

Methods: This is an observational cross-sectional study. Forty-four swimmers of both sexes classified in the children's, youth and junior categories participated in the study. The athletes responded to the Pain Catastrophizing Scale, which ranges from 0 to 52 points, with values above 30 points representing a significant level of pain catastrophizing. The Total Pain Catastrophizing score was calculated. Analysis of Variance and independent t-test were used for analysis.

Results: Of the 44 athletes evaluated, 33 completed the Pain Catastrophizing Scale, 13 of whom were in the Children's category, 10 in the Youth category and 10 in the Junior category. Of these, 21 were men and 12 were women. Only 6 athletes had a score higher than the cutoff point. There was no significant difference between the categories ($p = 0.946$) and, when comparing genders, there was no significant difference in pain catastrophizing ($p = 0.145$).

Conclusion: The study revealed that most of the athletes evaluated presented low levels of pain catastrophizing, with only 6 athletes demonstrating scores above 30 points, indicating a significant level of catastrophizing. Furthermore, there was no significant difference between categories and genders. Future studies with larger sample sizes and with athletes at different levels of competition need to be carried out to better investigate the factors that influence catastrophizing.

Implications: Pain catastrophizing is an exaggerated negative orientation towards harmful stimuli and should be considered important for the performance and well-being of athletes, especially those with a history of previous injuries. The presence of catastrophic thoughts can impair adaptation to physical discomfort and negatively influence sports performance. Therefore, it is essential that sports training and rehabilitation programs include psychological approaches that help to reduce pain catastrophizing, covering different factors that may be associated with the amplification of pain sensation. Continued studies on the impact of pain catastrophizing may contribute to the development of more specific and effective interventions for different age groups and sports modalities.

Keywords: athletes, catastrophization, pain perception

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KINEMATIC AND KINETIC ADJUSTMENTS AT THE TRUNK DURING SUBMAXIMAL AND MAXIMAL INSTEP SOCCER KICKS

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Background: During soccer matches, players frequently adjust kicking effort to modulate ball velocity and meet specific tactical demands. Submaximal kicks are typically used for short passes, while maximal kicks are employed for long passes or goal attempts. In maximal kicks, the trunk plays a crucial role in generating a downward energy flow toward the pelvis and the kicking limb, which may avoid excessive effort and overload at the lower limb. However, how these contributions vary across different kicking effort levels remains unclear.

Objectives: This study investigated the kinematic and kinetic adjustments at the trunk, hip, and knee joints of the kicking limb during instep kicks performed at three effort levels.

Methods: Forty-four amateur soccer players (age: 23.9 ± 4.8 years) performed kicks at maximal effort, 70-80% of maximal, and 50-60% of maximal. Three-dimensional motion capture was performed at 300 Hz, and ground reaction forces were recorded at 1200 Hz. Kinematic and kinetic data were processed using Visual 3D software. Statistical parametric mapping with repeated measures ANOVA was used to compare time series between effort levels.

Results: The trunk exhibited distinct adjustments in the sagittal plane depending on the kicking effort. During maximal kicks, in the backswing and leg cocking phases, trunk flexion moments generated a downward energy flow toward the pelvis, accelerating its retroversion and contributing to the forward motion of the kicking limb toward the ball. Subsequently, part of this energy was redistributed to the thigh and shank during the acceleration phase, favoring increased final velocity. In contrast, during submaximal kicks, trunk extensor moments were predominant and generated an upward energy flow from the pelvis to the trunk, decelerating pelvic retroversion. In the transverse plane, in both maximal and submaximal kicks, trunk rotation moments generated a downward energy flow toward the pelvis, inducing pelvic rotation toward the support limb and assisting the forward displacement of the kicking limb. Additionally, hip and knee moments in the kicking limb increased with effort, optimizing energy transfer to the shank.

Conclusion: Trunk-generated moments and energy flows act as additional resources for advancing the kicking limb, with axial trunk moments being recruited at all effort levels and sagittal trunk moments being used exclusively during maximal kicks. These findings highlight the importance of trunk muscles in coordinating kicking performance.

Implications: Training programs should include exercises to strengthen trunk flexor and rotator muscles, especially for maximal kicks. Incorporating strength and power training for the trunk and lower limbs at different intensities may improve intermuscular coordination and kicking efficiency. Educating players about proximal-to-distal control of movement may enhance performance across different kicking efforts and avoid joint and muscle overloads.

Keywords: Soccer kicking, Biomechanics, Kinetic chain, Energy flow

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INFLUENCE OF BIOPSYCHOSOCIAL FACTORS ON UPPER LIMB PERFORMANCE IN UNIVERSITY HANDBALL ATHLETES

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Background: Handball is an Olympic team sport played on a court, involving running, shooting, jumping, repeated accelerations, and directional changes. However, research on handball athletes is limited, especially among university-level players. High-performance throwing requires a combination of biomechanical factors, such as upper limb power and precise coordination of joint movements. Although these factors are crucial for performance, psychological and social variables may also influence sports outcomes. University

students have a higher prevalence of mental health disorders like anxiety and depression, and university athletes may be even more susceptible.

Objectives: This study aimed to analyze the relationship between biopsychosocial factors and functional performance in university handball athletes.

Methods: Participants included male and female university handball players aged 18 to 40 years, with at least one year of training. A cross-sectional analytical design was used, consisting of two assessment phases. Initially, a semi-structured questionnaire incorporating validated instruments evaluated biopsychosocial aspects (Disabilities of the Arm, Shoulder, and Hand; Athlete's Quality of Life Questionnaire; Athlete Burnout Questionnaire - ABQ; Perceived Motivational Climate in Sport Questionnaire-2; and Competitive Trait Anxiety Scale). Functional performance was assessed using the Seated Medicine Ball Throw (MBT) and Unilateral Seated Shot-Put Test (USSPT), followed by isokinetic strength assessment of shoulder rotators, elbow flexors and extensors, and wrist muscles using the BIODEX Multi-Joint System 4. Grip strength was measured with the Lafayette hydraulic dynamometer. In the second phase, 7-meter throw performance was evaluated. Correlation tests were applied according to data distribution ($p = 0.05$).

Results: A total of 36 university handball athletes were assessed. Strong positive correlations were found between biomechanical variables and performance in the MBT ($r = 0.7$, $p = 0.01$) and USSPT ($r = 0.7$, $p = 0.01$). Mean throwing velocity showed a strong correlation ($r = 0.7$, $p = 0.01$) with concentric strength of external shoulder rotators and a moderate correlation ($r = 0.4$, $p = 0.01$) with other biomechanical variables. The Physical/Emotional Exhaustion domain of the ABQ showed a moderate correlation ($r = 0.4$, $p = 0.01$) with MBT, a moderate correlation ($r = 0.7$, $p = 0.05$) with USSPT, and a weak correlation ($r = 0.2$, $p = 0.05$) with mean 7-meter throw velocity. The Reduced Personal Accomplishment domain showed a moderate negative correlation ($r = -0.4$, $p = 0.01$) with both performance tests. No significant correlation was found between target accuracy and any biomechanical or psychosocial variable.

Conclusion: Biomechanical variables were correlated with performance. Psychosocial factors had a low association with sports performance, with burnout symptoms showing only a low to moderate impact. Further studies with larger samples are needed to better understand the biopsychosocial dynamics of Brazilian university handball athletes.

Implications: This study demonstrated that biomechanical variables have a strong correlation with throwing performance, reinforcing the importance of strength and power training for university handball athletes. Psychosocial factors, particularly burnout symptoms, showed moderate correlations with performance, suggesting that emotional exhaustion may impact sports performance.

Keywords: Handball, university, performance, function, muscle strength

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ASSOCIATIONS BETWEEN PERFORMANCE IN THE FREQUENCY SPEED KICK TEST, HEART RATE VARIABILITY, AND BODY COMPOSITION IN AMATEUR MUAY THAI FIGHTERS

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Background: In martial arts, heart rate variability (HRV) measurements can be used to assess injury risk and susceptibility to fatigue. In Muay Thai, the frequency speed of kick test (FSKT) is used to measure kick speed, which may be influenced by autonomic modulation.

Objectives: We aimed to evaluate the correlations between FSKT, HRV, and body composition measures in amateur Muay Thai fighters.

Methods: This is a cross-sectional study with 37 Muay Thai fighters. They underwent FSKT-10 and multiple FSKT to measure the kick fatigue index (KFI). In addition, body composition was assessed using bioimpedance analysis and HRV using a heart rate monitor before and during the FSKT-10s. Inferential analysis consisted of the following methods: (1) the variation between the two moments (before and during the FSKT) was evaluated using the Wilcoxon signed rank test, and (2) correlations between the FSKT-10s or KFI derived from the FSKT-mult and all other variables were evaluated using Spearman's coefficient.

Results: The mean age was 27.9 ± 7.7 years, and all participants were male. Based on body mass index (BMI), 15 (44%) were eutrophic, 12 (35%) were overweight and 7 (21%) were obese. The median number of kicks in the FSKT-10 and the KFI were 20 (17–26) and 20 (14–29) %, respectively. When comparing the values before and during the FSKT-10s, there was a decrease in the percentage of interval differences of consecutive successive NN intervals greater than 50 ms (pNN50), approximate entropy, and parasympathetic nervous system (PNS) index, with an increase in the sympathetic nervous system (SNS) index. The number of kicks assessed in the FSKT-10s correlated positively with fat-free mass (FFM) and low frequency range (LF). The KFI correlated negatively with the FFM and PNS index, and positively with the LF and SNS index.

Conclusion: When amateur Muay Thai fighters perform the FSKT-10s, there is an acute effect on autonomic modulation with increased sympathetic activation, vagal withdrawal, and decreased system complexity. There are relationships between FFM and sympathetic activation with performance and susceptibility to fatigue.

Implications: The ability to generate force in the lower limbs with the least amount of fatigue is critical to the success of many sporting events, including amateur Muay Thai fights. In this sense, we used the FSKT-10s technique and its multiple version, as they are among the most used techniques during an official competition. Thus, the results of this study can be used by coaches as guidelines for developing strength and conditioning programs for their Muay Thai athletes in preparation for martial arts competitions.

Keywords: Exercise, Autonomic nervous system, Body composition

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