

### A SHORT DURATION STRENGTH TRAINING INTERVENTION IMPROVES FRAILITY AND FUNCTIONALITY IN OLD WOMEN

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**Introduction:** Frailty in older adults entails a high personal and healthcare cost due to its association with dependency, hospitalization, and mortality (1,3). Skeletal muscle is a fundamental pillar for maintaining physical function and autonomy (1–3). We aimed to implement a short-duration strength training program to improve functional parameters and delay frailty in community dwelling old individuals. **Methods:** This study involved 15 adult female patients over 65 years of age ( $72.8 \pm 4.3$  years). The training program lasted 6 weeks (twice a week) and included 2 lower limb exercises (leg press and knee extension). The Committee on Ethics in Research from INCLIVA granted ethical approval. A battery of baseline ( $n = 15$ ) and post-intervention ( $n = 6$ ) assessments was performed, including body composition (bioimpedance, ultrasound, DEXA), muscle strength, local muscular endurance, and functionality (frailty, FallSkip, 6-minute walk test). Statistical analysis was conducted using a paired  $t$  test to compare means before and after the intervention. **Results:** Our intervention improved lean mass measured by multifrequency bioimpedance ( $19.7 \pm 2.1$  baseline vs.  $20.3 \pm 2$  kg, post-intervention,  $p = 0.033$ ), 2/3 of the quadriceps ecography ( $1.64 \pm 0.2$  vs.  $2.1 \pm 0.3$  cm,  $p = 0.022$ ), leg press strength ( $163.4 \pm 72.5$  vs.  $270.4 \pm 122.3\%$  relative to body weight,  $p = 0.04$ ), and knee extension strength ( $49.8 \pm 15.4$  vs.  $73.1 \pm 22\%$  relative to body weight,  $p = 0.02$ ). Among the patients who completed the intervention ( $n = 6$ ), highlights the following: according to the self-reported FRAIL questionnaire, 2 of the 3 pre-frail patients improved to a robust state. According to Linda Fried's frailty phenotype, 2 out of 2 frail individuals improved to a pre-frail state, and one out of one pre-frail individual improved to a robust condition. According to the SPPB test, one of 3 pre-frail individuals improved to a robust state. From the FallSkip test, the only patient with a high risk of falls, reverted to a moderate risk condition. **Practical Applications:** We believe that this study and its continuation are essential for further strengthening the foundations of exercise as a specific and effective tool in the fight against frailty and physical depen-

dency in women, with or without comorbidities. **Acknowledgments:** This work was supported by the following grants: Instituto de Salud Carlos III CB16/10/00435 (CIBERFES); PID2022-142470OB-I00; PROMETEO (CIPROM/2022/56)-“Conselleria de Educació, Universidades, y Empleo de la Generalitat Valenciana”; Red EXERNET-RED DE EJERCICIO FISICO Y SALUD (RED2022-134800-T) Agencia Estatal de Investigacion (Ministerio de Ciencias e Innovación).

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### A STRENGTH TRAINING MODEL DELAYS FRAILITY IN AGED MICE

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**Introduction:** Frailty is a geriatric syndrome that increases vulnerability to stressors and affects multiple physiological systems, including skeletal muscle (1). Resistance training has been shown to reverse muscle mass loss and reduce mortality and cardiovascular disease risk in humans (2). While most studies involving exercise focus on low-intensity, high-volume aerobic training, this study introduces a new strength training protocol for older mice, emphasizing low-volume and high-intensity (3). The aim of this study was to design an individualized strength training protocol adapted to old mice to prevent or delay the onset of frailty. **Methods:** This experimental study involved male C57BL/6 mice ( $n = 7$ , age:  $20.25 \pm 0.14$  months) undergoing a strength training program for 6 weeks, with sessions held twice a week. The training involved climbing a 180 cm-long, 80° inclined ladder with weights attached to their tails. Mice started with 4 sets in the first week and

progressed to 9 sets by the last week, with a 5-minute rest between sets. The initial lifting weight was tailored to each mouse and increased based on performance. Functional tests assessing motor coordination, grip strength, maximum oxygen consumption, endurance, inverted strength, and ladder performance were conducted before and after the program. The first 3 tests, along with body weight loss, contributed to the Valencia Score (4). **Results:** There was an improvement in motor coordination ( $1.07 \pm 0.54$  vs.  $1.93 \pm 0.77$  minutes) and ladder performance, starting by lifting an average of  $110.17 \pm 23.99\%$  of their body weight and finished lifting an average of  $229.34 \pm 24.10\%$ . No significant differences were observed in the other tests. Regarding Valencia Score, there was a 34% of frail population in the beginning whereas at the end it was a 28%. **Practical Applications:** After 6 weeks of strength training, motor coordination and strength were improved, delaying frailty in the aged mice. Moreover, an individualized and adapted strength training protocol was successfully validated in this animal model. **Acknowledgements:** Instituto de Salud Carlos III CB16/10/00435 (CIBERFES) and the following grants: PID2022-142470OB-I00 funded by MICIU/AEI/10.13039/501100011033; PROMETEO (CIPROM/2022/56) de "Conselleria de Educaci3n, Universidades, y Empleo de la Generalitat Valenciana"; Red EXERNET-RED DE EJERCICIO FISICO Y SALUD (RED2022-134800-T) Agencia Estatal de Investigaci3n (Ministerio de Ciencias e Innovaci3n).

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## ACUTE EFFECTS OF MECHANICAL PROPERTIES OF THE QUADRICEPS AFTER A HIGH INTENSITY STRENGTH

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**Introduction:** Maintaining an upright body position involves multiple sensory inputs: gravity, body segment interrelations, surface support, and environmental objects (Gurfinkel et al., 2006) (2).

Muscle tone, influenced by non-neural and neural factors, is crucial for postural control (Ganguly et al., 2021) (1). Tools like mechanomyography and elastography now measure muscle tone changes objectively (Roch et al., 2020) (3). This study compares muscle mechanical properties before and after high-intensity exercise bout and examines their recovery over time. **Methods:** Sixteen physically active male volunteers (age  $24.6 \pm 6.37$  years; height  $1.75 \pm 0.05$  m; weight  $70.5 \pm 7.28$  kg and BMI  $23.1 \pm 1.23$   $\text{kg} \cdot \text{m}^{-2}$ ) performed 18 maximal voluntary contractions in 10-second isometry, with 5 seconds of rest between each repetition. Following the 18 contractions, the mechanical properties of the Vastus Medialis, Vastus Lateralis and Rectus Femoris were measured through MyotonPro to evaluate muscle tone, stiffness, elasticity, relaxation time and creep. Within-subjects analysis was evaluated using a linear mixed effects model to evaluate changes in muscle properties over time (significance set at  $p < 0.05$ ). **Results:** In relation to force, there was a significant decrease in the peak maximum force  $479 \pm 99.2$  N vs.  $215 \pm 77.9$  N; ( $p < 0.001$ ) and RFD 150–300 milliseconds  $961 \pm 365$   $\text{N} \cdot \text{s}^{-1}$  vs.  $407 \pm 188$   $\text{N} \cdot \text{s}^{-1}$ ; ( $p = 0.002$ ), without observing significant differences in Impulse and RFD 0–150 ms. Muscle tone, stiffness ( $p < 0.05$ ) and elasticity ( $p < 0.001$ ) increased significantly, whereas relaxation time ( $p < 0.001$ ) and creep ( $p < 0.001$ ) decreased after the protocol, indicating an internal restructuration over time. **Practical Applications:** The acute response showed a decrease in peak maximum force and RFD 150–300 milliseconds and an increase in muscle tone. These findings suggest that a bout of high-intensity strength exercise enhanced the mechanical properties of the quadriceps. Thus, high intensity strength exercise can be beneficial for people who have muscular hypotonicity and detrimental for people who have muscular hypertonicity.

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## ANTHROPOMETRIC AND NEUROMUSCULAR CHARACTERISTICS DIFFER BETWEEN ELITE, SUB-ELITE, AND AMATEUR FEMALE VOLLEYBALL PLAYERS

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**Introduction:** Volleyball is a court-based team sport characterized by high-intensity, short-duration explosive movements like jumps and blocks that are repeatedly executed during offensive and defensive actions in training/matches (1). Furthermore, anthropometric (2) and neuromuscular characteristics (3) play a significant role in determining volleyball performance, with limited evidence available for female volleyball players. The aim of this study was to compare anthropometric and neuromuscular characteristics across different competitive levels (i.e., elite, sub-elite, and amateur) among female volleyball players. **Methods:** Sixty-one female players ( $22.9 \pm 5.4$  years) participating in the First (elite), Second (sub-elite), and Third (amateur) Spanish Volleyball Divisions took part in this study. Subjects underwent anthropometric assessment and a neuromuscular testing battery consisting of standing spike, jumping spike, countermovement jump, squat jump, maximal spike jump, isometric handgrip test, modified agility *t* test, and star excursion balance tests. **Results:** In terms of anthropometric measurements, elite female volleyball players were significantly heavier compared to sub-elite female players ( $p = 0.033$ ;  $\eta_p^2 = 0.11$ ) and taller than sub-elite and amateur female players ( $p < 0.001$ ;  $\eta_p^2 = 0.31$ ). Regarding neuromuscular performance, elite female volleyball players had faster standing and jumping spike velocities than sub-elite and amateur counterparts ( $p = <0.001$ ;  $\eta_p^2 = 0.31$ – $0.36$ ), maximal spike jump (i.e., vertical jump) than amateur ( $p = <0.001$ ;  $\eta_p^2 = 0.31$ ), had greater isometric handgrip strength than sub-elite (both sides) and amateur (only non-dominant side) ( $p = <0.001$ – $0.005$ ,  $\eta_p^2 = 0.17$ – $0.23$ ), while sub-elite had quicker modified agility *t* test performance than amateur ( $p = <0.001$ ,  $\eta_p^2 = 0.21$ ). Finally, referring to dynamic balance significant differences were reported between elite vs. sub-elite and amateur female players in posteromedial and posterolateral values (dominant and non-dominant sides) ( $p = <0.001$ ,  $\eta_p^2 = 0.26$ – $0.31$ ), while differences in anterior values (dominant/non-dominant) were reported in sub-elite comparing amateur female volleyball players ( $p = 0.004$ ,  $\eta_p^2 = 0.15$ – $0.17$ ). **Practical Applications:** Anthropometric measurements and neuromuscular aspects such as hitting velocity and jump height while spiking, handgrip strength, and dynamic balance were key characteristics that distinguished elite players from sub-elite and amateur female volleyball players. **Acknowledgements:** This

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## COULD INDIVIDUALIZED RESISTANCE TRAINING IMPROVE PSYCHOLOGICAL SYMPTOMS IN ANOREXIA NERVOSA?

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**Introduction:** Anorexia nervosa (AN) is a severe eating disorders (ED) with the second highest mortality rate among all mental disorders (1). With a growing prevalence in younger and more diverse populations over the last decade, AN is most common in adolescent females. AN patients often engage in compensatory behaviors (e.g., laxatives, vomiting, excessive exercise) to maintain a low body weight. Despite the negative role of exercise, supervised exercise has shown to be positive. Further, resistance exercise programs (REP) have led to significant physical health and quality of life improvements in AN (2). Nevertheless, no studies have analyzed the impact of REP on AN symptoms. Consequently, the aim of this study was to analyze the effects of an REP on the psychological symptoms of AN patients under day hospital care. **Methods:** Following the Declaration of Helsinki and after giving written consent, a total 16 healthy controls (HC) and 32 patients ( $n = 16$  INT and  $n = 16$  ANC) participated in the study (1 male on each group). Mean age was 21.1 years ( $\pm 4.1$  HC,  $\pm 7.4$  INT; 10.3 ANC). Psychopathological symptoms (ED examination [EDE] questionnaire, Brief symptom inventory [BSI], and exercise dependence scale [EDS]), muscular fitness (handgrip strength [HGS] test and 5 times sit-to-stand test [STS]), and body composition (bioimpedance analysis [BIA], and anthropometry) were assessed. Intervention consisted of 10-week, 3 d·wk<sup>-1</sup>, individualized REP involving major muscle groups, with a target intensity of 6–7 based on the 0–10 OMNI-Resistance Exercise Scale (3). Nonparametric analyses were performed on females'

data. **Results:** At baseline, HC showed significantly different psychological symptoms and physical fitness values compared to AN groups. After the intervention, the INT group showed improvements at EDE subscales (Shape concern [ $p = 0.021$ ], Weight concern [ $p = 0.015$ ]), BSI scores (Anxiety [ $p = 0.025$ ] and global score [ $p = 0.05$ ]), and muscular fitness (STS average time [ $p = 0.047$ ]) compared to ANC. Significant differences between HC and AN groups remained at the end of the program. **Practical Applications:** This is the first study to show that individualized REP has a positive impact on both psychological and physical health in AN. These findings highlight the potential value of individualized REP as complementary tool for AN patients under hospital day care.

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## CROSS-EDUCATION EFFECTS AFTER SUBMAXIMAL AND SUPRAMAXIMAL ACCENTUATED ECCENTRIC LOADING ON MASS AND FUNCTION IN WOMEN

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**Introduction:** Unilateral resistance training affects both the trained and non-trained contralateral limb, known as cross-education effect (CE). Notably, resistance training involving accentuated eccentric loading have been shown to induce greater CE than traditional concentric-eccentric training. However, this effect has predominantly been studied in men, and its presence in women remains unknown. Thus, we investigated the effects of submaximal and supramaximal (i.e., eccentric loads above 100% of the one-repetition maximum [1-RM]) accentuated eccentric training on changes in lean mass and muscle function of trained (TL) and contralateral non-trained (NTL) legs in well-trained women. **Methods:** Thirty physically active female university students were randomly assigned of 2 training groups or a control group ( $n = 10/\text{group}$ ). Subjects in the training groups performed dominant leg isotonic training twice a week for 10 weeks (4 sets of 8 repetitions). Isotonic resistance was generated by an electric-

motor device at 2 different percentages of 1-RM for the eccentric phase; 90% submaximal load, SUB group and 120% (supramaximal load, SUPRA group). Concentric load was the same for both groups (30% of 1-RM). Changes in total thigh lean mass (TTLM), unilateral leg-press 1-RM, local muscle endurance (XRM), muscle power at 40 (P40), 60 (P60) and 80% (P80) of the 1-RM, and countermovement unilateral vertical jump height (CMJ) before and after training were compared between the groups and between TL and NTL. **Results:** NTL 1-RM (11.2 and 14.2%) and P40 (9.6 and 12.7%) increased significantly ( $p < 0.01$ ) in both SUB and SUPRA groups, respectively; without significant differences between groups. In addition, the SUPRA group showed significant ( $p < 0.05$ ) increases in TTLM (1.7%) and P60 (14.8%) in the NTL. With significant correlations between TL and NTL changes for 1-RM, CMJ and TTLM. However, significant differences ( $p < 0.05$ ) between TL and NTL changes were observed for 1-RM (CE: 53.2%) and P40 (CE: 55.1%) in the SUB group, and for TTLM (CE: 18.0%) in the SUPRA group. No changes in any variable were found for the control group. **Practical Applications:** Unilateral accentuated eccentric loading promoted significant changes in strength and mechanical power in the NTL in women. Both submaximal and supramaximal protocols produced similar neuromuscular adaptations in both the TL and NTL, suggesting that strong CE effects were induced by eccentric-overload training. Supramaximal loading significantly increased mechanical power with moderate loads and increased TTLM in both legs (1–3).

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## CURRENT STRENGTH-BASED CARDIOMETABOLIC RISK IN CHILDREN AND ADOLESCENTS FROM ARAGON: 1995–2000 TO 2020–2025

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**Introduction:** Physical fitness has been shown to be a powerful marker of health in childhood and adolescence (1). In particular, low muscle strength may serve as a marker of increased cardio-metabolic risk (CMR) in children and adolescents (2,3). This study aimed to compare the prevalence of children and adolescents at CMR using the cut-off points developed for the handgrip (HG) and standing long jump (SLJ) tests (2,3) in 2 time samples of children and adolescents in Aragon: 1995–2000 and 2020–2025. **Methods:** The sample size was 2,109 subjects in 1995–2000 period (48.93% female), and 607 in 2020–2025 (46.79% female), from different locations in Aragon. The first sample was derived from 2 previous studies conducted (4,5). Both samples performed HG, for upper body strength, and SLJ for lower body strength. The cut-off points for HG (adjusted for body mass) and SLJ developed by Castro-Piñero et al. (2) were used in children (6–10 years) while the cut-off points from the HELENA study (3) were used in adolescents (13–16 years), to identify subjects with elevated CMR. **Results:** In 2020–2025, the proportion of boys (6–10 years) at CMR was reduced compared to 1995–2000 using the SLJ cut-off points ( $OR = 0.39$ ,  $\chi^2 [1] = 10.19$ ,  $p < 0.001$ ). In contrast, the prevalence in male adolescents (13–16 years) at CMR, increased from 20.10%, in 1995–2000, to 29.10%, in 2020–2025, using the HG cut-off points ( $OR = 1.63$ ,  $\chi^2 [1] = 5.76$ ,  $p = 0.016$ ). Furthermore, boys (6–10 years) had higher SLJ values (+10.35%,  $d = 0.56$ ,  $p < 0.001$ ) while girls (6–10 years) demonstrated higher HG and SLJ values (+7.66%,  $d = 0.28$ ,  $p = 0.004$ ; +12.71%,  $d = 0.66$ ,  $p < 0.001$ ; respectively) than their counterparts in 1995–2000. In 2020–2025, male adolescents (13–16 years) also had lower SLJ levels than in 1995–2000 (–4.40%,  $d = -0.22$ ,  $p = 0.032$ ), although the proportion of subjects at CMR as assessed by this test, did not change significantly. **Practical Applications:** The most concerning finding is the significant increase in the prevalence of CMR among male adolescents, with odds rising by 1.63 times to a prevalence of nearly 1 in 3. Political, health and educational institutions must intensify their efforts to promote physical activity, exercise and sport during this crucial period of growth. **Acknowledgements:** Government of Aragon research group B72\_23R. D.D.-V. and S.A.-G. granted by Government of Aragon (CUS/621/2023).

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## DOES VITAMIN D STATUS AND RISK OF MALNUTRITION AFFECT THE IMPROVEMENT OF BODY COMPOSITION AND FITNESS IN OLDER PEOPLE DURING A 6-MONTH MULTICOMPONENT TRAINING?

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**Introduction:** Ageing is associated with the impairment of health and functional capacity driving frailty, while exercise and nutritional interventions seem to be effective for preventing and managing frailty status. Thus, the main aim of our study was to analyse whether physical fitness and body composition respond differently in older people with altered vitamin D and nutritional status during a 6-month multicomponent exercise training (MCT). **Methods:** The sample consisted of 32 old adults (mean age:  $81.8 \pm 6.3$  year old; 23 women) who underwent 6 months of supervised MCT, including strength, endurance, balance, coordination and flexibility exercises, at 3 days a week. Subjects were divided into those who had sufficient serum 25 (OH) D levels ( $\geq 30$  ng·ml<sup>-1</sup>) and were well nourished (Mini Nutritional Assessment [MNA]  $>23.5$  points) (VitD group;  $n = 11$ ), and those who were at risk of malnutrition (MnR) (MNA 17–23.5 points) and had deficient/insufficient 25 (OH) D levels ( $<30$  ng·ml<sup>-1</sup>) (LowVitD + MnR group;  $n = 21$ ). Malnutrition was assessed using the MNA questionnaire and vitamin D levels were measured using fasting blood samples. Physical fitness was measured by the following tests: 2.45 m up-and-go test, the chair stand test, the arm curl test, handgrip strength and the 30-m walk test. Fat-free mass was assessed using a portable bioelectrical impedance analyzer. Three assessments were made: at baseline, after 3 months of training and at the end of the MCT (6 months). **Results:** Both groups showed significant differences over time in the 2.45 m up-and-go test, the chair stand test, the arm curl test, and the 30-m walk test ( $p < 0.05$ ;  $r$  ranged from 0.37 to 0.62).

In addition, only VitD group showed a significant increase in fat-free mass (kg) from baseline 40.5(37.3–59.5) to the end of MCT 43.7(39.4–63.6) ( $P < 0.05$ ;  $r$  was 0.57). There were no significant differences between groups in any of the variable studied ( $p > 0.05$ ;  $r$  ranged from 0.01 to 0.27). **Practical Applications:** These results are consistent with the study performed by Bell et al. (1), in which subjects who trained and took micronutrient and macronutrient supplements showed greater improvements in body composition assessments. In Conclusions/Practical Applications, being well nourished and having adequate levels of serum 25 (OH) D could help to achieve greater improvements in body composition with MCT training. **Acknowledgements:** This study was funded by the “Ministerio de Economía, Industria y Competitividad” (DEP2016-78309-R) and “Centro Universitario de la Defensa de Zaragoza” (UZCUD2017-BIO-01), Biomedical Research Networking Center on Frailty and Healthy Aging (CIBERFES) and FEDER funds from the European Union (CB16/10/00477).

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## EFFECTS OF BARIATRIC SURGERY AND WHOLE-BODY VIBRATION ON CARDIORESPIRATORY FITNESS: PRELIMINARY RESULTS OF THE CIR-BAR STUDY

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**Introduction:** Cardiorespiratory fitness is regarded as a key indicator of overall health, given its predictive value in terms of both morbidity and mortality. Reducing body weight in people with severe obesity through bariatric surgery could lead to an improvement in peak oxygen uptake ( $\dot{V}O_2$  peak). The aims of the present study were: (a) To determine the effects of bariatric surgery and a whole-body vibration (WBV) intervention on  $\dot{V}O_2$ peak, and (b) To ascertain whether similar outcomes are observed when  $\dot{V}O_2$  peak values are expressed in absolute terms, relative to body mass and relative to lean tissue mass (LM). **Methods:** A total of 14 subjects (6 males) underwent

post-sleeve gastrectomy surgery. They were randomly assigned to complete 3 WBV training sessions per week for 16 weeks or continue with regular treatment (CG). All subjects were required to complete 3 assessments at our laboratory: one week before the surgery (pre-surgery), 7 weeks post-surgery (post-surgery) and 42 weeks post-surgery (post-WBV).  $\dot{V}O_2$ peak was assessed with the Adapted Bruce Protocol on a treadmill. LM was obtained from a Dual energy X-ray whole body scan. Repeated measures ANOVA were performed to evaluate the effects of the surgery and the exercise intervention. **Results:** Subjects presented an initial BMI of  $47.5 \pm 4.98 \text{ kg}\cdot\text{m}^{-2}$  and were  $39.2 \pm 10.39$  years. No significant differences were found between groups for baseline values ( $20.5 \pm 2.12 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$  WBV vs.  $22.6 \pm 2.99 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$  CG). No changes were found from pre- to post-surgery when  $\dot{V}O_2$ peak values were expressed relative to body mass ( $0.917 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$  WBV and  $0.525 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$  CG) or LM ( $0.038 \text{ ml}\cdot\text{kgLM}^{-1}\cdot\text{min}^{-1}$  WBV and  $0.117 \text{ ml}\cdot\text{kg LM}^{-1}\cdot\text{min}^{-1}$  CG). Nonetheless, significant decreases were found when  $\dot{V}O_2$ peak values were expressed as absolute values ( $-253.7 \text{ ml}\cdot\text{min}^{-1}$  WBV and  $-331.7 \text{ ml}\cdot\text{min}^{-1}$  CG; both  $p < 0.05$ ). When assessing changes from post-surgery to post-WBV significant improvements were found in both groups ( $5.878 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$  WBV and  $4.033 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$  CG; both  $p < 0.05$ ) when values were expressed in regards to body weight. Nevertheless, these improvements were only maintained in the intervention group when results were expressed as absolute values ( $178.1 \text{ ml}\cdot\text{min}^{-1}$  WBV  $p = 0.05$  vs.  $-106.2 \text{ ml}\cdot\text{min}^{-1}$  CG  $p = 0.304$ ) or in regards to LM ( $4.375 \text{ ml}\cdot\text{kg LM}^{-1}\cdot\text{min}^{-1}$  WBV  $p < 0.05$  vs.  $2.428 \text{ ml}\cdot\text{kg LM}^{-1}\cdot\text{min}^{-1}$  CG  $p = 0.116$ ). Group by time interactions were only found for absolute values. **Practical Applications:** A 16-week WBV training program seems to be effective in improving  $\dot{V}O_2$ peak in patients that undergo bariatric surgery. However, caution should be exercised when expressing  $\dot{V}O_2$ peak in studies involving patients who have experienced significant weight loss, as the selection of different methods to represent  $\dot{V}O_2$ peak could yield different results.

## IMPACT OF HANDGRIP STRENGTH ASYMMETRY AND WEAKNESS ON DISABILITY AND QUALITY OF LIFE IN SENIORS

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**Introduction:** Handgrip strength (HGS) is a key physical strength indicator linked to age-related health issues like functional disability and reduced health-related quality of life (HRQoL). Asymmetric limb strength is associated with reduced functionality, so both HGS asymmetry and weakness may contribute to disability. However, knowledge of their combined impact on functional disability and HRQoL in older Spanish adults is limited. This study examined the individual and combined associations of HGS asymmetry and weakness with functional disability and HRQoL among independently living older adults. **Methods:** 1,636 subjects ( $\geq 65$  years; 24% men) from the EXERNET study cohort were analyzed. Weakness was defined as HGS  $< 27$  kg for men and  $< 16$  kg for women (1). HGS symmetry was an HGS ratio of 0.9–1.1, with asymmetry outside that range (2). HRQoL was assessed using the EuroQoL-5 Dimension (3), with all dimensions collapsed into a health functional index via time-trade-off values (TTO). Functional capacity included balance, strength, agility, walking speed, and endurance. Functional limitations were defined as performance below the 20th percentile based on Spanish reference values (4). Logistic regression models assessed associations between HGS, functional disability, and HRQoL. **Results:** Compared to those with symmetric HGS and no weakness, individuals with both weakness and HGS asymmetry showed significantly impaired HRQoL in most dimensions, except anxiety/depression, including TTO values (odds ratio [OR] = 2.92; 95% confidence interval [CI] = 1.48–5.74). This group also had a higher risk for functional limitations across all capacities assessed (balance: OR = 2.21; leg strength: OR = 4.85; arm strength: OR = 10.48; agility: OR = 12.12; walking speed: OR = 5.26; endurance: OR = 2.62). However, those with only asymmetry or weakness showed increased functional disability only in some capacities (asymmetry: balance, arm strength, agility; weakness: arm strength). **Practical Applications:** Our study's findings suggest that HGS asymmetry and weakness can be early indicators of functional disability and impaired HRQoL. This insight opens the door for early interventions, offering hope for improved quality of life for older adults. **Acknowledgements:** IMSERSO (Grant Nos. 104/07 and 147/11). Ministerio de Economía y Competitividad, Government of Spain (DEP2016-78309-R). EXERNET-RED, red de Ejercicio Físico y Salud (RED2022-134800-T), Agencia Estatal de Investigación (Ministerio de Ciencias e Innovación). Red de Ejercicio Físico y Salud EXERNET (EXP 99828), Redes de Investigación en Ciencias del Deporte,

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## IMPACT OF LOW RELATIVE SIT-TO-STAND POWER ON FALLS, FRACTURES, HOSPITALIZATIONS AND MORTALITY IN OLDER ADULTS

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**Introduction:** Muscle power has recently been suggested as a biomarker of healthy aging (1). It is closely associated with physical function, frailty, and independence in activities of daily living (2), and can be easily and affordably assessed through the sit-to-stand test (STS) using the Alcazar equation (3). However, the relationship between STS power and other adverse events remains unclear. Therefore, the aim of this study was to evaluate the impact of low relative STS power on falls, fractures, hospitalizations, and all-cause mortality in older adults. **Methods:** A total of 1,662 subjects (732 men and 930 women; mean age =  $75.4 \pm 6.1$  years) from the Toledo Study for Healthy Aging were included. Relative STS power was assessed using the 30-second STS test (4) and defined as low if  $< 2.53 \text{ W} \cdot \text{kg}^{-1}$  in men and  $< 2.01 \text{ W} \cdot \text{kg}^{-1}$  in women. The number of falls and fractures in the previous year were recorded, while hospitalizations and all-cause mortality were recorded after  $9.7 \pm 3.5$  years and  $6.8 \pm 3.1$  years of follow-up, respectively. Binary logistic regression analyses and Cox proportional hazard regression models adjusted by age, educational level and comorbidities were performed. **Results:** There was a significant association between low relative STS power and falls (OR [95% CI] = 1.73 [1.08–2.75];  $p = 0.022$ ) and all-

types of fractures (OR [95% CI] = 1.86 [1.21–2.84];  $p = 0.004$ ) in men. In women there was a significant association between low relative STS power and hip fractures (OR [95% CI] = 3.25 [1.07–9.86];  $p = 0.012$ ) but not with falls (OR [95% CI] = 1.38 [0.98–1.95];  $p = 0.065$ ). An increased risk of hospitalization was found in older women with low relative STS power (HR [95% CI] = 1.29 [1.06–1.58];  $p = 0.012$ ) but not in older men with low relative STS power (HR [95% CI] = 1.14 [0.93–1.39];  $p = 0.209$ ). Low relative STS power increased all-cause mortality in both older women (HR [95% CI] = 2.04 [1.51–2.74];  $p < 0.001$ ) and men (HR [95% CI] = 1.57 [1.26–1.97];  $p < 0.001$ ). **Practical Applications:** Low relative STS power was associated with an increased likelihood of falls and fractures in men, and specifically to hip fractures in older women. Both men and women with low STS power showed a higher risk of all-cause mortality, while only women experienced a higher risk of hospitalization.

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## IMPACT OF RAPID WEIGHT LOSS ON BODY COMPOSITION AND PHYSICAL FUNCTION AFTER BARIATRIC SURGERY

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**Introduction:** Weight loss (WL) induced by bariatric surgery (BS) affects both fat mass (FM) and fat-free mass (FFM) (1), leading to unintended muscle loss, which could impact muscle strength and physical function (PF) (2). Scientific evidence strongly links resting metabolic rate (RMR) to FFM (3), suggesting that a decrease in FFM after BS could further slowdown RMR, potentially hindering WL and increasing the risk of weight

regain (4). While there is a broad agreement that BS improves clinical outcomes (1), its effects on muscle strength and PF remain controversial. This study aims to; (a) describe the short-term effects of BS on body composition, PF and RMR, and (b) to evaluate the association between changes in PF, lean tissue mass (LTM) and RMR. **Methods:** The presented data is part of an ongoing RCT (5). Nineteen subjects (11 women) completed 2 assessments (one week pre- and 7 weeks post-sleeve gastrectomy surgery). Body composition (DXA), RMR (indirect calorimetry) and PF (5 times sit-to-stand [STS], gait speed 6 m, hand grip and timed up and go test) were assessed in each assessment. Absolute changes and percentages were calculated. Paired *t*-tests were performed to assess the changes and Pearson correlations were used to evaluate the associations between them. **Results:** Subjects presented an initial BMI of  $46.57 \pm 4.57$  and  $40.11 \pm 9.32$  years. Seven weeks post-BS significant reductions were observed in body weight, adipose tissue (AT), LTM and RMR (all  $p < 0.001$ ). The change in RMR was strongly correlated with WL ( $R^2 = 0.582$ ;  $p = 0.009$ ), while a tendency between LTM and RMR changes ( $R^2 = 0.440$ ;  $p = 0.059$ ) was found. PF improved, measured with the STS improve significantly ( $p = 0.002$ ). No associations were found between changes in PF and changes in RMR or LTM (all  $p > 0.05$ ). **Practical Applications:** Bariatric surgery led to significant reductions in AT, LTM, and RMR. WL was strongly correlated with changes in RMR. Additionally, early improvements in PF, as shown by the STS test, highlight the functional benefits of surgery. **Acknowledgements:** S.A.G. have received a PhD grant from “Gobierno de Aragón” (CUS/621/2023). The present project has received funding from the CIBER Physiopathology of Obesity and Nutrition and CIBER of Hepatic and Digestive Diseases.

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## IMPACT OF THE FLIPPED CLASSROOM MODEL ON ACADEMIC PERFORMANCE AND MOTIVATION IN THE PRACTICAL CONTENT OF THE SUBJECT “MUSCULACIÓN, MÉTODOS DE ENTRENAMIENTO EN SALA DE PESAS”

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**Introduction:** The Flipped Classroom (FC) model focuses on pre-class tasks and guided discussions during in-person sessions. Its implementation has been shown to enhance autonomy, critical thinking, and digital skills, as well as foster collaborative work, contingent on student and teacher engagement (1). By allowing students to acquire foundational knowledge beforehand, this approach optimizes classroom time for problem-solving (2). Previous applications of this methodology in subjects such as Biomechanics have improved academic performance compared to traditional methods by strengthening learning dimensions (knowing, understanding, applying, and analyzing) (3). The aim of this study was to analyze the impact of the FC method compared to traditional approaches in practical topics related to the subject “Musculación, Métodos de Entrenamiento en Sala de Pesas” and its effect on students’ academic performance and motivation. **Methods:** The FC model was implemented during the 2nd semester (2S) of the 2023–2024 academic year of the Physical Activity and Sport Sciences Degree of the Universidad Politécnica de Madrid (UPM), where videos were created for the most complex practical lessons, to be watched prior to in-class activities. This model was compared with the traditional teaching method used in the 1st semester (1S). A total of 58 students (18% females;  $22.5 \pm 1.8$  years) participated in the project (G1 = 31 for 1S and G2 = 27 for 2S). Academic performance in practical content was assessed through the same exam in both semesters, while motivation was measured in G2 students using an ad hoc questionnaire administered at the end of the intervention. **Results:** Academic performance was similar in both groups (G1:  $7.9 \pm 1.3$ ; G2:  $8.1 \pm 1.5$  points,  $p = 0.245$ ). Regarding the interest in the approach, 92.3% of students found it interesting or very interesting, 61.5% felt it significantly or very significantly improved their learning, and 66.7% believed they learned faster and more actively compared to traditional methods. Additionally, 84.6% of students felt that this methodology adapted to their learning pace, expressing a stronger affinity for the FC model. Moreover, 61.5%

reported feeling motivated or very motivated with this type of methodology. **Practical Applications:** The results suggest that the FC model can foster high levels of motivation and interest among UPM students while maintaining similar academic performance to traditional methods. This teaching approach may serve as an effective alternative in practical university subjects like “Musculación, Métodos de Entrenamiento en Sala de Pesas,” providing students with an engaging and adaptable learning experience without compromising their academic outcomes. **Acknowledgements:** Proyecto de Innovación Educativa 2023-24 UPM (IE24.1103).

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## IMPROVEMENTS IN OXYGEN CONSUMPTION AT VENTILATORY THRESHOLDS ARE LIMITED BY ITS PROXIMITY TO $\dot{V}O_{2\max}$

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**Introduction:** It is traditionally assumed that in order to conduct high-intensity sessions, it is necessary to develop an “aerobic base” (1). However, this statement does not appear to be supported by scientific evidence. In fact, the best approach to obtain the maximum development of the oxygen consumption at the ventilatory thresholds 1 ( $\dot{V}O_{2VT1}$ ) and 2 ( $\dot{V}O_{2VT2}$ ), and maximum oxygen uptake ( $\dot{V}O_{2\max}$ ) remain poorly understood. The purpose was to determine whether the threshold position ( $\dot{V}O_{2VT1}$  and  $\dot{V}O_{2VT2}$  relative to  $\dot{V}O_{2\max}$  [% $\dot{V}O_{2\max}VT1$  and % $\dot{V}O_{2\max}VT2$ , respectively]) before training was associated with the improvement with training in  $\dot{V}O_{2VT1}$  and  $\dot{V}O_{2VT2}$  ( $\Delta\dot{V}O_{2VT1}$  and  $\Delta\dot{V}O_{2VT2}$ ). Additionally, to determine whether  $\dot{V}O_{2VT1}$  and  $\dot{V}O_{2VT2}$  before training was associated with the improvement with training in  $\dot{V}O_{2VT1}$  and  $\dot{V}O_{2VT2}$  ( $\Delta\dot{V}O_{2VT1}$  and  $\Delta\dot{V}O_{2VT2}$ ). **Methods:** Fourteen males ( $20 \pm 1.9$  years;  $68.6 \pm 1.9$  kg;  $70.9 \pm 5.5$  ml·kg<sup>-1</sup>·min<sup>-1</sup>) performed an incremental test before and after the first 3-month mesocycle

of the season. The test started with 1 minute at rest, followed by 3 minutes warm up at 50 W. Consequently, the load increased 5 W every 12 seconds until task failure. Expired gases were measured using a gas exchange analyser (Jaeger Oxycon Pro, Germany). VT1 and VT2 were determined as previously described (2). The following variables were measured:  $\dot{V}_{O_2}VT1$ ,  $\dot{V}_{O_2}VT2$ ,  $\dot{V}_{O_2}max$ ,  $\% \dot{V}_{O_2}maxVT1$  and  $\% \dot{V}_{O_2}maxVT2$ . The difference in  $\dot{V}_{O_2}VT1$ ,  $\dot{V}_{O_2}VT2$ ,  $\% \dot{V}_{O_2}maxVT1$  and  $\% \dot{V}_{O_2}maxVT2$  before and after the training program ( $\Delta \dot{V}_{O_2}VT1$ ,  $\Delta \dot{V}_{O_2}VT2$ ,  $\Delta \% \dot{V}_{O_2}maxVT1$  and  $\Delta \% \dot{V}_{O_2}maxVT2$ , respectively) was calculated. **Results:**  $\Delta \dot{V}_{O_2}VT1$  was inversely correlated with  $\% \dot{V}_{O_2}maxVT1$  before training ( $r = 0.584$ ;  $p = 0.028$ ) and  $\Delta \dot{V}_{O_2}VT2$  with  $\% \dot{V}_{O_2}maxVT2$  before training ( $r = 0.54$ ;  $p = 0.046$ ). In contrast,  $\Delta \dot{V}_{O_2}VT1$  was not correlated with  $\dot{V}_{O_2}VT1$  before training ( $r = -0.497$ ;  $p = 0.071$ ) nor  $\Delta \dot{V}_{O_2}VT2$  with  $\dot{V}_{O_2}VT2$  before training ( $r = -0.091$ ;  $p = 0.758$ ). **Practical Applications:** The key finding is the inverse relationship between  $\% \dot{V}_{O_2}maxVT1$  and  $\% \dot{V}_{O_2}maxVT2$  before training with the improvements with training in  $\dot{V}_{O_2}VT1$  and  $\dot{V}_{O_2}VT2$ , respectively. That is, those individuals with a lower threshold position before training, suffered a greater improvement with training in oxygen uptake at thresholds, regardless  $\dot{V}_{O_2}VT1$  and  $\dot{V}_{O_2}VT2$  before training. It seems that  $\dot{V}_{O_2}max$  limits the improvements in  $\dot{V}_{O_2}VT1$  and  $\dot{V}_{O_2}VT2$  in those individuals with a higher  $\% \dot{V}_{O_2}maxVT1$  and  $\% \dot{V}_{O_2}maxVT2$  before training (ceiling effect of  $\dot{V}_{O_2}max$  on  $\dot{V}_{O_2}VT1$  and  $\dot{V}_{O_2}VT2$ ). As a practical application, we can say that the threshold with a lower position (i.e., lower  $\% \dot{V}_{O_2}maxVT1$  or  $\% \dot{V}_{O_2}maxVT2$ ) should be prioritized, independently of the oxygen consumption at thresholds ( $\dot{V}_{O_2}VT1$  or  $\dot{V}_{O_2}VT2$ ).

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## INTENSITY AND INTRA-SET FATIGUE COULD BE IDENTICALLY PROGRAMMED IN BOTH HEMISPHERES OF BREAST CANCER SURVIVORS

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**Introduction:** Unilateral resistance training is an effective method to maximize strength and muscle mass in breast cancer (BC) survivors (1,2). However, it is unknown whether the surgery and adjuvant therapy associated with this disease could influence the stimulus individually received by the operated and non-operated hemispheres. Knowing this information would be key to determining whether the intensity and intra-set fatigue should be differently programmed for each hemisphere. On this matter, we elaborated a within-subject design using the unilateral bench press (UBP) to examine the effect of BC surgery and adjuvant therapy on (a) the load-velocity relationship of this exercise and (b) the intra-set fatigue incurred when performing a set of repetitions. **Methods:** Twelve women BC survivors (age =  $51.2 \pm 10$  years) completed 2 loading tests up to the one-repetition maximum in the UBP (one with each hemisphere) using a lightweight carbon bar (3). The general (including all the women) and individual (for each woman) load-velocity relationship was studied using second-order polynomials. The velocity attained at each intensity ( $\%1RM$ ) was analyzed and compared between hemispheres (repeated-measures *t* test). The UBP load-velocity relationship of each hemisphere was also used to program 2 sets of repetition against 60 and 80% 1RM (randomized order) until reaching 40% velocity loss (VL). The association between the repetitions completed and VL reached was examined using 5% thresholds (i.e., 10–15% VL, etc.) and compared between hemispheres (repeated-measures *t* test). **Results:** Regressions showed very close general load-velocity relationships for the operated ( $R^2 = 0.946$ ) and non-operated ( $R^2 = 0.950$ ) hemispheres. These adjustments were even stronger for individual relationships ( $R^2 \geq 0.984$  for both hemispheres). Between-hemisphere differences in velocity attained to each  $\%1RM$  were small ( $\leq 0.01 \text{ m} \cdot \text{s}^{-1}$ ) and not significant ( $p \geq 0.553$ ). Between-hemisphere differences in the repetitions completed at each VL threshold were  $<1$  repetition (VL thresholds  $\leq 30\%$ ,  $p \geq 0.351$ ),  $\sim 2$  repetitions at 35% VL ( $p = 0.133$ ), and  $\sim 3$  repetitions at 40% VL ( $p = 0.072$ ). **Practical Applications:** Practitioners working with BC survivors could use the same velocity as a reference to prescribe the intensity in the UBP for the operated and non-operated hemispheres. Similarly, they could program the same number of repetitions to be completed in both hemispheres to generate a similar fatigue level, especially when planning VL  $\leq 30$ .

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## PREFERENTIAL LEARNING STYLES AMONG STUDENTS OF THE BACHELOR IN PHYSICAL ACTIVITY AND SPORT SCIENCES AI-A PROJECT

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**Introduction:** During the teaching-learning process, the way of presenting the contents can be more or less attractive to the student depending on their preferred learning style (PLS), influencing their motivation to study (1,3). The AI-A project seeks to explore the effect of adapting the contents to the PLS of each student to prepare flipped-classroom classes. The aim is to identify and analyze the PLSs among the students of the Bachelor in Physical Activity and Sports Sciences (PASS) at the Universidad Politécnica de Madrid (UPM). **Methods:** The VARK questionnaire with license for research purposes was used to determine the students' PLS. The 4 core learning styles in this questionnaire include visual (V), aural (A), read/write (R), and kinesthetic (K) (2). All volunteers signed an informed consent before completing the questionnaire in the first class sessions of each subject. The project was implemented in several subjects taught by the Department of Health and Human Performance in all academic years, providing a global representation of the Bachelor's degree. **Results:** Responses were collected from 592 students (29.7% female). Most subjects showed a bimodal PLS (57.1%), with AK (70.4%) and VK (19.5%) being the most frequent, while 39.2% showed a monomodal preference, being K the predominant style (94.1%). Similar results were obtained when analyzing the data by sex. In all cases, the percentage of students with no K-component was under 10%, while students with an R-component were less than 7%. The number of respondents varied depending on the subject, being Human Anatomy (33.4%), Human Physiology (23.3%) and Exercise Physiology (26.9%) those with the highest representation. Despite this, the distribution of students did not show differences in terms of distribution by sex or PLS. **Practical Applications:** Among the students of the Bachelor in PASS at the UPM, the pre-

dominant PLS are bimodal AK and K. Teachers might consider the AK PLS in the preparation of classes and complementary materials, emphasizing oral communication and the design of their slides during their lectures. As for the high prevalence of PLS K, it would be necessary to emphasize practical activities throughout the mentioned Bachelor's Degree to increase students' motivation to study. Providing text-heavy materials does not seem to be the best option to reinforce the learning process. **Acknowledgements:** UPM "Convocatoria 2023-24 de Proyectos de Innovación Educativa y Mejora de la Calidad de la Enseñanza" AI-A Project (IE24.1102).

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## PROPOSITION OF OPTIMIZATION OF THE PROTOCOL TO MEASURE THE MAXIMUM STRENGTH OF THE LOWER LIMB WITH THE TAKEI DYNAMOMETER IN CHILDREN WITH PATHOLOGY

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**Introduction:** Muscle health is a critical issue in patients with pulmonary disease, especially in children, so it is recommended that lower limb strength be assessed as part of routine medical consultations. Nevertheless, reference protocols for measuring maximum lower limb strength are based on very expensive, heavy, voluminous and complicated equipment, making them difficult to use in a routine consultation. The Takei-5002 analogue dynamometer is a portable and inexpensive alternative to standard equipment. However, traditional measurement protocols involve biomechanically complex and difficult movements for most people, especially children (1), and the need for some knowledge of strength-training. This can lead to incorrect measurements and risk of injury if not performed correctly. For these reasons, our objective in this

work was to propose an adaptation of traditional protocols by adding a climbing-harness to the Takei Takei-5002 dynamometer in order to optimise the measurement of maximal lower limb muscle strength using a biomechanically- simple movement. We hypothesise that this movement could allow children with pulmonary disease to reach their maximum strength more efficiently, in safer and better adapted to quick routine medical consultation conditions. **Methods:** Thirty-five evaluations of maximum strength (kg) were performed on the Takei-5002 analogue dynamometer using traditional and harness-adapted protocols in children with CF aged between 6 and 18 years. The harness used was a Mammot Ophir Fast-Adjust. The harness adaptation consisted of attaching the harness to the dynamometer chain, which transfers the force to the subject's waist. This simplifies movement by isolating recruitment to the hip and knee joints, and releasing stress on the shoulder and spine joints. Measurement was repeated twice for each protocol with 2 minutes of rest between measurement; the best result of the 2 attempts was considered. **Results:** We observed differences between the 2 protocols, the harness-adapted protocol allowed subjects to achieve significantly higher strength results than with the traditional protocol ( $99.603 \pm 51.659$  kg vs.  $60.472 \pm 34.318$  kg respectively,  $p = 0.001$ ,  $d = 0.908$ ,  $n = 290$ ). **Practical Applications:** The proposed adaptation by adding a climbing harness to the Takei-5002 dynamometer allows the subjects to obtain significantly higher results of the lower limbs strength. Thus, this adaptation permits more accurate measurement of maximum strength and may facilitate the assessment of lower limb muscles health during routine medical consultation, especially for children with pulmonary disease. **Acknowledgements:** Instituto Sanitario Carlos III (ISCIII PI 23/00299).

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## RELATIONSHIP BETWEEN ISOMETRIC AND DYNAMIC STRENGTH IN HANDBALL PLAYERS: ARE THERE DIFFERENCES BETWEEN THE SEXES?

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**Introduction:** Previous research has showed the importance of both isometric and dynamic strength in a variety of athletic populations (1, 2). However, limited research examining the

relationship between isometric and dynamic strength in handball. Thus, the aim of this study was to determine the associations between isometric and dynamic strength in handball players. **Methods:** Seventeen male (age:  $21.5 \pm 3.16$  years; height:  $183.8 \pm 4.55$  cm; body mass:  $84.9 \pm 10.3$  kg) and 18 females (age:  $20.8 \pm 3.0$  years; height:  $168.3 \pm 6.1$  cm; body mass:  $68.5 \pm 8.5$  kg) participated voluntarily in this study. Each player performed 3 trials of the countermovement jump (CMJ) and isometric mid-thigh pull (IMTP) on a previously validated portable force plate (3). Normality of data was confirmed using the Shapiro–Wilk test. Pearson's  $r$  correlation coefficients were used to determine the associations between isometric (e.g., IMTP peak force and peak relative force) and dynamic strength (e.g., CMJ jump height, CMJ peak propulsive force, mRSI, jump momentum) for all players and males and females separately. Pearson's  $r$  correlational values were assigned descriptors using the following thresholds: 0.00–0.10 = “very weak,” 0.11–0.30 = “weak,” 0.31–0.50 = “moderate,” 0.51–0.70 = “strong,” 0.71–0.90 = “very strong,” and 0.91–1.00 = “nearly perfect” (4). Statistical significance level was set as  $p < 0.05$ . **Results:** CMJ jump height and peak propulsive force showed significant ( $p < 0.01$ ;  $p < 0.001$ , respectively) and strong to very strong correlations with IMTP peak relative force and peak force when all players were analyzed together ( $r = 0.52$ ;  $r = 0.71$ , respectively). However, these metrics presented weak correlations when males and females were analyzed separately ( $r = 0.34$ – $0.38$ ;  $r = 0.15$ – $0.33$ , respectively). Additionally, the jump momentum displayed significant ( $p < 0.001$ ) and very strong correlation with IMTP peak force for all players ( $r = 0.86$ ). The mRSI displayed significant ( $p < 0.05$ ) and moderate correlations with IMTP peak force when males and females were analyzed separately ( $r = 0.49$ ;  $r = 0.51$ , respectively). In contrast, the CMJ peak propulsive force showed significant ( $p < 0.05$ ) and moderate correlation with IMTP peak relative force only for female players ( $r = 0.47$ ). **Practical Applications:** This study showed that IMTP provides a strong indication of dynamic performance in this population. Also, our results highlighted the importance of achieving high levels of isometric strength to increase performance in a dynamic task.

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## THE GENETIC OF MUSCULAR STRUCTURE IS RELATED TO PERFORMANCE IN SPANISH MOUNTAINEERING SKIERS

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**Introduction:** Ski mountaineering (Skimo) has its origin in the 10th century in Norway, where it was used as a means of travel in harsh winters. The discipline consists of climbing mountains on skis or carrying them and then descending on skis. Competitive Skimo are timed racing events that follow an established trail through challenging alpine terrain while passing through a series of checkpoints. The recent evolution of this sport has generated an increase in scientific interest with the aim of determining the best performance factors (1). The high training load in combination with exposure to challenging competition conditions makes us consider it important for performance in this sport to study the factors associated with muscular structure and muscular health of the athletes, in particular, the genetic aspects. Therefore, the purpose of this study was to analyse whether a genetic profile related to muscle structure, muscle repair, and the surrounding extracellular muscle matrix can have an impact on the level of performance (sporting status) of Skimo athletes from the Madrid selection. **Methods:** Nineteen skiers from the Madrid Mountaineering Federation were evaluated. The sporting status score was determined by the sum of the 4 races of the Spanish Cup 2024 (2 vertical and 2 individual). Points were awarded based on the race finishing position (i.e., 100 points: 1st place; 90 points: 2nd place; 81 points: 3rd place). The muscle structure-related genetic profile that included ACTN3 rs1815739, DCN rs516115, GEFT rs11613457, MMP3 rs679620, COLA51 rs12722 and IL6 rs1800795 variants was studied by PCR-Q with predesigned Taqman Genotyping Assays. A total genotype score (TGS) was calculated attributing a value of 2 to the most favorable genotype for endurance according to the literature, a value of 1 for the intermediate genotype and a value of 0 for the least favorable genotype. **Results:** The TGS was significantly positively correlated with the sporting status score (Spearman's Rho = 0.647 [high correlation];  $p = 0.002$ ). Interestingly, the sporting status score was not correlated with the number of years of practice

( $p = 0.830$ ) nor with the hours of training per week ( $p = 0.364$ ).

**Practical Applications:** Our results showed that genetic polymorphisms related to muscle structure could represent an important factor in performance in Skimo athletes and could be more important than practice experience or training load in this population.

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## VOLUNTARY ISOMETRIC CONTRACTIONS AT MAXIMAL SHORTENING AS A METHOD OF NEUROMUSCULAR REEDUCATION IN HEALTHY SUBJECTS

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**Introduction:** Neuromuscular reeducation (NR) established its principles in the mid-20th century (1) and has since focused on improving motor activities in patients with pathologies by retraining the nervous system (2). However, its effects on healthy individuals are unknown. Voluntary isometric contractions at maximal muscle shortening (VICAMS) is a new technique that has been shown to acutely improve performance (3) following NR principles. This study aims to analyze their chronic effects on range of motion, strength, and vertical jump, and to compare them with traditional ballistic stretching (BS). **Methods:** Sixty healthy, recreationally active subjects (mean age:  $46.4 \pm 5.5$  years), were randomly distributed into 3 groups that received different workouts twice a week for 8 weeks: VICAMS; BS; and the control group (CG) that did not undergo any intervention. In both training, hip exercises (flexion, extension, abduction, and adduction) and knee exercises (flexion and extension) were applied. To assess chronic effects, active range of motion (AROM), maximal voluntary isometric force (MVIF), and countermovement jump height (CMJ) were determined before and after the intervention. **Results:** ANOVA with the Bonferroni post hoc test was used to evaluate the difference between groups, finding main time effects and time  $\times$  group interactions for all variables ( $p < 0.001$ ). Between-group differences were observed in the VICAMS group after the intervention, with higher AROM and MVIF values compared to the other groups. Intra-group differences were observed in the VICAMS and BS groups, as values for all variables increased from baseline. **Practical Applications:** The chronic effects of VICAMS have shown it to be an

effective system for improving active flexibility, strength, and jump height, as they have been significantly better than BS. These results suggest that NR using VICAMS in healthy subjects may be useful for trainers due to its effectiveness, speed, and low cost for its application.

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