KINEMATICS, GROUND REACTION FORCE AND EMG COMPARISON OF OVERGROUND AND NON-MOTORIZED TRAEMILL
Kashiwagi, Y.1, Hirano, T.1, Yarnagishi, M.1, Akita, H.1, Hakamada, N.2, Funato, K.3
1. Graduate school of Health and Sport Science, Nippon Sport Science University; 2. Japan institute sports science; 3. Nippon Sport Science University, Tokyo, Japan
Introduction Motor drive treadmill is used by endurance training or exercise and measurement evaluation of a laboratory test such as Oxygen uptake (VO2Max). But a difference of stride length, step frequency and knee joint torque were reported by comparison of motor drive treadmill and overground in many researches. Recently non-motorized with curve inclination-type treadmill (Curve -woodway) in a runway. However, there are few reports of the influence that special configuration (curve inclination) gives to human body during running movement of this treadmill and effective for practical use to training. The purpose of this study was to compare the kinematic, ground reaction force (GRF) and electromyography (EMG) parameter of non-motorized treadmill running (NR) to those of overground running (OR). Methods Eight healthy young subjects (age: 23.6±2.0 yrs, BH:170.8±2.7cm, BW:67.0±8.9kg) ran 30m indoor overground and non-motorized treadmill was attached on force plate at 3m/s and 5m/s. Motion capture (VICON MX20 Oxford :200fps) and GRFRisikler:1kHz and Bipolar surface EMG (Noraxon 1.5kHz) data for three steps were recorded. As for the running velocity adjustment, as for OR photo cell, NR let velocity curve feed back to a subject. EMG affixed to lateral gastrocnemius (GAI), tibialis anterior (TA), a gluteus maximus (GM), vastus lateralis (VL), vastus medialis (VM), rectus femoris (RF), biceps femoris (BF), erector spine (ES) which calculated average integrate EMG (IEMG) of three steps. Lower limb joint angle, GRF (Vertical Fz, Horizontal Fy) and EMG data were compared with between NR and OR. Results and Discussion Step frequency was significant difference of between NR and OR in both conditions (3m/s: NR 2.80±0.16 VS OR 2.9±0.53 Hz p<0.001, 5m/s: NR 3.2±0.25 VS OR 2.90±0.01 Hz p<0.001). Fz first impact was not observed in OR compared with NR. Statistically significant difference in Fz peak force and Fz impulse were identified in 5m/s condition (Peak force:3.08±0.43 VS. 3.34±0.34N/BW, p<0.05, impulse:0.320±0.02 VS. 0.355±0.018N·sec/BW, p<0.001). Erector spine of NR was indicated tendency higher muscle activity than OR. Conclusion Non motorized treadmill (curve) was indicated that has high Step frequency and lower COM displacement running form. By Fz first impact lower, reduce an injury risk of a knee, and running training is enabled. References Wark V., Frick, U. and Schmidtbleicher, D. (1999) Int. J. Sports Med., 19: 455–461. Riley P.O., Dicarry, J., Franz, J., Croce, U.D., Wilder, R.P. and Karekina, D. (2000) J Med. Sci. Sports Force... 40(6):1093–1100.

IN VIVO MEASUREMENT-BASED ESTIMATION OF THE TRICEPS SURAE MUSCLE-TENDON UNIT LENGTH CHANGE DURING ANKLE JOINT MOVEMENTS
Iwanuma, S.1, Hashizume, S.1,2, Akagi, R.3, Kanehisa, H.4, Yanai, T.1, Kawakami, Y.1
1. Waseda university (Tokorozawa, Japan); 2. JSPS Research Fellow (Tokyo, Japan); 3. Shibaura Institute of Technology (Saitama, Japan); 4. NIFS in KANODA (Kanoya, Japan)
Introduction The muscle-tendon unit (MTU) length is an important parameter that influences its mechanical functions. The triceps surae MTU length has been estimated on the basis of the equation derived from cadaveric measurements using ankle joint angle as an independent variable (Grieve et al., 1978; Hawkins and Hull, 1990). This estimation method is questioned by a recent in vivo study (Iwanuma et al., 2011) indicating that foot deformation caused by ankle joint movement affects the displacement of insertion of the MTU. Additional independent variables should therefore be included to improve the accuracy of the MTU length change estimation. This study aimed to newly develop a prediction equation of the triceps surae MTU length change, taking into consideration foot deformation during ankle joint movements. Methods Healthy young women (n = 10) and men (n = 10) volunteered as subjects. Using a magnetic resonance imaging scanner, sagittal images of the right foot were obtained at rest and during contractions at 10° dorsiflexed, neutral, 10° and 20° planar flexed ankle positions. The contraction levels were set at 30%, 60% and 80% of the maximal voluntary contraction of isometric planar plantar flexed ankle positions. The triceps surae MTU length changes were determined as the displacement of the calcaneal tuberosity on sagittal plane. A multiple regression equation analysis (forced entry method) was used to develop an equation for estimating the triceps surae MTU length change. As the independent variables, the orientation of posterior segment (the line connecting the anterior vertex of tibia and calcaneal tuberosity) relative to the longitudinal direction of tibia, the length of posterior segment and the displacement of the anterior vertex of talus were measured in each condition. Results and Discussion The regression analysis produced an equation with r² of 0.968 and the standard error of estimate of 1.5 mm (13.0%). The changes in the triceps surae MTU length estimated by the newly developed equation were similar to those obtained by in vivo measurements. Bland-Altman plot did not show a systematic error of the developed equation. These results indicate that the present equation is useful to estimate the change in the triceps surae MTU length during various ankle joint movements.

QUANTIFICATION OF IMPACTS IN ARTISTIC GYMNASTICS WITH ACCELEROMETRY: AN APPROXIMATION
Sanchez de los Santos, L., Grande Rodriguez, I., Campos Granell, J.
UNIVERSITY OF VALENCA
Intensity and volume of training in Artistic Gymnastics are increasing as the sooner athlete's age of incorporation creating some disturbance in them. Intensity is commonly measured through impacts and impulses registered by force platforms which suppose a medium-large size and difficult access device for coaches during training sessions. In contrast, accelerometers are smaller, non-invasive and easy-access devices than those ones. The aim of our study was to find the relation between impacts measured with force plate and accelerometers to assess accelerometers values that could be useful to quantify the intensity of gymnast training. Seven female (n=7) gymnasts performed three sets of jump test (SJ & CMJ) and landing test (LT). Accelerometer was fixed on the gymnast's lower back. Peak vertical ground reaction force (N, 3dBW) and vertical acceleration (m/s²) during take-off and landing phases as variables were collected to establish a significant correlation between both. There was no significant correlation between vertical force and vertical acceleration values of each test. Results could be influenced by different study limitations as the same size or the location and sample rate of the accelerometer. This study showed an initial approximation for further research works. It is required to solve some limitations in order to assess that accelerometers, as small and unobtrusive devices, could be a valid and reliable tool for quantifying the intensity of training sessions in Artistic Gymnastics.