

Special Issue “New Trends in Sport and Exercise Medicine”

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1. Introduction

The practice of regular physical activity has been proposed as a determinant in many disciplines, from wellness to physiotherapy; in fact, it reduces the risks of cardiovascular diseases and diabetes. Moreover, physical exercise decreases the incidence of some types of cancer, such as breast and colon cancer. Finally, rehabilitation protocols need correct exercise training to reach the complete “return to play” of the patients. Unfortunately, the mechanisms associated with the beneficial effects of physical activity are still under study. Therefore, advances in all aspects of sport and exercise medicine will be relevant for physicians, recreational sport practitioners and elite athletes.

This was the aim of this Special Issue “New trends in sport and exercise medicine”, that achieved great success. Sixteen papers have been published, which are briefly described below. They range from mobile applications in physiotherapy to changes in bioactive lipids in half-marathoners [1–16].

However, sport and exercise medicine are wide subjects and require more papers to clarify their different aspects. Therefore, we proposed a new Special Issue (https://www.mdpi.com/journal/applsci/special_issues/Sport_Exercise_Medicine_II, accessed on 8 September 2021) to continue on this path and receive new insights in sport and exercise medicine.



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2. Sana: A Gamified Rehabilitation Management System for Anterior Cruciate Ligament Reconstruction Recovery

The Anterior Cruciate Ligament (ACL) surgery reconstruction is necessary in approximately 76.6% of ACL ruptures. The rehabilitation following ACL reconstruction includes long-term programs that are often performed at home by patients, without supervision. The failure of rehabilitation programs increases the onset of secondary pathologies in the years after surgery. In this paper, Kungwengwe and Evans [1] studied a mobile application, called Sana, based on gamification theory, to improve the results of post-operative physiotherapy after ACL reconstruction. The program content is based on the Royal National Orthopedic Hospital guidelines for ACL rupture reconstruction. The data show that the patients are satisfied with the application, find it convenient, engaging and user-friendly, and that physiotherapists state that the system improves therapy administration and interactions with the patients, suggesting that the Sana system can make a positive contribution to ACL rupture post-surgery rehabilitation.

3. Effect of Physical Exercise on the Release of Microparticles with Angiogenic Potential

Microparticles (MP) are extracellular vesicles involved in cell-to-cell communications. They are present in physiological conditions, but their levels change in response to oxidative stress, inflammation, hypoxia and shear stress. Interestingly, these situations are also caused by physical activity. Notably, microparticles induced by physical activity are involved in angiogenesis. Di Credico et al. [2] reviewed the effects of different types of exercise on microparticle release in correlation with new vessel formation. Although training status, drugs and disease can affect microparticle formation, future studies will be necessary to clarify the effect of acute and chronic exercise on vascular adaptations.

4. The Effects of Wild Ginseng Extract on Psychomotor and Neuromuscular Performance Recovery Following Acute Eccentric Exercise: A Preliminary Study

Ginseng is a widely diffused anti-inflammatory agent with positive actions on the nervous system and cognitive function. Thus, it is a reasonable alternative to decrease exercise-induced inflammation. Jung et al. [3] studied the effect of ginseng extract (700 mg/day) on psychomotor and muscular performance after acute eccentric exercise. Although they only found a significant decrease in exercise-induced inflammatory markers such as Interleukin-6 (IL-6), this preliminary study opens new issues, which a future project, with a large sample, will elucidate.

5. Explosive Strength Modeling in Children: Trends According to Growth and Prediction Equation

Strength training is usually only performed in adults. Recently, the relevance of muscular strength in youth and adolescents has been shown to prevent cardiovascular diseases, metabolic disorders and obesity. However, it is very important to monitor developmental aspects in parallel with training and increases in performance. Looking at this scenario, Carnevale Pellino et al. [4] elaborated a model of predictive equations to correlate anthropometric parameters, fitness levels and the maturation of children.

This will provide practical suggestions for coaches who should consider age, body shape and body mass for strength training and, in particular, lower limb performance.

6. Contributions of Anthropometric and Strength Determinants to Estimate 2000 m Ergometer Performance in Traditional Rowing

Traditional rowing is a widely diffused sport, and many scientists are studying the importance of physiological characteristics to optimize the rowers' performance. Although, to date, the papers were focused on Olympic rowing, the paper by Sebastia-Amat et al. [5] analyzes the contribution of physical determinants such as height, body mass and strength of the lower/upper body on row ergometer performance in traditional rowing. The authors found that higher anthropometric determinants were positively correlated with higher performance, but upper body strength factors (determined by bench pull training) showed the best correlation with positive performance, evidencing the role of upper body strength in rowing execution.

7. Effects of Achilles Tendon Moment Arm Length on Insertional Achilles Tendinopathy

The Achilles tendon is the largest tendon in the body, and it is very important in the gait cycle because it links the ankle joint to the triceps surae. The insertional Achilles tendinopathy (IAT) is a painful chronic disorder that requires suture bridge surgical therapy. This technique is still under investigation and its level of effectiveness is unclear. Miyamoto et al. [6] performed a retrospective study to analyze the moment arm length in both healthy subjects and in post-operative patients. They observed a significant increase in the force of the IAT group after surgery, suggesting that a long moment arm is one of the causes of IAT and that suture bridge surgery is an effective technique that reduces the Achilles tendon moment arm.

8. Immediate Effects of an Inverted Body Position on Energy Expenditure and Blood Lactate Removal after Intense Running

Overtraining and overreaching are challenges for all athletes. Thus, physiological and psychological recoveries after training are important for health and optimal performance.

Kim and Park [7] studied the effect of a cool-down strategy with an inverted body position (IBP) on fatigue perception, blood lactate concentration and heart rate in 22 athletes. While the fatigue perception was not significantly modified by this recovery technique, blood lactate level and energy expenditure were significantly lower than in controls, suggesting that this technique could be useful in many disciplines that have short breaks during matches, such as martial arts and wrestling.

9. Ultrasound-Guided Percutaneous Needle Electrolysis and Rehab and Reconditioning Program for Rectus Femoris Muscle Injuries: A Cohort Study with Professional Soccer Players and a 20-Week Follow-Up

One of the most common sports injuries is rectus femoris muscle strain. Therefore, it is very important to elaborate rehabilitation programs that can induce a fast “return to play” in the athletes. Valera-Garrido et al. [8] studied the effects of a combination of percutaneous needle electrolysis and a specific rehabilitation program in professional soccer players with Rectus femoris muscle strain. The authors demonstrated that the combination of the two techniques permitted a safe “return to play”, with no re-injuries seen in a long-term check.

10. Effectiveness of Training Prescription Guided by Heart Rate Variability Versus Predefined Training for Physiological and Aerobic Performance Improvements: A Systematic Review and Meta-Analysis

During physical activity, the balance between the training load and the physiological responses to training, including neuromuscular and cardiovascular activity, is very important. Mendellin Ruiz et al. [9] conducted a systematic review comparing the effects of heart-rate variability-guided training versus a predefined training designed to optimize the aerobic performance of athletes.

Although they did not find significant differences between the two training methods, this review evidences the potential of the heart-rate variability methodology, suggesting that additional studies are necessary to specify the physiological effects of this method with respect to the generally used strategies.

11. Exercise Training of Secreted Protein Acidic and Rich in Cysteine (Sparc) KO Mice Suggests That Exercise-Induced Muscle Phenotype Changes Are SPARC-Dependent

The beneficial effects of physical exercise have been well documented, but the molecular basis of these positive outcomes is still unclear. One of the proteins induced by exercise is Secreted Protein Acidic and Rich in Cysteine (SPARC). Ghanemi et al. [10] performed functional studies in *Sparc null* mice, showing that muscle strength and performance are SPARC-dependent. Future studies on the roles of exercise-related proteins in muscle physiology and diseases will be important to clarify the benefits of physical activity for human health. In fact, all these mediator proteins represent potential molecular targets for pharmacological therapy.

12. Effects of High-Impact Weight-Bearing Exercise on Bone Mineral Density and Bone Metabolism in Middle-Aged Premenopausal Women: A Randomized Controlled Trial

Osteoporosis is a serious problem in western countries. High-impact exercise seems to be important for bone mass increase, but the majority of studies were performed in post-menopausal women. Prevention of the onset of osteoporosis would also be important to characterize the effects of high-impact exercise on middle-aged, pre-menopausal women. Kim et al. [11] performed this type of study and showed that a physical activity program (intensity set at 60–80% of maximal heart rate) reduces age-associated changes in bone markers, although it does not increase the bone mineral density.

13. Physical Activity and Redox Balance in the Elderly: Signal Transduction Mechanisms

Reactive Oxygen Species and cellular antioxidant machinery are very important in studies of age-associated diseases. Physical exercise stimulates both these components, creating contrasting effects. The intensity and volume of the exercise, together with the physiological characteristics of the people, seem to be the most important parameters. To better characterize the molecular pathways correlated with the oxidant/antioxidant effects of exercise, Galli et al. [12] reviewed the existent literature on this subject. Although more studies will be necessary to reach a comprehensive view of all the involved pathways, the

authors evidenced that, in the future, precision medicine will be able to administer physical activity in a personalized way, transforming wellness in targeted prevention.

14. Pulmonary Effects Due to Physical Exercise in Polluted Air: Evidence from Studies Conducted on Healthy Humans

Air pollution is associated with many chronic diseases (cancer, pulmonary disorders, etc.). However, outdoor physical activity is widely diffused in countries with high levels of pollution. Araneda et al. [13] reviewed the studies conducted on healthy people who performed physical activity in environments with low air quality. The authors concluded that exercise should be performed in safe environmental conditions by reducing pollution, increasing installation of correct filters in gyms and increasing mobile stations for urban races to monitor the load of pollutants.

15. Augmentation Index Is Inversely Associated with Skeletal Muscle Mass, Muscle Strength, and Anaerobic Power in Young Male Adults: A Preliminary Study

Arterial stiffness is correlated with performance parameters such as cardiorespiratory endurance and muscle strength. In fact, the increase in cardiorespiratory endurance reduces body mass index, low-density lipoprotein cholesterol and systolic blood pressure, which represent significant risk factors for cardiovascular disease. In young adults, this correlation is still unclear; thus, Lee et al. [14] investigated the relationship between muscle strength parameters and arterial stiffness in young males. They showed an inverse significant correlation with one of the parameters used to measure arterial stiffness, such as the Augmentation index, suggesting that strength training in young adults contributes to changes in arterial stiffness.

16. The Role of Cholinesterases in Post-Exercise HRV Recovery in University Volleyball Players

Exercise recovery is a complex process that depends on the equilibrium between the sympathetic and the parasympathetic branches of the autonomous nervous system on the heart rate. Notably, the parasympathetic branch slows the heart rate through the increase in acetylcholine release and, therefore, the activation of the Acetylcholinesterase enzyme that is abundant in the sino-atrial node. The levels of Acetylcholinesterase are generally indirectly measured by Cholinesterase in the blood. Hoyos-Flores et al. [15] found a positive correlation between heart rate variability and Cholinesterase levels after long-term and intermittent high-intensity training in volleyball players, suggesting that Cholinesterase and heart rate could be considered as the internal load of the recovery phases after training.

17. Changes in Plasma Bioactive Lipids and Inflammatory Markers during a Half-Marathon in Trained Athletes

After a competitive marathon cytokines, inflammation and oxidative stress increase in athletes. However, the relationship between bioactive lipids and inflammatory mediators is still uncharacterized. Gaggini et al. [16] studied the levels of Ceramides, Diacylglycerols and Sphingomyelin, together with inflammatory markers in athletes, after a half-marathon. Although they did not find a significant correlation between bioactive lipids and inflammatory markers, they observed a significant decrease in lipids after a race, suggesting that these molecules could represent new biomarkers to characterize exercise adaptation and evaluate specific training for different subject categories.

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References

1. Kungwengwe, T.; Evans, R. Sana: A Gamified Rehabilitation Management System for Anterior Cruciate Ligament Reconstruction Recovery. *Appl. Sci.* **2020**, *10*, 4868. [\[CrossRef\]](#)
2. Di Credico, A.; Izzicupo, P.; Gaggi, G.; Di Baldassarre, A.; Ghinassi, B. Effect of Physical Exercise on the Release of Microparticles with Angiogenic Potential. *Appl. Sci.* **2020**, *10*, 4871. [\[CrossRef\]](#)
3. Jung, H.; Lee, N.; Kim, Y.; Lee, S. The Effects of Wild Ginseng Extract on Psychomotor and Neuromuscular Performance Recovery Following Acute Eccentric Exercise: A Preliminary Study. *Appl. Sci.* **2020**, *10*, 5839. [\[CrossRef\]](#)
4. Carnevale Pellino, V.; Giuriato, M.; Ceccarelli, G.; Codella, R.; Vandoni, M.; Lovecchio, N.; Nevill, A. Explosive Strength Modeling in Children: Trends According to Growth and Prediction Equation. *Appl. Sci.* **2020**, *10*, 6430. [\[CrossRef\]](#)
5. Sebastia-Amat, S.; Penichet-Tomas, A.; Jimenez-Olmedo, J.; Pueo, B. Contributions of Anthropometric and Strength Determinants to Estimate 2000 m Ergometer Performance in Traditional Rowing. *Appl. Sci.* **2020**, *10*, 6562. [\[CrossRef\]](#)
6. Miyamoto, T.; Shinohara, Y.; Matsui, T.; Kurokawa, H.; Taniguchi, A.; Kumai, T.; Tanaka, Y. Effects of Achilles Tendon Moment Arm Length on Insertional Achilles Tendinopathy. *Appl. Sci.* **2020**, *10*, 6631. [\[CrossRef\]](#)
7. Kim, M.; Park, J. Immediate Effects of an Inverted Body Position on Energy Expenditure and Blood Lactate Removal after Intense Running. *Appl. Sci.* **2020**, *10*, 6645. [\[CrossRef\]](#)
8. Valera-Garrido, F.; Jiménez-Rubio, S.; Minaya-Muñoz, F.; Estévez-Rodríguez, J.; Navandar, A. Ultrasound-Guided Percutaneous Needle Electrolysis and Rehab and Reconditioning Program for Rectus Femoris Muscle Injuries: A Cohort Study with Professional Soccer Players and a 20-Week Follow-Up. *Appl. Sci.* **2020**, *10*, 7912. [\[CrossRef\]](#)
9. Medellín Ruiz, J.; Rubio-Arias, J.; Clemente-Suarez, V.; Ramos-Campo, D. Effectiveness of Training Prescription Guided by Heart Rate Variability Versus Predefined Training for Physiological and Aerobic Performance Improvements: A Systematic Review and Meta-Analysis. *Appl. Sci.* **2020**, *10*, 8532. [\[CrossRef\]](#)
10. Ghanemi, A.; Melouane, A.; Yoshioka, M.; St-Amand, J. Exercise Training of Secreted Protein Acidic and Rich in Cysteine (Sparc) KO Mice Suggests That Exercise-Induced Muscle Phenotype Changes Are SPARC-Dependent. *Appl. Sci.* **2020**, *10*, 9108. [\[CrossRef\]](#)
11. Kim, S.; Seo, M.; Jung, H.; Song, J. Effects of High-Impact Weight-Bearing Exercise on Bone Mineral Density and Bone Metabolism in Middle-Aged Premenopausal Women: A Randomized Controlled Trial. *Appl. Sci.* **2021**, *11*, 846. [\[CrossRef\]](#)
12. Galli, D.; Carubbi, C.; Masselli, E.; Vaccarezza, M.; Presta, V.; Pozzi, G.; Ambrosini, L.; Gobbi, G.; Vitale, M.; Mirandola, P. Physical Activity and Redox Balance in the Elderly: Signal Transduction Mechanisms. *Appl. Sci.* **2021**, *11*, 2228. [\[CrossRef\]](#)
13. Araneda, O.; Kosche-Cárcamo, F.; Verdugo-Marchese, H.; Tuesta, M. Pulmonary Effects Due to Physical Exercise in Polluted Air: Evidence from Studies Conducted on Healthy Humans. *Appl. Sci.* **2021**, *11*, 2890. [\[CrossRef\]](#)
14. Lee, D.; Byun, K.; Hwang, M.; Lee, S. Augmentation Index Is Inversely Associated with Skeletal Muscle Mass, Muscle Strength, and Anaerobic Power in Young Male Adults: A Preliminary Study. *Appl. Sci.* **2021**, *11*, 3146. [\[CrossRef\]](#)
15. Hoyos-Flores, J.; Rangel-Colmenero, B.; Alonso-Ramos, Z.; García-Dávila, M.; Cruz-Castruita, R.; Naranjo-Orellana, J.; Hernández-Cruz, G. The Role of Cholinesterases in Post-Exercise HRV Recovery in University Volleyball Players. *Appl. Sci.* **2021**, *11*, 4188. [\[CrossRef\]](#)
16. Gaggini, M.; Vassalle, C.; Carli, F.; Maltinti, M.; Sabatino, L.; Buzzigoli, E.; Mastorci, F.; Sbrana, F.; Gastaldelli, A.; Pingitore, A. Changes in Plasma Bioactive Lipids and Inflammatory Markers during a Half-Marathon in Trained Athletes. *Appl. Sci.* **2021**, *11*, 4622. [\[CrossRef\]](#)