The Relationship Between Toe Grip Strength and Physical Fitness in Elementary School Children

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Introduction: Toes are the only parts of the body connected to the ground, providing both tactile and pressure information through the plantar afferents, somatic sensation through these organs is also very important for various movements, including standing and walking. In particular, the toes control whole body posture and movement, and can generate propulsive force during walking and prevent forward falls. Toe function has been often represented as toe grip strength in various studies. Some investigators have found that low toe grip strength (TGS) is an important risk factor for falls among elderly individuals (Endo et al. 2002). The other side a decrease in children’s physical strength and athletic ability has become a problem in recent years. The present study was aimed to reveal the relationship between TGS and physical fitness in elementary school children.

Methods: From first to sixth grade 274 primary school children (men = 133, women = 141) were participated in this study. TGS was measured using a toe grip dynamometer (Takei Scientific Instruments, Japan). Physical performance was evaluated using MEXT’s physical fitness tests (Grip strength, sit-up, long seat type anteflexion measurement, sidesteps, multi-stage fitness test, 50-meter run, standing long jump, softball throw), manual muscle test (MMT) (Knee extension torque, knee flexion torque, hip extension torque and Hip flexion torque) and Jumping height (Rebound jump (RJ), squat jump (SQJ), counter movement jump (CMJ)). The correlations for mean TGS between boys and girls were calculated using Peason’s correlation coefficient. To assess relationships between mean TGS and the selected parameters, we calculated Pearson’s correlation coefficient by sex and conducted a stepwise multiple regression analysis that included physical characteristics, physical fitness and muscle strength as explanatory valuables. For all tests, statistical significance was set at p<0.05.

Results and Discussion: Toe grip strength was significantly increased after the third grade in comparison to the first grade for both genders (p<0.01). It was observed that muscle strength of elementary school children increases with growth. It tended boys higher than girls, however, was not significant gender differences in all of grade. In both genders, TGS was significantly correlated with MEXT’s physical fitness tests (p<0.01), MMT (p<0.01) in all of the items and boys SQJ (p<0.01) and CMJ (p<0.01) and girls RJ (p<0.05). The stepwise multiple regression analysis revealed that boys height (p<0.01), knee extension torque (p<0.01) girls weight (p<0.01), hip flexion/extension torque (p<0.01) and both genders grip strength (p<0.01), knee flexion torque (p<0.01) were associated with TGS. TGS was increased with the growth particularly for the affected height and weight, therefore it was analyzed eliminate the effect of height and weight. The grades were not significantly correlated between the grades for both genders. The stepwise multiple regression analysis revealed that boys knee extension torque and softball throw, girls hip extension torque, standing long jump and grip strength have been selected as the independent variable were associated with both of body weight correction TGS and height correction TGS. Knee extensor strength and hip extensor strength are widening the stride, help to make a walking or running in a large stride. Toe grip strength has been reported to perform the functions push the body forward during walking or moving and by strengthening the power of the walking speed and the running speed to be improved. From these, the TGS stronger person is considered that it is possible to push out to a more forward body and to stabilize the waist.

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The 2nd Congress, International Academy of Sportology [Held on Sep. 12, 2015]
[Received Dec. 18, 2015]