

DROP LANDING EXERCISE DOES NOT INCREASE MAXIMUM JUMP HEIGHT IN CHILDREN

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INTRODUCTION

A 7-month program of repeated drop landing has been shown to increase bone mass in prepubescent children (Fuchs et al., 2001), raising the question of whether these exercises might also have beneficial effects on the neuromuscular system. During landing after a drop from a height, the body's energy is partially absorbed through eccentric contraction of the same muscles that are used in vertical jumping. The eccentric contractions from repeated landings could thus produce an increase in coordinated muscle strength that would allow a child to jump higher. Maximum vertical jump height is known to increase with increased knee extensor strength in young adults (Colliander and Tesch, 1991). This study investigated whether a 7-month program of repeated drop landing would act to increase the maximum vertical jump heights of prepubescent boys and girls.

METHODS

Subjects were 49 prepubescent children aged 7-11 years. An intervention group of 9 boys and 6 girls (mean \pm SD age: 9.3 ± 0.9 yrs.; height: 1.35 ± 0.09 m; body mass index [BMI]: 17.6 ± 2.5 kg/m²) had performed 100 drop landings from a 61 cm height on each of 5 days per 2-week period over the preceding 7 months as part of their physical education class. A control group of 20 boys and 14 girls (age: 8.7 ± 1.0 yrs.; height: 1.39 ± 0.09 m; BMI: 18.4 ± 3.4 kg/m²) participated in a physical education class

that did not include the drop landing exercises. Group membership was determined by the child's school. Subjects and parents provided their informed consent.

During testing, each subject performed 5 maximum-height vertical countermovement jumps. Before each jump, the subject stood as still as possible on a pair of force plates (Bertec, Columbus, OH). Upon an oral signal, the subject jumped upward and attempted to touch as high as they could on a string dangling above them. Vertical ground reaction forces were measured at 1080 Hz from each force plate. Verbal encouragement and feedback was provided between jumps. Five warm-up jumps preceded the testing.

For each jump, the maximum height of the body center of mass (COM), relative to its height during standing, was computed. First, the vertical velocity and height of the COM at take-off were found by single and double integration, respectively, of the vertical acceleration of the COM from the start of the countermovement until take-off. COM vertical acceleration was computed from the bilateral ground reaction forces, the measured body mass, and gravity. Integration endpoints were identified from the force traces. From the COM height and velocity at take-off, projectile motion equations were used to compute the maximum COM height during the jump. Maximum jump height was defined as the average of a subject's two highest jumps. Jump height was normalized to body height.

A 2-factor analysis of variance determined whether maximum jump height differed between jumpers and controls, or between boys and girls. Body Mass Index (BMI = [body mass]/[body height]²) and subject age were included as covariates in the analysis. A significance level of 0.05 was used.

RESULTS AND DISCUSSION

Maximum jump height in these children was highly correlated to BMI ($r = -0.56$; $p < .001$); children with lower BMI jumped higher (Figure 1). After accounting for the effects of BMI, there was no difference in maximum jump height between the children who had performed 7 months of drop landing exercises and the children who had not ($p = .59$; Table 1), independent of sex ($p = .98$). Maximum jump height also did not differ between boys and girls ($p = .42$). Finally, maximum jump height was unrelated to age in these children ($p = .45$).

The present results are consistent with a previous study of young men in which two

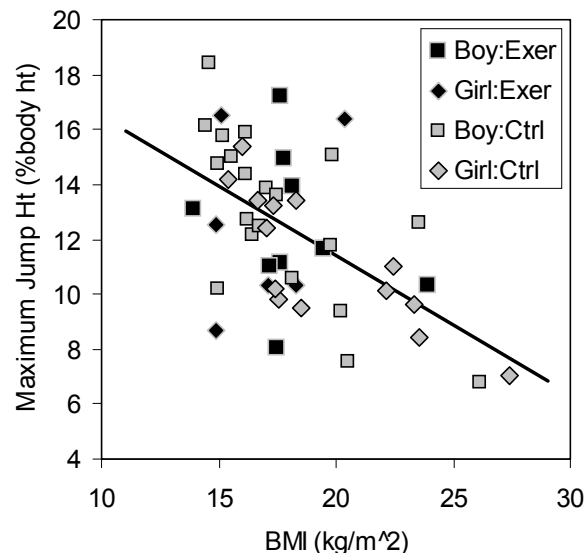


Figure 1: Relationship between BMI and maximum jump height in boys and girls in the exercisers (Exer) and controls (Ctrl)

Table 1: Mean \pm SD maximum jump heights (% of body height)

	Exercisers	Controls
Boys	12.4 \pm 2.7	12.9 \pm 3.0
Girls	12.5 \pm 3.3	11.3 \pm 2.4

different drop-jump training methods failed to increase vertical jump performance after 6 weeks (Young et al., 1999). It is likely that the drop landings from a 61 cm height did not provide a stimulus of the intensity or specificity needed to produce an increase in the coordinated muscle strength that would lead to higher vertical jumping ability.

The lack of a differential effect of sex on maximum jump height and on the influence of the drop landing exercises is consistent with previous findings of similar motor skills in prepubertal boys and girls (Branta et al., 1984). Only after adolescence do males typically exhibit a relative advantage in skills requiring strength and power.

While drop landing exercises have beneficial effects on the bone mass of prepubescent children, it appears that the benefits of these exercises do not extend to increases in maximum vertical jump height.

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