

## Poster und Freie Mitteilungen

## P 1

**A slow-release  $\beta$ -alanine dietary supplement: safety of use and effect on muscle carnosine**J. Décombas<sup>1</sup>, A. Egger<sup>2</sup>, J. Vuichoud<sup>1</sup>, H. Anwander<sup>2</sup>, F. Bouisset<sup>1</sup>, T. Stellingwerff<sup>1</sup>, C. Boesch<sup>2</sup><sup>1</sup>Nestlé Research Center, Lausanne<sup>2</sup>MR Center, University and Inselspital Bern

**Introduction:** Carnosine (Car= $\beta$ -alanyl-L-histidine), a dipeptide found in skeletal muscle, contributes to intracellular buffering during anaerobic exercise and can be increased by prolonged oral  $\beta$ -alanine ( $\beta$ A) supplementation. Large single doses of  $\beta$ A frequently result in unpleasant symptoms of paresthesia unless they are split into multiple small doses. The objective of these studies was to characterize symptomatology (acute & chronic) and to assess the carnosine deposition in, and wash-out from, muscle following supplementation (chronic) of one moderate daily  $\beta$ A dose in slow-release tablet form (TAB).

**Methods: I)** Pharmacokinetics of slow- and fast-release 1.6g  $\beta$ A, ingested in TAB or in solution (REF), were compared. Symptoms were assessed concurrently using quantitative and qualitative questionnaires in TAB, REF and a placebo (PLA) (n=11, crossover design). **II)** TAB and PLA were administered daily for 8 weeks (wk). Car was determined in *tibialis anterior* (Tm) and *gastrocnemius* (Gm) muscles at wk 0, 2, 4, 8 and 16 using <sup>1</sup>H-MRS (n=11+10, parallel design). Side-effects were tracked. Standard clinical chemistry and hematology (25 variables) were assessed at wk 0 and 8.

**Results: I)** After TAB (REF), peak plasma  $\beta$ A was 82  $\mu$ mol/L (\*\*248  $\mu$ mol/L), time to peak 1h (\*\*0.5h) with similar areas under the curve.  $\beta$ A loss in urine was 3-fold smaller (\*\*\*) after TAB. Symptoms after TAB and PLA ("very low") were never different. Sensations after REF were described as "pins and needles" and were located at arms and trunk near skin surface; intensity of "pins and needles" was correlated with peak  $\beta$ A (\*\*r=0.60) and never exceeded the intensity level "low". **II)** Muscle Car concentrations increased linearly in both muscles from wk 0 to 8 (\*\*), to +37.5% in Tm and +25.1% in Gm. Car levels had not returned to baseline at wk 16. Symptoms after TAB and after PLA did not differ. Clinical chemistry after 90g  $\beta$ A (cumulated) did not change [Statistics:\*\*=P<0.01; \*\*\*=P<0.001].

**Conclusions:** These data demonstrate the slower absorption kinetics, reduced urinary loss and triviality of sensory side-effects when  $\beta$ A (1.6g) is ingested in slow-release form rather than in solution. Furthermore, repeated once-a-day supplementation of slow-release  $\beta$ A over 8 wk results in continuous increases in muscle Car contents, absence of detectable paresthesia and no statistical alteration in clinical blood profile.

## P 2

**Effect of different sugars after exercise on liver glycogen synthesis, liver volume and metabolic profile using <sup>13</sup>C-MRS, MRI and GC-TOFMS**T. Buehler<sup>1</sup>, S. Bruce<sup>2</sup>, I. Breton<sup>2</sup>, M. Ith<sup>1</sup>, E. Scheurer<sup>1</sup>, C. Boesch<sup>1</sup>, J. Décombas<sup>2</sup><sup>1</sup>MR Center, University and Inselspital Bern<sup>2</sup>Nestlé Research Center, Lausanne

**Introduction:** Liver glycogen (Gn) is utilized during exercise. The stores are made up again during recovery after carbohydrates (CHO) ingestion, but the relative effectiveness of different CHO sources for liver Gn synthesis in humans is unclear. The aim of this study was to compare the effect of maltodextrin (MD) drinks containing galactose, fructose or glucose on postexercise liver Gn synthesis and metabolic profile.

**Methods:** In this double blind, triple crossover, randomized clinical trial 10 well-trained male cyclists performed 3 separate experimental trials. After performing a standard exercise protocol to exhaustion (~2h), subjects ingested one of three 15% CHO solutions: FRU (MD+fructose 2:1), GAL (MD+galactose 2:1) or GLU (MD+glucose 2:1), each providing 69 g·h<sup>-1</sup> CHO during 6.5 h recovery. Liver Gn concentrations were measured using <sup>13</sup>C magnetic resonance (MR) spectroscopy, liver volume was measured using MR imaging in two slice directions (axial, coronal), and a global metabolic profile was obtained from plasma using gas chromatography time-of-flight mass spectrometry (GC-TOFMS) [points in time: liver 4, plasma 10].

**Results:** Liver Gn concentrations (mmol·L<sup>-1</sup>·h<sup>-1</sup>) increased at faster rates with FRU (\*\*24 ± 2) and with GAL (\*\*28 ± 3) than with GLU (13 ± 2). Liver volumes (variation between axial and coronal determinations 4.0%) increased (\*\*\*) with FRU (+9 ± 2%; SE) and with GAL (+10 ± 2%), but not with GLU (+2 ± 1%, NS). Net liver Gn synthesis (g·h<sup>-1</sup>) appeared linear and was faster with FRU (\*\*8.1 ± 0.6) and with GAL (\*\*8.6 ± 0.9) than with GLU (3.7 ± 0.5). Plasma fructose was higher after FRU, but uric acid was not. The decrease in plasma FFA concentration observed by the enzymatic method was mirrored at individual levels of linoleic, oleic and stearic acids. A continued rise in galactonic acid, a metabolite of galactose, was observed after GAL. [Statistics:\*\*\*=P<0.001]

**Conclusions:** When ingested at a rate designed to saturate intestinal CHO transport systems, MD drinks with added fructose or galactose were twice as effective as MD+glucose in restoring liver glycogen during short-term post-exercise recovery. Increased liver size contributed ~10% with increased Gn concentration to net storage.

## P 3

**Maximal physiological and kinematic parameters during reduced-gravity treadmill VO<sub>2</sub>max testing.**B. Gojanovic<sup>1</sup>, P. Cutti<sup>1</sup>, R. Shultz<sup>1</sup>, G. Matheson<sup>1</sup>Sports Medicine Center and Boswell Human Performance Laboratory, Stanford University, California, USA

Training for distance running performance includes fast and short repeated intervals, to increase running economy, VO<sub>2</sub>max, and neuromuscular abilities (stride quality and speed). Overspeed running is a proposed way to improve running performance and has mostly been tried on sprinters with pulley mechanisms. Downhill running is another possibility, but impractical and associated with kinematic differences and risk of injury. It also appears athletes can't reach maximal intensity while running downhill on a 3% grade treadmill<sup>1</sup>. A device recently developed, the antigravity treadmill by AlterG<sup>®</sup> allows athletes to run on a regular treadmill but in a reduced gravity environment, effectively lowering the subjects body weight as far as 20% of the total weight.

**Objective.** To determine whether an athlete can reach maximal exercise capacity in terms of oxygen uptake and heart rate response when running at reduced body-weight.

**Methods.** 14 subelite runners (9 male, 5 female), aged 27 ± 2.1, 10 km personal best of 37:23 ± 01:10 for men, and 39:18 ± 00:14 for women. They each completed a typical short graded exercise test to determine maximal oxygen uptake (VO<sub>2</sub>max), once on a regular treadmill (CON) and also on the AlterG at body weights (BW) of 100%, 95%, 90% and 85% (AG100, AG95, AG90 and AG85). Outcome measures were VO<sub>2</sub>max, maximal heart rate (HRmax), peak running speed (V<sub>peak</sub>), stride rate (SR) and length (SL), maximal lactate and rate of perceived exertion (RPE) on Borg scale from 1 to 10.

**Results.** In each condition, VO<sub>2</sub>max was equivalent; so was HRmax, except in AG85 for men, where it was lower than on the regular treadmill. V<sub>peak</sub> increased significantly in men and women with reduced BW (from 19.7 ± 0.9 km·h<sup>-1</sup> and 17.8 ± 1.1 in CON to 22.6 ± 1.6 and 21.2 ± 0.9 in AG85, p<0.001 for men, p<0.01 for women). Maximal SR and SL increased as the BW was reduced in men, whereas women increased their SL length only. Lactate and RPE were not different across all tests.

**Conclusion.** overspeed running and training is possible on the AlterG at higher speeds than overground running, while maintaining exercise intensity and stimulating neuromuscular adaptations, more so in men with higher stride rates attained.

**References.** 1. Liefeldt, G, Noakes, TD, Dennis, SC. Oxygen delivery does not limit peak running speed during incremental downhill running to exhaustion. *Eur J Appl Physiol Occup Physiol* 1992; 64:493.

## P 4

**Electric bikes as a new active transportation modality to promote health**B. Gojanovic<sup>1</sup>, J. Welker<sup>2</sup>, C. Daucourt<sup>1</sup>, G. Gremion<sup>1</sup><sup>1</sup>Médecine du Sport, Département de l'Appareil Locomoteur (DAL), CHUV et

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Electrically assisted bicycles (EAB) are an emerging transportation modality favoured for environmental reasons. Some physical effort is required to activate the supporting engine, making it a potential active commuting option.

**Purpose.** We hypothesized that using an EAB in a hilly city allows sedentary subjects to commute comfortably, while providing a sufficient effort for health-enhancing purposes.

**Methods.** Sedentary subjects performed 4 different trips at self-selected pace: walking 1.7 km uphill from the train station to hospital (WALK), biking 5.1 km from lower part of town to hospital, with a regular bike (BIKE), or EAB at 2 different power assistance settings (EAB<sub>high</sub>, EAB<sub>std</sub>). Heart rate, oxygen consumption and need to shower were recorded.

**Results.** 18 sedentary subjects (12 female, 6 male) aged 36 ± 10 were included,  $\dot{V}O_{2\max}$  39.4 ± 5.4 mL·min<sup>-1</sup>·kg<sup>-1</sup>. Time to complete the course was 22 (WALK), 19 (EAB<sub>high</sub>), 21 (EAB<sub>std</sub>) and 30 min (BIKE). Mean % $\dot{V}O_{2\max}$  was 59.0%, 54.9%, 65.7% and 72.8%. Mean %HRmax was 71.5%, 74.5%, 80.3% and 84.0%. No significant difference between WALK and EAB<sub>high</sub>, but all other comparisons were different (p<0.05). 2 subjects needed to shower after EAB<sub>high</sub>, 3 after WALK, 8 after EAB<sub>std</sub> and all 18 after BIKE. WALK and EAB<sub>high</sub> elicited 6.5 and 6.1 MET (no difference), whereas it was 7.3 and 8.2 for EAB<sub>std</sub> and BIKE.

**Conclusions.** EAB is a comfortable and ecological transportation modality, helping sedentary people commute to work and meet physical activity guidelines. Subjects appreciated ease of use and mild effort needed to activate the engine support climbing hills, without the need to shower at work. EABs can be promoted in challenging urban environment to promote physical activity and mitigate pollution issues.

## P 5

**Hip muscle strength and fatigability in patients with symptomatic femoroacetabular impingement**

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**Introduction :** Femoroacetabular impingement (FAI) is a pathomechanical process, which may cause hip pain, disability and early development of hip osteoarthritis in young and particularly active adults. The objective of this study was to compare hip muscle strength and hip flexor fatigability between patients with symptomatic FAI and healthy controls.

**Methods :** Twenty-two patients with FAI and 22 matched controls were tested for muscle strength, while 15 patients and 15 matched controls were tested for muscle fatigability. Isometric maximal voluntary contraction (MVC) torque was measured for all hip muscle groups with hand-held and isokinetic dynamometry, and electromyographic (EMG) activity of rectus femoris (RF) and tensor fasciae latae (TFL) muscles was recorded during active hip flexion. Hip flexor fatigability was evaluated with isokinetic dynamometry as the torque fluctuations and EMG changes during a 20-s isometric submaximal contraction (50% MVC), and as the rate of torque decrease during a series of 20 consecutive isokinetic MVCs.

**Results :** FAI patients demonstrated significantly lower MVC torque than controls for hip adduction (28%,  $p < 0.01$ ), flexion (26%,  $p < 0.01$ ), external rotation (18%,  $p < 0.05$ ) and abduction (11%,  $p < 0.05$ ). TFL EMG activity was significantly lower in patients than in controls during active hip flexion ( $p < 0.05$ ). In comparison with controls, patients with FAI showed similar hip flexor torque fluctuations and EMG activity changes during the prolonged submaximal contraction, as well as the same rate of hip flexion torque decrease during the isokinetic MVCs.

**Conclusion :** Patients with symptomatic FAI presented hip muscle weakness – probably due to an impaired ability to activate hip muscles – but no greater hip flexor fatigability compared with controls. Hip muscle weakness can contribute – at least in part – to the functional disability that patients with symptomatic FAI may experience during dynamic weight-bearing activities of daily living.

**References :**

- 1) Leunig M et al. Clin Orthop Relat Res 2009 ;467 :616-22.
- 2) Casartelli NC et al. Osteoarthritis Cartilage 2011 ;(doi:10.1016/j.joca.2011.04.001).
- 3) Austin AB et al. J Orthop Sports Phys Ther 2008 ;38 :558-65.

## P 6

**Le sprint d'athlétisme et le vieillissement: une analyse cinématique**

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**Introduction :** Le sprint d'athlétisme est un mouvement complexe et exigeant qui nécessite une activité neuromusculaire maximale, une coordination parfaite des mouvements et une activité musculaire globale précise et parfaitement synchronisée. Le sprint est donc une activité idéale pour étudier le déclin progressif de la capacité physique due à l'âge. L'objectif de cette étude est d'analyser la foulée en sprint maximal à l'aide d'un enregistrement d'une caméra de haute vitesse, de décomposer cette foulée en ses différentes phases fonctionnelles, d'établir les changements de proportion de ces différentes phases et de pouvoir expliquer les altérations dues au processus de vieillissement.

**Méthodes :** Les finales de 60 m de sprint, hommes et femmes, de toutes les catégories d'âge (réparties en tranches de 5 ans) de 35 à 95 ans, au Championnat d'Europe d'Athlétisme en salle pour Vétérans (EVACI) à Gand en 2011, ont été enregistrées à l'aide d'une caméra de haute vitesse (1000 images par seconde). Chaque foulée a été décomposée dans les 6 séquences fonctionnelles suivantes: contact initial (amortissement), propulsion, décollage (toe-off), talon-fesse, élévation cuisse et préparation de contact. L'analyse cinématique a été complétée par le calcul des quotients entre les différentes phases et la géométrie de la foulée (différents angles, vitesse angulaire).

**Résultats :** Les temps sur 60 m de sprint augmentent jusqu'à 55 ans de 0.1 sec par tranche d'âge, puis de 0.4 sec jusqu'à 75 ans. La durée totale d'une foulée reste constante jusqu'à l'âge de 75 ans (autour de 220 msec), par contre la longueur de la foulée se raccourcit. La phase de propulsion se rallonge à partir de 65 ans, et celle de la suspension se raccourcit à partir de 55 ans. Le quotient entre phase de suspension et d'appui diminue à partir de 50 ans.

**Discussion :** Avec cette étude, il a été possible de montrer en détail la modification progressive de la biomécanique de la foulée due à l'âge. La performance en sprint régresse dans un premier temps à cause d'une diminution de la force d'explosivité, dans un deuxième temps à la suite d'une perte de flexibilité. La technique de sprint et la durée de la foulée, par contre, restent conservées jusqu'à l'âge de 75 ans chez les meilleurs vétérans.

## P 7

**Swissregard.ch – Swiss REGistry of Athletic Related Death. Retrospective analysis of case records from the Institute of Forensic Medicine in Bern from 1999 to 2008.**

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**Introduction:** Sudden deaths in athletes are dramatic events in sports. Incidences of 0.5 to 3.0 cases per 100,000 athletes per year have been reported. Differences in sports, etiology, ethnicity, gender, and geography underscore the need for national registries to estimate the national magnitude of the problem.

**Methods:** In cooperation with regional Institutes of Forensic Medicine we designed a web-based database for recording cases of sudden death and sudden cardiac death (SCD) in athletes. In this pilot study we reviewed case records from the Institute of Forensic Medicine in Bern from 1999 to 2008. Subjects aged 10 to 39 years were included.

**Results:** In the observed period there were 89 cases of SCD in young people. 13 cases (15%) were associated with sports participation. Mean age was 28.9 years in athletes and 29.9 years in non-athletes. In athletes, 5 of 13 cases (38%) occurred in the 36 to 39 year age group. There was a clear male predominance (12 cases, 92%). Interestingly, only 4 cases (31%) were associated with competitive sports. Most events happened during a soccer match (5 cases, 38%) followed by running (3 cases, 23%). An underlying heart disease could be determined in 10 cases (77%): Coronary artery disease was the most common pathology with 4 cases (31%), followed by aortic stenosis with 2 cases (15%), and hypertrophic cardiomyopathy, arrhythmogenic rightventricular cardiomyopathy, mitral valve prolapse and coarctation of the aorta with 1 case (8%) respectively. Pre-participation screening might have detected 6 of 13 cases (46%).

**Conclusion:** SCD during exercise is associated with an underlying heart disease and not restricted to competitive sports. Especially high intensity endurance activities may serve as triggers for to life-threatening arrhythmias in athletes with a predisposition. A prospective registry may help to tailor a national pre-participation program.

## P 8

**Autologous Matrix - Induced Chondrogenesis (AMIC) for Reconstruction of Osteochondral Lesions of the Talus**

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**Introduction:** Surgical treatment of osteochondral lesions (OCL) of the talus remains a challenging task to orthopaedic surgeons and frequently concern young sportive patients. Several operative techniques are available for treatment, however, certain restrictions remain. We present the clinical-radiological results of a novel one-step surgical technique for treatment of OCL of the talus. The autologous matrix-induced chondrogenesis (AMIC) – aided procedure combines debridement, spongiosa-plasty from the iliac crest and covering with a collagen I/III membrane.

**Methods:** Twenty-five patients (8 female, 17 male; mean age 35 years [range 17-55 years]) were prospectively assessed in our outpatient clinic for OCL of the talus. Clinical examination included the American Orthopaedic Foot & Ankle Society (AOFAS) hindfoot scale and Visual Analogue Scale (VAS). Radiological imaging consisted of conventional radiographs and magnetic resonance imaging (MRI). For the evaluation of MRI scans the magnetic resonance observation of cartilage repair tissue (MOCART)-Score was used. Surgical procedure consisted of debridement of the OCL, spongiosa-plasty from the iliac crest and coverage with a commercially available I/III collagen membrane. Clinical and radiological follow-up was performed after a minimum of 12 months postoperatively.

**Results:** Both function and pain could be improved largely and remained stable over a mean of 23.1 months postoperatively. The mean preoperative AOFAS hindfoot scale increased significantly from 60.2 points (SD  $\pm 15.9$ ) pre-operatively to 89.6 points (SD 11.9) at final follow-up ( $p < 0.01$ ). Pain measured with VAS improved significantly ( $p < 0.01$ ) from 5.0 (SD 1.7) to 1.5 (SD 2.1). At follow-up conventional radiographs showed osseous integration of the graft in all cases. MRI showed intact cartilage covering of the lesions in all cases with a mean MOCART-Score of 62.0 points (SD 17.1).

**Conclusion:** Excellent clinical and radiological results were demonstrated after a mean follow-up of 23.1 months. The results are comparable or superior with the results of ACI, OATS and MACI. More, the AMIC-aided technique is a readily available, economically efficient, and a successful one step surgical procedure. Therefore it can be recommended as treatment option of osteochondral lesions of the talus.

## P 9

**La capacité à répéter des sprints est davantage améliorée par un entraînement intense en hypoxie qu'en normoxie**R. Faiss<sup>1,2</sup>, O. Dèriaz<sup>2</sup>, G.P. Millet<sup>1</sup>

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**Introduction:** Les modalités d'entraînement en altitude pour les sports intermittents (sports d'équipe et de raquette) restent méconnues. Vogt et al. (1) ont montré des adaptations musculaires spécifiques induites par l'entraînement hypoxique à haute intensité. Notre étude évalue les effets d'un entraînement sous forme de répétitions de sprints (RSA) en hypoxie ou en normoxie sur la performance spécifique en RSA.

**Méthodes:** 50 sujets sains (35 ± 7 ans, 75 ± 9 kg, 179 ± 5 cm), répartis en trois groupes (Contrôle C, Entraînement en normoxie N ou en hypoxie H), ont effectué 2 séances de RSA en cyclisme pendant 4 semaines. Pré- et Post-, ils ont réalisé les tests suivants sur ergocycle (Lode Excalibur): sprint (10s); RSA (10s-20s) jusqu'à épuisement; Wingate; 3-min all-out. Tous les entraînements ont eu lieu dans une chambre normobarique hypoxique (H; 3000 m; F<sub>1</sub>O<sub>2</sub>=14.5% ou N; 485 m; F<sub>1</sub>O<sub>2</sub>=20.9%). Les paramètres mesurés étaient: nombre de sprints, puissance instantanée et moyenne ainsi que lactate ([La], Lactate Pro).

**Résultats:** L'entraînement spécifique a permis d'augmenter (p<0.01) le nombre de sprints répétés dans le groupe H (9.4 ± 4.8 vs. 13 ± 6.2 sprints) mais ni dans les groupes N (9.3 ± 4.2 vs. 8.9 ± 3.5) ou C (11.0 ± 7.1 vs 10.3 ± 6.2). Les groupes N et H ont amélioré (p<0.01) leurs performances de façon similaire grâce à l'entraînement. La performance sur 3 min all-out et la lactatémie post-RSA étaient similaires en pré- et post- (Tableau).

	Sprint 10s (W)		[La] post-RSA (mmol/l)		3 min all-out (W)		Wingate (W)	
	PRE	POST	PRE	POST	PRE	POST	PRE	POST
H	870 ±132	925 ±120*	15.0 ±2.3	15.4 ±2.1	368 ±45	383 ±39	699 ±102	718 ±94*
N	879 ±131	940 ±131*	14.2 ±1.7	14.8 ±1.6	371 ±49	382 ±47	688 ±75	723 ±86*
C	890 ±151	877 ±163	14.8 ±2.0	13.8 ±1.5	385 ±48	378 ±48	670 ±87	689 ±105

\* p&lt;0.01 pour différence par rapport à PRE

**Conclusion:** Un entraînement spécifique de sprints en hypoxie permet d'améliorer la performance de sprints répétés contrairement au même entraînement en normoxie. Les adaptations systémiques aérobies (3min all-out), glycolytiques (Wingate, [La]) et alactiques (sprint) étant similaires entre les groupes H et N, cette amélioration de la performance en RSA ne peut provenir que d'adaptations moléculaires périphériques induites par l'exercice hypoxique à haute intensité.

Référence : 1) Vogt M. et al. J Appl Physiol 91: 173–182, 2001.

## P 10

**Stressfrakturen im Schweizer Orientierungslauf- und Triathlon Nationalkader – Analyse von Inzidenz, Lokalisation und Risikofaktoren**

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**Einleitung:** Stressfrakturen im Ausdauersport ereignen sich mit 8 bis 25% pro Jahr sehr häufig. Die Wertigkeit verschiedener intrinsischer und extrinsischer Risikofaktoren (z.B. nutritiv, orthopädisch, endokrinologisch, gynäkologisch, trainingsphysiologisch) im Spitzensport ist weitgehend unklar.

**Methodik:** Retrospektive Datenanalyse aller Kaderathleten/-innen der Schweizer Orientierungslauf und Triathlon Nationalkader hinsichtlich Häufigkeit, Verteilung Risikofaktoren. Insgesamt wurden 200 Athleten/-innen eingeschlossen (Orientierungslauf; M89, F67; Triathlon; M29, F15). Die Datenkollektion bestand aus: 1) Analyse der medizinischen Akte; 2) Fragebogen; und 3) persönliches Interview.

**Resultate:** Insgesamt erlitten 36 Athleten/-innen eine Stressfraktur während der Kaderzeit (18%); OL F 22%, OL M 13%, Tri F 13%, Tri M 24%). Davon befanden sich 44% am Unterschenkel, 33% am Vorfuß, und je 11% an Mittel-/Rüftelfuss und Hüfte/Becken. In der Altersverteilung zeigten sich 50% der Stressfrakturen zwischen 19 und 21 Jahren, 22% über 25, 19% 18 und jünger, und 8% zwischen dem 22. und 25. Lebensjahr. Eine deutlich erhöhte Rate an primärer oder vor allem sekundärer Amenorrhö wurde gefunden. 38% der Athletinnen mit Stressfraktur zeigten eine Osteopenie oder Osteoporose. Orthopädisch-biomechanische Ursachen für eine Stressfraktur fanden sich in ca. 1/3 der Athleten/-innen. Weitere Daten werden am Kongress präsentiert werden.

**Diskussion:** Stressfrakturen im Ausdauersport sind häufig, oft begleitet von Symptomen der „Female Athlete Triad“. Alters- und Lokalisationen zeigten typische Verteilungsmuster. Das Verständnis und die Bedeutung der Risikofaktoren ist entscheidend, um Athleten at risk identifizieren zu können und durch Lebensstil- oder Trainingsmodifikationen eine Stressfraktur umgehen werden konnte.

## P 11

**Arthrose nach VKB-Ruptur – eine biomechanische und radiologische Langzeitstudie**

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Die Ruptur des vorderen Kreuzbandes (VKB) ist eine der häufigsten Sportverletzungen überhaupt mit grossen sozio-ökonomischen Auswirkungen. Im Langzeitverlauf gibt es noch viele Fragezeichen, insbesondere den Zusammenhang von Instabilität und Arthroseentstehung. Die vorliegende Arbeit hatte zum Ziel, in einem Tiermodell den Langzeitverlauf eines VKB insuffizienten Kniegelenks zu beobachten und kontinuierlich kinetische, kinematische, radiologische, biomechanische und morphologische Parameter zu dokumentieren. Hierzu wurde an 3 Katzen am linken Knie das VKB reseziert. Die Nachbeobachtungszeit betrug 12 Jahre (144 Monate), was ca. 68 Menschenjahren entspricht. Es zeigte sich, dass sich in den kinetischen und kinematischen Daten nach VKB Resektion eine Veränderung im Sinne eines Entlastungshinkens und eines Instabilitätsganges zeigt. Diese Befunde verschwinden jedoch nach ca. 3-4 Monaten wieder und die Ganganalyse ist bis kurz vor Studienende normal, wo es erneut zu einem Hinken kommt. Im Gegensatz dazu schreitet die Arthroseentstehung im Gelenk schnell voran und wird auch nicht aufgehalten. Symptomatisch wird sie jedoch erst zum Studienende hin. Diese Studie zeigt, dass im Katzenmodell die mechanische VKB Instabilität gut kompensiert werden kann, die Arthrose aber dennoch fortschreitet, wobei eine Symptomatik lange ausbleibt. Das Verständnis der Arthroseentstehung ist wichtig, um die konservativen und operativen Therapien der VKB-Ruptur dergestalt optimieren zu können, um Langzeitschäden und Spätfolgen minimieren zu können.

## P 12

**Physical activity levels during physical education lessons and their contribution to total physical activity.**S. Kriemler<sup>1</sup>, U. Meyer<sup>1</sup>, R. Roth<sup>2</sup>, L. Zahner<sup>2</sup>, M. Gerber<sup>2</sup>, J. J. Puder<sup>3</sup><sup>1</sup>Swiss Tropical- and Public Health Institute, Basel<sup>2</sup>Institute of Exercise and Health Sciences, University of Basel, Switzerland<sup>3</sup>Service of Endocrinology, Diabetes and Metabolism, Centre Hospitalier Universitaire Vaudois, Lausanne

For a growing number of children, physical activity (PA) during physical education lessons (PE) provides the main opportunity for being physically active. Although PA levels during PE have been shown to be relatively low, we do not know the contribution of PA during PE to overall PA.

**Purpose:** to assess different aspects of PA during regular PE lessons and to determine whether PE is effective at contributing to overall daily PA in primary school children.

**Methods:** Accelerometer measurements in 781/900 children (6 to 13 years old) over 4-7 days were done in of 59 randomly selected 1<sup>st</sup> and 5<sup>th</sup> grade classes. PA during PE with the amount of moderate-and-vigorous PA (MVPA; ≥2000 counts/min) during PE, total daily MVPA, and a comparison of days with and without PE was made by using a mixed linear regression model with sex, grade and overweight status (normal vs. overweight) as fixed factors and school class as random factor.

**Results:** Valid accelerometer data were available in 676 children (9.3 (SD 2.1) years old, 43% 1<sup>st</sup> grade, 51% females, 23% overweight). Children spent 32.8 (15.1) % of PE time in MVPA (16.7 min of a maximum of 49.9 min). There was a significant gender influence (β-coefficient 6.6 (95%-CI 5.0 to 8.2) in favour of the boys, whereas overweight and normal weight children did not differ. MVPA during PE accounted for 16.8 (8.5) % of total day MVPA. Irrespective of gender, grade and weight status, children were significantly more active (difference: 16.1 (29.0) minutes of MVPA; p<0.001) on days with PE than on days without PE.

**Conclusion:** Although PA levels during PE are low, PE has an important role in providing PA for children, especially for overweight children.

## P 13

**Combined impact of health behaviours on cardiovascular risk in children: a randomized prospective study**S. Kriemler<sup>1</sup>, U. Meyer<sup>1</sup>, T. Bloesch<sup>2</sup>, E. Peterhans<sup>2</sup>, L. Zahner<sup>2</sup>, C. Schindler<sup>1</sup>, J. J. Puder<sup>3</sup><sup>1</sup>Swiss Tropical- and Public Health Institute, Basel<sup>2</sup>Institute of Exercise and Health Sciences, University of Basel, Switzerland<sup>3</sup>Service of Endocrinology, Diabetes and Metabolism, Centre Hospitalier Universitaire Vaudois, Lausanne

Factors of negative health behaviour are known to be associated with increased cardiovascular risk in children, but their combined impact on a general population of children is not well documented. We aimed therefore to quantify the combined impact of easily assessable health behaviours in randomly selected children on their cardiovascular risk four years later.

502/540 randomly selected 6- to 13-year-old Swiss children took part in a baseline health assessment and 232 (64%) of those participated again in the same assessment four years later which included anthropometry, fasting blood samples and a health behaviour questionnaire.

A cardiovascular risk score was built by averaging sex- and age-related z-scores of waist circumference, blood pressure, glucose, inverted high density lipoprotein and triglycerides. Participants scored one point for each negative health behaviour: a BMI above the 85<sup>th</sup> percentile (IOTF), less than 60 min of moderate-vigorous physical activity per day, media use of more than 120 min daily, smoking and/or overweight parents. After four years of follow up, the age-, sex-, and social class-adjusted odds ratios (95% CI) for having an unfavourable cardiovascular risk score (highest tertile of age- and sex-adjusted z-scores) for children who had no or one (n=91) compared to two (n=77), three (n=39) or three and more (n=54) risk behaviours were respectively 1.44 (0.73 to 2.85, p=ns), 2.27 (1.02 to 5.08, p=0.046) and 2.59 (1.24 to 5.40, p=0.011).

Three or more negative health behaviours combined predicted a 2.6-fold higher risk of having an unfavourable cardiovascular risk score four years later. Thus, already in childhood, an accumulation of negative health behaviours is associated with a higher cardiovascular risk four years later in life which underlines the urge of early prevention.

## P 15

**Is power training or conventional resistance training better for function in elderly persons? A meta-analysis**M. Tschopp<sup>1</sup>, M. Sattelmayer<sup>2</sup>, R. Hilfiker<sup>2</sup><sup>1</sup>Physiotherapie Tschopp, Leukerbad, Valais, Switzerland<sup>2</sup>School of Physiotherapy, HES-SO // University of Applied Sciences Western Switzerland, Leukerbad, Valais, Switzerland

**Introduction:** We all would like to remain independent into high age. Important determinants of independent mobility are muscle strength and power (i.e. the product of force and movement velocity). In ageing, muscle power declines earlier and faster than strength and power is stronger associated with functional status than is muscle strength. Therefore, with this meta-analysis, we set out to compare the effects of power training (high velocity movements with intermediate load) with conventional training (low velocity with high load) on functional outcomes in older persons.

**Methods:** Systematic review and meta-analysis of randomised controlled trials. We included all randomised or quasi randomised trials investigating power training with high movement velocity versus conventional resistance training with low movement velocity in elderly persons over the age of 60 years. The primary outcomes were measures of functional outcomes; secondary outcomes were balance, gait, strength, power, muscle volume and adverse effects.

**Results:** 11 trials were identified involving 377 subjects. The pooled effect size for the follow-up values of the functional outcomes was 0.32 in favour of the power training (95% CI 0.06 to 0.57) and 0.38 (95% CI -0.51 to 1.28) for the change value. For balance, the pooled effect from three studies for self-reported function was 0.16 in favour of power training (95% CI -0.17 to 0.49). The pooled SMD for the follow-up values was 0.91 in favour of the power training (95% CI -0.17 to 1.99, P = 0.098, I<sup>2</sup> = 80.7%) and the only study with change from baseline had an SMD of 0.44 (95% CI -0.45 to 1.33, P = 0.334).

**Conclusion:** Power training is feasible for elderly persons and has a small advantage over strength training for functional outcomes. No firm conclusion can be made for safety.

**References:** Marielle Tschopp, Martin Karl Sattelmayer, Roger Hilfiker. Is power training or conventional resistance training better for function in elderly persons? A meta-analysis. Age and Ageing 2011; doi: 10.1093/ageing/afr005

## Poster

## P 14

**Réponses cardiorespiratoires du 30-15 Intermittent Ice Test**C. Besson<sup>1</sup>, M. Buchheit<sup>2</sup>, M. Praz<sup>3</sup>, O. Dériaz<sup>3</sup>, G. Millet<sup>1</sup><sup>1</sup>ISSUL, University of Lausanne, <sup>2</sup>ASPIRE, Qatar<sup>3</sup>IRR, SivaCare, Sion

**Introduction:** Le 30-15 Intermittent Ice Test (30-15<sub>ITT</sub>) a récemment été développé pour évaluer les qualités cardiorespiratoires des joueurs de hockey sur glace<sup>1</sup>. A vitesse maximale, la fréquence cardiaque maximale (FC<sub>max</sub>) et la lactatémie maximale [La<sub>max</sub>] étaient similaires à celles du test original en course à pied (le 30-15 Intermittent Fitness Test; 30-15<sub>IFT</sub><sup>2</sup>). Le but de cette étude était d'analyser les réponses cardiorespiratoires entre le 30-15<sub>ITT</sub> et le 30-15<sub>IFT</sub> chez des joueurs de hockey semi-professionnels.

**Methods:** Dix joueurs (âge : 23.6 ± 5.6 ans) de Ligue Nationale B ont effectué le 30-15<sub>ITT</sub> et le 30-15<sub>IFT</sub> dans un ordre aléatoire. Les variables cardiorespiratoires ont été mesurées avec un analyseur portable d'échanges gazeux. Le Seuil Ventilatoire (VT), le Point de Compensation Respiratoire (RCP) et les valeurs aux vitesses maximales ont été mesurés pour les deux tests. [La<sub>max</sub>] a été mesurée 1 minute après la fin de l'exercice.

**Results:**  $\dot{V}O_{2max}$  (60 ± 6.6 vs. 62.7 ± 4.4 ml min<sup>-1</sup> kg<sup>-1</sup>; p=0.02) et FC<sub>max</sub> (184.8 ± 7.0 vs. 189.4 ± 9.5 bpm; p=0.02) étaient inférieurs et [La<sub>max</sub>] supérieure (10.9 ± 1.3 vs. 8.6 ± 1.6 mmol l<sup>-1</sup>; p<0.01) dans le 30-15<sub>ITT</sub> en comparaison avec le 30-15<sub>IFT</sub> alors que VT (76.3 ± 4.7 vs. 75.5 ± 2.7 %FC<sub>max</sub>; 62.3 ± 4.9 vs. 64.2 ± 6.3 % $\dot{V}O_{2max}$ ) et RCP (90.6 ± 2.9 vs. 89.8 ± 2.7 %FC<sub>max</sub>; 85.9 ± 4.7 vs. 84.0 ± 7.3% $\dot{V}O_{2max}$ ) étaient similaires.

**Conclusion:** La nature intermittente du 30-15<sub>ITT</sub> induirait un ratio effort/récupération différent en patinage et en course. Avec des phases de glisse, le 30-15<sub>ITT</sub> est moins sollicitant pour la fonction cardiorespiratoire. Cependant, la composante anaérobie et la spécificité du pattern de locomotion et de l'environnement (température et équipement) font que le 30-15<sub>ITT</sub> est un test utile pour évaluer les effets de l'entraînement en hockey sur glace. Le fait que les seuils soient à des intensités relatives identiques permet de définir les plages d'intensités indifféremment en course et en patinage

**References:** 1) Buchheit M et al. J Strength Cond Res 2011; Vol.25, 5, 1457-64. 2) Buchheit M et al. J Strength Cond Res 2011; Vol.22, 2, 365-374.

## P 16

**Reconstruction of a Large Osteochondral Lesion of the Distal Tibia with an Iliac Crest Graft and Autologous Matrix Induced Chondrogenesis (AMIC) - Case Report**M. Miska<sup>1</sup>, M. Wiewiorski<sup>1</sup>, A. Leumann<sup>1</sup>, U. Studler<sup>2</sup>, V. Valderrabano<sup>1</sup><sup>1</sup>Orthopädische Universitätsklinik, Universitätsspital Basel<sup>2</sup>Institut für Radiologie, Universitätsspital Basel

**Purpose:** Joint preserving treatment of osteochondral lesions (OCL) in younger sportive patients remains a big challenge for the orthopaedic surgeon. Isolated OCL of the distal tibia are rare and no clear treatment guidelines have been established. We developed a novel surgical treatment method using a stable bone plug harvested from the iliac crest combined with the implantation of a collagen I/III membrane. With this case we report the successful use of Autologous Matrix Induced Chondrogenesis (AMIC) aided reconstruction for OCL of the distal tibia.

**Methods:** A 29 year old male patient (sports teacher) complained about persisting pain and recurrent swelling of the left ankle joint 12 months after an ankle sprain. Sport activities were no longer possible. Pain measured by the Visual Analogue Scale (VAS) was 4. The AOFAS Ankle-Hindfoot Scale was poor with 61 points. Imaging revealed edema of the subchondral bone and thinning of the cartilage above the osseous defect at the lateral distal tibia. Surgical course: The osteochondral defect was debrided followed by microfracturing of the underlying sclerotic bone. A cancellous bone plug was harvested from the iliac crest and impacted into the defect. A collagen membrane (Chondro-Gide, Geistlich, Wolhusen, Switzerland) was cut to match the chondral defect and fixed on the defect with fibrin glue.

**Results:** At 12 and 36 months the patient had a VAS of 0 points and returned to a full time job. AOFAS hindfoot score increased from 61 points preoperatively to 100 points after 12 months and remained 100 points after 36 months. At 12 months he returned to full sports. Conventional radiographs at one year showed successful osseous integration of the plug, osseous consolidation of the calcaneal osteotomy and a nearly anatomic shape of the tibial joint line. MRI dGEMRIC scans at 36 months showed intact cartilage layer over the defect and glycosaminoglycan content indicating fibrous cartilage repair.

**Conclusion:** This case demonstrates AMIC aided reconstruction of large osteochondral lesions of distal tibia to be a promising treatment method. Future research needs to compare this new technique to other available treatment methods in terms of radiological, clinical and histological outcome. Early return to full sporting activity after treatment with AMIC technique is possible.

## P 17

**Lactate minimum of a heart rate-based lactate minimum tests highly correlates with maximal lactate steady state in cycling and running**C. Perret<sup>1</sup>, K. Hartmann<sup>2</sup><sup>1</sup>Institute of Sports Medicine, Swiss Paraplegic Centre, Nottwil, Switzerland; <sup>2</sup>Institute for Human Movement Sciences and Sport, ETH Zurich, Switzerland

**Introduction:** The heart rate-based lactate minimum test (LMT-HR) is a highly reproducible exercise test to determine individual training intensity zones<sup>1</sup>. However, in contrast to wheelchair athletics<sup>2</sup>, the relation between the lactate minimum (LM) determined by a LMT-HR and the maximal lactate steady state (MLSS) in running and cycling is still not clear. The aim of the present study was to fill this gap.

**Methods:** 12 healthy, endurance trained male subjects (age: 38±6y; height: 181±5cm; weight: 77±6kg; training volume: 9±3h/wk) participated in the study. They performed a LMT-HR on a treadmill and on a cycle ergometer. Additionally, several endurance exercise tests were performed to determine exercise intensity at MLSS for both modes of exercise. Data for heart rate, power output, lactate, oxygen uptake and rating of perceived exertion at LM and MLSS were used for data analysis.

**Results:** All measured parameters revealed significantly higher values at MLSS compared to LM for both types of exercise but highly significant correlations between MLSS and LM for heart rate (running:  $r=0.809$ ,  $p<0.01$ ; cycling  $r=0.830$ ,  $p<0.01$ ) and power output (running:  $r=0.813$ ,  $p<0.01$ ; cycling:  $r=0.818$ ,  $p<0.01$ ) were found.

**Conclusion:** The LMT-HR seems to be a helpful tool to accurately determine exercise intensity at MLSS for running and cycling with one single exercise test and allows the determination of individual training intensity zones and training recommendations. For daily clinical practice it can be assumed that heart rate at MLSS is 10-12 bpm above heart rate at LM for running and cycling.

**References:** <sup>1</sup>Strupler M, Mueller G, Perret C. Heart rate based lactate minimum test - a reproducible method. *Br J Sports Med.* 43: 432-436, 2009.

<sup>2</sup>Perret C, Labruyère R, Mueller G, Strupler M. Does the lactate minimum of a heart rate based lactate minimum test correspond to the maximal lactate steady state? *Schweiz Z Sportmed Sporttraumatol.* 55: 109, 2007.

## P 18

**Validation of the lactate threshold test Swiss Olympic and a new MTB specific capacity test with race times at the MTB cross country World Championship**German E. Clémin<sup>1,2</sup>, Nicolas Siegenthaler<sup>2</sup>, Beat Stirnemann<sup>2</sup>, Rolf Vollenweider<sup>2</sup>, Beat Zimmermann<sup>1</sup><sup>1</sup>Sportmed.Zentrum Bern-Ittigen, Haus des Sports, Ittigen<sup>2</sup>Swiss Cycling, Haus des Sports, Ittigen<sup>3</sup>Scott MTB Racing Team

**Questions of the study:** How does the MTB cross country race performance in a major event correlate with a) the standard lactate threshold test Swiss Olympic b) a newly developed MTB specific capacity test?

**Methods:** 18 successful Swiss mountain bikers (11m; 3 elite, 4 U23, 4 juniors, age 21.8±4.6 / 7 f; 2 elite, 2 U23, 3 juniors, age 22.0±6.6) took part shortly after the WC Canberra 2009. They performed the lactate threshold test SO (LTT) and the MTB specific capacity test (CAP) the same day. The CAP consisted of a start loop of 4 min, 2min at Pmax LTT, 2min at Pmax-50W. This was followed by laps of 6minutes each, alternating 1min at P4mmol/l -50W, to 1min at P4mmol/l. An active pause of 45 sec was then given on a balance board in push up position to simulate a downhill passage. Next lap of 6 minutes, again in 1min intervals was started 20 Watts higher, means P4mmol/l-30W, alternating every other minute with P4mmol/l+20W. This was continued until exhaustion. HR was continuously monitored. Lactate and perceived exertion with the Borg scale were determined at the start, after the start loop, after each lap, at the test end and 2min later.

**Results/Discussion:** In LTT we found for m / f : Pmax at 380±38 / 269±21W, Piat310±36 / 219±25W, maxHR194±8 / 189±11, max La 11.3±1.8 / 11.2±2.8mmol/l, max Borg 19.8±0.4 / 19.6±0.8. In CAP we measured Pmax at 339±41 / 229±24W, maxHR193±8 / 194±8, max La 7.9±2.5 / 8.6±2.7mmol/l, max Borg 19.5±0.9 / 19.7±0.5. Lower lactate values in the CAP are explainable as it was the second test of the day. The partial correlation with all riders - values corrected for the influence of sex - showed significant values for the correlation between average lap time at WC and Pmax LTT ( $r=-0.65$ ;  $p=0.005$ ), Piat LTT ( $r=-0.66$ ;  $p=0.004$ ) and Pmax CAP ( $r=0.599$ ;  $p=0.01$ ).

**Conclusion:** The P max and the P iat in the standard lactate threshold as well as the Pmax in the MTB specific capacity test in the lab are valid for the performance prediction in cross country MTB.

## P 19

**Outcomes of Extracorporeal Shock Wave Therapy (ESWT) treatment on patients with chronic plantar fasciitis**

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**Introduction:** Chronic plantar fasciitis is a frequent and painful pathology of the heel. Predominantly, anatomic and biomechanical factors are responsible for the development of chronic plantar fasciitis. The treatment is often frustrating though several treatment options are available, demonstrating different levels of efficacy. The present article investigates in the effect of extracorporeal shock wave therapy (ESWT) as a therapy method on patients with chronic plantar fasciitis.

**Methods:** 67 (35 female) successional patients with chronic plantar fasciitis and several former treatments (Physiotherapy, Insoles, NSAR Medication, Cortisol-Injection) obtained an ESWT treatment. Patients were evaluated retrospectively on the basis of the numeric rating scale (NRS, range: 0 = no pain, 10 = maximum pain) measured prior the therapy start (time A), after the last therapy session (time B) and 6 weeks after the last therapy session (time C). Age, gender, bilateral symmetry, previous cortisol therapy and duration of symptoms were assessed as additional factors to measure their influence on the outcome of the ESWT.

**Results:** The main result demonstrates significant improvement of NRS pain scores between points of time A, B and C (A= 6.48 B= 3.97 C= 2.81;  $p < 0.001$ ). Younger patients were significantly more affected with bilateral chronic plantar fasciitis, whereas older patients suffered more often on either the left or right heel ( $p < 0.05$ ). Further, the analysis reveals that individuals with one-sided plantar fasciitis have better outcome regarding to the NRS scores than individuals with bilaterally plantar fasciitis ( $p<0.05$ ). In line with the results of Chuckpaiwong B. et al. (2009), the present study could not find any influence of cortisol therapy, duration of symptoms and gender on NRS outcome. A linear regression analysis revealed that the NRS scores from point of time B significantly predicted NRS scores of point of time C ( $p < 0.001$ ).

**Conclusion:**

ESWT is a successful therapy method for treatment of plantar fasciitis. Moreover the present study demonstrates the possibility to predict the outcome of ESWT after 6 weeks already after the last therapy session.

**References:** 1) Chuckpaiwong B et al. *J Foot Ankl. Surg.* 2009; 48(2):148-55.

2) Metzner G et al. *Foot Ankle Int.*2010; 31(9):790-6.3) Cole C et al. *Plantar Am Fam Physician.* 2005; 72(11):2237-42.4) Glatzer JL et al. *An Phys Sportsmed.* 2009 Jun;37(2):74-9.

## P 20

**Professional Ice Hockey Injuries: A 4 years prospective study**

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**Introduction:** Ice Hockey is the fastest team sport with players skating up to 60 km/h and a puck speeding up to 160 km/h. Aggressive contacts between players, rigid obstacles (boards, goalposts), and solid surface may result in high energy trauma and severe injuries despite protective equipments. Epidemiological data concerning junior and college teams are available, but we miss precise data at the professional level.

**Objective:** To determine on several seasons the epidemiology of professional ice hockey injuries, the mechanism of injury, and risk factors to allow the development and implementation of a prevention program.

**Material and methods:** All injuries occurring in one of the best Swiss Professional Hockey Team were recorded and monitored during 4 years. Injuries were graded as minor (time loss: 1-7 days), moderate (8-28 days), and major (>28 days). Summer preparation and return to play were controlled throughout the entire study.

**Results:** Incidence of injury was 6,48/1000 hours/player (forwards: 6,6, defensemen: 7,2, goalies: 2,5) and was stable over the 4 years of observation. Incidence of injury resulting in time loss was 2,3/1000hours/player (forwards: 2,6, defensemen: 2,0, goalies: 0,68). Most of the lesions were moderate (51%), (minor 36%, major 13%). Collision between players was the most common mechanism of moderate to severe injury. Contusions were the most frequently seen injuries (38%) tracked by strains/sprains (29%). Knee and shoulder were the most frequently injured part of body (both 12%). Concussion had a higher incidence in defensemen (0,64/player/1000hours) compared to forwards (0,2/player/1000hours). August (beginning of the ice summer camp) was the month with the highest injury rate with and without time loss (18,7% and 18,6% respectively).

**Conclusions:** In spite of its kinetics, ice hockey injuries rate is comparable to other contact team sports. Risk factors are first month of the season, summer training deficiency, and to be a defenseman for concussion. Measures of prevention might include optimal physical conditioning before and during the season especially for hip muscles, stronger helmet for defenseman, better hand protection.

## P 21

**In-vivo metabolic efficiency and insulin sensitivity: relationship with skeletal muscle mitochondrial content in older adults**Francesca Amati<sup>1,2</sup> and Bret Goodpaster<sup>2</sup><sup>1</sup>University of Lausanne, Lausanne, Switzerland<sup>2</sup>University of Pittsburgh, Pittsburgh, USA**Introduction**

Mitochondrial function has been implicated in age-related metabolic dysfunction. The purpose of this study was to examine the associations between skeletal muscle mitochondrial content and in vivo metabolic efficiency, capacity for fat oxidation and insulin sensitivity in older adults.

**Methods**

Mitochondrial volume density (MVD) was measured in muscle biopsies from 60 healthy older men and women (age 66.4±0.5, range 60-75.7) using transmission electron microscopy. The proportion of type I fiber (F1) was assessed with immunohistochemistry. Insulin sensitivity (IS) was measured by hyperinsulinemic euglycemic clamp. Resting energy expenditure (REE) and proportion of resting energy from fat (REF) before and after insulin stimulation were measured by indirect calorimetry. VO<sub>2</sub>peak was determined by GXT. Energy expenditure (EE), gross efficiency (GE), and proportion of energy expended from fat (EEF) were determined during one-hour of submaximal cycle ergometry (50% of VO<sub>2</sub>peak).

**Results**

There was a wide range of physical fitness among subjects (VO<sub>2</sub>peak from .87 to 4.05 l/min), and BMI ranged from 21.2 to 37.3 kg/m<sup>2</sup>. VO<sub>2</sub>peak (R<sup>2</sup>=.59, P<.001), EE (R<sup>2</sup>=.55, P<.001), GE (R<sup>2</sup>=.49, P<.001), EEF (R<sup>2</sup>=.31, P<.001), IS (R<sup>2</sup>=.52, P<.001) and F1 (R<sup>2</sup>=.11, P=.017) were positively correlated with MVD. These associations remained significant after adjusting for VO<sub>2</sub>peak. While REE (R<sup>2</sup>=.06, P=.07), and REF (R<sup>2</sup>=.09, P=.02) tended to be correlated with MVD in the fasting condition, this was not true in the insulin stimulated condition.

**Conclusion**

In this diverse cohort of older adults, mitochondrial content was strongly influenced by chronic physical activity. After adjusting for VO<sub>2</sub>peak, skeletal muscle mitochondria content remained positively associated with enhanced insulin sensitivity, better ability to oxidize fat and higher metabolic efficiency.

## P 22

**Whole-body vibration training: metabolic cost of vertical, oscillating or no vibration.**

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Whole-body vibration training (WBV) can improve strength and has recently shown benefit for overall fitness, increasing maximal oxygen consumption (VO<sub>2max</sub>)<sup>1</sup>. No study has compared metabolic demand for WBV using either vertical or oscillating vibrations.

**Purpose.** Our study aimed at comparing the metabolic demand of a typical WBV session using vertical or oscillating vibrations.

**Methods.** 10 young (age 21.7 ± 1.5) female sedentary subjects were asked to perform a 20 minute training session consisting of three sets of six 45 sec exercises, with 15 sec recovery. Three conditions were repeated in random order on different days: vertical vibrations at 35 Hz and 4 mm amplitude (VER, maximal acceleration = 19.7g), oscillating vibrations at 26 Hz and 7.5 mm amplitude (OSC, maximal acceleration = 20.4g), and no vibration (CON). Heart rate (HR), oxygen consumption and RPE (Borg scale) were monitored.

**Results.** Mean VO<sub>2</sub> (expressed as percentage of VO<sub>2max</sub>) during the 20 minute session did not differ between conditions: 28.7 % ± 6.7, 29.7 ± 4.2 and 32.4 ± 6.5, for CON, VER and OSC respectively (p=0.103). Mean HR (percentage of maximum HR) was 64.7 % ± 5.6, 65.6 ± 7.3 and 69.8 ± 7.9, OSC being significantly higher (p=0.019). No difference was observed for RPE. When we analyzed each three sets of exercises separately, mean VO<sub>2</sub> in the last third is higher for OSC (p<0.001).

**Conclusions.** WBV vibration is increasingly used for fitness and health purposes, having the advantage of potential positive results in less time than traditional exercise. Our study shows a higher HR response for OSC, but no difference for oxygen consumption or rate of perceived exertion. However, towards the end of the exercise session, mean VO<sub>2</sub> is higher with OSC. We can conclude that oscillating platform exercises elicit a higher HR response than vertical vibrations or no vibrations, and they could elevate oxygen consumption to higher levels, provided the session lasts more than 20 minutes.

## P 23

**Tapering and heart rate variability in marathon**B. Hug<sup>1</sup>, N. Naef<sup>1</sup>, A. Buerki<sup>1</sup>, G. Miller<sup>2</sup><sup>1</sup>SFISM (Swiss Federal Institute of Sport) Magglingen<sup>2</sup>UNIL (Institute of Sport Science) Université de Lausanne

**Introduction:** The purpose of this study was to examine the effects of three weeks of tapering (TP) following a 3-wk overload (OL) phase on heart rate variability (HRV), post-exercise parasympathetic reactivation and performance in marathon runners (MR).

**Methods:** Before and after OL and at the end of the first and second week of TP, 11 male MR (34.6 ± 5.7 yr; personal best < 3 h over marathon) performed an exhaustive test on a running treadmill. The test included running for 10 min at 60% vVO<sub>2max</sub>, 8 min at 80% vVO<sub>2max</sub> and until exhaustion at 95% vVO<sub>2max</sub>. Subjects were immediately seated after the test, and RR intervals was recorded for 10 min. HR recovery (HRR) and parasympathetic reactivation were examined with spectral (HF; LF) or time-domain (RMSSD) indices. Individual training program was based on an 22±10% increase in training load during OL followed by a 23 ± 8% decrease during TP.

**Results:** Running time to exhaustion did not change during the first week of TP but increased (614 ± 132 vs 727 ± 185 s; p<0.05) during the second week of TP. During TP, change in Tlim was correlated with change in HRR during the first 60s post-exercise (r=-0.84; P<0.01) and with the time constant for 10 min of the HR decay (r=0.69; P<0.05).

**Conclusion:** The findings of this study were 1) in well trained runners, change in performance was not associated to change in vagal-related HRV indices 2) HRR was slower after two weeks of TP. This was likely due to an increased sympathetic drive that counteracts the influence of the parasympathetic activity and therefore would slow HRR. Since performance increased during TP, one may suggest that in endurance athletes, increased sympathetic activity is not detrimental to performance and that tapering would induce a better sympatho-vagal balance favourable to performance.

## P 24

**Individualisierte funktionelle Ganganalyse im Ballett – ein Fallbericht**Leumann A,<sup>2</sup>Noack P,<sup>1</sup>Nüesch C,<sup>1</sup>Valderrabano V<sup>1</sup>Orthopädische Universitätsklinik, Universitätsspital Basel, Basel Schweiz ; <sup>2</sup>Swiss Olympic Medical Center Magglingen/Macolin,

**Kasuistik :** Eine 18 jährige professionelle Balletttänzerin klagt über Schmerzen im Mittelfuss. Bei St.n. zweimaliger Stressfraktur Metatarsale II rechts, ist es nun bei einem hyperlaxen Pes planovalgus et abductus zur dritten Stressfraktur des Metatarsale II links gekommen. Zusätzlich zur extensiven Bilddiagnostik (MRI, SPECT-CT) wurde eine funktionelle Ganganalyse durchgeführt. Da die Schmerzen nur in bestimmten Ballettschritten auftraten, wurden vergleichende Aufnahmen im normalen Gang und bei schmerzhaften Schritten durchgeführt. Darunter zeigten sich EMG-Veränderungen im Sinne einer Inverationsmodifikation der Peronealmuskulatur (Abb. 1) mit einer Frequenzreduktion der betroffenen Seite, sowie einen kinematischen Shift. Therapeutisch wurde das Metatarsale II links stabilisiert, um eine rasche Rehabilitation erreichen zu können. Der Pes planovalgus et abductus wurde mit einer orthopädischen Schuheinlage korrigiert. Bei einer schweren Female athlete Triade wurde zudem eine Osteoporosetherapie, eine Östrogensubstitution, eine Ernährungsberatung und eine psychologische Beratung durchgeführt.

**Diskussion:** Professionelle Sportler haben ein hohes Verletzungsrisiko. Um an den Leistungsstandard vor Verletzung anschliessen zu können, werden sehr hohe Anforderungen an die Therapie gestellt. Um diesem Anspruch gerecht werden zu können, braucht es nicht nur eine perfektionierte Therapie, sondern auch eine individualisierte Diagnostik mit funktionellen Untersuchungen. Im vorliegenden Fallbericht wurde deshalb die biomechanische Untersuchung speziell in der Sportart-typischen Belastungssituation durchgeführt.

## P 25

**Quantifizierte Beurteilung der Achillessehne beim Sportler mittels Elastosonographie**H.J. Rist<sup>1</sup>, M. Mauch<sup>1</sup><sup>1</sup>Praxisklinik Rennbahn AG, Muttenz

**Einführung:** Die Elastosonographie ist ein mittlerweile etabliertes Verfahren in der Tumordiagnostik. Jüngere Arbeiten zur Sehnenelastosonographie basieren auf einem Verfahren, welches lediglich eine farblich abgestufte (blau = hart über grün, gelb bis rot = weich) Darstellung ohne messbare Zahlen zulässt. Mit dem uns zur Verfügung stehenden neuen System (Aplio XG, Toshiba) ist durch die Bestimmung des sogenannten „Strain-Scores“ eine quantitative Bestimmung der Sehnenelastizität möglich. Da in der Literatur noch keinerlei Normwerte der Strain-Scores vorliegen, war das Ziel vorliegender Studie, diese sowohl an gesunden als auch symptomatischen Achillessehnen zu erfassen.

**Methodik:** Insgesamt wurden n=49 gesunde sowie n=26 symptomatische Achillessehnen von Sportlern (♂ 42, ♀ 33, 13-74 Jahre, 38.6±15.4 Jahre) untersucht, die einen Tegner-Aktivitäts-Score von mindestens 5 aufwiesen. Pro Proband wurde eine zufällig ausgewählte Seite gemessen. Die Unterschiede in den Strain-Scores zwischen gesunden und symptomatischen Sehnen wurden anhand des Student t-Tests ( $\alpha < 0.05$ ) geprüft.

**Ergebnisse:** Die quantitative Analyse der Strain-Scores für die gesunde Achillessehne ergab im Longitudinalschnitt Werte von 0.005 bis 0.156, axial von 0.002 bis 0.178. Die Mittelwerte variierten je nach Messfeld zwischen 0.061 ± 0.023 (proximal) bis 0.072 ± 0.027 (distal). Die symptomatischen Sehnen zeigten für alle Messfelder statistisch signifikant höhere Werte mit Mittelwerten zwischen 0.119 ± 0.004 (proximal) bis 0.140 ± 0.037 (distal) ( $p < 0.005$ ).

**Schlussfolgerung:** Das innovative Verfahren der quantifizierten Elastosonographie der Achillessehne lässt eine bisher nicht bekannte, durch Kennzahlen benennbare diagnostische Beurteilung der Sehnenqualität zu. Durch intraindividuelle Verlaufuntersuchungen wird möglicherweise künftig die Sehnenbelastbarkeit von Sportlern in der Rehabilitation biologisch gesteuert werden können. Hierzu bedarf es weiterer Studien.

**Literatur:** beim Verfasser

## P 26

**Reliabilität, Kriteriumsvalidität und Responsivität des adaptierten „Star Excursion Balance Test“ auf instabiler Unterlage.**Amacker A<sup>1</sup>, Meng J<sup>1</sup>, Mathieu N<sup>1</sup>, Jordan K<sup>2,3</sup>, Spring H<sup>2</sup>, Hilfiker R<sup>1,2</sup><sup>1</sup>Studiengang Physiotherapie; HES-SO // Fachhochschule Westschweiz; <sup>2</sup>Swiss Olympic Medical Center, Leukerbad; <sup>3</sup>Rehazentrum Leukerbad

**Einführung:** Der Star Excursion Balance Test (SEBT) wurde entwickelt, um das Gleichgewicht bei Problemen der unteren Extremitäten zu quantifizieren. Beim SEBT steht der Proband auf einem Bein und muss mit dem Fuss des anderen Beines so weit wie möglich in 8 Richtungen reichen. Dies bedingt Gleichgewicht, Kraft und Beweglichkeit des Standbeins. Der Test weist bei Patienten mit instabilen Sprunggelenken gute psychometrische Eigenschaften auf (1). Wird er jedoch zur Evaluation bei Präventionsprogrammen eingesetzt, zeigt er einen Deckeneffekt, das heisst, er lässt wenig Raum für Verbesserungen. Als neue Variante kann man den Test auf einer instabilen Unterstützungsfläche (z.B. Airex-Matte) durchführen. Das Ziel dieser Arbeit war es, die Reliabilität und Responsivität des SEBT auf einer Airex-Matte zu testen (SEBT-Airex) und die Resultate mit Krafttests, Sprungtests und mit dem klassischen SEBT zu vergleichen.

**Methoden:** Test-Retest Reliabilitätsstudie mit 28 jungen gesunden Probanden. Die Probanden führten den SEBT drei Mal in vier Richtungen (Antero-medial, medial, postero-medial und postero-lateral) mit und ohne Airex-Matte durch, sowie isokinetische Krafttests der Kniemuskelatur (60° und 360° / sec) und die Sprungleistung. Wir berechneten die Reliabilität (ICC2.1) und die Kriteriumsvalidität (Korrelationen zwischen den unterschiedlichen Tests). Die Responsivität wurde mit dem Standardized Response Mean (SRM) quantifiziert (vor und nach vier Wochen Training).

**Resultate:** Die Reliabilität des SEBT-Airex war gut, mit ICC-Werten zwischen 0.84 und 0.90. Die Korrelation mit dem klassischen SEBT war moderat bis hoch ( $r$ : 0.5 bis 0.8). Korrelationen zwischen dem SEBT und den Kraft- und Sprungtests waren moderat. Responsivität (SRM) des SEBT-Airex war 1.49 und des SEBT 1.35.

**Schlussfolgerung:** Der modifizierte SEBT auf einer Airex-Matte ist eine zuverlässige und änderungsempfindliche Variante für die Evaluation bei Präventionsprogrammen.

**Referenzen:** (1) Kinzey SJ, Armstrong CW. The reliability of the star excursion test in assessing dynamic balance. J Orthop Sports Phys Ther. 1998;27:356-360.

## P 27

**Effect of Whole Body Vibration Training on Proprioception in Athletes**<sup>1</sup>D. Thelin, <sup>2</sup>B. Gojanovic<sup>1</sup>Institut des Sciences du Sport et de l'Education Physique, Université de Lausanne.<sup>2</sup>Médecine du Sport, Département de l'Appareil Locomoteur (DAL), CHUV et Université de Lausanne.

**Introduction:** Whole Body Vibration (WBV) training has been studied with the aim of enhancing sport performance and injury recovery with mixed results. Positive effects on proprioception and balance mostly in elderly people have been shown. This study aims to investigate the effect of WBV training on proprioception in young athletes.

**Methods:** 12 subjects (22.0 yrs ± 2.5, 1.88 m ± 0.07) participated and 9 completed the 6 week training program: 3 workouts a week consisting of 3 times 2 min of WBV on the dominant leg, with rest in between for a total of 12 min per session. Proprioception was evaluated clinically by the Star Excursion Balance Test (SEBT): distances from footprint to standing leg in 3 directions were measured. Also, we looked at stabilometry, subjects standing 30 sec eyes open on one foot on a force plate (Winpod, Mediateurs©). Center of pressure (CoP) displacement (distance from footprint to CoP), CoP deviation (area under slope from footprint to CoP) and CoP speed of displacement were measured on two horizontal planes (X=med-lat, Y=ant-post).

**Statistical analysis:** 2x2 ANOVA across 4 variables and the 3 different time fractions (T 0-10s, T 10-20s, T 20-30s) for stabilometry. The p-value was set at 0.05.

**Results:** No effect of training was observed for CoP displacement or CoP speed of displacement between trained and untrained legs. Both legs showed a similar increment in proprioception, with the sole difference between groups being the T 20-30s of the CoP Y deviation significantly improved (diminished) in the trained leg ( $p = 0.027$ ).

**Discussion:** WBV training has the potential to improve proprioception in elite volleyball players' dominant leg, as evidenced by the significant improvement in mediolateral stability (Deviation CoP Y T 20-30s). This improvement could be a result of reduced fatigue since it only occurs in the late phase of the proprioception trial (T 20-30s time fraction). The sample size is small, and further research should be done to see if the trend towards improvement in other aspects of proprioception can be obtained by WBV training. This can potentially help improve the stability of foot and ankle joints, which is of paramount importance in athletic activities involving jumping and landing on one foot, for better performance and prevention of injuries.

## P 28

**Physiological profile of top Swiss mountain bikers participating at the World Championship 2009 in the Junior, U23 and Elite category of both sexes**German E. Clénin<sup>1,2</sup>, Nicolas Siegenthaler<sup>3</sup>, Beat Stirnemann<sup>2</sup>, Rolf Vollenweider<sup>2</sup>, Beat Zimmermann<sup>1</sup><sup>1</sup>Sportmed.Zentrum Bern-Ittigen, Haus des Sports, Ittigen<sup>2</sup>Swiss Cycling, Haus des Sports, Ittigen<sup>3</sup>Scott MTB Racing Team

**Questions of the study:** How does the performance profile in lab testing vs real race time differ in elite, U23 and junior top level mountain bikers of both sexes?

**Methods/Results:** The successful Swiss participants of World Championship 2009 in Canberra took part: 11 men; 3 elite, 4 U23, 4 juniors, 7 women; 2 elite, 2 U23, 3 juniors performed the lactate threshold test SO (LTT) and the MTB specific capacity test (CAP) shortly after the WC. Maximal power was measured in both tests (Pmax LTT; Pmax CAP) and the individual anaerobic threshold in the LTT was determined (Piat LTT). Lab tests are also expressed as percentage of the sex specific elite performance.

	n	Age	BMI	Pmax LTT	%of elite	Piat LTT	%of elite	PmaxCAP	%of elite
Elite m	3	27.6±5y	21.8±0.5	412±13W	100	343±5W	100	379±20W	100
U 23 m	4	21.3±0.9y	21.2±1.6	381±50W	92.5	311±44W	90.5	335±49W	88.5
Jun m	4	18±0y	20.3±1.4	353±19W	86.2	285±21W	83.1	311±20W	82.2
Elite f	2	31±5.6y	18.8±0.9	295±7W	100	250±1W	100	262±13W	100
U 23 f	2	19.5±0.7y	20.6±2.4	267±19W	90.7	206±27W	82.6	220±7W	83.8
Jun f	3	17.7±0.6y	19.7±1.4	253±6W	85.6	206±10W	82.6	213±4W	81.1

WC - Race	laps	distance	mean race time	Avg time / lap	% of elite	Mean ranking	Best ranking
WC men	7	45.3km	2:04:39	17:48	-	1	1
Elite m	7	45.3km	2:06:13	18:02	100	4.7	1
U 23 m	6	38.8km	1:54:56	19:09	93.7	16.3	3
Jun	5	32.4km	1:36:19	19:16	93.2	15	3
Elite f	5	32.4km	1:49:07	21:49	100	14	8
U23 f	4	25.9km	1:29:19	22:20	97.7	6	4
Jun f	3	19.4km	1:09:29	23:10	93.9	8	2

**Discussion/Conclusion:** In m and f the comparison between U23 and juniors to the elite riders shows a bigger difference in lab test results than in race performance. To make the difference for success and to reach faster lap times a better physical performance is needed. This is supported by coach observation and first analysis of split times, showing that differences are mainly made in physical and technical demanding uphill.

## P 29

**Vergleich der Messwerte zweier verschiedener Sprungkraft- Messsysteme**M. Mauch<sup>1</sup>, X. Kälin<sup>1</sup>, H.J. Rist<sup>1</sup><sup>1</sup>Praxisklinik Rennbahn AG, MuttENZ

**Einleitung:** Die Beurteilung der Sprungkraft ist ein wichtiger Bestandteil der Leistungsdiagnostik des Athleten vornehmlich aus schnellkräftigen Sportarten. Dabei stehen verschiedene Messinstrumente zur Verfügung, um die Sprungleistung zu testen. Neben Kraftmessplatten werden Beschleunigungsmesser eingesetzt, die es ermöglichen Kraft und Leistung auch im Feld zu testen (1). Da beide Methoden gleichwertig verwendet werden, ist es notwendig zu wissen, wie gut deren Messwerte übereinstimmen. Das Ziel dieser Studie war es, den Myotest<sup>®</sup> (MYO) (Myotest SA) hinsichtlich der Parameter Kraft, Leistung, Geschwindigkeit und Sprunghöhe mit Messwerten einer Kraftmessplatte (Quattro Jump (QUATTRO), Kistler) zu vergleichen.

**Methode:** 43 Mitarbeiter des schweizerischen Grenzschutzkorps (46.7 ± 7.3 Jahre) führten zweimal eine Serie von fünf Squat Jumps aus. Dabei wurden die Sprünge gleichzeitig mit einem wireless Myotest<sup>®</sup>-Gerät sowie einer Quattro Jump (Kistler) Kraftmessplatte gemessen. Um die Übereinstimmung der beiden Messsysteme zu erfassen, wurde die Limits of Agreement (LoA) Methode nach Bland and Altman angewendet (2). Der t-Test für gepaarte Stichproben wurde eingesetzt, um mögliche Unterschiede zwischen den Methoden zu prüfen. Das Signifikanzniveau wurde auf 5% festgelegt.

**Ergebnisse:** Die Messwerte von MYO lagen im Vergleich zu QUATTRO signifikant höher mit einem Bias von 5.01 ± 2.87cm für die Sprunghöhe, 2.55 ± 4.2Watt/kg für die Leistung und 0.9 ± 1.21N/kg für die Kraft. Für die Geschwindigkeit zeigten die Messsysteme eine gute Übereinstimmung.

**Diskussion:** Die Ergebnisse der vorliegenden Studie zeigen für drei von vier Variablen signifikante Unterschiede zwischen den Messwerten der beiden Systeme. Dies könnte auf den Algorithmus der zugrunde liegenden Messsysteme zurückzuführen sein. Der Vergleich von Testergebnissen auf der Grundlage verschiedener Systeme sollte aus diesem Grund sehr vorsichtig geschehen. Generell sollten in der Leistungsdiagnostik des Athleten neben dem Sprungtest noch andere Variablen hinzugezogen werden, um die Leistung des Athleten besser interpretieren und beeinflussen zu können.

**Literatur:**

- 1) Leard JS et al. J Strength Cond Res 2007;21: 1296-99.
- 2) Bland JM et al. Lancet 1986; i: 307-10.

## P 30

**Adaptations of Isokinetic Rotators Strength to Handball Practice and Shoulder Injury**F Degache<sup>1</sup>, F Molliet<sup>1</sup>, M Geny<sup>2</sup>, P Edouard<sup>3</sup><sup>1</sup>ISSUL, University Lausanne, Lausanne, Switzerland<sup>2</sup>Centre Thermal Yverdon, Yverdon, Switzerland<sup>3</sup>Exercise Physiology Laboratory, Jean Monnet University, Saint Etienne, France

**Introduction:** Although the internal (IR) and external (ER) rotator shoulder muscles contribute to the stability of the glenohumeral joint as dynamic stabilizers, their adaptations to improve the kinematics of overhead throwing could lead to muscular strength imbalances and could be considered as an intrinsic risk factor of shoulder injury<sup>1</sup>. We aimed to establish profiles of isokinetic IR and ER strength, and to analyze the association between shoulder pain and/or injury and isokinetic IR and ER strength in youth female volleyball players.

**Methods:** Sixteen youth female elite volleyball players divided in: 8 healthy volleyball players (HP), 8 volleyball players with shoulder injury history (SIHP). Isokinetic strength of the IR and ER strength was evaluated with use of a Con-Trex<sup>®</sup> dynamometer, with the subject in a seated position and 45° shoulder abduction in the scapular plane. Tests were performed at 60° s<sup>-1</sup> and 240° s<sup>-1</sup> in concentric, and 60° s<sup>-1</sup> in eccentric, for both sides.

**Results:** No side-to-side and intergroup differences were reported in concentric and functional ER/IR ratios. In HP and SIHP, no differences were found between the dominant and non-dominant side for IR and ER strength. No ER and IR strength weakness and/or rotator strength imbalances were associated with shoulder pain and/or injury.

**Conclusions:** Since no differences in strength and ratios were reported, playing volleyball could have not effect on rotator cuff strength and balance. Therefore, influence of the volleyball practice on rotators strength would not be likely to lead another risk factor of shoulder injury in addition to microtraumatic lesions.

**References:**

- 1) Warner JJ, Micheli LJ, Arslanian LE, Kennedy J, Kennedy R. Patterns of flexibility, laxity, and strength in normal shoulders and shoulders with instability and impingement. *Am J Sports Med.* Jul-Aug 1990;18(4):366-375.

## P 31

**Behandlung von chronischen Schmerzzuständen des Bewegungsapparates durch Physiotherapie kombiniert mit einem neuartigen Gerät (VARIPOINTER<sup>®</sup>)**Peter Freimüller<sup>1</sup>, Roland Hug<sup>2</sup><sup>1</sup>Allgemeinpraxis Dr. Illi, 6331 Hünenberg<sup>2</sup>Physiomed & Sport, 8706 Meilen

**Background:** Beschwerden des Bewegungsapparates stellen ein sehr häufiges Problem in der allgemein- und sportmedizinischen Praxis dar. Häufig gelingt trotz Ausschöpfung der zur Verfügung stehenden schmerz- und physiotherapeutischen Massnahmen die Remission der Beschwerden nur unvollständig. Als Alternative bieten sich Methoden wie etwa die Akupunktur. Ein neuartiges Produkt vereint diese und weitere alternativmedizinische Methoden in einem: Der VARIPOINTER<sup>®</sup>, ein Gerät der Firma Varifix, eignet sich besonders zur Anwendung durch den Patienten selbst bei Beschwerden der Extremitäten, des vorderen Rumpf- sowie des Kopf- und Nackenbereiches.

**Methodik:** Untersucht wurden prospektiv 10 Patienten weiblichen und männlichen Geschlechtes mit Beschwerden des Bewegungsapparates, welche unter bisheriger physiotherapeutischer und zum Teil medikamentöser Behandlung nur unvollständig angesprochen hatten. Sie hatten im Durchschnitt bereits 22.8 Behandlungen hinter sich und waren 39 bis 77 jährig. Sie mussten während mindestens 2 und maximal 5 Wochen das Gerät mindestens jeden 2. Tag über 10 bis 30 Minuten anwenden, zusätzlich waren sie weiterhin in physiotherapeutischer Behandlung. Gemessen wurde der Rückgang der Beschwerden in Prozent des Ausgangswertes unter Berücksichtigung der subjektiven Beurteilung durch den Patienten als auch durch den behandelnden Therapeuten.

**Resultate:** Bei 7 der 10 Patienten führte dieses Behandlungsschema im Durchschnitt zu einer 48.5%-igen Reduktion der Beschwerden. 6 von ihnen würden das Gerät wieder anwenden und würden die Anwendung auch weiterempfehlen. Bei einem weiteren Patienten trat zwar keine Besserung ein, dieser würde das Gerät aber trotzdem wieder anwenden. Ein anderer Patient fand die Anwendung des Gerätes unpraktisch und blieb in jeder Anwendung unterhalb der Mindestdauer. Ein letzter Patient gab unter der Anwendung des Gerätes Übelkeit an, litt jedoch auch unter psychiatrischen Beschwerden.

**Schlussfolgerung:** Diese Resultate sind tendenziell als sehr positiv zu bewerten, wenn auch aufgrund der geringen Patientenzahl keine endgültigen Schlussfolgerungen gezogen werden können. Die Anwendung des VARIPOINTER<sup>®</sup>, einzeln oder in Kombination mit Physiotherapie, sollte unbedingt weiter untersucht werden.

## P 32

**Zusammenhänge der Körperkonstitution mit Parametern der Rumpf- und Sprungkraft bei jugendlichen Kaderathleten**M. Mauch<sup>1</sup>, O. Rist<sup>1</sup><sup>1</sup>Praxisklinik Rennbahn AG, MuttENZ

**Einleitung:** Die Untersuchung der Muskel- und Fettmasse (Bodyanalyse), genauso wie die leistungsdiagnostische Prüfung der Kraftfähigkeiten sind Bestandteile der jährlichen routinemässig durchgeführten sportärztlichen Untersuchung von Kaderathleten. Hintergrund der Tests ist das Monitoring der Leistungsentwicklung der Athleten, um den Trainingsprozess bei Bedarf rechtzeitig anpassen zu können. Das Ziel vorliegender Studie war es, den Einfluss der Körperkonstitution auf Leistungsparameter der Sprung- und Rumpfkraft bei Kaderathleten zu untersuchen.

**Methode:** Insgesamt wurden die Daten von n=177 Kaderathleten (♂76, ♀101) verschiedener Sportarten (Kunstturnen n=107, Trampolin n=26, Fussball n=10, andere n=34) der Jahre 2008-2010 ausgewertet. Das Alter der Athleten betrug 8-19 Jahre (Ø12.6 ± 3.3 Jahre). Neben der Bodyanalyse (Muskel- und Fettmasse) (InBody, Biospace) wurde die Leistung (Pmax) aus dem Sprungkrafttest (Quattro Jump, Kistler) als auch aus dem Rumpfkrafttest (Zeit in sec) (Protokoll nach Swiss Olympic) ausgewertet. Zusammenhänge wurden anhand der Korrelationsanalyse (Pearson's r) geprüft ( $\alpha < 0.05$ ).

**Ergebnisse:** Es zeigen sich signifikante Zusammenhänge zwischen der absoluten Muskelmasse (kg) und der Sprungleistung (Pmax) mit Werten zwischen  $r = 0.639$  ( $p < 0.01$ ), nicht jedoch für die Rumpfkraftwerte. Hinsichtlich der Fettmasse (%) zeigen sich dahingegen signifikante negative Korrelationen sowohl für die Sprungleistung ( $r = -0.444$  bis  $r = -0.357$ ) als auch für die ventrale Rumpfkraft ( $r = -0.310$ ).

**Diskussion:** Bisherige Studien, die sich mit dem Zusammenhang von Körperkonstitution und Leistungsfähigkeit befasst haben (1, 2), zeigen widersprüchliche Ergebnisse. In vorliegender Studie konnten Zusammenhänge zwischen der Sprungleistung und der Muskel- und Fettmasse nachgewiesen werden. Hinsichtlich der Rumpfkraft zeigen sich jedoch keine oder nur geringe Zusammenhänge. Generell sollten die Werte der Körperkonstitution von Ärzten und Trainern bei der täglichen Arbeit mit Sportlern berücksichtigt werden. Jedoch sind weiterführende Studien notwendig, die auf der Basis einer grösseren Datengrundlage, vorliegende Ergebnisse ratifizieren.

**Literatur:** 1) Okely AD et al. Res Q Exerc Sport 2004; 75(3): 238-47.

2) Ugarkovic D et al. J Strength Cond Res 2002; 16(2): 227-30.