



BOOK OF ABSTRACTS

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PIC magnitude also increase (4). Examining MU behaviour during increasing intensity contractions might provide insight into the interactions between hormones and PICs. We hypothesised that DR and PICs would increase with contraction intensity, and intensity-specific increases will be enhanced when E concentration is elevated during the pre-ovulatory (OV) and mid-luteal (ML) phases; whereas elevated P concentration would blunt this increased gain in the ML phase.

METHODS: Thirteen females (27 ± 6 years) participated across three institutes, as part of a wider study. Participants reported a regular MC, confirmed by cycle tracking and urine ovulation testing, retrospectively verified with serum hormone concentrations. After one tracked cycle, participants visited the lab in three phases of the subsequent MC(s): early follicular (EF), OV, and ML. During each visit, participants performed triangular dorsiflexion contractions at 30, 50 and 70% maximum, and high-density electromyographic signals were sampled and decomposed into individual MU spike trains. Smoothed DRs were analysed for peak DR, and DR hysteresis (ΔF) using the paired MU analysis technique.

RESULTS: DR increased with contraction intensity, but was up to 10% higher during the ML phase compared to OV regardless of intensity ($+0.74$ - 1.99 pulses per second [pps]; $p \leq 0.043$). Estimates of PIC magnitude were modulated by MC phase and intensity. At 30%, ΔF was up to 12% greater at ML (5.89 ± 0.29 pps) compared to EF (5.19 ± 0.28 pps) and OV (5.33 ± 0.28 pps; $p \leq 0.003$) but not at 50 and 70% ($p \geq 0.139$). There was a significant interaction between phase and intensity ($p = 0.002$) whereby ΔF did not increase with intensity during the ML phase as it did in the other phases.

CONCLUSION: While DR was greater across all contraction intensities in the ML phase compared to OV, estimates of PICs across the MC were sensitive to contraction intensity, which presented as a saturation of PICs during the ML phase. This suggests that MC phase, and the associated fluctuations in E and P, do affect MU excitability, but these MC-related effects are diminished during higher intensity outputs. These data provide new mechanistic insight into motor output at a range of intensities across the MC.

1) Inglis et al., *Appl Physiol Nutr Metab*, 2020

2) Jenz et al., *J Neurophysiol*, 2023

3) Piasecki et al., *Sports Med Open*, 2023

4) Škarabot et al., *bioRxiv*, 2023

HIT THREE TARGETS WITH ONE ARROW: ECCENTRIC TRAINING HAS GREATER POTENTIAL THAN STATIC STRETCHING FOR DECREASING PASSIVE STIFFNESS, NOT JUST INCREASING STRENGTH AND FASCICLE LENGTHS, IN THE HAMSTRINGS

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INTRODUCTION: Hamstring strain injuries are common in high-speed running-based sports, with up to 80% of cases affecting the biceps femoris long head (BFlh) [1]. Recently, high passive muscle stiffness has been identified as a risk factor for strain injuries [2], alongside low muscle strength and short fascicle lengths. Passive muscle stiffness has traditionally been recognized to chronically decrease with repeated passive lengthening (e.g., static stretching); however, its actual efficacy remains controversial [3]. Instead, during active lengthening (eccentric contraction), the combination of externally applied tensile and internally generated contractile forces theoretically imposes greater mechanical stress on muscle fibers and connective tissues [4], potentially leading to further decreases in passive muscle stiffness than static stretching. Here, we examined chronic adaptations of passive stiffness in the biarticular hamstring muscles after long-term eccentric-only knee flexion training (ECC) versus knee-extended static stretching (SS).

METHODS: Eleven healthy young males participated in a 10-week intervention (three sessions per week) involving ECC for one leg and SS for the other. The ECC consisted of three sets of 10 repetitions performed at 50% of maximal eccentric torque, within 50 to 100% of the maximal range of motion, at an angular velocity of $5^\circ/\text{s}$. The SS involved three sets of stretching held for the same duration as ECC, at 100% of the maximal range of motion. Before and after the intervention, the shear moduli and architectures of the BFlh, semitendinosus, and semimembranosus (SM) were assessed using shear wave elastography and diffusion tensor MRI, respectively. Maximal isometric knee flexion torque was measured with a dynamometer. These variables were analyzed using the generalized mixed-effects models.

RESULTS: The maximal isometric torque increased after ECC (57% [mean value], $p < 0.01$), but not after SS. The volumes of the three muscles substantially increased after ECC (22 to 42%, all $p < 0.01$), whereas BFlh volume did not increase after SS. The fascicle lengths of BFlh (34%) increased after ECC ($p < 0.01$), but not after SS. Notably, both shear moduli of BFlh (-11%) and SM (-25%) decreased after ECC (all $p < 0.05$), whereas only SM shear modulus (-18%) decreased after SS ($p < 0.01$).

CONCLUSION: This study provides the first evidence that ECC has greater potential than SS for decreasing passive stiffness of a specific muscle, as well as increasing muscle strength and fascicle lengths within a matched intervention period. Our findings represent an important first step toward reconsidering the conventional approach to a chronic decrease in passive muscle stiffness and may offer practitioners a more comprehensive and time-efficient strategy aimed at preventing BFlh strain injury.

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3. Russell et al. *Scand J Med Sci Sports* (2024)

4. Crameri et al. J Physiol (2007)

EXPERIMENTALLY-INDUCED THERMAL PAIN AND NATURALLY OCCURRING MUSCLE PAIN HAVE DIFFERENT EFFECTS ON FORCE PRODUCTION DURING A FIXED PERCEIVED EFFORT HANDGRIP TASK.

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INTRODUCTION: At fixed workloads, experimentally-induced or naturally occurring muscle pain increase perceived effort (PE) compared to innocuous conditions. However, potential differences or interactive effects between pain types on PE and motor behaviour are relatively unknown. We examined the changes in force production during a fixed PE task with concurrent experimental thermal pain and naturally occurring muscle pain. We hypothesised that both sources of pain would lead to a reduction in force during fixed PE tasks.

METHODS: Forty healthy active adults (50% female, 25 ± 4 years old) visited the laboratory twice to perform an intermittent (3s ON:OFF) isometric handgrip task performed at a light (13/100) or hard (50/100) PE intensity – visit order randomised. Each visit followed the same procedure, with an experimental and control condition interspersed by 2min rest – order randomised. Each condition involved two blocks (block 1 and block 2) of 5 contractions each, repeated 5 times. A painful thermal stimulation was applied specifically in block 1 of the experimental condition, while a non-painful warm stimulation (control) was applied in all other blocks. Participants rated thermal and muscle pain during a 30s rest period after each block on the category-ratio 100 scale. Force (peak and mean force, integral) and electromyographic (EMG) signals were continuously recorded. Data were analysed with repeated measures ANOVAs, with a-priori focus on i) the condition $\times$ block interaction to isolate the effect of thermal pain in block 1 of the experimental condition, ii) the intensity $\times$ condition $\times$ block interaction to determine the effect of PE intensity on thermal pain-related effects. Linear regression analysis was used to assess how muscle pain affected force production, while controlling for PE intensity, sex and their interaction.

RESULTS: The intensity effect on force and EMG (all $p < .001$) confirmed that participants understood the PE task. The condition $\times$ block effect revealed a higher force production (all $p < .002$, $\eta^2 > .212$) in the presence of thermal pain. There was no intensity $\times$ condition $\times$ block effect on force production (all $p > .570$, $\eta^2 < .003$). The linear regression analysis revealed that when muscle pain increased by one unit, there was a decrease of 0.37N peak force, 0.25N mean force, and 0.80N.s force integral (all $p < .001$).

CONCLUSION: Contrary to our hypothesis, when participants regulate their force production according to a fixed PE intensity, thermal pain leads to an increased force production. Alternatively, increased muscle pain is linked to a decrease in force production. The intensity of PE did not impact thermal pain-related effects on force production. When thermal pain is induced, exerting more force may be a distraction strategy that facilitates exercise-induced hypoalgesia. However, when experiencing muscle pain, increasing force is likely counterproductive as this would promulgate further muscle pain.

THE DISCHARGE CHARACTERISTICS OF MOTOR UNITS IN PERONEUS LONGUS AND BREVIS DIFFER DURING FOOT ABDUCTION AND ANKLE PLANTAR FLEXION.

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INTRODUCTION: Peroneus Longus (PL) and Peroneus Brevis (PB) are activated during abduction of the subtalar joint and plantar flexion of ankle joint. Previous studies have found that PL exhibits greater EMG amplitude during abduction than plantar flexion from low-to-moderate target forces[1]. Moreover, the conduction velocity of muscle fiber action potentials differs between two functions[2]. These results suggest that the discharge characteristics of Motor Units (MUs) discharge likely differs between the two functions. The purpose of our study was to compare the discharge characteristics of MUs from peroneal muscles during abduction of the subtalar joint and plantar flexion of ankle joint.

METHODS: Nine active males consented to participate in the study. Ultrasound recordings were used to ensure the appropriate placement of the grid electrodes over the PL and PB muscles. The experimental procedure comprised of isometric contractions of abduction and plantar flexion of the foot at five target forces (5, 10, 20, 40 and 60% of MVC) during which HD-EMG recordings were obtained from PL and PB.

Force fluctuations during the steady contractions were quantified as the Coefficient of Variation for force (CoV force) separately for abduction and plantar flexion. Moreover, the MU discharge characteristics comprised Recruitment Threshold (RT), Mean Discharge Rate (MDR), Coefficient of Variation of InterSpike Interval (CoV ISI) and Standard Deviation of filtered Cumulative Spike Train (SD fCST).

Linear mixed models were used to compare muscles and functions at five target forces. In all models, muscles, functions, and target forces were specified as fixed factors, and participants were assigned as random factor.

RESULTS: Significant effects were found for all five outcome variables: (1) CoV force during abduction was significantly greater than that during plantar flexion ($p < 0.05$); (2) RT of MUs in PL was significantly greater during abduction than plantar flexion across all target forces ($p < 0.05$), whereas RT of MUS in PB was greater during plantar flexion than abduction ($p < 0.05$); (3) MDR increased linearly with target force ($p < 0.05$); (4) CoV ISI was significantly greater during abduction than during plantar flexion for both muscles; and (5) the variability in neural drive (SD fCST) was significantly less during abduction than plantar flexion ($p < 0.01$) and for PB compared with PL ($p < 0.05$).

CONCLUSION: These results indicate that the discharge characteristics of MUs in the peroneal muscles differ during foot abduction and ankle plantar flexion. These findings suggest that the neural drive to the muscles differs during the two actions.

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Oral Presentations

OP-MH02 Clinical Population Groups

AN IMMERSIVE AND HOLISTIC ONE-WEEK BLUE EXPERIENCE TO IMPROVE THE OVERALL WELL-BEING OF PERSONS WITH PARKINSON'S DISEASE: THE SAIL4PARKINSON PROJECT

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INTRODUCTION: The Sail4Parkinson (S4P) is a one-week adapted physical activity intervention program for persons with Parkinson's disease (PD), with the mission of combining physical training of water sports with the physical, emotional, and psychological stimulus that comes from contact with the sea and the lands around. The aim of this study was to investigate the acute effects of different innovative aquatic and mind-body activities on clinical, psychosocial, and motor symptoms in persons with PD after the S4P project week.

METHODS: Thirteen subjects (6M:7F, median Hoehn-Yahr: 2; range: 2-3) volunteered to participate in the one-week S4P project. From the second to the sixth day, several aquatic activities (i.e., sailing, surfing, paddling) were performed during the day after a daily session of mindfulness at sunrise, yoga, or tai chi at sunset. On the other hand, during the first (PRE) and the last (POST) day, main general and PD outcomes (i.e., anthropometrics, body composition, balance, muscular strength, upper-limb flexibility, heart rate variability, and quality of life) were assessed.

RESULTS: Repeated-measures ANOVA and adjusted post-hoc comparisons revealed significant changes in Fat-Free Mass (PRE-POST change: +1.80%; $p=0.049$) and Skeletal Muscle Mass (PRE-POST change: +2.69%; $p=0.044$). A significant reduction was observed in the time to complete the Five Times Sit-to-Stand Test (PRE-POST change: -14.75%; $p=0.002$) and the time to complete the Timed Up and Go Test (PRE-POST change: -15.93%; $p=0.005$). Balance evaluations showed a significant reduction in mediolateral oscillation length (PRE-POST change: -39.18%; $p=0.020$) and mediolateral oscillation velocity (PRE-POST change: -39.18%; $p=0.020$), both performed with open eyes. Non-parametric test run on clinical scores revealed a significant reduction in the Apathy Evaluation Scale (PRE-POST change: -20.61%; $p=0.028$).

CONCLUSION: Despite the short-term intervention, the S4P project demonstrated several beneficial effects on both motor and non-motor PD symptoms, reducing fall risk and apathy. Preliminary data suggest that these innovative activities may be valuable for this population, particularly in enhancing psychosocial well-being through teamwork and blue environmental stimuli. Therefore, promoting these activities to be repeated twice per year, for instance, and promoting similar training at home, could become an effective strategy for improving the management of PD and the overall quality of life of these persons.

EFFECT OF A 12-WEEK LIFESTYLE INTERVENTION PROGRAM ON FREE-LIVING GLYCEMIC PROFILE AND CARDIOMETABOLIC HEALTH IN BREAST CANCER SURVIVORS WITH METABOLIC SYNDROME

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INTRODUCTION: Cancer treatments and a sedentary lifestyle increase the risk of type 2 diabetes (T2D) in breast cancer survivors (BCS). Lifestyle Interventions (LI), which provide physical activity (PA) and dietary guidance, may be an effective adjunctive treatment for BCS, but the impact of exercise training on glucose homeostasis remains inconclusive [1]. This study aimed to compare glucose variability indices between two groups of BCS participating in the MovIS clinical trial [2].

METHODS: BCS patients with metabolic syndrome ($n=27$, 52.3 ± 8.6 yrs [mean $\pm$ SD]) were randomized into a control group (CG, $n=12$) and an intervention group (IG, $n=15$). All patients received recommendations on PA and Mediterranean diet before beginning a 12-week trial, during which they kept a daily log for PA. IG patients also underwent a 3-times-a-week aerobic training program with progressive increases in exercise intensity (40-70% of heart rate reserve) and duration (20-60 min). Before (T0) and after (T1) the trial, participants' body composition (BIA), cardiorespiratory fitness (GXT estimated VO_2max), and cardiometabolic profile (routine laboratory parameters) were assessed along with glycemic variability (flash

glucose monitor - FGM), which was assessed over 14 days (12 ± 1.8 days) after T0 and before T1. Glycemic variability was calculated with the EasyGV software (v.9.0.R2). Statistical significance ($\alpha=0.05$) was determined using a Repeated Measures GLM (SPSS software v.17).

RESULTS: At T1, both groups significantly improved fat mass (CG -1.0%; IG -3.8%), triglycerides (CG -4.2% IG: -15.9%), insulin levels (CG -14.1%; IG -15.6%), and HOMA-IR (CG -13.7%; IG -16.3%). Cardiorespiratory fitness (IG +3.1%; IG +16.4%) and between-day glycemic variability index (CG +12.5%; IG -3.6%) significantly changed in both groups and resulted significantly better in the IG compared to the CG. Time spent within the normal glucose range (CG -11.0%; IG -1.8%) and with a glycemia above 180 mg/dL (CG: +1.1%; IG +0.7%) worsened at T1. Although time x group interactions were, respectively, nonsignificant and barely significant, CG changes were broader.

CONCLUSION: The LI program improved body composition and cardiometabolic health in BCS patients at high risk for T2D, with an overall, although nonsignificant, lower effectiveness in CG than in IG patients. Since aerobic training effectively increased cardiorespiratory fitness solely in the IG and given that selected parameters of the glycemic profile improved significantly more in the IG than in the CG group, improvements seem to be attributable to the supervised exercise as an adjunctive effect over guidance alone. However, other glycemic parameters did not improve in IG patients. Thus, further research is needed to support the role of aerobic training in improving glycemic profile in BCS at high risk of diabetes.

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VIRTUAL REALITY-BASED EXERGAME FOR HOSPITALIZED CHILDREN WITH CANCER: AN EXPLORATORY STUDY ON COMPLIANCE, ACCEPTANCE AND EXERCISE INTENSITY.

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INTRODUCTION: Pediatric cancers represent 2270 new cases each year in France [1]. The disease and its treatments cause significant symptoms (e.g., fatigue, reduced quality of life). Exercise is recognized as a non-pharmacological intervention in pediatric oncology to mitigate the numerous side effects [1]. However, exercise is often restricted by the constraints of cancer treatments and hospitalization (e.g., isolation in sterile room, amputation, fatigue) [1]. Virtual Reality-based exergames (VRE) have shown promise in promoting physical activity [2] but their application in pediatric oncology remains underexplored. This study aims to assess the feasibility of a VRE for pediatric cancer patients undergoing treatment in a hospital setting. Specifically, it evaluates compliance and acceptance while assessing exercise intensity to ensure alignment with WHO recommendations (> 3 MET).

METHODS: Thirteen pediatric cancer patients (diagnosed with leukemia or sarcoma) participated in VRE sessions proposed four times during afternoons per week over a two-month period in the pediatric oncology unit of Sud Hospital, Rennes. The VRE used in this study was developed by the lab team and designed to resemble Beat Saber with additional adaptability options. A total of 131 sessions were analyzed to assess compliance rates (number of sessions offered relative to those proposed), Technology Acceptance Model [3] was used to assess acceptance and exercise intensity was assessed with Lee et al. model [4].

RESULTS: The VRE showed a solid compliance rate of 68%, with individual variability influenced by factors such as age, prior VR experience, and intended use. Acceptance was high, with a strong user experience rating ($5.36/6 \pm 0.51$), and no serious side effects were reported. The average exercise intensity per child reached 4.44 ± 1.91 MET, exceeding the moderate-intensity threshold.

CONCLUSION: The key findings indicate that this VRE practice is feasible and well-accepted in a pediatric oncology setting, providing effective moderate-to-vigorous exercise levels in accordance with WHO recommendations while ensuring patient engagement, despite individual differences. Expanding the variety of VR content could better cater to the needs of diverse age groups, particularly adolescents. Furthermore, integrating autonomous adaptation based on physiological and kinematic data could improve the programs effectiveness and engagement by targeting specific intensity levels.

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