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ORAL ABSTRACT PRESENTATION

A COMPARISON BETWEEN HEART RATE AND POWER OUTPUT TO PRESCRIBE EXERCISE INTENSITY

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Introduction: Exercise intensity can be prescribed based on internal (e.g., heart rate, HR) or external variables (e.g., power output, PO). However, these variables may be affected by different aspects such as environmental temperature or nutritional status (1). The purpose of this work was to analyze the possible changes in HR and PO under different conditions: control, glycogen depletion, and hyperthermia. **Methods:** Two women (58.6 ± 2.69 kg; 161 ± 2.97 cm; 25.3 ± 0.91 years; 47.2 ± 1.15 ml·kg⁻¹·min⁻¹) and 4 men (71.5 ± 4.21 kg; 176 ± 2.09 cm; 22.3 ± 1.57 years; 53.3 ± 2.27 ml·kg⁻¹·min⁻¹) performed an incremental test protocol on a cycle ergometer (Lode Excalibur, Germany) in 3 conditions (control, glycogen depletion, and hyperthermia [$\sim 36^\circ$ C]). The test started at 30 W and increased 30 W every 3 minutes until exhaustion. Capillary lactate levels were analyzed using a lactate analyzer (Biosen-C-line-EKF Diagnostic, Germany) at rest, in the last 30 seconds of each step and immediately postexhaustion, whereas HR was monitored constantly (Jaeger-CareFusion, Germany). Lactate threshold (LT) was determined through the Dmax method (2) and the OBLA 4 method (3). HR and PO at these 2 LTs were compared among conditions using a 2-way repeated measures ANOVA. Bonferroni post hoc tests were used. The effect size was calculated by partial eta-squared (η_p^2). **Results:** PO was significantly different between conditions at the LT calculated through Dmax ($p = 0.012$; $\eta_p^2 = 0.588$) and OBLA 4 ($p < 0.001$; $\eta_p^2 = 0.802$). PO at the Dmax LT was higher in glycogen depletion (185 ± 30.6 W) than hyperthermia (162 ± 19.6 W; $p = 0.022$). PO at the OBLA 4 LT was higher in glycogen depletion (217 ± 37.9 W) than control (200 ± 35.3 W; $p = 0.049$) and was higher in control than hyperthermia (179 ± 29.2 W; $p = 0.026$). By contrast, HR was similar among conditions at the LT calculated using Dmax (control:

146 ± 6 bpm; depletion: 147 ± 10 bpm; hyperthermia: 149 ± 11 bpm; $p = 0.812$; $\eta_p^2 = 0.051$) and OBLA 4 (control: 153 ± 6 bpm; depletion: 158 ± 7 bpm; hyperthermia: 155 ± 13 bpm; $p = 0.571$; $\eta_p^2 = 0.131$). **Discussion:** In our study, PO at the LT seems to change among conditions whereas HR does not seem to be affected, supporting previous results (1). Therefore, if the objective is to stimulate a metabolic pathway, it is recommended to prescribe exercise intensity based on an internal variable, such as HR, to induce the same physiological stimulus among conditions. Contrary, if the purpose is to analyze changes in performance among conditions, it is suggested to observe mechanical variables, such as PO at the LT. However, more research is needed to further investigate the relationship between these variables and whether these differences would be maintained in steady states.

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Oral Abstract Presentation

THE INFLUENCE OF MENSTRUAL CYCLE PHASE ON NEUROMUSCULAR PERFORMANCE

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Introduction: The effects of the menstrual cycle (MC) on neuromuscular performance (NP) and perception effort have presented mixed results (1–3). The aim of this study was to investigate the changes in half-squat velocity, perceived exertion, and jump height during 3 different phases of the MC: early follicular phase (EFP), ovulation phase (OP), and midluteal phase (MLP). **Methods:** Fifteen professional footballers participated in the study (56.7 ± 4.1 kg, 24.0 ± 3.5 years). Footballers were evaluated during 3 different phases of the menstrual cycle with a crossover design. To verify EFP, the OP, and MLP for each participant, a combination of calendar-based counting and ovulation tests was used (4). For each phase, the mean propulsive velocity (MPV) in the 80% 1RM half-squat, perceived exertion (PE), and jump height (JH) was measured. The ANOVA

test was used to identify differences between MC. **Results:** Performance for MPV ($\text{m}\cdot\text{s}^{-1}$) did not show significant differences through MC phases (EFP: 0.61 ± 0.1 ; OP: 0.59 ± 0.1 ; LP: 0.6 ± 0.1 ; $p > 0.17$). PE did not change significantly either (EFP: 7.4 ± 0.8 ; OP: 7.5 ± 0.8 ; LP: 7.53 ± 0.9 ; $p > 0.17$). However, JH (cms) showed significantly greater values ($p = 0.03$) in the LP (34.2 ± 4.3) compared with EFP (32.9 ± 3.9) and OP (33.03 ± 4.07). **Discussion:** In conclusion, neuromuscular performance measured as MPV at 80% 1RM and PE did not change during the 3 main phases of the MC. JH was greater in the luteal phase. These data suggest that female footballer maintain a similar muscle performance during different phases of the MC which may facilitate the organization of strength training. However, the individual responses should be considered to detect female athletes more prone to experience muscle performance declines during different phases of the MC (1). Moreover, it is important to find the dependent variables that could be more sensitive to changes in neuromuscular performance.

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Oral Abstract Presentation

DECISIVE FACTORS FOR A GREATER PERFORMANCE IN LINEAR-MULTIDIRECTIONAL SPEED IN BASKETBALL PLAYERS BASED ON GENDER

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Introduction: Multidirectional speed actions are considered a key performance determinant in basketball match; therefore, analyzing this skill is crucial to comprehend the basketball players' requirements. This study aimed to analyze the relationship between functional movement and strength-related variables on linear and multidirectional speed based on gender. In addition, we aimed to determine the predictive effect of the analyzed sports performance-related variables on linear and multidirectional speed. **Methods:** Fifty basketball players (54% female) completed the assessment in which the weight-bearing dorsiflexion test, y-balance test, countermovement jump unilateral, drop jump unilateral, triple hop test unilateral, and 10 meters of linear and multidirectional speed with different cut-off angles (45° , 90° , and 180°) were performed. The speed variables were divided according to time execution into "low responders" and "high responders" to establish a comparison between performance groups. Both gender and performance were compared using Student's *t* test and ANOVA. Multiple regression determined the multivariate influence of the independent variables as predictors of performance differentiating between gender. **Results:** Males showed higher performance in all tests assessed compared with females ($ES = 0.62\text{--}2.05$; $p < 0.034$). The faster the athletes, the greater the ankle mobility ($p < 0.011$). Regarding both vertical and horizontal strength variables, all reflected significant differences on speed test performance ($p < 0.021$), so that the stronger the athletes, the fastest they were. For the male players, the faster in linear speed, the greater change of direction deficit (CODD) ($p < 0.001$). Multiple regression analysis revealed that a slow and vertical stretch-shortening cycle (SSC) was the physical ability that best estimated the change in speed tests in females (45–65% variance explained; $p < 0.001$). By contrast, in men, it was a fast and horizontal SSC (30–61% variance explained; $p < 0.022$) that best predicted performance in speed actions. **Conclusions:** The main findings of this study suggest that gender should be considered to emphasize strength training in different vectors, as well as to determine the strength threshold within an individualized range of the force-velocity curve, especially when performing training programs focused on improving linear and multidirectional velocity. In addition, the faster the male players were, the higher the CODD, so more emphasis on eccentric actions, braking, and technique (1) might be recommended for basketball players.

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Oral Abstract Presentation

DOES SKELETAL MUSCLE OF CYSTIC FIBROSIS ADULT PATIENTS RESPOND TO A STRENGTH TRAINING PROGRAM?

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Introduction: Cystic fibrosis (CF) is a genetic disease caused by mutations in the cystic fibrosis transmembrane conductance regulator (CFTR) gene that encodes for an ion channel. Along with lung impairment, other tissues are also affected by the mutations. Recently, it has been observed that it directly affects muscle tissue, causing dysfunction (1). The adult CF population has increased, up to 57.2% of total CF population according to the last registry (2). The exact magnitude of these deficiencies in CF adult patients has not been fully elucidated. Most exercise programs within the treatments are focused on cardiovascular training, and few are focused on the muscle (3). Therefore, our main aim was to assess the effect of an 8-week telematic and supervised strength exercise program on muscle strength and body composition in adult patients with CF. **Methods:** A randomized controlled trial was conducted in CF adult patients from Hospital Universitario La Princesa. Patients were divided into 2 groups: exercise (EG) and control group (CG). EG performed an 8-week telematic and supervised strength training program, 3 times a week, 1 hour a day. CG followed life style recommendations of their doctor. The following variables were evaluated: (a) upper and lower limbs strength on disc and pulley machines: leg press (LP) and lat pulldown (LPD); (b) body composition using dual-energy x-ray absorptiometry (DXA): Body Adiposity Index (BAI), Fat Mass Index (FMI), and total and segmental muscle mass; and (c) lung function using spirometry: forced expiratory volume in 1 second (FEV1). **Results:** Twenty-three patients (EG = 14, CG = 9) aged 32.13 ± 7.72 years were included. For body composition, significant decreases in BAI and FMI were observed ($F[1,21] = 16,264$; $p < 0.05$; $\eta_p^2 = 0,436$) and ($F[1,21] = 16,840$; $p <$

0.05 ; $\eta_p^2 = 0,445$), respectively. Significant increases in muscle mass were also observed, specifically in the trunk ($F[1,21] = 4,920$; $p < 0.05$; $\eta_p^2 = 0,190$). Regarding the strength, significant improvements were observed in LP ($F[1,21] = 7,799$; $p < 0.05$; $\eta_p^2 = 0,281$). There were no significant changes in the LPD.

Discussion and Conclusion: Despite the structural failure of the CFTR receptor at the muscular level, muscle responds to strength training, improving strength of the lower limbs. Despite the endocrine and nutrient absorption problems, the 8-week telematic and supervised strength exercise program achieved significant improvements in the body composition of adults with CF, with a decrease in fat mass and an increase in muscle mass.

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Oral Abstract Presentation

ANALYSIS OF THE LOAD-VELOCITY RELATIONSHIP IN THE DECLINE BENCH PRESS IN TRAINED MEN AND WOMEN

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Introduction: The decline bench press exercise has been shown to have greater activation of the lower pectoralis major area when compared with an incline bench press (1). The purpose of this study was to analyze the load-velocity relationship in this exercise and to compare sex-related differences. **Methods:** A descriptive research design was used. Twelve young healthy men and women (6 men and 6 women), experienced in resistance training, performed one testing session where a progressive loading test was conducted for the determination of 1RM strength and individual load-velocity relationship in the decline bench press exercise. Velocity data were captured with a linear encoder (Speed4Lifts, v2.0, Madrid, Spain), which has been validated elsewhere (2). This investigation was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of the Universidad Politécnica de Madrid (reference number: 2022-069). After being informed of the purpose and experimental procedures, the subjects signed a written informed consent form

before participation. **Results:** A very close relationship between mean propulsive velocity (MPV) and %1RM was observed ($R^2 = 0.94$). This relationship improved when plotting data separately by sex ($R^2 = 0.96$ for males and $R^2 = 0.97$ for females). Individual load-velocity profiles gave an $R^2 = 0.99 \pm 0.01$. Significant sex-related differences were found for MPV, with males having faster velocities than females at 30, 35, and 40% 1RM ($p = 0.01$). A prediction equation to estimate relative load (% 1RM) from MPV ($m \cdot s^{-1}$) was obtained for males ($R^2 = 0.96$; $SEE = 4.38$) and for females ($R^2 = 0.97$; $SEE = 3.47$). Mean velocity attained with the 1RM load (V1RM) was $0.15 \pm 0.02 m \cdot s^{-1}$. **Discussion:** The results of this study show that a strong correlation exists between relative load and MPV in the decline bench press exercise, allowing the possibility of using one to predict the other with great precision, especially when a sex-specific equation is used. If maximum accuracy is needed, an individual load-velocity profile is recommended.

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Poster Presentation

DOES SUPERVISION DURING EXERCISE INFLUENCE STRENGTH IMPROVEMENT IN OLDER ADULTS? A SYSTEMATIC REVIEW AND META-ANALYSIS

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Introduction: Although it has previously been shown that unsupervised home-based (UHB) exercise training can provide health

benefits for reducing the detrimental effects of aging (1), we still do not know how effective an UHB exercise program can be compared with one that is supervised. Thus, the aim of this systematic review and meta-analysis was to analyze whether a supervised exercise program improves muscle strength variables significantly more than an unsupervised program in older adults.

Methods: Two researchers systematically searched 5 databases (PubMed, CINAHL, PsycInfo, SPORTDiscus and Web of Science) up to 04/09/2022. The electronic search was supplemented by a thorough manual review. Randomized controlled trials that compare supervised center-based (SCB) versus UHB in older adults (≥ 60 years) were included. The outcomes analyzed were upper-body and lower-body strength using handgrip and knee extension tests, respectively. **Results:** A total of 9,191 articles were found. Finally, 12 studies were included in the final synthesis ($N = 1,238$; mean age 67 years). A total of 11 studies analyzed lower-body strength, whereas 4 of them analyzed upper-body strength. SCB training significantly improved lower-body strength measured through the knee extension test ($SMD = 0.18$, 95% $CI = 0.06-0.30$, $p = 0.003$) compared with UHB, with no heterogeneity (0%) but signs of publication bias (Begg's test $p = 0.043$). Sensitivity analyses confirmed significance when removing each study at a time. No greater effectiveness was found in the upper-body strength variable measured through the handgrip test for SCB training compared with training without the supervision of a professional ($SMD = 0.13$, 95% $CI = -0.18$ to 0.45 , $p = 0.404$), with no heterogeneity (37.12%) or signs of publication bias (Begg's test $p = 0.154$). **Discussion:** Training under the supervision of a professional in a center improved measures of lower-body strength to a greater extent than training at home without direct supervision. However, no additional benefits were found for the upper-body strength variable. This may be due to the small number of studies that analyzed this outcome as well as the fact that most exercise programs focus exclusively on lower-body exercises. Our analyses suggest that SCB exercise sessions are recommended, whenever possible, to improve lower-body strength in older adults.

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Oral Abstract Presentation

VELOCITY AND LOAD EFFECTS IN MECHANIC WORK DURING ECCENTRIC PHASE IN JUMP SQUAT

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Introduction: An essential parameter for the effectiveness of strength training programs is mechanical work (MW). MW is the product of the amount of force exerted by displacement during the task (1). This variable could be important in explaining performance in sporting actions such as jumping. The literature, within the force generated during the entire displacement, considers the capacity to generate force in the eccentric phase to be relevant, but few studies have evaluated the influence of the MW performed during the final moments of the eccentric phase. The aim of this study is to determine the influence of the different eccentric execution speeds on the MW in the jump squat and how this variable influences the performance of the concentric phase. **Methods:** A total of 14 male participants performed 4 sets of 4 repetitions at 50% of their 1RM, with 4 different tempos of the eccentric phase (5s, 2s, maximum speed with stop, and maximum speed with continuous jumps), in the half squat with jump exercise. The exercise was performed on a Smith machine. A linear encoder (T-Force System, Ergotech, Spain, Murcia) was used to measure the estimated 1RM, displacement (cm), and time (ms). **Results:** For data analysis, a 2-factor ANOVA and a post hoc analysis with Bonferroni adjustment for pairwise comparisons were performed. Pairwise comparisons for strength in the first 100 milliseconds of the concentric phase and for mechanical work in the eccentric phase showed differences between all times ($p < 0.05$), except for jumping at maximal velocity with standing versus maximal velocity with continuous jumping. **Discussion:** It is concluded that as the speed of the eccentric phase increases, greater MW and greater strength are achieved in the first 100 milliseconds of the concentric phase. These results are in line with other studies (2). This may help athletes to improve jumping performance by taking into account mechanical work as an exercise prescription.

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Oral Abstract Presentation

EFFECTS OF 12-WEEK RESISTANCE EXERCISE TRAINING IN FRAIL INSTITUTIONALIZED CENTENARIANS

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Introduction: The population aged 80 and older is growing faster than any other age groups in the world, with the number of centenarians rapidly increasing (1). The oldest old are at high risk of intrinsic capacity deterioration with subsequent loss of functional independence, which translates into increased personal vulnerability and health cost (2). The objective of this study was to determine whether a resistance training intervention can improve physical function, functional independence, frailty, and health-related quality of life in frail institutionalized elderly older than 100 years. **Methods:** The study was a multicenter randomized controlled trial, conducted at 11 geriatric nursing homes in Spain. A total of 12 frail institutionalized centenarians (101.33 ± 2.06 years, 83.3% female) were included. Centenarians were randomized to an intervention ($n = 6$) or a control ($n = 6$) group. The intervention group performed supervised resistance training (1–3 sets of 8–10 repetitions as fast as possible, at 50–70% of the estimated one-repetition maximum; 8 exercises) at 2 sessions \cdot wk^{-1} for 12 weeks. The following outcomes were assessed before and after the 12 weeks: physical function [short physical performance battery (SPPB), Physical Performance Mobility Examination (PPME), isometric knee extension strength (IKE), and 30-second sit-to-stand], functional independence [Barthel Index], frailty [Fried's phenotype and FTS-5], and health-related quality of life [EuroQoL-5D Index (EQ-5D) and Visual Analog Scale (VAS)] were evaluated in both groups before and after the intervention. **Results:** Repeated measures ANOVA revealed significant group-by-time interaction ($p < 0.05$) for all the measured outcomes. After the 12-week training period, the intervention group significantly improved all the variables except for FTS-

5: PPME (baseline: 3.8 ± 2.6 points vs. post-training: 6.5 ± 3.3 points), IKE (9.7 ± 4.3 kg vs. 12.5 ± 3.9 kg), Barthel index (32.50 ± 18.64 points vs. 50.00 ± 19.24 points), Fried's phenotype (3.83 ± 0.75 vs. 3.00 ± 0.63), and EQ-5D (0.112 ± 0.118 vs. 0.233 ± 0.090) among others (all $p < 0.05$). **Discussion:** To the best of our knowledge, this is the first time that the effects of 12-week resistance training have been assessed in centenarians. Our findings suggest that no one is too old to benefit from resistance training, as we found a recovery of physical function and improvement of quality of life. Importantly, no major adverse events occurred during the intervention period despite the frailty of the centenarians. Therefore, supervised resistance exercise training could be considered a safe and effective intervention even in frail institutionalized people older than 100 years.

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Poster Presentation

DIETARY NITRATE INGESTION DOES NOT IMPROVE NEUROMUSCULAR PERFORMANCE IN MALE ROCK CLIMBERS. A RANDOMIZED, DOUBLE-BLIND, PLACEBO-CONTROLLED STUDY

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Introduction: Dietary nitrate ingestion in beetroot juice (BJ) form is commonly used as an ergogenic aid in endurance (Jones et al., 2021) and team sports modalities (Thompson et al., 2016). However, the effect of this supplement in rock climbing performance is barely studied. The purpose of the current study was to investigate the effect of acute BJ ingestion on neuromuscular and bio-

chemical parameters in male rock climbers. **Methods:** Ten physically active rock climbers (28.8 ± 3.7 years) underwent a battery of neuromuscular tests consisting of countermovement jump (CMJ) and squat jump (SJ) test, isometric handgrip strength, pull-up failure, and half crimp test. Subjects performed the neuromuscular test battery twice in a cross-over manner separated by 10 days, 150 minutes after having consumed either 70 ml of BJ (6.4 mmol NO₃⁻) or a 70 mL placebo (0.0034 mmol NO₃⁻). In addition, nitrate (NO₃⁻) and nitrite (NO₂⁻) saliva concentrations were analyzed, and a side effects questionnaire related to ingestion was administered. **Results:** No differences were reported in the different neuromuscular parameters measured such as countermovement jump ($p = 0.960$; ES = 0.03), squat jump ($p = 0.581$; ES = -0.25), isometric handgrip strength (dominant/nondominant) ($p = 0.459$ – 0.447 ; ES = 0.34–0.35), pull-up failure test ($p = 0.272$; ES = 0.51), or maximal isometric half crimp test ($p = 0.521$ – 0.824 ; ES = 0.10–0.28). Salivary NO₃⁻ and NO₂⁻ increased significantly after BJ supplementation comparing placebo ($p < 0.001$), whereas no side effects associated to ingestion were reported ($p = 0.330$ – 1.000) between conditions (BJ/placebo ingestion). **Conclusion:** Acute dietary nitrate supplementation (70 ml, 6.4 mmol NO₃⁻) did not produce any statistically significant improvement in neuromuscular performance or side effects associated in male rock climbers.

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Poster Presentation

BACK SQUAT MEAN PROPULSIVE VELOCITY ACROSS THE MENSTRUAL CYCLE IN FEMALE RUGBY PLAYERS: PRELIMINARY RESULTS

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Introduction: There is little research on the variation of sports performance in women during the different phases of the menstrual cycle (MC). The MC is related to sports performance and

injury risk through the hormones that govern it [3]. The loss of mean propulsive velocity (MPV) was related with fatigue and, consequently, with the risk of injury [1]. **Objective:** To determine if the different phases of CM produce significant changes in MPV in female rugby players. **Methods:** Four active rugby players (height 162.0 ± 4.2 cm; body mass 61.3 ± 9.3 kg; age 25.1 ± 2.2 years) with experience in training with loads participated in the study. Two different tests have been performed: an incremental power test [2] and a maximal MPV test, both in back-squat exercise. MPV and power data have been taken with a VITRUVÉ Encoder (Speed4lifts, Spain), and the MC has been controlled with ovulation strips (EllaTest, Qingdao Hightop Biotech, China). Friedman tests were performed to analyze differences between the MC phases in power and MPV. Effect size was calculated by W Kendall with the following criteria: $=1.0$ small, >0.3 medium, and >0.5 long. Results are expressed as mean (M), and SD. Statistical analyses were performed with SPSS version 26.0 (IBM), and the level of significance was set at 0.05. **Results:** Significant differences were found between the early and late follicular phases ($p = 0.01$, $W = 0.05$), with higher values in power and MPV in the late follicular phase. There were not significant differences in the rest of phases in power and MPV. **Discussion:** These preliminary results showed that the early follicular phase produced the least development of MPV and power in female rugby players. The differences in MPV between phases were 14% between the early and late follicular phase and 6.6% between late follicular and luteal phase ($p = 0.16$; $W = 0.25$). **Practical application:** It seems that the late follicular phase produced the highest capacity to develop MPV and power compared with the rest of the cycle. These preliminary results could help coaches to plan the strength training and to diminish the risk of injury based on the differences observed in MPV and power in the MC phases.

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Oral Abstract Presentation

EFFECTS OF PROTEIN-CARBOHYDRATE VS. CARBOHYDRATE ALONE SUPPLEMENTATION ON IMMUNE INFLAMMATION MARKERS IN ENDURANCE ATHLETES

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Introduction: The impact of ingesting carbohydrates alone or combined with proteins to support exercise immune adaptation in endurance athletes is scarcely investigated (Naclerio et al., 2019). This study compares the effect of ingesting a combined protein-carbohydrate supplement vs. a carbohydrate-only supplement postworkout on immune inflammation markers after a 10-week periodized endurance training program in well-trained athletes. **Methods:** Twenty-five men completed the study after being randomly assigned to one of the following intervention groups: combined protein-carbohydrate (PRO-CHO $n = 12$, 31 ± 9 years, $\dot{V}O_{2peak}$ 61.0 ± 5.6 ml·kg⁻¹·min⁻¹) or nonprotein isoenergetic carbohydrate (CHO, $n = 13$, 33 ± 8 years, $\dot{V}O_{2peak}$ 60.6 ± 6.9 ml·kg⁻¹·min⁻¹). Treatment consisted of ingesting 24 g of assigned supplement, mixed with 250 ml of orange juice, once a day immediately postworkout (or before breakfast on nontraining days). Measurements were conducted preintervention and postintervention on total leukocytes, leukocyte subsets (i.e., neutrophils, eosinophils, basophils, monocytes, and lymphocytes), and platelets. The inflammatory status was assessed by the neutrophil-to-lymphocyte ratio (NLR), the platelet-to-lymphocyte ratio (PLR), and the systemic immune inflammation index (SII). **Results:** Postintervention, significant increases were observed for the CHO group only for the 3 inflammatory markers: NLR ($p = 0.050$, $d = 0.58$), PLR ($p = 0.041$, $d = 0.60$), and SII ($p = 0.004$, $d = 0.81$) but not for PRO-CHO ($p > 0.05$). **Conclusion:** Ingesting a postworkout protein-carbohydrate combined beverage promoted a more favorable immune status than carbohydrate-only ingestion by attenuating cellular inflammation over a 10-week training period in endurance male athletes.

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Poster Presentation

COMPARISON BETWEEN THE DETECTION OF THRESHOLDS USING LACTATE AND SmO₂ IN DIFFERENT MUSCLES IN CYCLING

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Introduction: There are different models to calculate the metabolic thresholds using lactate (1, 2). In recent years, muscle oxygen saturation (SmO₂) assessment using near-infrared spectroscopy (NIRS) has been suggested as a noninvasive method to detect these thresholds. However, most of the investigation was focused on only one muscle, and little is known about detection can be different in each muscle. The aim was to compare the detection of the first and second lactate thresholds (LTP1 and LPT2) using lactate and SmO₂ data in different muscles during a cycling incremental test. **Methods:** Nineteen trained triathletes participated of this study (11 men and 8 women) with an age 23 ± 6 years, height 1.73 ± 0.1 m, and body mass 64.9 ± 8.7 kg. Subjects performed an incremental test in a cycle ergometer (Cardgirus W3, Spain) with 3-minute steps and power increments of $0.5 \text{ W} \cdot \text{kg}^{-1}$ in the first 10-second of each step and with a cadence of 90 ± 10 rpm. The test ended when the cadence was below 80 rpm or the subject decided to give up. NIRS dispositives (Moxy, EE. UU.) were located in 8 positions: right and left sides of vastus lateralis, tibialis anterior, gastrocnemius, and dominant side of the triceps sural and biceps femoris. Lactate (Lactate Pro2, Netherlands) was determined at the last 30 second of each step. Differences between the detection of the threshold using lactate and SmO₂ data were assessed using Student's *t* test. Intraclass correlation coefficient (ICC) between both methods was assessed and classified as 1.00–0.81 (excellent), 0.80–0.61 (very good), 0.60–0.41 (good), 0.40–0.21 (reasonable), and 0.20–0.00 (deficient). **Results:** No differences between lactate and SmO₂ detection of LTP1 and LTP2 were observed in both vastus lateralis and at LTP2 in biceps femoris ($p > 0.05$). The other muscles had differences in both thresholds ($p < 0.05$). The ICC varied from excellent (ICC 0.82–0.81 in biceps femoris, gastrocnemius, and tibialis anterior in LTP2) to good (ICC 0.45–0.58) in vastus lateralis in LTP2 and biceps femoris, vastus

lateralis, and triceps in LTP1 (ICC 0.56–0.45), with the lower values at tibialis anterior in LTP1 (ICC 0.39–0.27). **Discussion:** The detection of thresholds using NIRS seems adequate. However, power output producing muscles during pedaling detected very good thresholds in muscles that are used during the exercise (3), whereas stabilizers muscles of position the SmO₂ detected the threshold before that the lactate. The NIRS would be a good technology for detecting thresholds.

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Oral Abstract Presentation

EFFECT OF ORAL CONTRACEPTIVES ON BONE (RE)MODELING MARKER CONCENTRATIONS IN RESPONSE TO INTERVAL RUNNING IN ENDURANCE-TRAINED FEMALES

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Introduction: Beyond its reproductive function, estradiol is a key regulator of bone metabolism [1] and its deficiency promotes bone resorption [1]. Exercise may affect circulating concentrations of bone (re)modeling markers either by increasing bone formation marker (e.g., procollagen type 1 propeptide N (P1NP)) or decreasing bone resorption marker (e.g., type I collagen carboxy-terminal cross-linking telopeptide (β -CTX-1)) concentrations [2]. Given the high prevalence of oral contraceptive (OC) use in female athletes [3] and the resulting endogenous estrogen levels decrease during the active pill-taking phase (APP) composed of synthetic estrogens [4], the aim of this study was to examine the bone (re)modeling marker responses to exercise in OC users. **Methods:** Eight OC users (age: 25.49 ± 3.97 years;

body fat: 24.74 ± 6.8 5%; $\dot{V}O_2\text{max}$: 48.68 ± 6.39 $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$; endurance training: 267.19 ± 82.54 $\text{min}\cdot\text{wk}^{-1}$) performed an interval running test consisting of 8 bouts of 3 minutes at 85% of the maximal aerobic speed. Blood samples were taken to analyze P1NP and β -CTX-1 before and after this interval test in the different sex hormonal environments across the OC cycle: withdrawal (WP) and APP. Two-way repeated measures ANOVA was performed to compare OC cycle phases and pre-post exercise values. **Results:** Main effect for time (pre: 45.36 ± 5.97 $\text{ng}\cdot\text{ml}^{-1}$; post: 57.73 ± 11.24 $\text{ng}\cdot\text{ml}^{-1}$; $p < 0.001$) and phase (WP: 54.17 ± 11.52 $\text{ng}\cdot\text{ml}^{-1}$; APP: 49.18 ± 10 $\text{ng}\cdot\text{ml}^{-1}$; $p = 0.003$) was shown for P1NP, with a trend toward a significant time \times phase interaction ($p = 0.051$). No significant differences were shown in β -CTX-1 values for time (pre: 394.25 ± 115.91 $\text{pg}\cdot\text{ml}^{-1}$; post: 397.56 ± 137.94 $\text{pg}\cdot\text{ml}^{-1}$) and phase (WP: 422.56 ± 142.99 $\text{pg}\cdot\text{ml}^{-1}$; APP: 369.25 ± 102.51 $\text{pg}\cdot\text{ml}^{-1}$). **Discussion:** These results reflect a greater bone formation marker concentration in WP than in APP, suggesting that the cyclic decrease in endogenous estradiol levels observed during APP could alter the anabolic response to exercise, whereas bone resorption was affected neither by time nor phase. This contrasts with the lack of differences shown by others between menstrual cycle phases [2], possibly due to the lower endogenous estradiol levels during the APP [4], despite the highest exogenous estrogen concentration. These lower P1NP concentrations during the APP could endanger the long-term bone health of OC users since the anabolic response to exercise could be compromised owing to the effect of synthetic hormones on bone metabolism regulation.

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Poster Presentation

RESPIRATORY MUSCLE TRAINING IN AN ELITE FEMALE TRIATHLETE: A CASE STUDY

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Introduction: It has been shown that inspiratory muscle training (IMT) can improve muscular strength and endurance, playing an important role in sports such as swimming, cycling, or triathlon (1). In addition, IMT training seems to play a determining role in fatigue (metaboreflex) in aerobic endurance disciplines and is easily implemented through devices with resistance to air conduction (2, 3). The object of this study exposes the effect of IMT for 15 weeks in a triathlete (competing in Spanish, European, and world championships). **Methods:** Maximal inspiratory pressure (MIP) was evaluated using the POWERBreathe® Kinetic KH1 electronic device of an elite triathlete (20 years old, body mass: 53 kg, and height: 1.65 m). The evaluations were made after 21 days, 33 days, and 51 days, to adjust the resistance of the training (dates according to availability between competitions). Training was performed with the POWERBreathe Competition Series apparatus, and the protocol consisted in 2 sessions per day (minimum 5 days per week) of 30 breaths at 75–79% of adjusted MIP performed after 21 days, 33, and 51. **Results:** Compared with baseline (133 cmH_2O ; 2.5 $\text{cmH}_2\text{O}\cdot\text{kg}^{-1}$), PIM improved by 17% at 21 days (156 cmH_2O ; 2.9 $\text{cmH}_2\text{O}\cdot\text{kg}^{-1}$), 23% at 33 days (163 cmH_2O 3.1 $\text{cmH}_2\text{O}\cdot\text{kg}^{-1}$), and 20% at 51 days (160 cmH_2O ; 3.0 $\text{cmH}_2\text{O}\cdot\text{kg}^{-1}$). On the other hand, differences of 17%, 4% and –2%, respectively, were found in each measurement with the previous one. **Discussion:** The maximum MIP value reached by the athlete is among the highest MIP values references in elite athletes (4) and according to their characteristics (body mass and height). The athlete begins study with a very high MIP value compared with the references. After 4 weeks, she showed her maximum MIP value and seems to stabilize at a value of 3.0 $\text{cmH}_2\text{O}\cdot\text{kg}^{-1}$. Despite starting the study with high MIP values, the athlete achieved a high percentage of improvement (20%) after training with POWERBreathe, and also, she reported an improvement at the perceptual level. In conclusion, this case study highlights that IMT training can be beneficial for a high performance female triathlete in a short period of time.

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Poster Presentation

SEX DIFFERENCES IN LOAD-VELOCITY PROFILES IN THREE DIFFERENT ROWS EXERCISES

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Introduction: Velocity-based training (VBT) has been developed to provide accurate and objective data to support resistance training prescription [1]. The interest by VBT is increasing in recent years, but some studies have shown differences in the velocity-profile between men and women in exercises as squat, bench press, or shoulder press [2]. This study aimed to examine the differences in the load-velocity profile in prone bench row (PBR), smith machine bent over row (SMBOR), and barbell bent over row (BBOR) exercises between men and women. **Methods:** Thirteen men and 13 women were tested during the PBR, SMOR, and BBOR exercises. The individual load-velocity profiles were determined by means of an incremental loading test (from 30% to 100% of the 1 repetition maximum [1RM] in approximately 5% increments). The relationship between mean propulsive velocity (MPV) and each percentage of 1RM (% 1RM) was analyzed. A second-order polynomial equation for predicting the corresponding MPV of each % 1RM was developed for men and women. A mixed-model analysis of variance (ANOVA) was applied to each dependent variable with the exercise (PBR, SMOR, and BBOR) as a within-subject factor and sex (men and women) as a between-subject factor. Significance was set at $p < 0.05$. **Results:** The ANOVAs applied on the MPV attained at each tested %1RM revealed that higher velocity values were generally achieved for the SMOR, followed by the PBR, and finally the BBOR. Men provided higher velocity values than women. Significant exercise \times sex interactions were observed only from 30% to 40 %1RM. Very strong correlation between bar velocity and relative load was observed in both sexes for PBR, SMOR, and BBOR ($r > 0.94$, $p < 0.01$). **Discussion and conclusion:** These results reveal that the load-velocity relationship during PBR, SMOR, and BBOR is markedly steeper in men than in women. The same result (i.e., lower velocities at low % 1RM in women) has been reported in other studies when compared bench press, squat, or shoulder press exercises [2, 3]. Based on the results of this study, it can be concluded that men presented higher mean propulsive velocity, especially under 85% 1RM, compared with women during PBR, SMOR, and BBOR exercises.

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Oral Abstract Presentation

ENERGY SUBSTRATES EVOLUTION AROUND VENTILATORY THRESHOLDS IN ACTIVE OLDER FEMALE ADULTS

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Introduction: Lipids and carbohydrates (CHO) are largely sensitive to changes in exercise intensity (1). Key points in human metabolism are their oxidation rates at their maximum (i.e., the maximal fat oxidation [MFO] and the maximal CHO oxidation [CHOox] peak, this at exhaustion or maximal power [P100]). Notwithstanding, both rates at the ventilatory thresholds VT1 and VT2 may also need attention because of their relation to MFO and P100 (1). This work aims to analyze CHOox and FATox rates in a group of active women over 60 considering the relationship among these 4 points in a graded cycling test, what remains unknown. **Methods:** Twenty-one active women (66.04 ± 11.44 years) completed a submaximal incremental cycling protocol (10 W/3'15"), with continuous gas analysis by indirect calorimetry, power registration, and pre-post test lactate measurements (3–5 minutes). Oxidation rates were calculated by applying Frayn's equations (2), considering the mean $\dot{V}O_2$ and $\dot{V}CO_2$ of the last 30 seconds at the MFO, VT1, VT2, and P100 points, as well as the first step of the test (P1) (3). Ventilatory thresholds were calculated considering the last 30 seconds and using 2 methods per point. VT1 was calculated by analyzing the lowest point of the ventilatory oxygen equivalent ($EqO_2:VE/VO_2$), as well as by plotting the CO_2 excess, with respect to VO_2 (3). VT2 was calculated plotting the natural logarithms of EqO_2 and $EqCO_2$, with respect to VO_2 , in addition to the incremental jump criterion of RER with respect to $\dot{V}O_2$ (4). **Results:** Active elderly women confirmed limited ability to oxidize both FATox and CHOox in each point P1 (0.73 ± 0.1 W·kg⁻¹ FFM), MFO (0.99 ± 0.27 W·kg⁻¹ FFM), VT1 (1.09 ± 0.34 W·kg⁻¹ FFM), VT2 (1.61 ± 0.40 W·kg⁻¹ FFM), and (P100: 1.91 ± 0.38 W·kg⁻¹ FFM). MFO and VT1 points showed no differences, as suggested (1), confirming the

reduction of fat oxidation on them. Conversely, both VT1 vs VT2 and VT2 vs P100 displayed significant differences for FATox, although not for CHOox. **Conclusion:** Future studies will confirm the potential role of MFO in the detection of the first threshold, at least in inactive older women.

Poster Presentation

MODERATE-INTENSITY CYCLIC HYPOXIC TRAINING AS A LONG-TERM EFFECTIVE TOOL TO IMPROVE CARDIOVASCULAR RISK OUTCOMES IN PATIENTS RECOVERED FROM COVID-19: THE AEROBICOVID STUDY

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Introduction: Most of the infected patients who recovered from SARS-CoV-2 received hospital discharge with sequels after COVID-19. Rehabilitation program for these patients has been determined as crucial to achieving a good level of health. Besides, the recovery duration may vary from 10 days to 3 months, being necessary to set up strategies to accelerate their recovery as well as maintain the improvements as a period of cessation are common. The aim of this study was to analyze the long-term effects of a training program under hypoxic conditions on cardiovascular risk factors in patients recovered from COVID-19. **Methods:** Eighty-four patients recovered of COVID-19 (age: 48.48 ± 9.79 years, body mass: 83.15 ± 16.55 kg, BMI: 29.86 ± 5.06 ; $\dot{V}O_{2max}$: 21.13 ± 6.16 kg·ml⁻¹·min⁻¹) were divided in the control group (CG) who were not available to participate in the intervention but who could take part in the

assessments: training and recovery with hypoxia (TH:RH), training in normoxia and recovery with hypoxia (TN:RH), or training and recovery in normoxia (TN:RN). Training groups performed of 3 and 6 sets of 5 minutes cycling (90–110%) with 2.5 minutes of passive recovery between sets. Subjects training or recovering under hypoxic conditions inspired a fraction of O₂ of 13.5%. Anthropometric and body composition, biochemical parameters, and maximal oxygen uptake were evaluated preintervention (T1) and postintervention (T2) and 8 weeks after training cessation (T3) with intention-to-treat analysis. **Results:** Fat-free mass significantly decrease in CG (-1.17% ; $p = 0.004$). Fat mass significantly decrease in TH:RN in T3 compared with T2 ($+1\%$; $p = 0.024$). Although all of the training group showed significant decrease in hip circumference in T3 compared with baseline ($p < 0.001$), TH:RH achieved significant improvements in the waist circumference too (-1.89% ; $p = 0.002$). According to maximal oxygen uptake, although TN:RN showed significantly a decrease (-7.17% ; $p = 0.003$) in T3 compared with T2, groups who training ($+7.59\%$; $p = 0.036$) or recovery ($+7.08\%$; $p = 0.019$) in hypoxia showed higher values in T3 compared with baseline. **Discussion:** Hypoxic stimulus during exercise or recovery may lead an additional benefit on fat mass located in the trunk and maximal oxygen uptake, maintaining improvements after training cessation. Training programs combined with hypoxia may be a useful tool to maximize the effects of exercise, increasing adherence and motivation as benefits as even maintaining after training cessation. As patients who recovered from SARS-CoV-2 show postacute sequelae of COVID-19, they could need usual period of inactivity which could be balance with this type of program.

Poster Presentation

THE EFFECT OF TIME-OF-DAY ON MODIFIABLE HAMSTRING INJURY RISK FACTORS IN SOCCER REFEREES

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Introduction: Soccer referees normally are involved refereeing at various times in the day, ranging from morning to night-time matches under floodlights (Reilly et al., 2007). The aim of this study was to

determine the effect of time-of-day on modifiable hamstring injury risk factors in soccer referees. **Methods:** Twenty-eight referees (age: 25.9 ± 3.8 years) volunteered to take part in the study. In a randomized counter-balance order, soccer referees realized a neuromuscular test battery based on modified injury risk related to hamstring injury such as range-of-motion values (e.g., straight leg raise test and ankle dorsiflexion range-of-motion), isometric knee flexion strength, and dynamic balance realized in the morning (9.00 hours), midday (14.00 hours), and evening (19.00 hours). In addition, before realized, the neuromuscular tympanic temperature was obtained and rate of perception exertion (RPE) was measured 30 minutes after the competition of the test battery. **Results:** Significant differences were obtained in the isometric knee flexion strength in the dominant limb comparing 9.00 vs. 19.00 hours ($p = 0.048$, $d = 0.47$), whereas no differences were obtained in the nondominant limb between time-of-day points ($p = 0.165$, $\eta^2 = 0.07$). In addition, no differences were reported in the range of motion values in straight leg raise test (dominant/nondominant) ($p = 0.125$ – 0.556 ; $\eta^2 = 0.02$ – 0.07) and ankle dorsiflexion (dominant/nondominant) ($p = 0.176$ – 0.321 , $p = 0.06$ – 0.11) values as same reported in dynamic balance in the anterior, posterolateral, and posteromedial in the dominant ($p = 0.271$ – 0.348 ; $\eta^2 = 0.04$ – 0.05) and nondominant limb ($p = 0.114$ – 0.686 ; $\eta^2 = 0.01$ – 0.07) **Conclusion:** Time-of-day affected isometric knee flexion strength values in the dominant limb; however, no diurnal variations were showed in range-of-motion and dynamic balance in soccer referees.

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Poster Presentation

BREAKING DOWN THE RISK OF FALLS IN THE ELDERLY: FALLSKIP

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Introduction: Balance and gait are the major predisposing factors for falls in older adults and safe, and effective gait is a clear indicator and predictor of quality of life and life expectancy 1. There are several classifications of gait components: gait pattern and dynamic balance control and rhythm, speed, and variability 3. Therefore, it is necessary to intervene on it from different components of exercise. The aim of this study is to analyze the different components of gait and the risk of falls in older adults using FallSkip technology and monitor their evolution after the intervention. **Methods:** Sixty-seven adults older than 72 years were assessed using the FallSkip device to determine the risk of falls. 41 participated in a multicomponent exercise programme for 9 months, 2 days per week, whereas 26 participated as the control group. The intervention group went from a center of gravity swing of 40.06 mm² (ED 26) to 37.6 mm² (ED 21.04) $p = 0.015$, whereas the control group increased from 41.38 mm² (ED 28) to 52.51 mm² (ED 26.5) $p = 0.0047$. The center of gravity swing during walking of the intervention group increased from 76.2 mm² (SD 18.36) to 74.69 mm² (SD 19.12) and the control group increased from 77.40 mm² (SD 19.91) to 82.31 mm² (SD 17.36) $p = 0.016$. The intervention group increased from 225.5 W (ED 40.4) to 256.8 W (ED 46.6) $p = 0.0075$ of power when lifting. The control group reduced it from 225.1 W (ED 41.8) to 221.2 W (ED 39.2) $p = 0.0280$. The total test time was reduced by the intervention group from 18.68 seconds (ED 2.09) to 18 seconds (ED 2.2) and the control group from 18.89 seconds (ED 2.04) to 19.79 seconds (ED 2.1). **Results:** The results of this study show that after 9 months, the control group lost stability in both standing and walking. However, the intervention group was able to maintain and improve gait parameters.

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Poster Presentation

EXERCISE IN CARDIAC REHABILITATION

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Introduction: Cardiac rehabilitation, based on strength and resistance training, has proven to reduce all-cause mortality and the likelihood of rehospitalization in people who have suffered a myocardial infarction (AMI) or chronic heart failure (CHF). The intensity at which these workouts should be performed is highly controversial and clinical practice guidelines recommend using relatively low loads (40–60% 1RM) (1). However, new evidence suggests that training above this intensity is safe and achieves equal or greater benefits than training at low loads (2). Therefore, this review aimed to evaluate the effectiveness of strength training at different intensities in improving functional parameters in patients after AMI or CHF. **Methods:** A review of the current evidence on cardiac rehabilitation and strength training was conducted using the terms “resistance training,” “strength training” and “heart failure,” and “myocardial infarction” in the PubMed, Clinical Key, and Web of Science databases. We included articles published from 2000 onwards that had at least a 5 on the PEDro scale, which included strength training within cardiac rehabilitation and that were published in English or Spanish. **Results:** Twelve articles were included for data extraction. Five studies assessed strength through 1RM, showing significant improvements in all of them (100%). Eight studies assessed $\dot{V}O_2\text{max}$, showing significant improvements in 4 of them (100%), and time to exhaustion, showing significant improvements in 6 of them (50%). Six articles evaluated the 6-minute walking test showing significant improvements in all of them (100%). Improvements in the quality of life were observed in 4 articles taken with different types of measurements. **Discussion:** RT seems to significantly improve the strength, cardiorespiratory fitness, functional capacity, and quality of life of people with AMI and CHF as well as their quality of life. RT does not seem to be harmful to the central cardiac system, although there are too few data to make a strong statement about its safety in all types of patients.

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Poster Presentation

TRAINING PRESCRIPTION IN TYPE 2 DIABETES: A CASE STUDY

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Introduction: Diabetes is a chronic noncommunicable disease characterized by high blood glucose levels. Specifically, type 2 diabetes (T2DM) is increasingly prevalent and is responsible for more than 90% of diabetes cases today. Strength training is one of the available interventions which has been shown to be adequate to improve the health and quality of life of patients with T2DM (1). Therefore, the present work tried to verify the effect of strength training in an older adult with T2DM. **Methods:** A 69-year-old man underwent resistance training program (3 days · wk⁻¹, on alternate days) for 10 weeks (2 familiarization + 8 progressive training) at his home. The subject completed between 6–8 exercises per session and 1–3 sets each. The intensity was prescribed according to the relationship between the number of repetitions performed and the number of possible repetitions for each set. According to this, the subject never completed more than half of the possible repetitions per set. Parameters related to glucose control (HbA1c and fasting blood glucose), as well as handgrip and lower limb strength and functional capacity with the 5 times-sit-to-stand test, were analyzed both before and after the training intervention. A pre-post comparison of the variables studied was performed. **Results:** HbA1c decreased from 7.6% to 7.1% after the training protocol. Also, a downward trend in fasting blood glucose was observed. The functional capacity measured through the 5 times sit-to-stand test (5 STS) improved by 30.33%, as well as the strength measured through dynamometry and the movement speed of a submaximal load. **Conclusions:** The results obtained extend the evidence that supports the positive effect of resistance training in the treatment of T2DM. The program allowed to reduce HbA1c and glycemia levels and improve strength and functional capacity in a 69-year-old subject.

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Poster Presentation

IMPACT OF COVID-19 CONFINEMENT ON STRENGTH, FITNESS, AND LUNG FUNCTION IN CHILDREN WITH CYSTIC FIBROSIS

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Introduction: Cystic fibrosis (CF) is a genetic-multisystemic condition that causes progressive chronic lung disease and multiple associated comorbidities. From 2009 to 2010, the influenza pandemic (H1N1) resulted in very high mortality among CF patients (1); this fact conditioned the 2020 pandemic (SARS-CoV-2) to be classified as a highly vulnerable population recommending longer isolation time than the rest of the people, reporting a reduction in hospital admissions and an improvement in lung function in CF (2,3). However, COVID-19 confinement also implied decrease in physical activity (PA) levels (4). Therefore, it is interesting to analyze confinement's impact on lung function and physical fitness in a group of children with CF. **Methods:** Observational study of a cohort of 10 children with CF evaluated at the Hospital Infantil Universitario Niño Jesús at 3 time points: T1 before the start of confinement (January 2020), T2 at the end of confinement (July 2020), and T3 6 months after the end of confinement (December 2020). The variables analyzed at all times were forced expiratory volume in 1 second (FEV1), peak oxygen consumption ($\dot{V}O_{2peak}$), and relative body mass upper-limb strength. **Results:** At T1, the mean age was 11.9 ± 2.68 years, FEV1

z-score -1.70 ± 1.48 , $\dot{V}O_{2peak}$ 41.7 ± 7.86 ml·kg⁻¹·min⁻¹, and FrMS 0.47 ± 0.17 kg·kg⁻¹·weight. FEV1 z score significantly improved ($p = 0.003$) between T1–T2 reaching -1.02 ± 1.45 and remained significantly unchanged between T2–T3. On the other hand, relative body mass upper-limb strength not have significant changes between T1–T2 but did between T2–T3 with an increase from 0.45 ± 0.16 kg·kg⁻¹·weight to 0.50 ± 0.12 kg·kg⁻¹·weight, $p = 0.013$. Finally, $\dot{V}O_{2peak}$ showed a nonsignificant downward trend between T1–T2 but was clinically relevant. **Discussion and conclusion:** Our results highlight the period in which patients were in isolation significantly improved pulmonary function, which was associated with a lower risk of infections, coinciding with Meystre 2005 and Fusco 2014, which prove that the reduction of hospital admissions is associated with an improvement of pulmonary function (2,3). However, confinement led to a decrease in PA levels (4) which could affect the reduction in $\dot{V}O_{2peak}$ and the decrease in relative body mass upper-limb strength. It is noteworthy that at T3 after resuming regular activities, a significant increase in strength was observed along with a smaller decline in $\dot{V}O_{2peak}$, highlighting muscle strength as a variable of interest to achieve maintenance in cardiorespiratory fitness which is, by itself, a prognostic variable in CF (5).

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Poster Presentation

MONITORING MODIFIABLE INJURY RISK FACTORS OVER AN IN-SEASON MESOCYCLE IN SEMI-PROFESSIONAL FEMALE FIELD HOCKEY PLAYERS

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Introduction: This study aimed to determine the fluctuations of modifiable injury risk factors and fatigue parameters during a mesocycle in semiprofessional female field hockey players.

Methods: Fourteen players (age: 22.6 ± 4.9 years) participated in the study over 4 months of the competitive season. The players were tested each month for their maximal isometric knee flexion, hip adduction, and abduction muscle strength; passive straight leg raise and ankle dorsiflexion range of motion (ROM); countermovement jump height; and perceptual fatigue. **Results:** Statistical differences were reported in isometric knee flexion strength in the dominant and nondominant limb ($p < 0.001, \eta_p^2 = 0.629, 0.786$, respectively), nondominant isometric hip abductors strength ($p = 0.016, \eta_p^2 = 0.266$), and isometric hip adductors strength in dominant and nondominant limbs ($p < 0.001, \eta_p^2 = 0.441-546$). In addition, significant differences were reported in the

straight leg raise test ($p < 0.001, \eta_p^2 = 0-523, 0.556$) and ankle dorsiflexion ($p = 0.001, \eta_p^2 = 0.376, 0.377$) for the dominant and nondominant limb, respectively. Finally, the jump height measured showed significant differences ($p < 0.001, \eta_p^2 = 0.490$), whereas no differences were reported in fatigue parameters ($p = 0.089-0.459$). **Discussion:** Fluctuations in maximal isometric muscle strength, ROM values, and vertical jumping capacity are reported during a competitive season which can be used to target recovery strategies to make them more efficient.

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