3RD BIOMECHANICS IN SPORT AND AGEING SYMPOSIUM

INJURY PREVENTION AND REHABILITATION

BUDAPEST, 13-14 OCTOBER 2025

PROGRAMME, BIOSKETCHES, and ABSTRACTS

HUNGARIAN UNIVERSITY OF SPORTS SCIENCE
BUDAPEST

WELCOME MESSAGE

Welcome to the 3rd Biomechanics in Sport and Ageing Symposium: Injury Prevention and Rehabilitation, organised by the Hungarian University of Sports Science and the Department of Kinesiology, Budapest, Hungary, 13-14 October 2025.

The aim of the symposium is to provide a scientific platform for a state-of-the-art update on the progress in Injury Prevention and Rehabilitation with respect to sport biomechanics and ageing.

Sport and ageing might appear unrelated. Yet we consider sport and ageing as complementary: assessment and training methods developed in sport science are transformed into diagnosis and treatment of ageing-related impairments.

The symposium starts with two keynote presentations, which will be free of charge and open to the public. First, professor Anthony Blazevich (Edith Cowan University, Australia) will focus on muscle function and injury prevention in sport. Professor Jason Franz (UNC Chapel Hill & NC State University, USA) will provide an overview of how age affects the biomechanics of tendons in the lower extremities.

Then, registrants for the symposium will have the opportunity to attend two sessions of invited presentations on the biomechanics of the ageing musculoskeletal system and two sessions of invited presentations on injury prevention and rehabilitation on muscle and tendon injuries.

Session 1 will address the disease of the 21st century, muscle wasting or sarcopenia. Recent epidemiological studies and meta-reviews suggest that low skeletal muscle quantity and quality are associated with and can, if not corrected, exacerbate clinical conditions. Prevention of skeletal muscle loss and rehabilitation of dysfunctional muscles is thus at the pinnacle of experimental research. This is especially true with respect to ageing, as the senior segments of society have been growing in every country around the world. Because Parkinson's disease often evolves in conjunction with ageing, it is relevant to minimize muscle loss in this debilitating condition.

Session 2 will also feature an international array of distinguished researchers addressing the exciting hypothesis that long-term sport participation protects against the age-related decline in musculoskeletal health. While this expectation is attractive, the data extracted from master athletes can be contradicting. Therefore, it is timely to provide an update on the role of lifelong physical activity plays in joint, bone, and muscle-tendon function.

Session 3 will kick off the second day of the symposium with a focus on new developments in understanding hamstring muscle structure and function. Experts will discuss how novel data from the level of motor units and sarcomeres to whole-body kinematics can be integrated into the practice of hamstring strain injury prevention.

Session 4 will provide a state-of-the-art overview of recent developments in Achilles tendon injuries. Presentations will provide a fresh perspective on how injuries modify the structure and function of the Achilles tendon. The session concludes with new insights into how to select exercise for the rehabilitation of Achilles tendinopathy.

The 3rd Symposium will end with practical workshops. The workshops will demonstrate new methods that allow coaches and sport scientists to view and receive feedback on movement kinematics in real time. Additional workshops will feature technology used to examine architecture and function of muscles and tendons.

Special thank you goes to our sponsors! Without their support, the 3rd Biomechanics in Sport and Ageing Symposium would not be possible.

Welcome to Budapest! Network, learn, and enjoy the symposium!

Sincerely yours,

Prof. dr. Zsolt Radák, PhD, Vice-Rector for Research and Innovation and Patron of the symposium

Dr. András Hegyi, PhD, Prof. dr. h. c. Tibor Hortobágyi, PhD, co-chairs of the scientific committee

Mr. Dániel Mezei, Ms. Eszter Kerekes, Ms. Kata Kádár, Dr. Annamária Péter, PhD co-chairs of the organising committee

SCIENTIFIC PROGRAMME

13 October (Athens lecture hall, Level -1, K1 building)

08:00	Registration *(K1 building, level 0)*
09:00	KEYNOTE SESSION *(Athens lecture hall, K1 building, level -1)*. Chair: Tibor Hortobágyi
	09:00 OPEN KEYNOTE PRESENTATION 1 (45 minutes) - **Anthony Blazevich** (Edith Cowan University, Australia): Eccentrics, muscle geometry, and Nordics: Is our current model of muscle injury correct?
	09:45 Q&A
	10:00 OPEN KEYNOTE PRESENTATION 2 (45 minutes) - **Jason Franz** (University of North Carolina Chapel Hill and North Carolina State University, USA): The ageing Achilles tendon: a neuromechanical catalyst for declines in locomotor performance and economy
	10:45 Q&A
11:15	Social programme: Castle walking tour / exercise at the Dr. Koltai Jenő Sports Center
12:30	Lunch (on your own)
13:15	Opening - András Hegyi, scientific co-chair
13:30	**SESSION 1 - MUSCLE WASTING AND ITS PREVENTION IN AGEING** (3 x 20 minutes presentations + discussion) *(Athens lecture hall, K1 building, level -1).* Chair: Bálint Kovács
	Martino Franchi (University of Padova, Italy): Structural and functional mechanistic bases of neuromuscular alterations in ageing
	Urs Granacher (University of Freiburg, Germany): Resistance training: a key strategy against dynapenia and sarcopenia
	Uroš Marušič (Science and Research Centre of Koper, Slovenia): Brain-muscle crosstalk and preservation of muscle strength and mass in accelerated ageing
14:50	Coffee break

15:20	**SESSION 2 - LIFE-LONG PHYSICAL ACTIVITY AND MASTER ATHLETES** (3 x 20 minutes presentations + discussion) *(Athens lecture hall, K1 building, level -1)*. Chair: Leonidas Petridis
	Lauri Stenroth (University of Eastern Finland): Do we accelerate joint ageing by being physically active?
	Jessica Piasecki (Nottingham Trent University, UK): Peak performance across the lifespan and the implications for bone health
	Gaspar Epro (London South Bank University, UK): Muscle-tendon adaptations in master athletes
16:40-16:50	Info session
17:00-18:00	**POSTERS 1** *(Aula, K1 building, level -1)* - Assessors: Blazevich, Finni, Franz, Hortobágyi, Kovács, Stenroth, Van Hooren
19:30	Speakers dinner / social event organised by students (bar tour)

14 October, Athens lecture hall, Level -1, K1 Building

08:00	Registration
09:00	**SESSION 3 - HAMSTRING INJURIES: INTEGRATING CUTTING-EDGE SCIENCE INTO PRACTICE** (3 x 20 minutes presentations + discussion) *(Athens lecture hall, K1 building, level -1).* Chair: András Hegyi
	Patricio Pincheira (University of Southern Queensland, Australia): Hamstrings in action: injury mechanisms and neuromechanical adaptations
	Gaël Guilhem (INSEP Paris, France): Hamstring muscle properties: a role in injury risk exposure?
	Johan Lahti (R5 Athletics & Health, Finland): Sprint-related hamstring injury risk reduction in high-level athletes: screening and exercise selection
10:20	Coffee break
10:50	**SESSION 4 - ACHILLES TENDON INJURIES: MODERN APPROACHES** (3 x 20 minutes presentations + discussion) *(Athens lecture hall, K1 building, level -1).* Chair: Annamária Péter

	Toni Arndt (The Swedish School of Sport and Health Sciences, Sweden) - Internal structural organization of the human Achilles tendon; what has happened to sub-tendons?
	Taija Finni (University of Jyväskylä, Finland) - Structure and function of the impaired Achilles tendon: old problem in new perspectives
	Benedicte Vanwanseele (KU Leuven, Belgium) - Exercise selection in the rehabilitation after Achilles tendinopathy
12:10	Info session
12:15	Lunch (organised for those with meal ticket)
13:45-15:15	**POSTERS 2** *(Aula, K1 building, level -1)* - Assessors: Blazevich, Finni, Franz, Hortobágyi, Kovács, Stenroth, Van Hooren
15:30	**WORKSHOP 1: USING WEARABLES TO ESTIMATE TISSUE-LEVEL LOADING** - presented by **Bas van Hooren** (Maastricht University, The Netherlands)
	WORKSHOP 2: REAL-TIME FEEDBACK FROM MARKERLESS MOTION CAPTURE TO REDUCE INJURY RISK IN ATHLETIC MOVEMENTS - presented by **Simi Reality Motion Systems GmbH**, Germany
	WORKSHOP 3: ASSESSING MUSCLE MECHANICAL AND NEUROMUSCULAR FUNCTION IN AGEING - presented by **András Hegyi, Alberto Botter, Giacinto Luigi Cerone** (HUSS, Hungary & LISiN Laboratory, Italy)
	All workshops: *Dr. Koltai Jenő Sports Center, Csörsz str. 2-8.*
19:00	Closing dinner *(Dr. Koltai Jenő Sports Center, Csörsz str. 2-8.)*
19:15	Student award ceremony and closing - Tibor Hortobágyi, symposium co-chair

ABSTRACTS

ORAL ABSTRACTS

OPEN KEYNOTE PRESENTATION 1

ECCENTRICS, MUSCLE GEOMETRY, AND NORDICS: IS OUR CURRENT MODEL OF MUSCLE INJURY CORRECT?

Anthony Blazevich (Edith Cowan University, Australia)
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Muscle injuries are common in running-based sports, contributing to a significant loss of game and training time. A simple model of muscle injury insists that muscles are 'stretched' whilst active and this causes damage to myofibrils within the muscles, leading to a muscle tear. According to this theory, exercises that stretch the muscle whilst under load, such as the Nordic hamstrings exercise, reduce injury risk by triggering an increases in muscle fibre length (increased serial sarcomere number), shifting the muscle's force-length capacity towards longer lengths, and thus protecting the muscle from injury. However, (i) many muscles work on the ascending limb or plateau region of their force-velocity relations (calf muscles during running and jumping; biceps femoris long head during running) so they are commonly injured at "short" lengths, (ii) muscles are particularly strong when contracting eccentrically so they should resist injury regardless of their length, and (iii) evidence suggests that the muscle length at which force is produced, not the eccentric contraction mode itself, stimulates serial sarcomere number increases, so eccentric training should not be unique in minimising injury risk according to his model.

An alternative model states that "muscle injury" is largely an issue of connective tissue failure, either within the extracellular matrix or at the aponeuroses that overlie a muscle or run within it. This is consistent with (i) muscle imaging data showing significant damage near connective tissue inscriptions, (ii) the high rate of injury in muscles with complex architectures and thus multiple connective tissue inscriptions, and (iii) alterations in muscle activation resulting from movement pattern variations or muscle fatigue being associated with injury risk. According to this theory, eccentric training may still be useful because a stress can be placed on muscle fibre-connective tissue attachment sites using such training but maintaining 'optimum' muscle activation patterns to minimise unaccustomed shear strains within muscles should also be an important target.

In this presentation, these models will be contrasted, and we will ask the question as to how the model adopted affects the loads, ranges of motion and speeds that should be prescribed for the Nordic hamstrings exercises.

OPEN KEYNOTE PRESENTATION 2

THE AGEING ACHILLES TENDON: A NEUROMECHANICAL CATALYST FOR DECLINES IN LOCOMOTOR PERFORMANCE AND ECONOMY

Jason Franz (University of North Carolina Chapel Hill and North Carolina State University, USA)
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Older adults consume oxygen at faster rates than younger adults for reasons that remain poorly understood. Unraveling the mechanisms involved could point to modifiable factors to improve walking economy, enhance walking speed, and augment fatigue resistance. Much emphasis has been placed on muscle-level explanations, to include reduced contractile efficiency, elevated antagonist coactivation, and/or compensatory recruitment strategies. I will use this keynote to summarize over 10 years of our research implicating the aging Achilles tendon as a highly complementary neuromechanical catalyst for declines in locomotor performance and walking economy among older adults. From experimental studies to computational simulations, we will carefully connect the dots from series elastic tissue mechanics to muscle- and limb-level biomechanical and physiological changes due to aging. Along the way, I will highlight preliminary studies that leverage these discoveries for the prescription of ankle exoskeletons and the personalized treatment of individuals with Achilles tendinopathy. Thereafter, I will broaden our conceptual framework to include the understudied role of structure-function relations within the human foot, with prospective applications in footwear design, fatigue mitigation, and falls prevention for older adults. Throughout, I will emphasize the importance of interdisciplinary collaboration, scientific creativity, intellectual curiosity, and mentorship over biomechanics tools and techniques alone.

Acknowledgements

- Contributions from members of the UNC Applied Biomechanics Laboratory and research sponsorship from the US National Institutes of Health.

SESSION 1 – MUSCLE WASTING AND ITS PREVENTION IN AGEING

STRUCTURAL AND FUNCTIONAL MECHANISTIC BASES OF NEUROMUSCULAR ALTERATIONS IN AGEING

Martino Franchi (University of Padova, Italy)
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The talk will present the main role of muscle structural and functional parameters influencing muscular and performance decline during different stages of ageing, discussing how neural and morphological factors are intertwined in this process.

The distinct functional decline at different stages of the ageing process will be discussed, introducing the concept of how structural and functional properties are influenced by different trajectories of ageing. Ultimately, in this context, the role of long-life exercise will be discussed.

RESISTANCE TRAINING: A KEY STRATEGY AGAINST DYNAPENIA AND SARCOPENIA

Urs Granacher (University of Freiburg, Germany)
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Sarcopenia, the age-related decline in skeletal muscle mass and function, and dynapenia, the disproportionate loss of muscle strength, represent central determinants of functional decline in older adults. Epidemiological data indicate that up to 10-16% of individuals aged ≥65 years are affected by sarcopenia, while dynapenia is estimated to affect 25-40% of this population, with prevalence rates increasing substantially with advancing age.

Declines in muscle strength are often more predictive of mobility limitations and disability than loss of muscle mass alone. Strength deficits contribute to impaired gait and balance, and increase fall risk, whereas improvements in strength and mass through targeted interventions markedly extend years of independent living. Evidence suggests that while both muscle mass and strength are linked to mobility outcomes, strength exerts the stronger protective effect, highlighting the role of neuromuscular performance in healthy aging.

Among the available exercise interventions, progressive resistance training stands out as the most effective nonpharmacological strategy to counteract dynapenia and sarcopenia. Large-scale reviews and meta-analyses reveal robust dose-response relationships, showing that higher training intensities and volumes lead to greater improvements in strength, lean mass, and mobility. In addition, structured programs that incorporate balance, core, and power training produce not only muscular adaptations but also functional benefits, including slower gait decline, enhanced balance, and reduced mobility disability.

This keynote will synthesize current evidence on resistance training as a cornerstone of healthy aging. Particular emphasis will be placed on the interplay between muscle strength, muscle mass, and mobility, and how these factors converge to determine functional independence. The presentation will provide evidence-based recommendations for optimizing resistance training prescriptions, tailored to the needs of older adults. By translating research into practice, it becomes possible to effectively mitigate dynapenia and sarcopenia and preserve mobility well into later life.

BRAIN-MUSCLE CROSSTALK AND PRESERVATION OF MUSCLE STRENGTH AND MASS IN ACCELERATED AGEING

Uroš Marušič (Science and Research Centre of Koper, Slovenia)
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Background: Accelerated aging, whether due to neurodegeneration or immobilization, impairs muscle strength, mobility and independence. An important mechanism is impaired crosstalk between brain and muscle, which affects both central motor control and peripheral muscle integrity. This work aimed to investigate how altered corticomuscular interactions contribute to functional loss in Parkinson's disease (PD) and bed rest, and how targeted interventions can preserve muscle strength and mobility.

Methods: We integrated findings from three complementary approaches: (i) EEG-EMG recordings during isometric knee extensions to assess corticomuscular coherence in early PD, (ii) a randomized feasibility trial testing a four-month in-home dynamic standing intervention after physical therapy in PD, and (iii) preliminary data from a bed rest model using immersive virtual reality (VR)-based strength training.

Results: Early-stage PD patients showed reduced corticomuscular coherence in the beta range, although cortical beta power was preserved, suggesting impaired brain-muscle coupling that may underlie early motor decline (Omejc et al., 2025). Translating this mechanistic insight to the intervention, the dynamic standing protocol successfully maintained

physiotherapy progress: Participants maintained their mobility, strength and balance while decreasing the amount of time they spent seated, in contrast to control subjects who regressed (van Emde Boas et al., 2024). The initial results of VR-based training during bed rest suggest that immersive, multisensory engagement can mitigate disuse-induced muscle weakness and preserve neuromuscular activation (unpublished results).

Conclusion: Across neurodegenerative and inactivity models, impaired brain-muscle crosstalk emerges as a central mechanism of muscle loss and functional decline. Importantly, targeted interventions - from sustained postural activity in PD to VR-enhanced training during bed rest- can preserve strength, mobility and quality of life. These findings highlight the potential of combining mechanistic biomarkers with innovative, accessible interventions to counteract the accelerated aging process and maintain functional independence.

References:

- Omejc, N., Stankovski, T., Peskar, M., Kalc, M., Manganotti, P., Gramann, K., ... & Marusic, U. (2025). Cortico-Muscular Phase Connectivity During an Isometric Knee Extension Task in People with Early Parkinson's Disease. IEEE Transactions on Neural Systems and Rehabilitation Engineering.
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SESSION 2 - LIFE-LONG PHYSICAL ACTIVITY AND MASTER ATHLETES

DO WE ACCELERATE JOINT AGEING BY BEING PHYSICALLY ACTIVE?

Lauri Stenroth (University of Eastern Finland)
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Joints allow us to move. The unrestricted and pain-free function of the joints is of paramount importance for our ability to stay physically active as we age. Osteoarthritis, a degenerative joint disease that results in pain and functional limitations, affects around 8 percent of the world's population, with increasing prevalence with age. At age 70, the prevalence is approximately 38 percent. Thus, the disease is strongly age-related. Moreover, the age-related changes in the properties of joint tissues are largely mirrored by those seen in osteoarthritis.

Osteoarthritis was traditionally viewed as a "wear and tear" condition, which raised worries that using and loading the joints may be harmful and accelerate the typical age-related changes, eventually leading to osteoarthritis. Our understanding has since evolved, and physical activity is recognized as a crucial factor in supporting joint health and potentially preventing age-related adverse changes in joint tissues. Physical activities also form a key component of osteoarthritis treatment strategies, aiming at reducing pain and maintaining functional abilities.

That said, the effect of physical activity, and especially the effect of mechanical loading on joints induced by physical activities, is not trivial. While physical activity is seen overall as positive for maintaining joint health and potentially preventing age-related adverse changes in joint tissues, controversies also exist. For example, loading induced by daily physical activities has been linked with a higher rate of disease development or worse tissue quality.

The role of physical activity in maintaining joint health throughout the lifespan appears to be nuanced. Instead of seeing joint loading as categorically good or bad, physical activity should be optimized (for different conditions). This talk focuses on the complex role of physical activity and the associated mechanical loading of exercising joints on joint health. Special focus is given to ageing joints, highlighting the current (lack of) knowledge on the role of physical activity in the maintenance of joint health throughout the lifespan.

Acknowledgements:

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PEAK PERFORMANCE ACROSS THE LIFESPAN AND THE IMPLICATIONS FOR BONE HEALTH

Jessica Piasecki (Nottingham Trent University, UK)
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There are many physiological changes that occur across the life-span, in order to continue to achieve high performance it is essential to be aware of these changes and adapt training and rehabilitation processes accordingly. In particular, we see declines in bone density, muscle size and strength along with a reduction in motor unit number. Collectively this deterioration contributes to a decline in performances, both endurance and power related, across the life course.

Some of these changes remain similar between males and females whilst others differ, the possible contributions to these differences may be attributes to variations in levels of sex hormones, of which female are subject to a dramatic decline via their menopausal transition.

Master athletes offer an interesting model of ageing, being a unique cohort of individuals whom have been able to maintain very high levels of physical activity into older age. Despite this physical activity masters athletes are not always immune to the inevitable age related physiological declines, and work has demonstrated declines in bone density, muscle size and strength and reduced motor unit numbers.

This talk will bring together a collection of age related research on both active and none active individuals to understand the role of physical activity on bone health and other key parameters that contribute to a healthy and independent older individual.

MUSCLE-TENDON ADAPTATIONS IN MASTER ATHLETES

Gaspar Epro (London South Bank University, UK)
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Aging is characterized by a general structural and functional deterioration. Already from the middle age, human neuromuscular system starts to decline at an accelerated rate, causing a cascade of negative effects throughout the body. This leads to a decrease in mobility and a loss of independence in older age. Even though this can rather be seen as a combination of various contributors, the gradual loss of spinal motor neurons and impaired neural activation (2) is often regarded as the driving factor behind the age-related loss in functional capacities, which can be related to the loss of muscle fibres (Lexell et al. 1988), changes in muscle architecture (7), reduced muscle mass and the resultant deteriorations in muscle force and power capacity (5). Muscle's function is however difficult to separate from the properties of the tendon, which transmits the muscle generated forces to the skeletal system. Similar to muscles also tendons are affected by ageing. Despite the generally reduced adaptability to experienced stresses in old age, both muscle and tendon maintain its mechanosensitivity to physical exercise (3). However, even with regular long-term exercise master athletes still may exhibit age-related deteriorations in neuromuscular function (8) and alterations in MTU biomechanical properties (9). This seems however dependant of the used exercise modalities, as master sprinters seem to partly counteract the typically seen reductions in MTU properties (4), whereas long-distance runners' tendons show already from middle-age a higher vulnerability to larger volumes of mechanical loading (1). The presentation will give an overview of the current knowledge of muscle-tendon adaptations and its performance implications in master athletes.

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SESSION 3 - HAMSTRING INJURIES: INTEGRATING CUTTING-EDGE SCIENCE INTO PRACTICE

HAMSTRINGS IN ACTION: INJURY MECHANISMS AND NEUROMECHANICAL ADAPTATIONS

Patricio Pincheira (University of Southern Queensland, Australia)
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Hamstring strain injuries remain the most prevalent non-contact muscle injury in running sports such as rugby league, often leading to significant time lost from training and competition. More than 80% of these injuries occur during high-speed running, particularly in the late swing phase of sprinting when the hamstrings contract eccentrically to decelerate the limb at long muscle lengths. This neuromechanical condition—high force combined with rapid lengthening—creates a critical window of vulnerability. Notably, accelerations and decelerations during match play can load the hamstrings to levels comparable to near-maximal sprinting, highlighting that injury risk is not limited to peak speed efforts.

Two strategies have shown consistent protective effects: sprint training and eccentric strengthening. Regular sprint exposure appears to condition the hamstrings for the specific mechanical demands of competition, while eccentric exercises, particularly the Nordic hamstring exercise, can reduce injury incidence by more than 50% when implemented consistently. Adaptations include increased muscle strength and fascicle length, likely underpinned by sarcomerogenesis and hypertrophy.

Despite these advances, we still know very little about the mechanisms underpinning hamstring injury and adaptation, particularly during movement. Neural factors such as motor unit recruitment, reflex behaviour, and coordination, as well as the role of tendons and connective tissue, remain poorly understood.

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HAMSTRING MUSCLE PROPERTIES: A ROLE IN INJURY RISK EXPOSURE?

Gaël Guilhem (INSEP Paris, France)
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During the Olympics, running fast is the most prevalent motor task, 100-m dash being the one of the most-expected event. Yet, the achievement of such running sprints requires both extreme athletic capabilities together with robust musculoskeletal system in order to limit the risk of injury. Despite extensive research and injury prevention initiatives these last decades, lower limb muscle injury remains one of the main cause of training or competition interruption. While functional capacities such as muscle force or joint flexibility have been related to injury risk, these global indexes do not fully reflect the force transmission capacities of muscle-tendon tissues, may conceal localized properties and in turn lead to perfectible preventive training programs. Recent works have been focused on the putative role of muscle geometry and mechanical properties in injury risk exposure. Such investigations have been conducted at the whole muscle scale and in specific areas of the muscle-tendon complex, particularly exposed to injury (i. e. aponeuroses). This talk will propose to expose the current literature on this topic and will present recent data originating from the FULGUR project dealing with the links between muscle properties and muscle injury.

SPRINT-RELATED HAMSTRING INJURY RISK REDUCTION IN HIGH-LEVEL ATHLETES: SCREENING AND EXERCISE SELECTION

Johan Lahti (R5 Athletics & Health, Finland)
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Hamstring injuries remain the leading cause of time-loss in sprint-related sports, with high recurrence rates that continue to challenge both athletes and practitioners. Effective risk reduction requires more than isolated tests or exercises; it demands an multifactorial approach linking mechanisms, screening, and training design.

This presentation first addresses the demands of sprinting, where lengthening contractions at high velocity create substantial loading of the hamstrings. Both modifiable (strength, sprint exposure, pelvic control) and non-modifiable risk factors will be discussed. Screening will then be discussed as a tool for building context rather than predicting injury. Practical examples include strength assessment, sprint technique filming, pelvic angle testing and range of motion assessments, which help identify how torque production and hamstring loading vary across athletes. Such insights enable individualized programming.

Exercise selection will focus on evidence-based strategies: combining hip- and knee-dominant strengthening, eccentric overload, sprint-specific exposure and range of motion exercises. Some attention will be given to the realities of congested competition schedules, where strength training must be carefully placed to minimize residual fatigue. Examples include scheduling strength work after games, using isometrics before eccentric loading, and employing recovery modalities such as heat exposure. During the season, maintaining strength requires relatively low volumes, freeing space for sport-specific demands, while off-season training provides the opportunity for greater strength development.

In summary, hamstring injury risk reduction relies on connecting science with context: understanding mechanisms, screening effectively, and embedding smart training strategies within the competitive calendar.

Acknowledgements

- To my PhD mentors Jean Benoit Morin, Pascal Edouard, and Jurdan Mendiguchia

SESSION 4 - ACHILLES TENDON INJURIES: MODERN APPROACHES

INTERNAL STRUCTURAL ORGANISATION OF THE HUMAN ACHILLES TENDON; WHAT HAS HAPPENED TO SUB-TENDONS?

Toni Arndt (The Swedish School of Sport and Health Sciences, Sweden)
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The Achilles tendon (AT) is one of the most important tendons in the human body. In contrast to the representation of tendons in textbooks and models of the musculoskeletal system, tendons are not simple viscoelastic bands but are intricate multi-stranded structures. According to some literature, the AT is characterized by the presence of three sub-tendons corresponding to the three separate triceps surae muscles. These sub-tendons have been reported using imaging techniques and dissection in human specimens and using histological samples in rats and rabbits. However, the concept of sub-tendons in human AT remains controversial. An important question is whether the relatively clear identification of inter-sub-tendon regions in rat and rabbit AT can also be applied to human AT. Although our interpretations often consider the possibility, it is not yet clear that these regions can be specifically attributed to individual muscles – a prerequisite to the premise upon which sub-tendons are based. We are at present conducting a project attempting to identify human Achilles sub-tendons in histological cross-sections to see whether the previously reported rat and rabbit models could be confirmed in humans. For this purpose, AT samples from fresh human cadavers were analyzed histologically after Masson's trichrome staining. We observed the presence of numerous fascicles of varying size and number in all samples. In no cases could three distinct components corresponding to three sub-tendons attributed to specific muscles be observed. We suggest that caution be exercised, and the state of the science be acknowledged when using the term sub-tendon to investigate and/or describe internal AT tissue function.

STRUCTURE AND FUNCTION OF THE IMPAIRED ACHILLES TENDON: OLD PROBLEM IN NEW PERSPECTIVES

Taija Finni (University of Jyväskylä, Finland)
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Background: Achilles tendon rupture is a feared injury often without warning. Ruptures occur typically during sports activities where high forces appear. The assaulting event often involves calf muscle lengthening with high muscle activity when ankle reaches dorsiflexion. Research typically focus on the tendon itself, but the muscles attached have a vital role in returning to daily activities and sport.

Methods: I will use data from a cross-sectional ACHILLES-study when examining differences between healthy and injured individuals, and data from a prospective NoARC trial (NCT03734532), and when evaluating good recovery from Achilles tendon rupture.

Results: Healthy individuals have shorter and thinner Achilles tendon compared to tendinopathic or ruputured individuals. In more detailed examination, tendon fascicles arising from each head of the triceps surae, the soleus, gastrocnemius medialis (MG) and lateralis muscles are all shorter in healthy, compared to injured. Longer tendon induces muscle adaptations with shorter fascicles contributing to limited range of motion and decreased force production. Concurrently, the material properties of the muscle-tendon unit are altered. Shorter muscle fascicle length is associated with stiffer muscle belly (rp= -0.25 [-0.48 to 0.025]), but a more compliant aponeurosis (rp= 0.29 [0.06 to 0.50]) at rest in individuals with Achilles rupture. Those with greater strength, the entire muscle-tendon unit is stiffer. When recovering after Achilles rupture, MG fascicle shortening during heel-rise task increased from 6 to 12 months after rupture, reflecting improved capacity to work. However, the between-limb differences remained, the injured limb having persistently shorter resting MG fascicle length and longer MG subtendon length. One-year after rupture MG muscle had remodelled to shorter fascicle length, tendon regained stiffness allowing muscle to function effectively in daily activities such as walking. Such a recovery was accompanied by increased moderate-to-vigorous physical activity and daily steps reaching population-based normal levels by 6 and 12 months, respectively.

Conclusions: Rupture-related persistent structural changes with adaptation of muscle and tendon properties allow muscle fascicles to function effectively even with slightly elongated Achilles tendon. With active rehabilitation, Achilles tendon rupture may not severely compromise participation in overall health-promoting physical activity.

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EXERCISE SELECTION IN THE REHABILITATION AFTER ACHILLES TENDINOPATHY

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Achilles tendinopathy is one of the most common foot and ankle overuse injuries. Although, Achilles tendinopathy is a multifactorial process, it is believed that repetitive mechanical loading of the Achilles tendon plays a crucial role in the etiology and recovery of tendinopathy. Patients with AT have altered and often weakened morphological1, and mechanical2,3 properties compared to asymptomatic tendons. Rehabilitation from AT has long been advised to incorporate active treatment in which a gradual increase in tendon loading is preferred. However, insight in the internal loading (strain) of the tendon and in the factors that influence this internal loading during the recovery process are not know yet. To determine optimal training and rehabilitation programs we need to obtain better insight the effects of alterations in the tendon structure and muscle function on tendon strains in Achilles tendinopathy. We followed 40 patients with Achilles tendinopathy during their 12 weeks rehabilitation programs assessing tendon morphological and mechanical characteristics and muscle strength and function at 6 and 12 weeks after the start of the treatment. Significant functional improvements were observed, with VISA-A scores and hop test results showing marked improvements ($p<0.001$). No morphological changes were found but a significant increase in Achilles tendon stiffness ($p = 0.001$) and Young's modulus ($p < 0.001$) was observed over the course of the rehabilitation program. No differences in tendon non-uniformity were found following a 12-week rehabilitation program. Mechanical changes did not have a significant effect on the tendon strains during rehabilitation exercises. These findings suggest that tendon adaptation in response to mechanical loading primarily involves changes in mechanical properties rather than morphology, highlighting the complexity and variability in tendon adaptation. Clinically, these mechanical properties should be considered in the load progression throughout rehabilitation as potentially higher strains will be induced when clinical improvements precede mechanical adaptations.

WORKSHOP 1

RUNNING INJURY PREVENTION AND PERFORMANCE ENHANCEMENT USING WEARABLES

Bas van Hooren (Maastricht University, The Netherlands)
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In this talk Asst. Prof. Bas Van Hooren will discuss how wearables may be used to assess loading at common running injury locations, and how to use wearables to improve running performance. He will also discuss limitations of running wearables and demonstrate how a running wearable may be used to assess biomechanical loading during running.

WORKSHOP 2

INTEGRATING MARKERLESS MOTION CAPTURE INTO RETURN-TO-SPORT TESTING: THE SIMI MODULE BASED ON DR. CHRIS POWERS' PROTOCOL

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The ability to make informed return-to-sport (RTS) decisions following injury is critical for reducing re-injury risk and optimizing long-term athlete health. Traditional assessment methods often lack the objectivity, reliability, and ecological validity required for high-level decision making. To address this, Simi has developed a markerless motion capture module, based on the established Return-to-Sport testing protocol designed by Dr. Chris Powers, that provides an efficient and evidence-based approach to athlete evaluation.

This presentation will introduce the core features of the Simi markerless module, highlighting its ability to capture and analyze biomechanical performance across six standardized movement tasks. Emphasis will be placed on the advantages of markerless technology—rapid setup, non-invasive workflow, and objective data output—making it highly applicable in both clinical and high-performance sport settings. Case examples and reporting outputs will demonstrate how the system translates complex movement data into actionable insights, supporting practitioners in determining readiness for return to sport.

Acknowledgements

- The presenter acknowledges Dr. Chris Powers for the development of the original Return-to-Sport protocol on which this module is based, and the Simi Reality Motion Systems team for their contributions to the design, development, and validation of the markerless solution.

WORKSHOP 3

ASSESSING MUSCLE MECHANICAL AND NEUROMUSCULAR FUNCTION IN AGEING

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Age-related loss of muscle mass and muscle function appear on a different chronological scale for each individual and negatively affect the quality of life. Early detection of muscle decline is important for successful preventive actions. High-density surface electromyography (HDEMG) has recently been proposed as a tool to detect age-related decline in neuromuscular function at an early stage, and ultrasonography is frequently used to assess the size and texture of the muscles. However, these measurements are typically performed separately, and in different conditions (i.e., contraction vs. rest), missing valuable insights into the interplay between the neuromuscular and mechanical properties of the muscles. Additionally, HDEMG signals should be interpreted while considering muscle architecture. However, the concurrent acquisition of HDEMG and ultrasound signals have been challenging, especially from the same muscle region. This demo session will illustrate the simultaneous acquisition of high-density surface EMG (HDEMG) and ultrasound signals from the same muscle region using a novel electrode grid that is fully transparent to ultrasound. The session will address the methodological challenges associated with concurrent HDEMG and ultrasound recordings and describe how the new electrode design overcomes these limitations. Potential applications of this combined approach to the investigation of neuromuscular function will also be discussed.

POSTER SESSION 1

KINEMATIC ANALYSIS OF PICKLEBALL FOREHAND RETURN AND ACCURACY SKILL TRANSFER OF BADMINTON AND TENNIS PLAYERS

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Background: As a growing sport aiding to develop agility, coordination and strategy of recreational practitioners, similar skills from racquet sports found to be present in pickleball leading to post-career satisfaction of retired athletes, incidentally benefiting older adults' life-long participation. Data expected from this research were kinematic information from racquet sports athletes performing pickleball skills, helping in the training design development for pickleball participants including athletes and older adults.

Methods: Participants were twelve (N=12) badminton (BG) and tennis (TG) players with formal training and competition experiences. Skill accuracy was assessed while motion is being captured, gathering kinematic data using Kinovea 2023.1.2.

Results: Results show difference in accuracy scores of TG and BG with mean difference of 2.66 ($d = 0.983$). TG exhibited greater shoulder joint displacement during the forehand return, resulting to large effect size (Cohen's $d = 1.24$). Elbow angular displacement along with differences in shoulder joint displacement showed a weak relationship with accuracy scores ($r2 = 0.12$), despite BG showing lesser elbow angular displacement across striking phases. Large effect was observed between groups in elbow angular displacement during the countermovement and follow-through phases.

Conclusions: In conclusion, the coexistence of differences in shoulder joint displacement, elbow angle movement between phases, and base of support is apparent with skill accuracy scores of two groups. Future investigations are recommended to include effects on risk factors and physiological markers, and considering prominent movement analysis systems such as Motion Analysis Corporation (MAC) in accumulating information on pickleball performance.

Keywords: Skill transfer, Motor Acquisition, Sustainable Recreation

DEFYING AGE: BIOMECHANICAL EVIDENCE OF LIFELONG SPORT PARTICIPATION PRESERVING MUSCLE AND BONE HEALTH IN OLDER ADULTS FROM OGUN STATE, NIGERIA

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Background: This study investigates the biomechanical impact of long-term sport participation on muscle-tendon structure and function in ageing adults, using athlete case studies from Ogun State, Nigeria—an underrepresented context in ageing and sport research.

Methods: We conducted a comparative cross-sectional analysis involving 42 master athletes (aged 50–75) across disciplines (track, martial arts, football, tennis) and 38 age-matched sedentary controls. Assessments included ultrasound-derived muscle architecture (vastus lateralis and biceps femoris thickness and fascicle length), isokinetic dynamometry for hamstring/quadriceps torque ratios, and femoral neck bone mineral density (BMD) via DXA. Functional mobility was evaluated using the Lower Extremity Functional Scale (LEFS), and habitual activity levels through the IPAQ.

Results: Master athletes demonstrated significantly higher muscle thickness (mean difference: +13.2%, $p<0.001$), longer fascicle lengths (mean: 11.4 cm vs. 9.2 cm; $p=0.003$), and greater femoral neck BMD (+16.8%; $p=0.001$). Hamstring-to-quadriceps peak torque ratios were significantly higher in athletes (0.71 ± 0.09 vs. 0.58 ± 0.11, $p=0.002$), suggesting enhanced injury resistance. LEFS scores were elevated in athletes (74.3 ± 6.2 vs. 61.2 ± 5.9; $p=0.004$; Cohen's $d = 2.14$). Achilles tendon stiffness, assessed via elastography, was better preserved in athletes with >30 years of continuous training, although 19% showed early signs of tendinopathy—primarily among veteran footballers—due to chronic overload.

Conclusions: The results confirm that sustained sport participation significantly mitigates age-related musculoskeletal decline, particularly in lower-limb strength, bone health, and tendon elasticity. However, the data also reveals the importance of injury-specific load management in high-impact disciplines. This study is among the first to integrate real-time muscle and tendon analysis in a resource-limited African setting, demonstrating feasibility and delivering context-specific insights for healthy ageing interventions in sub-Saharan Africa.

Acknowledgements:

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THE EFFECTS OF CONCETRIC AND EXCENTRIC OVERLOAD TRANING ON PATELLA TENDON MECHANICAL PROPERTIES IN OLDER ADULTS

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Background: By age collagen-containing tissues, including tendons, become less rigid and tendons have lower tensile strength than young individuals, which increases the risk of patellar tendon injuries. A functional effect of reduced tendon stiffness may cause slower force production, which affects the time needed to slow down bodyweight, thus increasing the number of falls in old age. Eccentric training puts more mechanical stress on the tendon, which can stimulate collagen fiber reorganisation. This suggests that excentric training could be a promising solution.

Objectives: This study aims to investigate the effects of resistance training comprising concentric and eccentric loads on patella tendon stiffness and RTD (rate of torque development) in older adults.

Methods: 60 participants (30 male, 30 female) are randomly assigned to three groups focusing on concentric overload, eccentric overload and an active control group (walking program). Participants will perform machine-based resistance training sessions three times per week for three month. Before and after the intervention, muscle strength, rate of torque development and tendon properties will be assessed. Statistical analyses will determine intervention-induced changes, with the primary outcome being the patella tendon stiffness.

Expected Results: The central hypothesis is that eccentric overload resistance training will positively impact patella tendon stiffness and rate of torque development and improve the functional performance.

Conclusion: If confirmed, the findings may emphasize the importance of resistance training in reducing the number of patellar tendon injuries and the risk of falls.

Keywords: aging, resistance training, eccentric overload, muscle-tendon function, patella tendon stiffness, RTD

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IN-VIVO ASSESSMENT OF MUSCLE MICROSTRUCTURAL PROPERTIES IN PARKINSON'S DISEASE USING QUANTITATIVE ULTRASOUND RADIOFREQUENCY TECHNIQUE

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Background: Parkinson's disease (PD) is the second most prevalent neurodegenerative disorder, affecting approximately 1% of individuals over 60 years [1]. Current clinical tools, such as the Hoehn-Yahr Scale and the Unified Parkinson's Disease Rating Scale (UPDRS), are non-quantitative and may limit accurate disease monitoring [2]. Quantitative ultrasound (QUS) has emerged as a promising method to provide objective biomarkers of muscle quality. Among QUS techniques, ultrasound Nakagami imaging quantifies tissue microstructure and has shown potential in neuromuscular disorders such as Duchenne Muscular Dystrophy [3]. Its application to Parkinson's disease, however, remains unexplored. This study aimed to investigate whether Nakagami imaging could reflect disease severity in PD and support patient evaluation.

Methods: The study included 17 PD-patients (7M/10F) and 15 healthy controls (7M/8F). PD-patients were divided into early-stage (H-Y ≤ 2, n = 7) and late-stage (H-Y > 2, n = 10) groups based on UPDRS Part III and Hoehn-Yahr scores. The International Physical Activity Questionnaire (IPAQ) was utilized to assess physical activity levels in all participants. B-mode and Radiofrequency (RF) data were collected from tibialis anterior (TA) and gastrocnemius medialis (GM) on both limbs using an ultrasound apparatus (ArtUs EXT-1H, Telemed UAB). B-mode data were used to investigate muscle geometry while Nakagami parameters were derived from RF signals.

Results: The three groups were matched for age (69–77 years), height (1.64–1.68 m), and body mass (68–73 kg), but not for IPAQ scores. One-way ANCOVAs showed no differences between limbs; thus, only group comparisons are reported. Significant differences in Nakagami parameters were observed between controls and late-stage patients in both GM ($p < 0.001$) and TA ($p < 0.01$). Further differences emerged between early- and late-stage patients in GM ($p < 0.001$), as well as between early-stage patients and controls ($p < 0.001$). No group differences were found in muscle geometry. Nakagami parameters of GM on the most affected side correlated with the Hoehn-Yahr scale (R = 0.619, p = 0.01). These findings suggest that ultrasound Nakagami imaging can quantitatively differentiate PD severity and may complement current clinical scales. Further research is needed to establish its clinical utility and role in long-term monitoring.

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THE MEDIATING EFFECT OF RELATIVE LEG EXTENSOR STRENGTH IN THE RELATIONSHIP BETWEEN RELATIVE FEMUR LENGTH AND MAXIMUM KNEE FLEXION ANGLE DURING THE COUNTERMOVEMENT JUMP

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Background: Movement strategies vary across athletes and may be influenced by both strength and anatomical proportions. The countermovement jump (CMJ) is a common movement pattern in sports and a well-studied exercise for both athletic performance and biomechanics research. Studies on CMJ have shown that technical differences exist between athletes, resulting in altered loading of the joints involved. To the authors' knowledge, the variables associated with these technical differences are an understudied area. Therefore, the purpose of this study was to investigate the mediation effect of relative knee extensor strength between relative femur length and maximal knee flexion angles during the CMJ.

Methods: Thirty-six collegiate team sport athletes (16 males, 20 females) underwent anthropometric measurements, strength testing (5RM leg extension), and CMJ kinematic assessment with inertial measurement units (Xsens Awinda). Relative femur length (femur-to-height ratio), relative leg extensor strength (leg extension-to-bodyweight), and maximum knee flexion angle during the CMJ were analyzed. Mediation analysis was performed using the PROCESS for SPSS (Hayes, 2022), with 5000 bootstrap resamples.

Results: The relative femur length significantly predicted the leg extensor strength ($p = 0.043$), and the leg extensor strength positively predicted the maximum knee flexion angle ($p = 0.018$). The direct effect of relative femur length on the knee flexion angle was not significant ($p = 0.637$), whereas the indirect effect through leg extension strength was significant, B = 185.08, SE = 93.34, 95% CI [45.54, 435.90]. When scaled to the interquartile range of relative femur length ($\Delta x = 0.012$), it corresponded to a ≈2.2° change in the knee flexion angle. Sobel test results showed a similar trend ($z = 1.61$, $p = 0.11$), although it was not statistically significant. These findings suggest that the relationship between relative femur length and CMJ knee flexion angle can be largely explained by relative knee extensor strength.

Conclusions: Relative femur length influences CMJ strategy indirectly through leg extensor strength, showing that strength acts as a mediator of anatomical factors in jumping kinematics. Although these findings may not directly translate into practice, they provide a step towards understanding the role of anatomical and physiological variables in movement strategies.

BIOMECHANICAL EFFECTS OF KNEE JOINT ANGLE ON SOLEUS FUNCTION IN ISOKINETIC PLANTARFLEXION

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Purpose: Contribution of the gastrocnemii muscles to ankle moment is influenced by the knee joint position because they span the knee and the ankle joint as well. However limited information is available on the effect of knee joint position on soleus activation under dynamic plantarflexion, hence the aim of this study was to investigate if soleus have a compensatory strategy in fascicle behavior or EMG activity during knee flexed plantarflexion in order to reduce the magnitude of the decrement in ankle moment.

Equipment and Methods: Isokinetic dynamometry with EMG and ultrasound measurements was used to estimate medial gastrocnemius and soleus behavior during knee flexed and extended plantarflexions using three angular velocities. Seventeen healthy males were participated in this study.

Results: Flexed knee plantarflexions resulted in lower peak ankle moments at all ankle angular velocities by 18% ($p=0.1062$) at 30°·s-1, 44% ($p<0.001$) at 60°·s-1 and by 18% ($p=0.0001$) at 120°·s-1. Soleus showed significantly higher EMG activity during knee flexed plantarflexion at 30°·s-1 ($p=0.0094$) and 60°·s-1 ($p=0.0142$). The magnitude of mean shortening of the medial gastrocnemius and soleus show statistically significant difference between knee flexed and knee extended plantarflexion at any contraction velocity.

Conclusions: Soleus may perform a compensatory EMG activity in knee flexed plantarflexions possibly to counteract the reduced contribution of gastrocnemius to ankle moment at low angular velocity contractions.

Keywords: Muscle function; Concentric contraction; Dynamometer; Ultrasound; EMG

NEUROMUSCULAR CHARACTERISTICS OF PREVIOUSLY INJURED AND NON-INJURED BICEPS FEMORIS IN COMPETITIVE ATHLETES: RESEARCH PROPOSAL

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Background: Strain injuries are frequently observed in the biceps femoris long head (BFlh), particularly in sprint based athletic activities.[1] Most studies focus only on the mechanical aspects of injury mechanisms, yet injury rates keep increasing. The neuromuscular aspects of hamstring injuries (HSI) are unclear, especially at the level of motor units (MUs). The objective of this ongoing study is to investigate the MU characteristics of the BFlh based on high-density surface electromyography (HD-sEMG) signal decomposition in recently injured track and field athletes in comparison to healthy, non-injured athletes during submaximal contractions and an isometric fatigue protocol on a dynamometer to find a correlation between the assessed neuromuscular characteristics of the BFlh and the history of HSI. The study also seeks to determine whether muscle length has an effect on MU characteristics, providing further insight into the neuromuscular mechanisms underlying HSI.

Methods: High-density surface electromyography (HD-sEMG) is being used to assess MU activity using three 8x4 grids (96 channels) during submaximal contractions and an isometric fatigue protocol on a dynamometer at different BFlh muscle lengths. The analysis of the variables of interest is being done by signal decomposition to individual motor units using DEMUSE software.

Expected results: We expect that the previously injured group will exhibit lower BFlh MU discharge rates and greater coefficient of variation (CoV) for interspike interval (ISI) compared to the healthy group. Additionally, we expect that different muscle lengths will influence MU characteristics, including recruitment threshold discharge rate, and spatial activation patterns. Furthermore, we anticipate that isometric fatigue will induce neuromuscular changes and that individuals with a history of HIS may exhibit altered neural drive responses compared to the healthy controls.

Conclusion: The findings of this study will reveal whether there is a link between the neuromuscular properties of the BFlh muscle and a history of hamstring injuries. This will serve as a foundation for subsequent longitudinal follow-up studies and interventions and may facilitate a deeper comprehension of the underlying mechanisms of hamstring injuries, may serve as a screening tool, and may contribute to a reduction in injury rates in the long term.

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TRANSVERSE ARCH SUPPORT IMPROVES GAIT BIOMECHANICS OF FEMALES WITH FLEXIBLE FLATFOOT

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Background: Flexible flatfoot, characterized by medial longitudinal arch collapse, can lead to altered biomechanics and musculoskeletal complications. Foot orthoses are widely used to address flexible flat foot, but the impact of dual-arch (medial longitudinal plus transverse arch) support remains understudied. This study explores the effects of single-arch and dual-arch orthoses on arch height, joint kinematics, and kinetics during walking and jogging in young females diagnosed with flexible flatfoot.

Methods: Nineteen females with flexible flatfoot were tested under three conditions: regular shoes, single-arch foot orthoses (SFO), and dual-arch foot orthoses (DFO). Motion capture and a 3D force plate gathered biomechanical data, while dynamic foot morphology was assessed using high-speed dual fluoroscopic imaging. Key variables included normalized truncated navicular height, medial arch angle, angles and moments at the metatarsophalangeal, subtalar, ankle, knee, and hip joints.

Results: Both orthoses significantly increased normalized truncated navicular height and reduced medial arch angle (SFO: $p = 0.026$; DFO: $p < 0.001$), with DFO vs. SFO showing greater effects across 16-100% of the stance phase. During both walking and jogging, SFO and DFO significantly reduced metatarsophalangeal joint range of motion (SFO: $p = 0.013$; DFO: $p < 0.001$) and increased maximum subtalar dorsiflexion (SFO: $p = 0.002$; DFO: $p < 0.001$). DFO further reduced metatarsophalangeal dorsiflexion and ROM compared to SFO ($p < 0.001$). Additionally, DFO decreased ankle ROM and maximum knee flexion during walking ($p < 0.001$). Both SFO and DFO can significantly reduce plantarflexion moments of the subtalar joint during stance phase of walking ($p < 0.001$ for both). SFO and DFO can also significantly increase ankle plantarflexion moment in the early support phase (SFO: $p < 0.001$; DFO: $p = 0.048$) and reduce the ankle plantarflexion moment in the late support phase ($p < 0.001$ for both). During jogging, only DFO significantly increased metatarsophalangeal joint plantarflexion moments during the stance phase ($p < 0.001$) compared to the control condition.

Conclusion: Maintaining the integrity of the transverse arch structure enhances longitudinal stiffness and elastic responsiveness of the foot. These findings have implications for treating arch dysfunction and provide insights for shoe developers seeking to enhance propulsion.

Keywords: Flexible Flatfoot, Foot Orthoses, Transverse Arch Support, Medial Longitudinal Arch, Gait Analysis, Joint Kinematics, Foot Stability

THE SHAPE AND VOLUME OF THE HAMSTRING MUSCLES OF SPRINT-BASED ATHLETES AND THEIR POSSIBLE EFFECTS ON INJURY RISK

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Background: Strain injury in the biceps femoris long head (BFlh) is common in sprint-based sports, especially at the proximal muscle-tendon junction. MRI-based musculoskeletal modelling has shown that a wider proximal region of the BFlh muscle increases the fibre strain in this region during sprinting. Additionally, optimised force-sharing between hamstring muscles may reduce injury risk, which is at least partly dependent on the distribution of muscle volume. This study aimed to examine distribution of muscle volume in hamstrings, and whether there are differences in BFlh muscle shape between sprint-based and strength-trained athletes.

Methods: Thirteen sprinters/hurdlers/long jumpers (World Athletics score = 1078 ± 62, 5 females) and 12 strength-trained controls (6 females) participated in this study. The bi-articular hamstrings were scanned using 3D freehand ultrasound. Surface meshes were segmented and were analysed using bootstrapping-based statistical shape modelling. Volumes were normalised to body dimensions (mm3/kg×m). Average hip extensor torque was measured between 45° and 20° hip flexion angles defined by 3D motion capture, at slow ($60°\cdot s^{-1}$) and fast ($350°\cdot s^{-1}$ concentric contractions using an isokinetic dynamometer.

Results: Of all muscles, only semitendinosus (ST) volume was larger in the sprint-based athletes. Sprint-based athletes produced significantly greater torque than controls at fast concentric contraction ($p<0.05$), while no difference was found at $60°\cdot s^{-1}$. BFlh shape was different between groups: 5% of the vertices were larger in the sprint-based group, which was located mostly in the proximal region, and 8% of the vertices were smaller, and were located in the middle region of the muscle ($p<0.05$).

Discussion: The unique shape of the BFlh in sprint-based athletes may contribute to larger strain at the proximal muscle-tendon junction in sprinting, possibly increasing strain injury risk. This might be mitigated by the large volume of ST, which may unload and protect the BFlh in the late swing phase of sprinting. The larger relative volume of the fusiform ST may explain why sprint-based athletes are strong at fast compared to slow velocity hip extension when measured in a range of motion that is similar to the early stance phase of sprinting.

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POSTER SESSION 2

THE IMMEDIATE EFFECTS OF VERBAL AND VISUAL INSTRUCTIONS ON LIFTING MOVEMENT KINEMATICS IN CHILDREN - A CASE STUDY

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Background: Injuries greatly influence sports performance, making proper technique paramount. The development of sports-specific skills is the most efficient and cardinal during childhood. The present study examined the immediate effects of verbal, visual, and combined instructions on the simultaneous hip and knee joint extension of the concentric phase of the deadlift in children. Both visual and verbal instructions could enhance lifting technique, but the combined use of them, may lead to greater improvements in performance and retention.

Methods: Twelve healthy children, aged 9-11, took part in the study without previous technical training. To objectively assess movement quality, we created a scoring system, which we used for inclusion. Having the inclusion requirements met, participants were randomly sorted either to verbal, visual or combined groups. Reflective markers were placed on the lateral malleolus of the ankle, lateral condyle of the knee and the trochanter major, allowing for detailed movement analysis performed with online motion capture software. The simultaneity of knee and hip joint extension during the deadlift was determined by using the mathematical distance, using the joint position-time curves. Preceding the instructions, participants performed three repetitions without any instructions with a 1kg medicine ball. Participants were instructed accordingly to their groups and after that they repeated the deadlift, using a ball equal to 10% of their bodyweight. Retention of the technique was re-evaluated after 48 hours.

Results: Relative to the pre-instruction values, angular mathematical difference of the hip and knee-joint was decreased by 48% in the verbal instruction group, by 39% in the combined and by 25% in the visual group, which meant that the joints moved more simultaneously based on retention phase measurements.

Conclusions: These findings suggest that the verbal instruction group was the most effective approach to improve and retain deadlift technique among young participants. The results highlight the importance of verbal instructions in physical education and sports.

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ACHILLES TENDON PROPERTIES IN HEALTHY YOUNG MALE AND FEMALES: A PILOT STUDY

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Introduction: Systematic reviews suggest that up to 80% of Achilles tendon injuries occur in men. However, sex-differences in Achilles tendon mechanical and morphological properties have been inconsistent. Therefore, this study aimed to compare selected Achilles tendon properties between healthy young males and females.

Methods: Healthy young adults (4 males, 5 females; age: 31.3 ± 9.19 years, mass: 67.8 ± 17.48 kg height: 174.7 ± 9.59 cm) participated in this study. Study volunteers were sports science university students and pursued various sports disciplines without a recent or past Achilles tendon injury. Maximal plantarflexor isometric torque was measured by dynamometer in a prone position with the knee extended and ankle at 90˚. Achilles tendon moment arm and stiffness were measured using the tendon excursion method. Morphological parameters of the Achilles tendon at rest, such as cross-sectional area and thickness were assessed by ultrasound at the level of the medial malleoli. A series of independent t-tests were performed to analyze sex-differences using the JASP (version 0.19.3) statistical program.

Results: We observed no sex-differences in the measured morphological and mechanical variables of the Achilles tendon. Specifically: moment arm (cm); male = 3.0 ± 0.8 female= 2.92 ± 0.36 (t = -0.182, p = 0.860), stiffness (N/mm); male = 293.97 ± 347.80 female = 229.16 ± 102.93 (t= -0.401, p = 0.700), and tendon thickness (mm); male = 6.65 ± 1.0 female = 6.36 ± 0.57 (t = -0.384, p = 0.713). Maximal plantarflexor isometric torque (Nm); male =72.5 ± 23.05 female =70.73 ± 20.20 (t = -0.118, p = 0.909), Sex-differences in tendon cross-sectional area (mm²) revealed a large effect size (d = 1.25) without statistical significance (male = 85.5 ± 21.20, female = 65 ± 11.57 , t = -1.862, p = 0.105).

Conclusion: The current preliminary data are limited by the small sample size. The lack of sex-differences in Achilles tendon properties might be related to differences between the two sexes in training history, sports disciplines, and training status at the time of testing. Additional data we are currently collecting might help resolve the inconsistencies in sex-differences in Achilles tendon properties reported by previous studies.

PRESERVED STRETCH-SHORTENING CYCLE EFFICIENCY BUT IMPAIRED EXPLOSIVE STRENGTH IN OLDER ADULTS: IMPLICATIONS FOR ECCENTRIC OVERLOAD TRAINING

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Introduction: Age-related decline is not uniform in measures of neuromuscular function. There is a relative maintenance in maximal voluntary eccentric vs. concentric and isometric force (MVC). It is unclear how age effects measures that are even more closely related to daily function such as stretch-shortening cycle (SSC) efficiency tested during dynamometry and vertical jumps. Identifying age-differences in neuromuscular outcomes could inform prescription of resistance training especially with an eccentric overload to target age-typical deficiencies at the start of a resistance training program.

Methods: We compared healthy, active young adults (32.4 ± 5.59 years, n=4) and older adults (73.75 ± 2.75 years, n=4) in selected neuromuscular outcomes of the knee extensor muscles. Participants performed MVC knee extension and SSC contractions on a dynamometer and peak strength, the rate of torque development and mechanical efficiency was calculated. In addition, squat and counter-movement jumps were also performed where jump height and related parameters calculated. All measurements were conducted twice to establish test-retest reliability.

Results: Mechanical efficiency and SSC effect during SSC contractions were similar between Young (Y: 45.09 ± 2.06%) vs. Old (O: 44.92 ± 1.13%) and (Y: 1.10 ± 0.10 vs. O: 1.08 ± 0.17) respectively. However, younger adults demonstrated knee extensor higher torque and rate of torque development during the isometric contractions (Y:0.78 ± 0.24 vs. O: 0.25 ± 0.17 Nm/ms, $p = 0.01$, $d = 2.50$). There also were no age-differences in MVC (Y: 130.45 ± 15.91 vs. O: 122.87 ± 23.26 Nm, $p = 0.60$, $d = 0.39$). Squat jump height (Y: 0.27 ± 0.05 vs. O: 0.13 ± 0.02 m, $p < 0.01$, $d = 3.17$), and countermovement jump height (Y: 0.34 ± 0.06 vs. O: 0.15 ± 0.03 m, $p < 0.01$, $d = 3.87$). All measurements demonstrated excellent test-retest reliability (ICC > 0.85).

Conclusion: While mechanical efficiency and SSC effect remain preserved with aging, explosive strength and jump performance show significant age-related declines. The lack of significant difference in MVC despite age differences suggests it may not be a sensitive indicator of age-related muscle function changes. Such data inform our subsequent eccentric overload training intervention to improve older adults' neuromuscular function especially affected by aging.

BEYOND DURATION: POSTURAL ERROR AS AN OBJECTIVE ENDPOINT IN THE PRONE PLANK TEST

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Background: Trunk muscle strength plays a crucial role in many sports fields, especially in sport-specific movements. While the plank test is widely used to assess trunk muscle endurance, yet its lack of standardization limits its effectiveness in high-performance environments. The study aimed to establish objective criteria for identifying the endpoint of the static plank position and introduce a novel variable, postural error (PE), for assessing trunk stability.

Methods: This study involved 23 (age = 15.22 years, weight = 66.3 kg, height = 174 cm) healthy female basketball players competing in the Hungarian U16 first league. Using optical motion capture, the thoracic kyphosis (TK) and lumbar lordosis (LL) were monitored during the test. The TK and LL angles were determined using 3D spline fitting with the spinous processes of ten specific vertebrae (C6, T1, T4, T6, T8, T10, T12, L2, L4, and L5). The endpoint of the prone plank test was determined based on the area under the LL angle curves, which characterizes the magnitude of displacements over time.

Results: Comparison of expert-estimated and calculated endpoints revealed that the most accurate mathematical formula used the average of the first 15 seconds as an initial angle, with a maximum allowable deviation of ±25°. Beyond determining the cutting point, PE was introduced to capture differences in postural control strategies. This metric differentiated performance among athletes with similar plank durations, highlighting subtle variations in trunk stability.

Conclusion: The present study introduces a new method for objectively defining the endpoint of the prone plank test and introduces PE as a complementary measure of trunk stability. Together, these contributions provide a more reliable and sensitive approach for evaluating trunk muscle endurance in young athletes, with potential applications in both training and performance monitoring. Furthermore, this method may support injury prevention and rehabilitation by enabling early detection of trunk stability deficits and guiding targeted corrective strategies.

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BIOMECHANICAL PERSPECTIVES ON THE IMPACT OF SPORT IN NEUROLOGICAL DISORDERS: INSIGHTS FROM FINITE ELEMENT ANALYSIS

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Background: Age-related neurological disorders, such as Parkinson's disease, represent a major global health challenge due to their progressive impact on motor control, independence, and quality of life. The decline of musculoskeletal structures, including sarcopenia, tendon dysfunction, and joint instability, further exacerbates functional limitations in affected individuals. While sport science has traditionally focused on enhancing athletic performance, its biomechanical principles hold great promise for clinical applications in neurological rehabilitation. Understanding the interplay between neuromuscular decline and mechanical loading is essential for developing effective, personalized interventions.

Methods: This study adopts a multidisciplinary approach that combines sports biomechanics and computational modeling. Finite Element Analysis (FEA) was employed to simulate the biomechanical consequences of neurological deterioration on critical muscle–tendon units, including the hamstring and Achilles tendon. Model parameters were informed by experimental data from sport-related assessments and prior clinical findings. Structural and functional changes were quantified under varying loading conditions to capture the influence of age, disease progression, and physical activity levels.

Results: Preliminary FEA results demonstrate significant alterations in stress distribution and strain patterns in tendon and muscle tissues associated with neurological decline. These changes were particularly evident in simulations of reduced muscle activation, which mimic the neuromuscular deficits observed in Parkinson's disease and related disorders. Importantly, simulations incorporating sport-based activity protocols—such as resistance training and dynamic loading—revealed improved mechanical resilience and functional compensation in musculoskeletal structures. These findings highlight the potential of sport-derived interventions to slow down degeneration and enhance mobility in patients with neurological disorders.

Conclusions: The integration of experimental biomechanics and FEA provides a powerful framework to investigate the role of sport in managing neurodegenerative conditions. The results suggest that life-long physical activity, when guided by biomechanical modeling, can support musculoskeletal health, reduce functional decline, and promote independence in ageing populations. Sport-based rehabilitation strategies may thus serve as innovative, evidence-based approaches to improve outcomes in neurological care.

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MUSCLE-SPECIFIC ADAPTATIONS OF DISTAL HAMSTRINGS TENDON MECHANICAL PROPERTIES FOLLOWING ACUTE STRETCHING

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Background: Static stretching is frequently used to improve flexibility, but its acute impact on tendon mechanical properties remains uncertain. Due to significant structural and functional differences between the distal medial and lateral hamstring tendons, there may be muscle-specific responses following static stretching. This study examined the muscle-specific adaptations in the mechanical properties of the distal hamstring tendons following acute static stretching.

Methods: Fifteen healthy adults were recruited and performed a set of hamstring static stretches (5 sets × 90 s). Three-dimensional ultrasound images of the medial and lateral hamstring distal tendons were obtained at rest and during submaximal contractions at 20%, 40%, 60%, and 80% of maximum voluntary isometric contraction (MVC) of the knee flexors, before and immediately (within 10 minutes) after stretching. The hip joint was set in neutral position and the knee fully extended (180°). Ultrasound images were manually digitized to reconstruct three-dimensional tendon models. Tendon length, volume, and cross-sectional area (CSA) were measured at three sites along the tendon, and strain was calculated relative to rest.

Results: MVC torque decreased significantly after stretching (-7.9% ± 3.7% $p < 0.01$). After static stretching, tendon elongation (strain) was greater for biceps femoris long head (BFlh) (11.6 ± 6.5%, collapsed across force levels) and least for the medial hamstrings tendons (semitendinosus, ST: 7.7 ± 4.3% and semimembranosus, SM: 5.2 ± 4.1%). Additionally, CSA strain was greater for lateral hamstring tendons (BFlh: 12.1 ± 7.1% and biceps femoris short head: 13.8 ± 8.4%, collapsed across force levels) than the medial hamstrings tendons (ST: 9.4 ± 6.8% and SM: 8.9 ± 6.1%). No significant changes in tendon-volume strain were detected ($p>0.05$).

Conclusion: Changes in the mechanical properties of distal hamstring tendons after stretching varied across muscle. The greater elongation observed in the BFlh and the increased CSA strain in the lateral tendons suggest that stretching may acutely shift mechanical load distribution within the hamstring muscle group. These findings underscore the need to consider tendon-specific adaptations when incorporating stretching into training regimens or rehabilitation protocols.

Acknowledgements:

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INTEGRATION OF DIGITAL TECHNOLOGY IN SPORTS NUTRITION: APPLICATION POSSIBILITIES OF SOFTWARE SUPPORTING SPORTS DIETETIC COUNSELING FOR AMATEUR AND ELITE ATHLETES

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Introduction: Interpersonal dietary counseling, tailored to individual needs and based on behavioral change principles, is highly effective for athletes. Integrating digital technology in sports nutrition offers new avenues for personalized dietary guidance, performance optimization, and habit monitoring via software solutions. This poster explores the application of such software for both amateur and elite athletes and shares initial usage experiences.

Methods: We reviewed the key features and applications of sports dietetic counseling software, highlighting their role in nutritional data management, analysis, and personalized diet creation within a novel hybrid (online-contact) counseling model. This approach aims to enhance athletes' nutritional knowledge and the effectiveness of dietary education, thereby improving the quality and safety of support. A 3-month pilot study tracked 80 amateur and elite athletes' software usage, followed by a questionnaire assessing their experiences. Descriptive statistical analysis was conducted using Microsoft Excel 2019.

Results: The pilot study included 92.9% amateur and 7.1% elite athletes. Application usage varied, with 46.5% using it 2-3 times weekly and 25.6% daily. Regarding functionality, 39.5% were satisfied or very satisfied, 62.8% found it easy to use, while 23.3% encountered difficulties with specific features. 74.4% were satisfied with the provided diets. Our findings indicate the potential for this new counseling method to become a routine, enabling faster creation of individualized diets, facilitating real-time dietitian-athlete communication, and allowing for timely professional intervention.

Conclusions: Digital technology integration in sports dietetics offers significant advantages for both amateur and elite athletes. Software solutions enable more precise nutritional monitoring and analysis, leading to more effective personalized diets. Healthcare professionals can leverage

these tools for up-to-date athlete status monitoring and tailored guidance, strengthening relationships and engagement. Future research should focus on the long-term impacts of such software and further advancements in the digitalization of sports dietetic counseling.

THE ACUTE EFFECT OF WHOLE-BODY VIBRATION ON POSTURAL BALANCE AND NEUROMUSCULAR SYSTEM IN ACL-RECONSTRUCTED AND HEALTHY ATHLETES: A PRELIMINARY STUDY

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Background: The objective of anterior cruciate ligament reconstruction (ACLR) is to reestablish neuromuscular control and mechanical stability. Nevertheless, proprioceptive and neuromuscular deficits, particularly in postural balance, may persist even after complete rehabilitation. Whole-body vibration (WBV) has been suggested as a neuromuscular stimulus capable of improving muscular activity and proprioception. The aim of this study was investigating the acute effect of WBV on the body sway and its neuromuscular control in ACLR and healthy individuals.

Methods: Twenty-seven competitive athletes were divided into two groups: 13 ACLR and 14 healthy controls (HC). Utilizing center of pressure (CoP) sway measurements on a force platform, postural balance was evaluated in both static and dynamic conditions (single-leg and double-leg stance) in both the anterior–posterior (AP) and medio-lateral (ML) directions. Synchronized surface electromyography (sEMG) was bilaterally recorded from the vastus lateralis (VL), biceps femoris (BF), tibialis anterior (TA), and lateral gastrocnemius (LG). Participants performed seven 30-second sets of WBV in randomized conditions (0.0 to 8.4g).

Results: After WBV, the HC group exhibited significant decreases in CoP sway during static single-leg stance (ML and AP; $p \leq 0.03$), whereas the ACL-R group did not exhibit any significant changes. In double-leg stance with closed eyes, ACL-R participants demonstrated more ML sway during dynamic conditions ($p = 0.027$). The ACL-R group exhibited a significant decrease in sEMG activity in the operated leg for BF during static and dynamic double-leg stance ($p \leq 0.041$), whereas the HC group exhibited reduced VL activity in the dominant leg ($p = 0.033$). The distal muscles (TA, LG) were less activated in the HC group during single-leg tasks ($p \leq 0.049$). There were no significant between-group differences, but moderate r effect sizes were observed (e.g., BF, LG; ES≈ 0.38).

Conclusions: In both ACLR and healthy individuals, a single WBV session induces neuromuscular responses, with a particular emphasis on the reduction of muscle activity. Nevertheless, the HC group was the only one to experience improvements in postural balance, whereas the ACLR participants exhibited increased sway in dynamic tasks, which suggests that sensorimotor integration was impaired. The integration of long-term WBV into rehabilitation protocols may facilitate the sensory-motor improvement of balance control, as these findings underline persistent neuromechanical changes in the ACLR population.

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EFFICACY OF HYALURONIC ACID COMBINATION ON MUSCULOSKELETAL HEALTH, ACTIVE AGEING AND REGULAR PHYSICAL EXERCISE ADHERENCE IN ELDERLY PENTATHLETES

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Background: It is important to explore how elderly athletes prevent sarcopenia and avoid tendon injury to continue regular exercise as it has been their routine for many years of sporting activity. Hyaluronic acid helps to lubricate joints and knees (Xiang et al., 2024); Pillay et al., 2024) Šimek et al., 2025). However, fewer studies are on pentathlete sports related to biomechanics. Hungary (from the European Federation) and Pakistan (from the Asian Federation) are both member countries of the Modern Pentathlon Association; hence, there is a convergence of a common theme.

Methods: This study is correlational cross-sectional study completed using STROBE list. A total sample of 220 pentathletes was recruited from Pakistan's governmental sports organisation through purposive sampling. The researchers administered valid and reliable instruments of Musculoskeletal Health Questionnaire (Norton et al., 2018), Active Ageing (Rantanen et al., 2018) and Regular Physical Exercise Adherence (Pereira et al., 2023) with demographic sheets that indicate a dichotomous question of taking hyaluronic acid with details of age, income and gender. After normality testing, Pearson product-moment correlation, regression analysis and multivariate analysis of variance were carried out. Independent samples t-test was taken to explore mean score differences between groups who take hyaluronic acid as compared to those who do not take hyaluronic acid and with mean differences on musculoskeletal health, active ageing and regular physical exercise adherence.

Results: Correlation shows significant associations among musculoskeletal health, active ageing, regular physical exercise and hyaluronic acid use combination. Multivariate analysis of variance shows high mean averages for males with higher income levels, with a mean age of 35.5 years of age have better musculoskeletal health and perform exercise regularly. The independent sample t-test shows significant mean differences between the athletes who use the hyaluronic acid combination and those who do not on three psychometric constructs.

Conclusions: Extraneous and control variables are underlying metabolic diseases that can be posed during the lifetime of athletes; hence is a limitation of the study. Further longitudinal and cross-cultural Asian and European studies can give more insight into healthy ageing and sporting behaviour. The present study confirms the positive efficacy of hyaluronic acid on joints, kinematic function and intensive exercise-induced muscle pain. Hyaluronic acid may also reduce the impact of rapid sarcopenia in elderly pentathletes.

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BIOGRAPHICAL SKETCHES

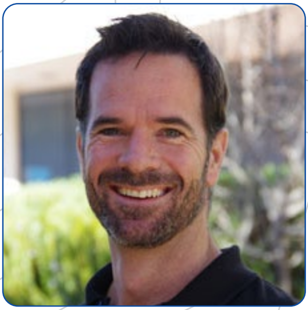
ALBERTO BOTTER

Alberto Botter received the M.S. degree in Electronics Engineering and the Ph.D. in Biomedical Engineering from Politecnico di Torino (Italy) in 2005 and 2010, respectively. He is currently associate professor of biomedical engineering at Politecnico di Torino. His primary research interests include the development and application of innovative methodologies to investigate the electrical, anatomical, and mechanical properties of skeletal muscles in vivo. His work spans areas such as high-density surface electromyography, ultrasound imaging, neuromuscular electrical stimulation, and innovative electrode technology. He is a member of the editorial board of the Journal of Electromyography and Kinesiology (Elsevier) and serves as Associate Editor for IEEE Access (Institute of Electrical and Electronics Engineers). He has authored over 100 peer-reviewed articles, four book chapters, and holds a patent on an electrode technology enabling the simultaneous acquisition of high-density surface EMG and ultrasound images.

ANDRÁS HEGYI

András Hegyi received his Kinesiology MSc degree from the Hungarian University of Sports Science (HUSS, Hungary) in 2013 and received his PhD degree from the Neuromuscular Research Centre of the University of Jyväskylä, Finland in 2020. Then, he worked as a post-doc researcher at the University of Nantes (France), where he worked with elite athletes, in close collaboration with the French Institute for Sports (INSEP). András has returned to the HUSS in 2023, where he currently works as a research fellow. He also acts as the head of biomechanics and sports science at the Brüll Alfréd Methodology and Research Centre, which aims provide evidence-based support for elite athletes. His main research interests include the neuromuscular, muscle morphological, and mechanical properties of skeletal muscles in relation to sports performance and injury prevention.

ANTHONY BLAZEVICH



Tony Blazevich, PhD, is a Professor of Biomechanics and lecturer in clinical neurophysiology in the School of Medical and Health Sciences, Edith Cowan University, Australia. His research aims to determine: (1) the relative influence of musculo-tendinous and neural factors on human movement performance; and (2) the adaptive responses of these factors to exercise training and detraining in both healthy, sports, aged, and clinical populations. His research uses a broad range of techniques in the areas of biomechanics, neurophysiology and strength & conditioning. He has published over 240 peer-reviewed research papers, gaining ~20,000 citations, and is the author of Sports Biomechanics: The Basics (3rd edition, Bloomsbury, UK). Professor Blazevich has also worked with athletes for >30 years, from development programs to Olympic Gold medallists, with a specific focus on rugby union, athletics (track & field), and field sports.

BAS VAN HOOREN

Bas Van Hooren, PhD is an assistant professor, sport science consultant, strength and conditioning specialist and elite athlete. He obtained his PhD on injury prevention and performance enhancement in running-based sports at Maastricht university in 2024. Bas has been involved as a sport science consultant for various professional organizations and has been active as a strength and conditioning coach at the Dutch Olympic committee. As an athlete he has won several medals at the Dutch national championships between 2011-2025, and he became Dutch National champion in 2017. He is currently working as an assistant Professor at Maastricht University. Bas combines his theoretical knowledge as a sport scientist/researcher with practical experiences from being an athlete and coach to translate complex theoretical concepts into useful and evidence-based practical applications. He has published over 60 journal articles on topics ranging from biomechanics to exercise physiology and has given multiple workshops on sport science related topics for a variety of audiences throughout Europe.

BENEDICTE VANWANSEELE

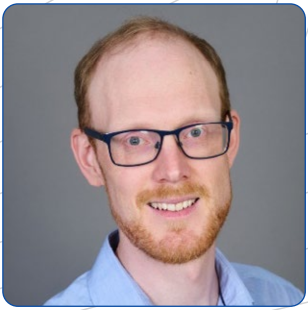
Prof. Vanwanseele is a full professor and the head of the Human Movement Biomechanics research group at the Department of Movement Sciences, KU Leuven. She is also the director of the Leuven Institute of Sports Science. She is an international recognized expert in muscle and tendon biomechanics covering highly specialized biomechanical modelling techniques including musculoskeletal modelling and finite element modelling, with medical imaging. She has published more than 100 full papers in peer-reviewed international journal, attracted research grants, supervised 15 PhD students to completion and is currently supervising 10 PhD students. She has presented her research at several national and international conferences. Prof. Vanwanseele focuses her research on developing insights and innovative methodologies to achieve personalized rehabilitation and training regimes to enable each of us to perform optimally. Prof. Vanwanseele is also involved in the implementation of evidence-based methods to improve training programs for elite athletes such as the Belgian national hockey team and is the co-founder of a Spin-off company RunEasi.

GAËL GUILHEM

As the head of the Sport, Expertise and Performance Lab at the French Institute of Sport (INSEP), Dr Gaël Guilhem leads a scientific team of +30 researchers, engineers and PhD candidates involved in research and expertise projects applied to elite sport performance. His research strives to better understand the role neuromuscular system properties in motor performance and injury risk in elite athletes. Conducted in close collaboration with Olympic and Paralympic sport federations, these projects aim to enlighten staffs decision-making processes to better individualize training contents for athletic and preventive purposes. Dr Guilhem was the principal investigator of the FULGUR project funded by the French Research Agency (2.1 M€, 10 universities research institutes, 3 sport federations) aiming to improve sprint running performance and better understand injury risk exposure of elite athletes in the perspective of the Paris 2024 Games.

Dr. Guilhem was the Local Chair President of the European Congress of Sport Science 2023 hosted in Paris prior to the Olympic and Paralympic Games. As a member of the French-Speaking Olympic Sports Medicine Research Network (ReFORM), Dr Guilhem contribute to the objectives of the IOC Research Centres for the Prevention of Injury and Illness, by establishing long-term research programmes on injury prevention, fostering collaborative relationships with sport institutions and setting up knowledge translation mechanisms to share scientific research results towards sport stakeholders.

GASPAR EPRO



Gaspar Epro is a Senior Lecturer at London South Bank University specializing in biomechanics. He earned his PhD from the German Sport University Cologne in 2017. His main research areas are the adaptability of the human musculoskeletal system in response to mechanical loading (exercise), as well as the interaction between neural and motor system during human locomotion and sports performance. He has conducted extensive research on the plasticity of muscle-tendon units and human locomotor stability across the human lifespan from health young adults (incl. high-performance athletes) up to elderly population (incl. master athletes).

Apart of his academic career, he is an athletics coach and biomechanical diagnostician at elite performance level, with experience from various major international competitions (i.e. Olympic Games, World Championships) as a personal / team coach or team leader representing different countries (Estonia, Puerto Rico, Germany).

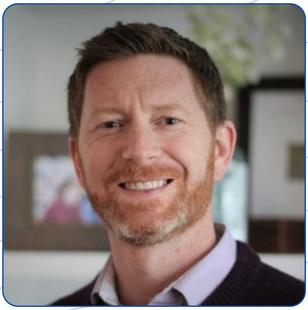
GIACINTO LUIGI CERONE

Giacinto Luigi Cerone obtained the M.Sc. degree and the Ph.D in Biomedical Engineering, summa cum laude, from Politecnico di Torino, Torino, Italy, in 2014 and 2019 respectively. Currently he is an Assistant Professor at the Laboratory for Engineering of the Neuromuscular System – Politecnico di Torino, Italy. In 2020 he was awarded as

Innovative Engineer of the Year by the Turin Engineering Association. Since 2025, he has been professor of the Programmable Biomedical Devices course at Politecnico di Torino.

His main activity concerns the hardware, firmware, software design and certification of biomedical instrumentation. His research activity is mainly focused on the design of modular, wireless and embedded systems for the acquisition of HD-sEMG and EEG signals, the neuromuscular electrical stimulation and the tele-monitoring of vital parameters. He holds eight patents, and he is author/co-author of more than forty papers related to the design of biomedical instrumentation for the neuromuscular field research.

JASON FRANZ



Dr. Franz received his B.S. (2004) and M.S. (2006) degrees in Engineering Mechanics from Virginia Tech and, after serving as a staff scientist in PM&R at the University of Virginia, received his Ph.D. (2012) in Integrative Physiology from the University of Colorado, Boulder. He then completed an NIH Post-Doctoral Fellowship in the Department of Mechanical Engineering at the University of Wisconsin-Madison.

In 2015, Dr. Franz joined the Lampe Joint Department of Biomedical Engineering at the University of North Carolina at Chapel Hill and North Carolina State University and is now a Full Professor and Director of the UNC Applied Biomechanics Laboratory. His research takes a mechanisms-based approach in rehabilitation engineering to develop solutions to help people age gracefully.

He is the author of over 150 publications and currently serves as Principal Investigator on multiple NIH-funded research projects, all predominantly focused on rehabilitation engineering strategies to mitigate age- and disease-related mobility impairment and falls risk.

He also serves as Faculty Director for Postdoctoral Success, where he supports the success, recruitment, and workforce development of postdoctoral trainees across the UNC School of Medicine.

JESSICA PIASECKI

Jessica Piasecki is an Associate Professor of Female Physiology whom has relevant expertise with research across the female lifespan. Her current work strives to understand the mechanisms of the sex hormones at the central and peripheral nervous system, how this impacts functionality and symptomology and how this translates into later life (ill)health. JP has extensive methodological experience in hormone analysis, electromyography (HD-EMG), trans cranial magnetic stimulation (TMS), MRI as well as qualitative data collection through questionnaires, focus groups/interviews and subsequent thematic analysis. Prior to this her work revolved around building a fundamental understanding of the role of exercise on musculoskeletal health and the mechanistic connections between muscle and bone through ageing.

She built a large data set of masters athletes and a body of work surrounding this cohort that stemmed from training age, bone health, type of training and the role of the nerve with age associated deterioration. She was also a former international athlete and competed in the marathon at the Tokyo Olympic Games. Her virtual presentation will cover the latter body of work and hopefully provide some insight into the influence of exercise on musculoskeletal health through ageing.

JOHAN LAHTI

Johan Lahti is a Doctor of Sport Sciences and a strength and conditioning coach (CSCS). He is one of the owners of R5 Athletics & Health gym in Helsinki, and is currently the Director of Physical Development for Jokerit hockey club's junior program. In this role, he also leads an eight-year research project on youth development in ice-hockey. On the private sector he works with numerous sports, including footballers, golfers and badminton players. He has published numerous works on biomechanics, including analyses of common strength training exercises and the biomechanics of sprinting.

His PhD focused on hamstring injury risk reduction in professional football, which he defended in 2021. His supervisors included Jean-Benoit Morin, Pascal Edouard and Jurdan Mendiguchia. He regurlarly holds hamstring lectures and workshops for private clinics and football clubs in different countries.

LAURI STENROTH

Lauri Stenroth is an associate professor of rehabilitation engineering at the Department of Technical Physics, University of Eastern Finland, and leads the Human Movement Biomechanics research group – a subgroup of the Biophysics research group. His research focuses on musculoskeletal health and performance, especially joint health and age-related impairments. In his research, he utilizes a wide range of experimental and investigational techniques such as medical imaging, motion capture, musculoskeletal simulations, and biosignal measurements. Stenroth holds the title of docent in biomechanics, especially human movement biomechanics. He received a PhD in Sport Sciences with biomechanics specialization from the University of Jyväskylä, Finland, in 2016, before joining the Biophysics of Bone and Cartilage Research group at the University of Eastern Finland as a postdoctoral researcher.He has played an integral role in the development of the Human Measurement and Analysis (HUMEA) laboratory at the Department of Technical Physics. Stenroth has also worked as a visiting researcher at the University of Copenhagen and Copenhagen University Hospital in Denmark, researching patients with a traumatic knee injury. The majority of his current research is related to osteoarthritis, with ongoing projects on joint load modifications and monitoring in relation to joint health.

MARTINO FRANCHI

Martino Franchi is an Assistant Professor in Human Physiology at the University of Padova's Department of Biomedical Sciences. His academic journey includes a BSc and MSc in Sports Sciences from UCSC Milan, followed by a MRes at Manchester Metropolitan University (MMU) where he also completed his PhD.

His research focuses on human muscle functional, structural, and molecular remodeling in response to different contraction types. After a postdoc in muscle physiology at the University of Nottingham, he held dual positions as a Postdoctoral Research Fellow in muscle plasticity and in the Sports Medicine Research Group at the Balgrist University Hospital in Zurich (UZH). He was a recipient, as Co-I, of a Swiss grant for implementing novel ultrasound techniques for the study of specific lower limb muscles and patellar tendon mechanical properties of the Swiss Ski National Teams. His main interests lay in muscle and tendon functional and structural adaptations to loading, disuse, and ageing, with a from-the-macro-to-the-micro approach. He was recently awarded funding for 3 Italian Projects of National Interest (PRIN) to study the neuromuscular hallmarks of ageing (Trajector-AGE project) and exercise recovery strategies after muscle disuse (ReActiveAge project). He serves on editorial boards for prestigious journals in physiology and sports medicine, He is a member of the Editorial Board of “The Journal of Physiology” and of “Medicine & Science in Sports and Exercise”.

PATRICIO PINCHEIRA

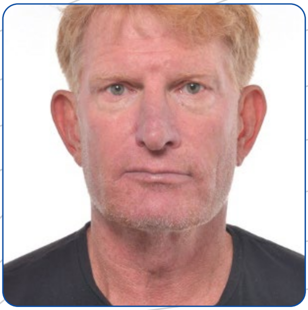
Dr. Patricio Pincheira is a physiotherapist and lecturer in Exercise and Sports Science at the University of Southern Queensland, Australia. He completed his PhD at the University of Queensland (2015–2023) and his master’s studies at the University of Jyväskylä (2013–2015). Before that, he held academic positions at Universidad de los Andes and Universidad Mayor in Chile (2008–2015).

His research combines expertise in muscle mechanics, neuromuscular physiology, and human movement analysis with a strong focus on innovation in health technologies. He investigates how advanced imaging, computer vision and artificial intelligence can be integrated to better understand muscle architecture and motor function. Through projects involving ultrasound imaging, high-density electromyography and markerless motion capture, he seeks to quantify movement patterns and neuromuscular properties in both clinical and athletic populations. More broadly, his research contributes to developing low-cost, non-invasive, and scalable approaches for assessing human performance and health, with potential impact across sport, clinical practice, and allied health professions.

TAIJA FINNI

Taija Finni is a professor and vice dean at the Faculty of Sport and Health Sciences, University of Jyväskylä, Finland. She received a PhD in biomechanics in 2001, has worked as a full professor of since 2010, is a docent in exercise physiology, and a biomechanist with broad expertise. Regarding the tendon, she has utilized in vivo force transducers to assess forces in humans, published critical reviews related to methodology, and examined internal tendon movement in rats and in humans. Her recent research examines patients with Achilles tendon rupture and tendinopathy.

TONI ARNDT



Toni Arndt performed his undergraduate studies in New Zealand and Australia in biology and Human Movement Sciences before receiving a scholarship for a PhD at the German Sport University, Köln. His PhD involved studies concerning asymmetrical loading of the Achilles tendon. This line of study continued at the Karolinska Institute in Sweden as a post-doc, together with unique invasive techniques for determining intrinsic foot kinematics. At present Toni Arndt is a professor in biomechanics, specializing in lower extremity muscle-tendon function, athletic footwear, parasports and sports biomechanics at The Swedish School of Sport and Health Sciences (GIH) in Stockholm.

He was Dean of Research and Doctoral Education at GIH for six years and Pro Vice-Chancellor between 2022-2024. He has published over 90 peer reviewed scientific articles and has supervised 13 PhD students to completion. In 2020 Toni was awarded the national Swedish senior prize for sport science research.

He is a previous President of the International Society of Biomechanics. Toni is a consultant for World Athletics responsible for investigating compliance of athletic shoes for use in elite competition.

UROŠ MARUŠIČ

Dr. Uroš Marušič is Senior Research Associate at the Science and Research Centre Koper, and Full Professor at Alma Mater Europaea University. With more than 14 years of experience in neuroscience, human movement science, and translational research, he bridges academic excellence with applied innovation in the fields of health and technology.

His interdisciplinary work focuses on neuroplasticity, sensorimotor function, neurorehabilitation, and the use of mobile brain/body imaging (MoBI). He has more than 80 publications listed on PubMed alone. Dr. Marušič has led and participated in numerous national and EU-funded projects and actively contributes to international research networks.

Two major grants (as PI):

- TBrainBoost - ERA TALENTS for Boosting and Balancing Brain Circulation (Horizon Europe, 2023–2027, €2M), supporting knowledge transfer and researcher mobility across sectors; and
- TwinBrain – TWINning the BRAIN with machine learning for neuro-muscular efficiency (Horizon 2020, 2020–2023, €900K), which advanced international collaboration in AI-powered neurophysiological research.

URS GRANACHER

Urs Granacher is a Full Professor of Exercise and Human Movement Science at the Department of Sport and Sport Science, University of Freiburg, Germany. He holds a degree in Sport Science and earned both his PhD and habilitation (post-doctoral thesis) in Exercise and Human Movement Science. His research focuses on strength and conditioning across the lifespan, with particular emphasis on the development and evaluation of targeted intervention programs, including neuromuscular training, resistance training, and balance training, to enhance physical fitness, improve mobility, and reduce fall risk.

Dr. Granacher serves on the editorial boards of ten scientific journals, including Sports Medicine and the British Journal of Sports Medicine. He was appointed by the German Federal Minister of the Interior as Chairman of the PotAS Commission, tasked with reforming the German elite sport system (PotAS Commission).

WILLIAM THORP

William Thorp is Head of Baseball and Technical Sales Manager at Simi Reality Motion Systems, where he specializes in markerless optical motion capture applied to sports technology and performance analysis. Over the past three years with Simi, he has been actively involved in integrating advanced measurement systems into elite training and rehabilitation environments. He works extensively with professional teams, academic institutions, and research groups to bridge the gap between cutting-edge biomechanical assessment tools and their practical application in sport.

Before joining Simi, Mr. Thorp competed as a semi-professional baseball player, an experience that continues to inform his athlete-centered approach to technology and performance monitoring. At Simi, he has played a central role in the development and deployment of innovative motion capture systems, including the Nemo tracking engine and specialized baseball modules, which provide objective, data-driven insights into athlete readiness and performance. His work emphasizes translating complex biomechanical data into actionable feedback for coaches, therapists, and athletes.

At the Hungarian University of Sports Science symposium, William Thorp will present how Simi has worked to create integrated solutions for athlete monitoring, with a particular focus on standardized testing procedures, reporting workflows, and their impact on evidence-based decision-making in sports performance and rehabilitation.

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