COMPARISON OF VERTICAL JUMPING HEIGHT IN PRIMARY SCHOOL BOYS AND GIRLS WITH AND WITHOUT FLAT FOOT

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Abstract
Flat foot deformity is the most common condition among children in primary schools. The present study aimed to compare the vertical jump height of 10 to 12-year-old healthy elementary school children with flat feet. For this purpose, 800 boys and girls students, between 10 and 12 years old were selected in the study with 17 and 25 BMI, lack of difference in leg length, smooth soles of both feet, no musculoskeletal disorders, with 2 flat feet, no history of fractures in the bones of the legs, ankles and feet. 150 children diagnosed with flat foot disease were selected which 20 girls (group one) and 20 males (group two) were chosen randomly from among 20 healthy female subjects (group three) and 20 males (group four).Navikular test was used for the measurement of flat foot deformity. Bone loss breakdown was measured by the Brody method. Sargent jump test was used to measure the height of the jump from standard protocol. All four groups carried out vertical jump test under the same conditions. For each person the test was repeated three times after ten minutes of warm-up and the best record was intended as the subject's record. The results showed no significant difference between the heightjumpof them. The comparison of the boys' jump with flat foot and normal foot using independent t test showed that there was no significant difference in the jump between two groups (P>0.05). Also no significant differences was observed between healthy girls' jump compared to healthy boys and the girls' jump with flat feet compared to flat feet boys. So it seems complication of flat feet does not have any impact on children vertical jump performance, but corrected this abnormality is only necessary way to reduce the damage.

Key words: *vertical jump, girl, boy, flat foot, elementary school.*

Introduction

Proper functioning of legs helped the activities of walking, running and jumping up and down the stairs (12). Foot situation is a determining factor of lower extremities performance(8). Dysfunction is often caused due to loss of normal structure of the foot and leg deformities (12). Flatfoot is a biomechanical problem that subtalar severe joint oversion when bearing weight, subtalar plantar flexion bone, plantar flexion heels of tibia; dorsiflexion and abduction of navicular bone, forefoot supination and heel valgus (7). Flat foot deformity is the most common condition among children in primary schools (22). Flatfoot may lead to impaired postural control, disruption of the pressures on the soles of the feet, the incidence of various injuries of the lower extremities, changes in mobility of joints, ankles and feet, which likely lead to change in the pattern of active muscles (20). Among children 10-year-old flatfoot disorder is very common% (85.71) (23). The prevalence rate of flatfoot in society causes concern as these abnormalities can affect people and their performance facing them with limits performance. That is why a lot of research has been conducted to evaluate the effect of flat feet on athletic performance. In this regard, Theodore and colleagues (2) found that flat feet does not cause any malfunctions in exercising. Children with flat feet syndrome and children with normal foot were successful in all motor tests as an extent. They reported that there is no need to treat flexible flat foot in order to improve athletic performance (2). Yang Hu also announced flat foot has no effect on vertical jump ability (13). While Toomey and colleagues reported that musculoskeletal disorders, especially disorders of the lower extremities, including factors that may affect patients' performance and physical activity (11). Other researchers have reached the conclusion that the situation in the leg and foot disorders may affect the ability to jump (9). Aristotle and his colleagues suggested that the use of insoles to correct flat foot increases the vertical force in the jump-off (1).There is still controversial literature on impact of flat foot in athletic performance. The vertical jump and leg explosive power is one of the most basic sports skills both in daily activities and in many athletic fields and is a major factor in athletic success (12). So the main purpose of this research is to compare the vertical high jump of 10 to 12-year-old elementary school children with and without flat foot.

Materials and methods

Participants
In this study, 800 students of boys and girls of primary school between 10 to 12 years old were studied and it was found that 150 of these are subjects with flat feet and 20 girls and 20 boys were selected randomly among them and 20 female and 20 male, were randomly selected among

healthy subjects. The consent form was completed and signed by parents before the test. Of inclusion criteria for the study are age 10 to 12 years, BMI between 17 and 25, no difference in leg length, soles of both feet flat, lack of musculoskeletal disorders that disrupt visible in step one, no history of fracture on bones of the legs, ankles and feet (16).

Diagnosis of flatfoot

Initially the flat foot footprint was evaluated by pedescope. For the diagnosis of flat foot subjects were asked to bare feet on pedescope, and after some minutes of weight-bearing, the surface of the foot to bear weight were white and the areas that would not have completed were seen pink. To draw the footprint of the subjects were asked to put one barefoot in white powder first and then the other foot without any slip in powder then put on black screen first heel and then the whole foot gently on landing page. For the measurement of flat foot deformity of bone loss navikular test was used.

Navikular bone breakdown was measured by Brody method (15). The navicular drop in each subject was measured three times for each leg to determine the bilateral disorder and average of them was used to classify subjects into two groups: normal foot, flatfoot. If the navicular drop was between 5 and 9 mm respectively, considered in natural, decline of more than 10 mm, was put in flat foot.

Sargent jump test

Sargent jump test was used to measure the height of the jump from standard protocol. All subjects were tested under identical conditions. Before starting the test, it was fully explained to the participants how to implement and each of them practiced several times to learn more. First after 10 minute warm-up, the tip of fingers were dipped in plaster and stood in a distance of 15 cm from the scaled wall so the dominant hand shoulder was(right or left) side of walls. The soles of their feet were on the ground, they get up and stretch a hand with the middle finger dipped in plaster that had left marks on the wall(M1) was recorded in centimeters and was said as "standing reach height". When his hands were backin flight, knees were bent about 90 degrees. Along with the jump, they pulled up hands moved upward jump and the highest point on the wall was marked with his fingertips mark (M2).The distance between the two marks (M1 and M2) were recorded as the athlete's vertical jump test. Test was repeated three times for each person and the best record was intended as the person's record.

Statistical Analysis

"SPSS 21 was used for the analysis of the obtained data. The Kolmogorov-Smirnov test and Shapiro-Wilk tests were used to normality test and Levene's test was used for the homogeneity of variances. Independent Samples T-test was used to compare groups. Statistical significance was set at $p< 0.05$."

Results

Table 1. Mean and standard deviation of variables, height, weight and age.

	Girls		Boys	
	Normal foot	Flat foot	Normal foot	Flat foot
Height	144.7±6.16	143.9±6.25	145.2±6.36	144.1±7.25
Weight	43±7.6	44±6.9	42±9.2	43.3±8.1
Age	11.9±0.79	11.8±0.86	11.1±0.73	11.5±0.93

According to the results in table 1, significant difference was observed in parameters such as age, weight, height and body mass index in boys as well as girls and boys flatfoot and normal ones($P>0.05$).

Table 2. Results of independent t test between normal foot and flatfoot groups in vertical jump between girls and boys.

Groups	df	T	Sig.
healthy and flatfoot boys jump	22	1.223	**0.197**
healthy and flatfoot girls jump	22	1.349	**0.191**
healthy girls and boys jump	22	-1/009	**0.324**
flatfoot girls and boys jump	22	-4/22	**0.677**

Statistical analysis showed there is no significant difference the flat foot and normal girls jump. Also the comparison of flat foot and normal foot boys Jump showed no significant difference in two groups($p>0.05$).

In other words, there was not statistically different between jump of boys and girls with flat foot. Statistical results also showed there was no significant difference between healthy girls and boys jump. The girls and boys with flat feet in the jump were not statistically significant.

Conclusion

The statistical analysis showed there was not significantly different between girls and boys in vertical jump with flat foot and normal ones. In other words, the results of this study showed that complication of flat foot does not effect on the performance of 10 to 12 years old boys and girls.The results of this study are consistence with the results of Yang Hu. Yang Ho (2013) stated that there was no relationship between girls and boys in vertical jump with flat foot and normal ones and

flatfoot should not be considered as the person's judge therefore jumping ability. Maura showed that feet deep functional testing results were better than the other groups (15). Theodore and his colleagues concluded that morphology does not affect athletic performance and flatfoot does not weaken motor skills. The results of this study were matched with the results of Chen and colleagues (17) and Lee et al (18) investigated the impact of flat foot jump ability. The results of this study were not consistence with the results of Lee and Kim (2014), Rouhiet al (2013), Lin et al (2001) which announced flat foot, causing poor performance of walking, running, agility (10,9, 4). It seems foot arch on does not effect on vertical jumping ability as it is very short activity, but affect other functions of sports such as running and walking. The reason is that it is probably a long-distance running and agility active and ground reaction forces helped them. How the arch is reduced, ground reaction forces and the forces are useful for person's advance is reduced (19). Thus reducing all forces is also very important for the slow movement.

Perhaps one of the reasons is motor abilities such as cardiorespiratory endurance, speed and agility with flat foot subjects with normal group is different. Gastrocnemius muscles are important for vertical jump (6). Bazuvand and colleagues (20) reported that gastrocnemius and soleus muscle activity leads to the Achilles tendon are not under the influence of postural foot, probably this is the reason for difference in jump among healthy and flat foot subjects. The difference between good and poor performance in the vertical jump was for the power of the joints (5).

People who have good vertical jump have strength and momentum and joints motions in the ankle and knee. It seems that the ability of jumping depends on feature of the power and speed of muscle strength in lower extremity and muscle strength and lower extremity is the main and original reason for vertical jump performance (3).Flatfoot alone may not lead to a decrease in athletic performance but later complications of flatfoot affect performance. Since Yang-ho (14) said flat foot are with the other foot deformities such as hallux valgus and falling together and fingers that this may lead to pain and reduced mobility. So in our study due to the low age of the subjects, may still lead to other complications of flat foot deformity, and so the performance is not affected. The results also showed that the jump of healthy boys and girls do not differ statistically. Autumn and colleagues (11) demonstrated that puberty causes boys and girls different in vertical jump. Since our subjects were pre or close to mature, yet the difference was not created in performance between boys and girls. Also, there does not exist significant difference between boys and girls with flat foot condition in the jump. In other words, in both sexes, male and females, flat feet does not affect the performance of individuals. However, this result does not mean that it will not affect the later ages. Bastik et al., (2016) has reported that movement education programs that are implemented regularly for a long time affect features of physical fitness in 10-12 aged children in a positive way. In this context, the need of getting education program that can improve the movement competence in a correct way and be building the skill of moving on sturdy basis emerges.

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