride variability), losses in horizontal velocity and poor optimal posture at takeoff (Berg et al., 1994). Scott et al (1997) suggested that an increase in task-specific training could contribute to a higher level of consistency in the run-up. A more consistent run-up would lead to small changes over the final steps of the approach and would minimize last stride variability (smaller SD of TBD at takeoff) (Bradshaw & Aisbett, 2005).

CONCLUSION: Given the differences between expert and beginner jumpers in terms of their physical qualities and long jump experience, the similarities noted were interpreted as an indication that regulation of step length in the LJA is more a naturally emergent behaviour rather than a learned strategy. However, through specific training, young athletes could learn to initiate visual control earlier in the LJA, achieving this way a more consistent run-up.

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