

Kinematic data were analyzed using the APAS software and the average amplitude of EMG of each active phase was estimated using the average rectified value (ARV) and plotted as a function of time. In kinematic analysis, we verified that trunk-horizontal angle ($53.0^\circ \pm 4.9^\circ$) were slightly higher in the long-frame situation. By analyzing the variations of the trunk-horizontal angle with handlebar height, the results showed large differences between the handlebar high situation ($56.6^\circ \pm 3.7^\circ$) and low ($49.3^\circ \pm 2.5^\circ$). Regarding the trunk-upper limb angle ($77.8^\circ \pm 4.81^\circ$), the results show always higher values in longer above situation. The elbow angle was always lower in high handlebar situation ($124.1^\circ \pm 17.9^\circ$) compared to the low handlebar ($142.8^\circ \pm 9.7^\circ$). In terms of electromyography ARV data, we found that GM values were higher in higher power cycling situation and in longer frame position. When analyzed ARV of DA muscle and frame size the data show higher values in higher power cycling situation and the short frame position. This study showed that the stroke pedal kinematics varies with bike geometry changes and is also very influenced by pedaling power. The great variability of EMG data only possible to analyze the gluteus maximus and deltoid muscles and the influence of kinematic parameters in the range of muscle activation.

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Analysis of internal load in indoor cycling

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The analysis of the dynamics of external and internal load in cycle indoor (CIn) is very importance to guide the instruction during a cycling indoor class. To quantify the individual load carried by and the perception of this with the effort put in will allow you to tailor the response of cardiorespiratory and metabolic during the class. The internal load will be quantified by the heart rate (HR) and the forces applied over a force plate. These parameters will be used as objective parameters of the internal load, while in the exercise room, the reading of the HR is the most used, and in this sense, we will base the analysis of the internal load, essentially in the parameter of physiological HR and less in the load held in Newtons on the force plate. The aim of this work was to examine the response to the effort made by the participants of the CIn, based on internal and external load produced, relating to the perceived exertion (PSE). The PSE was the scale used to regulate the intensity used by the performer over the tests. Voluntarily participated in this study, 13 men (33.7 ± 7.3 (years); 74.3 ± 7.6 (kg); 176 ± 6.3 (cm)) and 15 women's (31.5 ± 6.3 (years); $59, 7 \text{ kg} \pm 6.7$ (kg); 166 ± 4.5 (cm)). The participants were divided into two distinct groups (randomly). One of the groups (A) was informed, during the first assessment, about the intensity and the way should regulate over the tests, as well as, should remain in future class respecting these intensities according to the different levels and according to the scale of perceived exertion. Nothing was said to the second group (NA), leaving to the discretion of the participants the load regulation during the tests and CIn class. The main result of this research was that the Group (A), differed significantly the different levels requested, on the contrary the Group (NA) was not able to differentiate the different intensity levels during the test. The lack of instruction on how to act and to keep a good PSE between the two assessments does not promote similar behaviour in the group, thus reinforcing the need to teaching the scale PSE during cycle class.

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Maximum and mean force relationship to body composition in swimmers

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In swimmers, a low level of body fat and a high quantity of lean mass could generate an increase in higher energy expenditure and loss of performance, on the other hand, high levels of body fat increase the contact

surface with the water, causing greater drag and loss of performance (Lowensteyn et al., 1994). The purpose of this study was to analyze the relationship between maximum and mean force determined from tethered swimming and body composition in swimmers. Eleven males (18.0 ± 4.0 years of age, 180.2 ± 6.8 cm in height and 71.8 ± 9.5 kg in body weight) and five female swimmers (16.8 ± 3.6 years of age, 166.2 ± 5.5 cm in height and 61.1 ± 9.8 kg in body weight) underwent a maximal tethered swimming force test (Fmaxtethered), which consisted of two 30 seconds maximal efforts in tethered apparatus (Cefise®) with a 10 minutes rest interval to maximum and mean force determination (Fmax and Fmean) (Morouço, 2011). Body composition was assessed by dual-energy X-ray absorptiometry method (DXA), lean mass of the upper limb (LM_UL) and lower limb (LM_LL) and body fat percentage also of the lower and upper limb, (respectively, %BF_UL and %BF_LL) were determined. Upper and lower limb total mass was also assessed. Correlations were analyzed using Pearson's coefficient, $\rho \leq 0.05$ was adopted. Fmax (19.0 ± 4.7 kg) was significantly correlated to LM_UL (6741.9 ± 1573.1 g; $r=0.70$, $p<0.01$), LM_LL (20146.5 ± 3844.4 g; $r=0.63$, $p<0.01$), %BF_UL ($16.0 \pm 8.6\%$ $r=-0.69$, $p<0.01$) and %BF_LL ($19.6 \pm 8.1\%$; $r=-0.67$, $p<0.01$). Fmed (17.7 ± 4.3 kg) was correlated to LM_UL ($r=0.68$, $p<0.01$), LM_LL ($r=0.62$, $p<0.05$), %BF_UL ($r=-0.72$, $p<0.01$) and %BF_LL ($r=-0.71$, $p<0.01$). No correlations were observed between Fmax and Fmed and total mass of lower and upper limb. Tethered swimming may represent a useful method for propulsive force and biomechanical proficiency analysis, as well as relationship with regional body composition, which seems to play an important role in swimming propulsive force, contrary to total mass. Upper limb body composition is more related to Fmax and Fmean, comparatively to lower limb and %BF is negatively related to Fmax and Fmean, strengthening the relevance of body composition analysis in swimming.

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Development of an inertial sensor for the fencing hand analysis: correction on installation misalignments

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In sports the use of technology to help improve the athlete's performance has become integral. Video capture is a common method, but inefficient when dealing with obscured body parts. Inertial sensors allow to fill that gap by collecting the accelerations and rotations, but it's highly dependent of proper installation alignment in order to avoid measurement errors. This method proposes an inverse kinematics inspired quaternion rotation formula during the initial calibration, with the results being a highly reliable instrument, even under noise. The hardware used was an Arduino Due microcontroller and a GY-80 IMU, with an ADXL345 accelerometer. The experiment took place on top of a surface plate and the IMU was attached to a v-block for the static measurements. Twenty-two five second samples were recorded in a static position, while other six samples were recorded being statically held by a hand in the air, all in several orientations. The average of each sample was passed through the quaternion formula in order to calculate the vector's new position, as well as the norm for both vectors. The first error analysis checks how much the measured gravity deviates from the real gravity of the experiment location. The second checks if the measurement falls within the chosen range of precision. In all samples, the vector aligned perfectly with the direction of the Earth's gravity without any change in the vector's length. The error of the measured gravity was $\pm 1\%$ at most, even in the semi-static samples. For the measurement error with a precision value of 99.9%, only the semi-static samples fell outside of that range by 0.4% at most. This method can not only determine the rotation axis and align the sensor with the gravity perfectly, but it's highly precise and reliable, even in semi-static situations with no noise filtering applied. And the first step to create a tool that will allow to measure the movement of a single body part, in this case the fencing hand, with far more detail than video.

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