0.735 (p=1.34×10^-27), r^2 = 0.730 (p=3.37×10^-17) respectively. Based on our developed estimation equations, the authors prototyped a wearable activity monitor with 2.4GHz wireless function for the walkers. This wearable activity monitor designed to be attached on the occipital head of the walker and measured both the acceleration and the position. Measured data were sent to the database server and calculated the energy expenditure in real time. Then, total walking distance, expenditure energy were transmitted and delivered to the walker by the bone conductive speaker.

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The Effects of Rubber Swimsuits on Swimmers Measured by a Lactic Acid Curve Test

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INTRODUCTION: The rubber swimsuit was one of the causes of the record rush in 2009. Similar to wetsuit, the rubber swimsuit was made from Neoprene rubber. The effects of wearing a wetsuit on swimmers were widely reported. Tomikawa et al. suggested that the benefits of wearing a wet suit were not only the improvement in swimming propulsion efficiency, but the reduction in energy consumption. This study verified the influence of wearing the rubber swimsuit on the swimmer's exercise load by using a lactic acid curve test. METHODS: Eight female university swimmers participated in this study. They performed the lactic acid curve tests with four different suits. They wore three types of rubber swimsuits and a cloth swim suit with water-repellent. All swimsuits were full-length type covering from shoulder to ankle. The lactic acid curve test consisted of 4 times 200m swimming. The speed of four stages in the test was set from the best record of each 200m freestyle race (80%V200, 85% V200, 90% V200, 95% V200). The speed was controlled by pace maker. Blood from the fingertip was taken 0 min and 3 min (5min) after each trial and the blood lactate was determined. RESULTS: The blood lactate concentration after 90% V200 and 95% V200 trials with rubber swimsuits tended to be lower than those with a cloth swimsuit (90% V200; rubber swimsuits 3.01±1.42 mmol/L, cloth swimsuit 3.89±1.37 mmol/L, 95% V200; rubber swimsuits 8.73±2.57 mmol/L, cloth swimsuit 10.46±2.57 mmol/L), but not significant. An examination of the trials revealed that the number of arm strokes decreased due to the use of the rubber swimsuits. DISCUSSION: It is suggested that the rubber swim suits improved propulsion efficiency and decreased swimmer exercise load same as wearing wetsuit, indicating that the rubber swimsuit may improve the race performance of swimmers. REFERENCES: 1. Tomikawa et al.; Factors related to the advantageous effects of wearing a wetsuit during swimming at different submaximal velocity in triathlete. Journal of Science & Medicine in Sport,, 11(4), 417-423, 2008.

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Comparison of the Development of Underwater Exercise Between China and Japan

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INTRODUCTION: In China, the effect of the underwater exercise as prescription or physical therapy has not been recognized enough by people. According to the investigation in 2004 (Ying Wang), only six places of 96 swimming pools in Beijing, China have served exercise programs in the water. 94 % of participants were women from 18 to 40 years old. The aims of the participants doing underwater exercise program were diet (96%) and beauty (48%). In this study, we clarified the problems of promotion of the underwater exercise in China, and we examined the promotion plan for this plan in China. METHODS: A questionnaire about the promotion of underwater exercise was used for the investigation in Beijing, China. We performed questioner surveys in 103 swimming pools in Beijing City in July in 2008 The questions were about swimming pools facilities, exercise classes and future expectations. We also collected a precedent study about the underwater exercise in Japan, a history document and arranged factor: how to work to affect the spread of the present conditions of the underwater exercise. RESULTS: Significant differences were observed in the depth of swimming pool, the water temperature, and the room temperature between China and Japan(p<.0001). Swimming pools in Beijing showed that the depth of swimming pool was deeper (199.4±43.9cm), the water and room temperatures were lower (27.6±1.0°, 27.9±0.8°, respectively). Swimming pools in Japan showed that the depth was shallower (123.3±61.1cm) and the water and room temperatures were warmer (30.3±0.9°, 31.3±1.7°, respectively). DISCUSSION: For promoting the underwater exercise in Beijing, the condition of the pool facility is one of the most important keys. Swimming pools should be shallower (100~120cm) and the water and room temperatures should be warmer (30°~35°). Shallower and warmer pool facilities will help the promotion of the underwater exercise. The setting of the policy to make awareness of peoples¡¯ health through underwater exercise would be profitable for many people. In the underwater exercise program, depending on Chinese present conditions, to improve the underwater exercise program, like many people aim, may contribute the nation's health promotion. The management philosophy is to make wide publicity of the underwater exercise to make many people aware of it. Not only to pursuit profit, but also to contribute to nation's health.

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Preliminary Results of a "Multi-2D" Kinematic Analysis of "Straight- vs. Bent-arm" Freestyle Swimming, Using High-Speed Videography

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Synchronized, high-speed digital cameras were used for underwater videotaping of swimmers, each of whom were required to perform a series of trials with both bent-arm and straight-arm pull patterns. The resulting video footage was digitized and processed using "Multi 2-D" motion capture software. Results demonstrated (1.) The advantages of using high-speed videography for quantifying swimming stroke mechanics. (2) The resulting data provided insight into the relationship between the varying degrees of elbow-bend during the pull cycle, and fluctuations in linear hip and wrist velocities.

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Electromyography in Water Cycling at Different Cadences

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INTRODUCTION: Equipment that is used to improve physical fitness on land are being adapted for water, such as the bicycle. The effects of cadence and load on lower limb muscles activities using elec-

tromyography (EMG) are well documented in cycling literature[1,2] . The purpose of this study was to compare the EMG activity of Rectus Femoris (RF) Biceps Femoris (long head), Gastrocnemius medialis (GAS) in watercycling at different intensities, performed during cycling in an aquatic-specific bike. METHODS: Eight male subjects, between ages of 19 and 30.Each subject completed in a randomized order a 30 seconds of exercise in a water cycling (HidroRaider, Italy) bout at the cadence of 60, 80, 100 bpm, with an interval of 3 minutes. Using a wireless signal acquisition system (bioPLUX research, Portugal) and EMG sensors (emgPLUX, Portugal), muscle activity of Rectus Femoris (RF) Biceps Femoris (long head), gastrocnemius medialis (GAS) of the right leg was recorded throughout the test and was synchronized with the video images. The raw EMG was processed offline using Python data analysis software (version 2.4). The signals were subsampled to a frequence of 200Hz, then low-pass filtered with a smoothing window of 10 samples and full-wave rectified. In order to analyse only the most significant swim cycles, we selected the [middle-100; middle+ 300] samples of the raw signal on all identical pathways. For each subject, muscle and test condition, the mean, standard deviation, maximum and minimum values of EMG were determined. RESULTS: The results demonstrated that the mean EMG signal value of the muscles increased with the different cadences (60,80, 100 bpm). The values were higher in GAS and BF than in the RF. The exercise realized in the cadence 100bpm showed a relevant difference from the exercise realized in the 60 bpm in the EMG signal for the three muscles. DISCUSSION: The increase of the EMG activity with change cadence in water influences the lower extremity muscular activity during cycling. This shows that speed of the movement could be an important variable to take in account in cycling training in aquatic environments.REFERENCES: 1. Baum BS, Li L. (2003) *Lower extremity muscle activities during cycling are influenced by load and frequency*. Journal of Electromyography and Kinesiology, 13(2), 181-190. 2. Sarre, G.; Lepers, R.; Maffiuletti, N. & Millet, G.(2003). *Influence of cycling cadence on neuromuscular activity of the knee extensors in humans*. Eur J Appl Physiol, 88: 476–479.

WS-001

Invited Workshop in CFD Methodology: its Usefulness and Basic Steps

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Computational methods for swimming and aquatic research has a relatively recent history. One of the first important papers were published in 1996 and modeled drag on a circular disc the size of a hand by computational fluid dynamics (Bixler & Schloder 1996). From this point in time, numerous studies has already been published, and CFD is believed to be an important research tool for future studies in swimming and aquatics. The aim of this 30 min workshop is to discuss these questions: What is CFD methodology? Which problems can CFD solve? What are the basic steps for doing a CFD analysis? CFD applied to swimming research: past, present and future directions. The workshop aims at reaching an audience of young researchers and novices to CFD. Referece: Bixler, B. & Schloder, M. (1996). Computational fluid dynamics: an analytical tool for the 21st century swimming scientist. Journal of Swimming Research, 11, 4-22.